DRAFT DECISION
Roma to Brisbane Gas Pipeline Access Arrangement 2017–2022

Attachment 3 – Rate of return

July 2017

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Note

This attachment forms part of the AER's draft decision on the access arrangement for the Roma to Brisbane Gas Pipeline for 2016–21. It should be read with all other parts of the draft decision.

The draft decision includes the following documents:

Overview

Attachment 1 - Services covered by the access arrangement

Attachment 2 - Capital base

Attachment 3 - Rate of return

Attachment 4 - Value of imputation credits

Attachment 5 - Regulatory depreciation

Attachment 6 - Capital expenditure

Attachment 7 - Operating expenditure

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Shortened forms

Shortened form	Extended form
AER	Australian Energy Regulator
ATO	Australian Tax Office
capex	capital expenditure
CAPM	capital asset pricing model
CPI	consumer price index
DRP	debt risk premium
ECM	(Opex) Efficiency Carryover Mechanism
ERP	equity risk premium
Expenditure Guideline	Expenditure Forecast Assessment Guideline
gamma	Value of Imputation Credits
MRP	market risk premium
NGL	National Gas Law
NGO	national gas objective
NGR	National Gas Rules
NPV	net present value
opex	operating expenditure
PTRM	post-tax revenue model
RBA	Reserve Bank of Australia
RFM	roll forward model
RIN	regulatory information notice
RPP	revenue and pricing principles
SLCAPM	Sharpe-Lintner capital asset pricing model
STTM	Short Term Trading Market
TAB	Tax asset base
UAFG	Unaccounted for gas
WACC	weighted average cost of capital
WPI	Wage Price Index

3 Rate of return

The allowed rate of return provides a network service provider a return on capital that a benchmark efficient entity would require to finance (through debt and equity) investment in its network.[1] The return on capital building block is calculated as a product of the rate of return and the value of the regulatory asset base (RAB). The rate of return is discussed in this attachment.

3.1 Draft decision

Our draft decision is to reject APTPPL's proposal[2] and determine an allowed rate of return of 5.75 per cent (nominal vanilla). We are satisfied that this rate of return achieves the allowed rate of return objective (ARORO).[3] That is, we are satisfied that this allowed rate of return is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies APTPPL in providing reference services.[4]

This allowed rate of return will apply to APTPPL for 2017–18. A different rate of return will apply to APTPPL for the remaining regulatory years of the 2017–2022 access arrangement period. This is because we will update the return on debt component of the rate of return each year to partially reflect prevailing debt market conditions in each year. We discuss this annual update further below.

Our allowed rate of return is a weighted average of our return on equity and return on debt estimates (WACC) determined on a nominal vanilla basis that is consistent with our estimate of the value of imputation credits.[5] We are to determine the allowed rate of return such that it achieves the ARORO.[6] Also, in arriving at our decision we have taken into account the revenue and pricing principles (RPPs) and are also satisfied that our decision will or is likely to contribute to the achievement of the National Gas Objective (NGO).[7] Our rate of return and APTPPL's proposed rate of return is set out in the following table 3-1.

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1 The term network service provider relates to service providers that provide gas and electricity transmission and distribution services.

2 APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 130, 157, 163, 171.

3 NER, cl. 6.5.2(b); cl. 6A.6.2(b); NGR, cl. 87(2).

4 NER, cl. 6.5.2(c); cl. 6A.6.2(c); NGR, cl. 87(3).

5 NER, cl. 6.5.2(d)(1) and (2); cl. 6A.6.2(d)(1) and (2); NGR, cl. 87(4).

6 NER, cl. 6.5.2(b); NER, cl. 6A.6.2(b); NGR, r. 87(2).

7 NEL, s.16; NGL, s. 28.

Table 3-1 Draft decision on APTPPL's rate of return (% nominal)

	Previous allowed return (2012-17)	APTPPL's proposal (2017-22)	AER draft decision (2018)	Allowed return over 2018 regulatory control period
Return on equity (nominal post–tax)	7.75	8.39	7.2	Constant (7.2%
Return on debt (nominal pre–tax)	7.01	7.26	4.79	Updated annually
Gearing	60	60	60	Constant (60%)
Nominal vanilla WACC	7.31	7.7	5.75	Updated annually for return on debt
Forecast inflation	2.55	2.3	2.45	Constant (%)

Source: AER analysis; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 130, 157, 163, 171.

Our return on equity estimate is 7.2 per cent. This rate will apply to APTPPL in each regulatory year. Our return on debt estimate for the 2017–8 regulatory year is 4.79 per cent. This estimate will change each year as we partially update the return on debt to reflect prevailing interest rates over APTPPL's debt averaging period in each year. Our return on debt estimate for future regulatory years will be determined in accordance with the methodology and formulae we have specified in this decision. Due to updating the return on debt each year, the overall rate of return and APTPPL's revenue will also be updated.

We agree with APTPPL's adoption of the Guideline foundation model approach in its rate of return proposal, specifically:[8]

- adopting a weighted average of the return on equity and return on debt (WACC) determined on a nominal vanilla basis (as required by the rules)
- adopting a 60 per cent gearing ratio
- adopting a 10 year term for the return on debt
- applying our method of extrapolating third party data series and updating the return on debt each year
- estimating the return on debt by reference to a third party data series
- adopting the Sharpe-Lintner CAPM as the foundation model

8 APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 130, 157, 163, 171.

- estimating the risk free rate used in the return on equity with nominal Commonwealth government securities (CGS) averaged over 20 business days as close as practical to the commencement of the regulatory control period

Our return on equity estimate for this draft decision is 7.2 per cent. We derived this estimate by applying the same approach we applied to determine the allowed return on equity in our most recent decisions.[9] The Australian Competition Tribunal (Tribunal) has upheld this approach.[10] This approach entails applying the Guideline approach referred to as the foundation model approach.[11] We applied the same approach in previous decisions.[12] This is a six step process, where we have regard to a considerable amount of relevant information, including various equity models. At different stages of our approach we have used this material to inform the return on equity estimate.

Our return on equity point estimate and the parameter inputs are set out in

table 3-2.

Table 3-2 Draft decision on APTPPL's return on equity (nominal)

	AER previous decision (2012–17)	APTPPL's proposal (2017–22)	AER draft decision (2017-18)
Nominal risk free rate (return on equity only)	2.95%	1.94%[a]	2.6%[b]
Equity risk premium	4.8%	6.45%	4.55%
Market risk premium	6%	8.06%	6.5%
Equity beta	0.8	0.8	0.7
Nominal post–tax return on equity	7.75%	8.39%	7.2%

Source: AER analysis; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 130, 133, 157, 163, 171.

[a] Based on APTPPL's indicative averaging period adopted for its proposal of 20 business days to 29 July 2016

[b] Calculated with a placeholder averaging period of 20 business days up to 28 April 2017.

9 AER, *Final decision: AusNet, Attachment 3—Rate of return*, April 2017; AER, *Final decision: TasNetworks, Attachment 3—Rate of return*, April 2017; AER, *Final decision: Powerlink, Attachment 3—Rate of return*, April 2017 Also see our most recent decisions on SA Power Networks, Ergon Energy and Energex.

10 For example, see Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 813.

11 AER, *Better regulation: Rate of Return Guideline,* December 2013.

12 AER, *Draft decision, AusNet Services Transmission Revenue Review 2017-2022, Attachment 3–Rate of return*, July 2016; AER, *Final decision: Jemena determination 2016–20, Attachment 3—Rate of return*, May 2016; AER, *Final decision: CitiPower determination 2016–20, Attachment 3—Rate of return*, May 2016; AER, *Final decision: AusNet, Attachment 3—Rate of return*, April 2017; AER, *Final decision: TasNetworks, Attachment 3—Rate of return*, April 2017; AER, *Final decision: Powerlink, Attachment 3—Rate of return*, April 2017

Our decision on the return on debt approach is to:

- estimate the return on debt using an on-the-day approach (that is, based on prevailing market conditions near the commencement of the access arrangement period) in 2017–18 of the 2017–2022 access arrangement period, and
- gradually transition this approach into a trailing average approach (that is, a moving historical average) over 10 years.[13]

This gradual transition will occur through updating 10 per cent of the entire return on debt each year to reflect prevailing market conditions in that year (a full transition).[14] Our draft decision is to estimate the return on debt in each regulatory year by reference to:

- a benchmark credit rating of BBB+
- a benchmark term of debt of 10 years
- independent third party data series—specifically, a simple average of the broad BBB rated debt data series published by the Reserve Bank of Australia (RBA) and Bloomberg, adjusted to reflect a 10 year estimate and other adjustments[15]
- an averaging period for each regulatory year of between 10 business days and 12 months (nominated by the service provider), with that period being consistent with certain conditions that we proposed in the Guideline.[16]

In relation to the choice of data series we note that in the Guideline we proposed to use one or more third party data series to estimate the return on debt. At that time, however, we had not formed a view on which data series to use. Our April 2014 issues paper outlined how we would make this choice and sought submissions from service providers. We adopted a simple average of the RBA and Bloomberg data series and our choice was affirmed by the Tribunal. Since then, however, some service providers including MultiNet in its proposal have proposed making use of the Thomson Reuters

13 This draft decision determines the return on debt methodology for the 2017–22 regulatory control period. This period covers the first five years of the 10 year transition period. This decision also sets out our intended return on debt methodology for the remaining five years. However, we do not have the power to determine in this decision the return on debt methodology for those years. Under the NGR, the return on debt methodology must be determined in future decisions that relate to that period.

14 By entire return on debt, we mean 100% of the base rate and debt risk premium (DRP) components of the allowed return on debt.

15 For the RBA curve, our final decision is to interpolate the monthly data points to produce daily estimates, to extrapolate the curve to an effective term of 10 years, and to convert it to an effective annual rate. For the Bloomberg curve, our final decision is to extrapolate it to 10 years using the spread between the extrapolated RBA seven and 10 year curves (where Bloomberg has not published a 10 year estimate), and to convert it to an effective annual rate. While we do not propose estimating the return on debt by reference to the Reuters curve, we do not rule out including doing so in future determinations following a proper period of consultation.

16 AER, *Rate of return guideline*, December 2013, pp. 21–2; AER, *Explanatory statement—Rate of return guideline*, December 2013, p. 126.

10 year yield curve in addition to or in place of the Bloomberg data series. We have considered these proposals but maintain our position of using a simple average of the Bloomberg and RBA curves for reasons discussed in section 3.4.2.

Our formula for automatically updating the return on debt annually is set out in Appendix J and K of this decision.

The approach to estimating debt used in this draft decision (of moving to a trailing average with a full revenue neutral transition) is currently operating for most network businesses including privately owned network businesses, although this issue needs to be reconsidered by the AER for the NSW and ACT regulated businesses following Tribunal and the NSW Full Federal Court decisions (Ausgrid, Endeavour Energy, Essential Energy, ActewAGL, and Jemena Gas Networks). We consider this approach will meet the ARORO and NGO for the reasons set out in this decision. It reflects what we consider to be the best outcome having regard to each of the four mandatory factors that we must have regard to under r.87(11). Detailed discussion of the factors under r87(11) and the ARORO are contained later in this decision.

Since we first made the Guidelines in 2013 there have been a number of applications for review to the Australian Competition Tribunal (ACT) of AER decisions. There have also been two applications for judicial review of subsequent ACT decisions to the Full Federal Court. We have taken into account the decisions of the ACT and Full Federal Court in making subsequent decisions. Section 3.3.7provides a high level summary of some of our key considerations in light of these decisions.

In this decision, we have considered and responded to relevant submissions and issues raised in relation to past regulatory determination processes, and concurrent determination processes for gas distribution services (AGN, Multinet and AusNet) and gas transmission services (APA and APTPPL) revenue proposals.

3.2 APTPPL's proposal

Return on equity

APTPPL proposed a return on equity estimate of 8.39 per cent.[17] It proposed the use of the Sharpe-Lintner CAPM and the use of 10 year CGS yields to estimate the risk free rate. APTPPL proposed a market risk premium of 8.06 per cent and an equity beta of 0.8 which are departures from the Guideline.[18]

Return on debt

[17] APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 130, 133, 157, 163, 171.

[18] APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 130, 133, 157, 163, 171.

APTPPL proposed to adopt the Guideline approach for credit rating and term.[19] It proposed the return on debt should be estimated using the RBA curve in exclusion of all other third party curves.[20] It also proposed to depart from the Guideline approach for debt transition and adopted an immediate trailing average approach.[21]

3.3 AER's assessment approach

The National Electricity Law/National Gas Law (NEL/NGL) and rules (NER/NGR) form our framework for determining the rate of return. The key components of this framework include:

- national electricity/gas objective (NEO/NGO) and the RPPs in the NEL/NGL
- the overall rate of return—consisting of the allowed return on equity and debt
- the ARORO and its elements
- return on debt factors
- considering interrelationships within the rate of return
- use of the Guideline
- consideration of information before us.

3.3.1 National electricity and gas laws

In performing or exercising an economic regulatory function or power, we must do so in a manner that will or is likely to contribute to the NGO.[22] The NGO states:

> The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas;

When we make a determination, and set the rate of return we are exercising economic regulatory functions or powers.

In addition, we must take into account the RPPs when we exercise discretion.[23] In the context of the rate of return decision, we take particular account of the following RPPs:

- A service provider should have a reasonable opportunity to recover at least the efficient costs the operator incurs in providing direct control network services.[24]

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19 APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 132, 134, 136, 161.

20 APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 160.

21 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p.160.

22 NEL, s. 16(1)(a), NGL, s. 23.

23 NEL, s. 16(2); NGL, s. 28(2)(a)(i).

24 NEL, s. 7A(2); NGL, s. 24(2)(a).

- A service provider should have effective incentives to promote economic efficiency in the direct control network services that it provides. That economic efficiency should include efficient investment in the electricity system, efficient provision of electricity network services, and the efficient use of the electricity system.[25]
- A price or charge should allow for a return that matches the regulatory and commercial risks involved in providing the reference service to which that charge relates.[26]
- The economic costs and risks of the potential for under or over investment by a service provider in a distribution or transmission system that the service provider uses to provide reference network services.[27]
- The economic costs and risks of the potential for under or over utilisation of a distribution or transmission system that the service provider uses to provide reference network services.[28]

3.3.2 The overall rate of return

We determine the allowed rate of return for a regulatory year as a weighted average of the return on equity for the regulatory control period in which that regulatory year occurs and the return on debt for that regulatory year. This must be determined on a nominal vanilla basis that is consistent with the estimate of the value of imputation credits.[29] In determining the allowed rate of return, we must have regard to the desirability of consistent application of financial parameters that are relevant and common to the return on equity and debt.[30]

The rules require that we estimate the return on equity for a regulatory control period such that it contributes to the achievement of the ARORO. In estimating the return on equity, we have regard to the prevailing conditions in the market for equity funds.[31]

We must determine the return on debt for a regulatory year such that that it contributes to the achievement of the ARORO.[32] We may estimate the return on debt using a methodology which results in the return on debt (and consequently the allowed rate of return) being or potentially being, different for different regulatory years in the regulatory control period.[33] In estimating the return on debt we have regard to the following factors:

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25 NEL, s. 7A(3); NGL, s. 24(3).
26 NEL, s. 7A(5); NGL, s. 24(5).
27 NEL, s. 7A(6); NGL, s. 24(6).
28 NEL, s. 7A(7); NGL, s. 24(7).
29 NER, cl. 6.5.2(d); NER, cl. 6A.6.2(d); NGR, r, 87(4).
30 NER, cl. 6.5.2(e), NER cl, 6A.6.2(e); NGR, r. 87(5).
31 NER, cl 6.5.2(g); NER, cl 6A.6.2(g); NGR, r. 87 (7).
32 NER, cl. 6.5.2 (h); NER, cl. 6A.6.2(h); NGR, cl. 87(8).
33 NER, cl. 6.5.2 (i); NER, cl. 6A.6.2(i)(2); NGR, cl. 87(9)(b).

- the desirability of minimising any difference between the return on debt and the return on debt of a benchmark efficient entity referred to in the ARORO.
- the interrelationship between the return on equity and the return on debt.
- the incentives that the return on debt may provide in relation to capital expenditure over the regulatory control period, including as to the timing of capital expenditure.
- any impacts (including in relation to the costs of servicing debt across regulatory control periods) on a benchmark efficient entity referred to in the ARORO that could arise as a result of changing the methodology that is used to estimate the return on debt from one regulatory control period to the next.[34]

3.3.3 Allowed rate of return objective

We are to determine the allowed rate of return such that it achieves the ARORO. The objective is:[35]

> …that the rate of return for a distribution network service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the distribution network service provider in respect of the provision of prescribed distribution services.

The regulatory regime is an ex-ante (forward looking) regime.[36] As such, we consider a rate of return that meets the ARORO must provide ex-ante compensation for efficient financing costs.[37] This return would give a benchmark efficient entity a reasonable opportunity to recover at least its efficient financing costs. This is a zero net present value (NPV) investment condition, which can be described as follows:[38]

> The zero NPV investment criterion has two important properties. First, a zero NPV investment means that the ex-ante expectation is that over the life of the investment the expected cash flow from the investment meets all the operating expenditure and corporate taxes, repays the capital invested and there is just enough cash flow left over to cover investors' required return on the capital invested. Second, by definition a zero NPV investment is expected to generate no economic rents. Thus, ex-ante no economic rents are expected to be extracted as a consequence of market power. The incentive for investment is just right, encouraging neither too much investment, nor too little.

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34 NER, cl. 6.5.2 (k)(4); NER, cl. 6A.6.2(k)(4); NGR, cl. 87(11)(d).

35 NER, cl. 6.5.2(c); NER, cl. 6A.6.2(c); NGR r. 87(3).

36 The AEMC describes, 'allowed revenues for network businesses are now set using the expenditure required by prudent, efficient operators as a benchmark. Companies have incentives to beat the benchmarks so they can keep some of their savings and pass the rest on to customers'. See AEMC, *Overview 2014–15*.

37 See section H.2.1 of appendix H.

38 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 14.

SFG advice to the AEMC during the rule change process supports our position that setting an allowed return that results in a zero NPV investment outcome is very important to achieving efficient investment incentives stating:[39]

> A divergence between the regulated rate of return and the prevailing cost of funds will distort incentives for investment. All investment is, in some way, discretionary. Energy network businesses have an obligation to maintain a reliable energy supply, but there will not necessarily be one way to achieve this objective. The business will select the project which achieves the reliability objective but has the highest net present value of expected cash flows to the business. In the situation where the regulated rate of return is equal to the prevailing cost of funds, every project is a zero net present value investment. The business may subsequently be able to earn a return above the cost of funds, if it is able to be more cost-effective in implementing the project than assumed in the benchmark cash flow projections.

Under our regulatory framework, a benchmark efficient entity's assets are captured in its RAB. The return on capital building block allows a benchmark efficient entity to finance (through debt and equity) investment in its network.[40] Because investments usually carry a degree of risk, to satisfy the zero NPV condition the allowed rate of return must be sufficient to compensate a benchmark efficient entity's debt and equity investors for the risk of their investment.[41]

We see the NPV=0 concept given effect in the Revenue and Pricing Principles. That is, the service provider should be given a reasonable opportunity to recover it efficient costs. It should be provided with effective incentives to promote efficient investment in, provision and use of, services. A return should be commensurate with the regulatory and commercial risks involved in providing the reference service. We should have regard to the economic costs and risks of the potential for under and over investment by a service provider in a pipeline with which the service provider provides pipeline services and to the economic costs and risks of the potential for under and over utilisation of a pipeline with which a service provider provides pipeline services.

It is an essential concept that underlies the regulatory scheme that is given expression in the NGO and the RPPs and the ARORO must be understood in this important context.

We consider a change in methodology is only likely to result in an outcome that meets the ARORO if it results in ex-ante compensation for efficient financing costs and is revenue neutral in a present value sense and does not affect the present value of future cash flows through the PTRM (avoiding windfall gains or losses to the service providers and consumers). A change in methodology is also only likely to achieve the NGO if it does not result in a material distortion of investment incentives. In our view a

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39 SFG pp. 63-64.

40 This includes both new and existing investment.

41 This risk is based on the risk of the underlying assets (that is, the RAB). See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 18, 22.

change to the trailing average without a revenue neutral transition will result in an allowed rate of return either above or below the efficient financing costs of a benchmark efficient entity due to the immediate change to the new methodology and not achieve the ARORO. We consider a rate of return materially above or below efficient financing costs due to the change in methodology will create material investement distortions and would not achieve the NGO. A change in methodology that results in a material wealth transfer may also increase regulatory risk and as a consequence the overall financing costs of the benchmark efficient entity.

By combining a trailing average approach with the on the day approach, investment distortions can be limited, but only if the combination involves a revenue neutral transition between the two methodologies. Th revenue neutral transition also limits the realisation of financial risk from the change in methodology. This reduction in risk should assist to achieve the lowest cost financing over the life of the assets.

In this sense, we consider the ability to use a trailing average in a manner that will meet the ARORO and NGO is contingent upon the use of a revenue neutral transition.

Elements of the ARORO—efficient financing costs

A key concept in the ARORO is 'efficient financing costs'. Because the market for capital finance is competitive, a benchmark efficient entity is expected to face competitive prices in the market for funds. Therefore, we consider efficient financing costs are reflected in the prevailing market cost of capital (or WACC) for an investment with a similar degree of risk as that which applies to a service provider in respect of the provision of reference services.[42] As Alfred Kahn stated, 'since the regulated company must go to the open capital market and sell its securities in competition with every other would-be issuer, there is clearly a market price (a rate of interest on borrowed funds, an expected return on equity) that it must be permitted and enabled to pay for the capital it requires'.[43]

We consider employing a rate of return that is commensurate with the prevailing market cost of capital (or WACC) is consistent with the zero NPV investment condition (see above). We also consider economic efficiency more generally is advanced by employing a rate of return that reflects rates in the market for capital finance.[44] Similarly, Partington and Satchell interpret efficient financing costs as the opportunity cost of capital, which is a market rate of return for assets with a given level of risk.[45]

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42 See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 15. We note the cost of capital (from a firm's perspective) is also known as investors' required rate of return (from an investors' perspective).

43 Kahn, A.E., 'The economics of regulation: Principles and institutions', The MIT Press, Massachusetts, 1988, p. 45.

44 See sections 1.1 and 2.1 of appendix I.

45 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 15.

Elements of the ARORO—benchmark efficient entity

A key concept in the ARORO is a 'benchmark efficient entity'. It is essential to recognise the context in which this term is used. The ARORO aims at setting *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*. Given this, three important concepts to consider are: 'risk', 'similar' and 'reference services'. Having understood these concepts, we can better understand a benchmark efficient entity for APTPPL to give effect to the ARORO.

'Risk'

The risk of a benchmark efficient entity is a core element of the rate of return due to the important relation between risk and required returns in finance theory. Risk is the degree of uncertainty about an event—such as the uncertainty around the expectation of the return on an investment.[46] It is strictly a forward looking concept as no event is uncertain after it has occurred.

'Risk' has a specific meaning in finance theory. As such, it is important to apply this specific meaning in setting a rate of return that achieves the ARORO. In finance, there are two distinct types of risk—systematic (market or non-diversifiable) and non-systematic (firm-specific or diversifiable). That is, in finance:[47]

> The risk of any share can be broken down into two parts. There is the *unique risk* that is peculiar to that share, and there is the *market risk* that is associated with market-wide variations. Investors can eliminate unique risk by holding a well-diversified portfolio, but they cannot eliminate market risk. *All* the risk of a full diversified portfolio is market risk.

Similarly, McKenzie and Partington advise:[48]

> modern finance theory specifies that the risk to be compensated via the WACC is the non-diversifiable, or systematic, component of total risk (in simple terms, that risk which cannot be eliminated by holding stocks in a well diversified portfolio). This risk is measured as covariance, or equivalently beta, risk.

The rate of return allows a benchmark efficient entity to compensate investors for the risk of committing capital to fund investments in its network. We do not consider investors require compensation for all risk facing a benchmark efficient entity. In setting the allowed return on equity, we provide compensation for the systematic risk that a benchmark efficient entity would face through the equity beta (see section 3.4.1). The equity beta under the Sharpe–Lintner capital asset pricing model (CAPM) measures

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46 Bishop, S., Faff, R., Oliver, B., Twite, G., 'Corporate Finance', Ed. 5 Pearson Prentice Hall, 2004, p. 577.

47 Brealey, R., Myers, S., Partington, G., Robinson, D., 'Principles of corporate finance', 2007, The McGraw-Hill Companies Inc., 2007, p. 201.

48 McKenzie, M., Partington, G., *Risk, asset pricing models and WACC*, June 2013, p. 10.

systematic risk as the sensitivity of an asset or business[49] to the overall movements in the market. It does this by measuring the standardised correlation between the returns on this asset or business with that of the overall market.[50] The key risks for debt holders are systematic (beta) risk, credit risk (the risk of default and credit rating downgrades) and liquidity risk.[51] In setting the allowed return on debt, we provide compensation for a benchmark efficient entity's efficient costs from facing these risks, as they are included in the promised returns we observe using Bloomberg and RBA data.[52]

As such, when looking at the risks of supplying reference services, it is important to differentiate between risk that is to be compensated through the allowed rate of return (compensable risk) and non-compensable risk. When developing the Guideline, we commissioned Frontier to explore these risks and to provide advice on what risks we should compensate service providers for through the allowed rate of return.[53]

We accept the ARORO requires us to set an allowed rate of return that compensates for the efficient financing costs of a benchmark firm for bearing a similar degree of compensable risk as that which applies to the network service provider in respect of the provision of the relevant reference services. This will reflect an ex-ante return that includes a risk premium over the risk free rate for bearing this level of compensable risk.

'Similar'

A benchmark efficient entity for APTPPL is one that has a similar degree of risk as that which applies to the network service provider in respect of the provision of the relevant reference services.[54] As such, when developing the Guideline, we looked at the concept of 'a similar degree of risk' in some detail. We also sought advice from Frontier Economics on the risks to which energy network service providers are exposed in delivering regulated services.[55] We concluded the compensable risks facing the different service providers[56] were 'similar' for the purposes of characterising a

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49 Theoretically, this asset or business is 'a benchmark efficient entity'. In practice, we use a sample of businesses we consider comparable to a benchmark efficient entity to calculate equity beta (see section 3.4.1).

50 McKenzie, M., Partington, G., *Risk, asset pricing models and WACC*, June 2013, p. 21; Brealey, R., Myers, S., Partington, G., Robinson, D., 'Principles of corporate finance', 2007, The McGraw-Hill Companies Inc., 2007, p. 107.

51 McKenzie, M., Partington, G., *Risk, asset pricing models and WACC*, June 2013, p. 14.

52 We observe the promised returns of debt issued by a sample of firms we consider comparable to a benchmark efficient entity based on the benchmark credit rating and term. In practice, we may overcompensate a benchmark efficient entity for these risks as we observe broad BBB debt whereas we consider a benchmark efficient entity would issue BBB+ debt.

53 Frontier, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013.

54 NER, cll. 6.5.2(c), 6A.6.2(c); NGR, r. 87(2)(3).

55 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, June 2013.

56 That is, gas, electricity, transmission and distribution service providers.

benchmark efficient entity.[57] For this analysis, see chapter three of the Guideline's explanatory statement.[58]

'Reference services'

The allowed rate of return is to be 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 to the provision of reference services.[59] As such, it is important to understand how the rules characterise 'reference services'.

The NGL defines a reference service as, 'a pipeline service specified by, or determined or approved by the AER under, the Rules'.[60]

Risk, regulation and a benchmark efficient entity

The rules specify that the allowed rate of return is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies:[61]

- to the service provider in which the decision relates
- in respect to the provision of reference services,[62].

As discussed under 'Risk' above, risk is the degree of uncertainty about an event.[63] For instance, investing in the share market is risky because there is a spread of possible outcomes. The usual measure of this spread is the standard deviation or variance.[64] Similarly, the risk of a benchmark efficient entity would be the uncertainty around its expected return. More specifically, the systematic or market risk of a benchmark efficient entity would be the uncertainty around its expected return relative to the expected returns on the market. We would measure this as the standardised

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57 As discussed under the above heading 'similar', compensable risk refers to risk that is to be compensated through the allowed rate of return.

58 AER, *Better regulation: Explanatory statement to the rate of return guideline*, December 2013, pp. 32–45.

59 See NER cl. 6A.6.2(c). Instead of 'prescribed transmission services', the distribution rules refer to 'standard control services' and the NGR refers to 'reference services'. See NER, cl. 6.5.2(c), NGR r. 87(3).

60 NGL, Chapter 1, Part 1 (2—Definitions)

61 See NER, cl. 6.5.2(c). Instead of 'standard control services', the transmission rules refer to 'prescribed transmission services' and the NGR refers to 'reference services'. See NER 6A.6.2(c), NGR 87(3). Also see section 2B of the NEL.

62 The NER defines standard control services as: 'a direct control service that is subject to a control mechanism based on a Distribution Network Service Provider's total revenue requirement'. Instead of 'standard control services', the transmission rules refer to 'prescribed transmission services' and the NGR refers to 'reference services'. See NER 6A.6.2(c), NGR 87(3). Also see section 2B of the NEL.

63 Bishop, S., Faff, R., Oliver, B., Twite, G., 'Corporate Finance', Ed. 5 Pearson Prentice Hall, 2004, p. 577.

64 Brealey, R., Myers, S., Partington, G., Robinson, D., 'Principles of corporate finance', 2007, The McGraw-Hill Companies Inc., 2007, p. 201.

correlation between a benchmark efficient entity's returns with that of the overall market (measured by the equity beta in the CAPM).[65]

Brealey et.al. use the figure we have presented as figure 3-1 to illustrate the following.[66]

> Investments A and B both have an expected return of 10%, but because investment A has the greater spread of possible returns, it is more risky than B. We can measure this spread by the standard deviation. Investment A has a standard deviation of 15%; B, 7.5%. Most investors would prefer B to A. Investments B and C both have the same standard deviation, but C offers a higher expected return. Most investors would prefer C to B.

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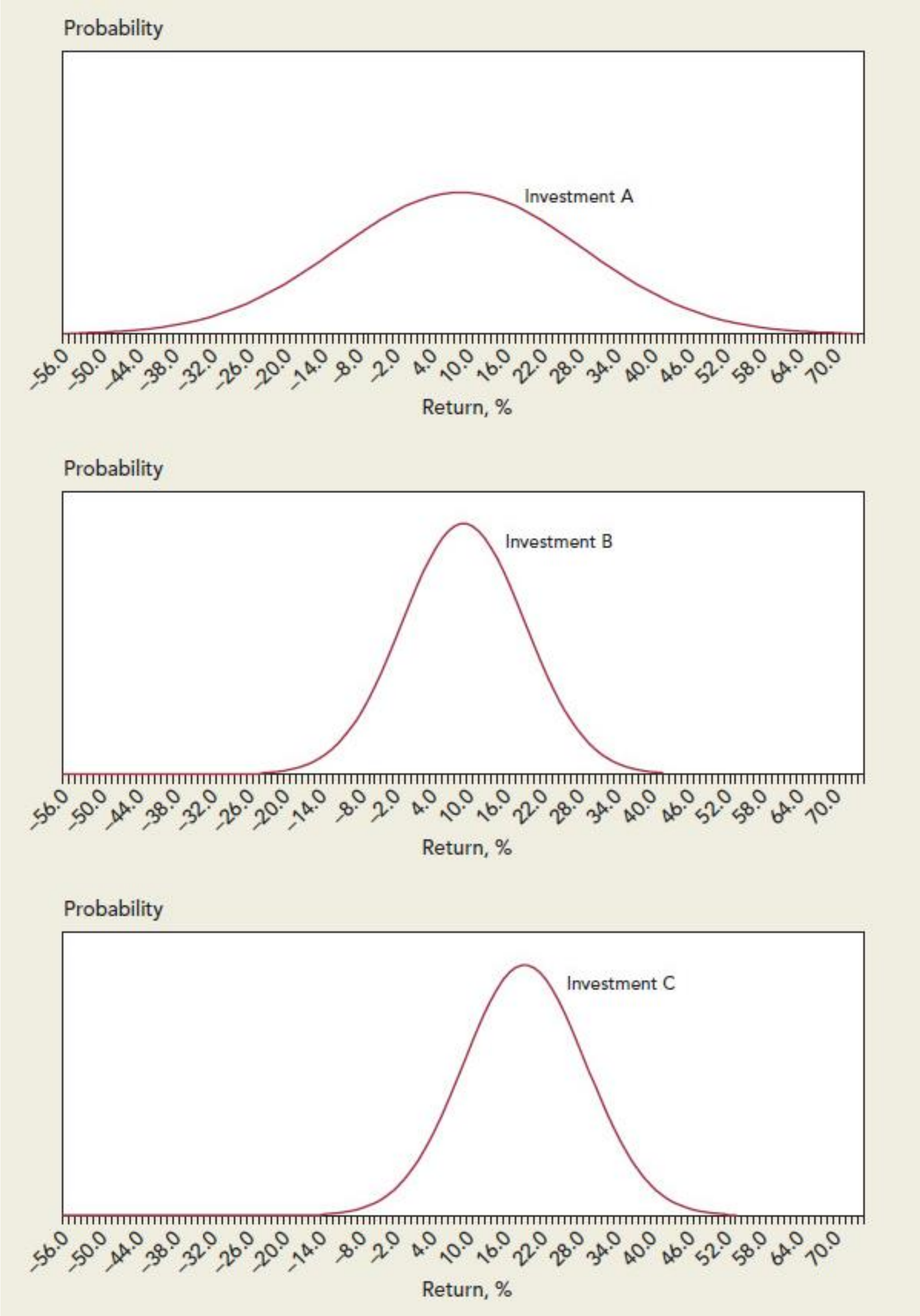
65 McKenzie, M., Partington, G., *Risk, asset pricing models and WACC*, June 2013, p. 21; Brealey, R., Myers, S., Partington, G., Robinson, D., 'Principles of corporate finance', 2007, The McGraw-Hill Companies Inc., 2007, p. 107.

66 Brealey, R., Myers, S., Allen, F., 'Principles of corporate finance', 2011, Ed. 10, McGraw-Hill Irwin, Figure 8.2, p. 187.

Figure 3-1 Risk versus expected return



Source: Brealey, Myers, Allen (2011), Figure 8.2.

We use the above example to explain the relationship between risk and return for a single investment. Investors are generally assumed to prefer an investment with a lower variance for a given expected return under the assumption that investors are risk averse. However, we note that for an investment that is to be included in an investment portfolio the risk that is relevant to its price is the risk it will add to this portfolio. Therefore, under the assumption that investors hold fully diversified 'efficient' market portfolios, it is an investment's non-diversifiable (or systematic) risk that is relevant. In the case of equity investments, as discussed above, this is measured by the equity beta of the investment.

We consider a benchmark efficient entity *with a similar degree of risk as that which applies to the service provider in the provision of its reference services* would be an entity, whether it is conceived as regulated or not, that has a similar degree of systematic risk as that which applies to APTPPL in the provision of its reference services. This is a change from the approach we took in our Guideline, in which stipulated a definition for what we considered to be a benchmark efficient entity. That definition included a characteristic of being regulated. Following the Full Federal Court decision, we have departed from adopting that definition in this decision. Nevertheless, in assessing the characteristics of a benchmark efficient entity, again in accordance with the Full Federal Court decision, we have relied upon some of the reasoning and analysis in our Guideline and explanatory statement, and past decisions, to assess what constitutes a similar degree of risk as that applying to APTPPL in the provision of its reference services.

To understand this better, it is essential to understand the relationship and distinction between risk and expected returns. All else being equal, we consider an entity providing unregulated services in a competitive market is likely to have a higher risk and more variable expected returns than a monopoly business such as APTPPL in its provision of reference services. This is because regulation:

- mitigates monopolies from being able to extract monopoly rents, thereby constraining potential profits
- increases the certainty of the revenue stream, thereby reducing risk.

For clarity, regulation of the kind embodied in the national electricity and gas legislation reduces both risks that are compensated through the rate of return (for example, demand risk) and risks that would not be compensated through the rate of return (for example, by allowing cost pass throughs for unsystematic risks such as industry-specific tax changes or geographic-specific natural disasters). We only focus on risks that are compensated through the rate of return (compensable risks).

Incentive regulation affects compensable risks by allowing service providers to earn more stable cash flows with periodic resets of revenues to better reflect actual expenditure. Most unregulated businesses do not have these same protections or restrictions, and so are likely to have a different systematic risk profile. We carefully considered this role when developing the Guideline when considering whether a benchmark efficient entity referred to in the context of the ARORO is likely to be regulated.[67] Frontier has also recognised the role of regulation in affecting risk in advising:[68]

> The form and nature of regulation applicable to Australian energy networks mitigates most of the business risks they face as compared to the business risks faced by other types of firms in the economy. Regulated revenues are set on a periodic basis and changes in volumes may only affect the timing of revenues (under a revenue cap). Even where revenues fall short of expectations due to lower volumes (as under a price cap), the lower volumes imply that costs would probably also have been lower than expected. Unanticipated or poorly-managed changes in costs are partly borne by customers and only partly by the network business through the building block form of incentive regulation that applies. Stranding and optimisation risks are minimal for energy networks, a complete contrast to businesses operating in other sectors.

Consumer Challenge Sub-Panel 3 (CCP3) also recognised this in highlighting the need to take into account the protections provided under the regulatory framework when making assessments about a benchmark efficient entity with a similar degree of risk as a service provider. These included risk reductions arising from:[69]

- a revenue cap, which removes volume risk
- the indexation of the RAB, which protects the value of the underlying assets even when they might otherwise be written down in a commercial environment
- the progressive transition to a 10-year trailing average, including annual updating of the return on debt.

Many of the risks that the regulatory regime affects are systematic and therefore affect the cost of capital (or rate of return). From being inherently less exposed to systematic risk, reference service providers have lower equity betas than if they were operating in a competitive market and therefore lower costs of equity. Also, given their lower risk cash flows, reference service providers might issue a higher proportion of debt than if they were operating in a competitive market. This reduces their cost of capital if debt is cheaper than equity, for example due to taxes or other market imperfections. As a result, we consider a benchmark efficient entity faces lower compensable risk than would otherwise be the case absent price regulation of reference services in a competitive market. As such, it would have a lower cost of capital.

Significantly then, when considering a benchmark efficient entity for APTPPL, in order to achieve the allowed rate of return objective, we must consider it has a similar degree

[67] AER: *Better regulation: Explanatory statement to the rate of return guideline*, December 2013, pp. 32–45.

[68] Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, p. 4.

[69] See CCP3, *Submission to the AER: An Overview — Response to AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for a revenue reset for the 2016-2020 regulatory period*, 22 February 2016, p. 31.

of risk as that which applies to the service provider in the provision of its reference services and account for these effects on systematic risk.

Some systematic risks that price regulation of the provision of reference services reduces include:

- Demand risk: the revenue or price setting mechanism mitigates demand risk. Under a price cap, service providers may mitigate the risk of forecast error by restructuring tariffs, such that higher fixed charges are set to offset falls in demand. Under a revenue cap, where forecast quantity demanded differs from actual quantity demanded, service providers are made whole for any variation through price adjustments in subsequent years..
- Inflation risk: service providers of reference services face less inflation risk than unregulated businesses. Under the regulatory framework, they effectively expect to receive a real return on their investments in their RABs.
- Interest rate risk: Both providers of reference services and firms operating in competitive markets are exposed to interest rate risk. The regulatory framework effectively moves risk of interest rate movements impacting financing costs onto customers. Where service providers raise capital during the averaging period/s that they know in advance they can further limit their exposure to this risk. To the extent they are unable to raise capital over the averaging period/s, they can still materially reduce their exposure to interest rate risk by hedging the base rate.

Table 3-3 summarises a selection of provisions in the rules that have the effect of mitigating various systematic and non-systematic risks.

Table 3-3: Key clauses in the rules that mitigate systematic risk

Rule	Effect on risk
50	The term of each access arrangement period is a fixed duration, and generally five years, in which a service provider is provided with a regulated return on its assets in respect to the provision of its reference services, certainty about reference tariffs and fixed terms of access for its services, supported by arbitration.
92	A reference tariff variation mechanism accounts for indexation and annual increases in efficient input costs. The reference tariff variation can be used to smooth the reference tariff from year to year to provide service providers with a stable level of revenue over each access arrangement period, reducing risks of short term revenue and pricing volatility.
97(5)	The prices service providers may charge for reference services are certain. Reference tariffs are not to vary during the course of an access arrangement period except as provided by a reference tariff variation mechanism.
76, 77, 78,87(1), 90	The AER's determination of reference tariffs incorporates a return on and of the service provider's asset base. The historical asset base rolls forward from one access arrangement period to the next and from year to year within each access arrangement period. The NGR provides for recovery of historical asset costs through depreciation, the earning of a return on the asset base, indexation and recovery of future efficient capex. This substantially lessens risks in capital investment that might otherwise apply to a business operating in a workably competitive market.
87	The AER sets the rate of return on the asset base by reference to the risks faced by the service provider. The AER updates this each access arrangement period to account for changed market conditions.

87A	Provision for tax in determining total revenue is required regardless of whether the service provider pays tax.
79, 91	The AER assesses expenditure requirements for each service provider by reference to the amount necessary to meet standards and objectives. These include the need to meet the expected demand for services and to meet safety and integrity standards and regulatory obligations or requirements. The AER does not assess expenditure by reference to the capacity of consumers to pay. This removes risks that could otherwise arise in providing a reliable and safe service. The AER reassesses the requirements of service providers for each access arrangement period to account for changes in market conditions and trends.
97 (1)(c)	Allows service providers to pass through certain costs to consumers in circumstances where this might not be possible in a workably competitive market. For instance, the pass through provisions provide for a pass through of costs that arise through regulatory changes.
80-86, and 103-104	Includes provisions for appropriate planning which allow for greater certainty to deal with changes in the commercial environment, including provisions for dealing with the funding of new projects during an access arrangement period, and the treatment of extensions and expansions and customer access queuing.
Parts 19-21	Provides for a statutory billing and settlements framework with prudential requirements (and other similar provisions) to minimise financial risk associated with providing and charging for services. There is also provision for dealing with potential risks associated with retailer insolvency.

Source: NGR, AER analysis.

Outcomes of a workably competitive market

For clarity, we consider the regulatory regime should seek to replicate the outcomes of a workably competitive market to the extent possible (notwithstanding that this is not an explicit requirement of the rules nor the NEL/NGL). We consider that this would entail replicating (to the extent possible while achieving the objectives of regulation) outcomes that a workably competitive market would theoretically produce with respect to efficiency and the resulting prices and service levels.[70] Incentive regulation aims to replicate these outcomes where competition is not available to achieve this. We are in an environment where competition is not viable as energy network service providers are natural monopolies. Consistent with economic theory, 'the essence of natural monopoly is that there are increasing returns in production and that the level of demand is such that only a single firm can be profitable'.[71]

70 The basis for desiring a competitive market outcome in microeconomic theory stems from the theorems that a competitive equilibrium is Pareto-efficient and any Pareto-efficient allocation can be decentralised as a competitive equilibrium. This is where, in microeconomic theory, a 'competitive market equilibrium' is where firms' maximise their profits, consumers maximise their utilities and the market clears (there is no waste or undersupply). See Mas-Colell, A., Whinston, M.D., Green, J.R., *Microeconomic theory*, Oxford University Press, 2006, p. 314. It is worth noting that these theorems are derived from strong assumptions including an absence of externalities and market power, price taking behaviour and symmetric information. See for example Varian, H.R., *Intermediate micro economics: A modern approach*, ed. 7, W.W. Norton &Company, 1987, pp. 585; Hindriks, J., Myles, G.D., *Intermediate public economics*, The MIT Press, 2006, pp. 12–13.

71 Hindriks, J., Myles, G.D., *Intermediate public economics*, The MIT Press, 2006, p. 232.

Incentive regulation aims to replicate workably competitive market outcomes by:

- Constraining monopoly rents by seeking for customers to only pay for efficient costs of providing the service.
- Incentivising service providers to operate efficiently.

Applying the first point to the allowed rate of return, the allowed rate of return should be consistent with the efficient financing cost of providing reference services.[72] This means it should be consistent with the efficient financing costs of debt and equity capital combined at the efficient gearing ratio that is required to provide the reference services. As we discuss above and in section 3.4.1 and 3.4.2, we consider the current (or prevailing) costs of equity and debt (which when weighted appropriately represent the weighted average cost of capital) to be the efficient financing costs. Prevailing market rates for capital finance are expected to be competitive.[73] Prevailing market rates also represent the costs that other service providers will face to enter the market.[74]

Applying the second point to the allowed rate of return, we encourage services providers to operate efficiently by setting an allowed rate of return that:

- Does not distort investment decisions. This differs from cost of service regulation, which entails compensating service providers for their actual costs no matter how inefficient.
- Is consistent with the expected return in the competitive capital market (determined by demand and supply) for an investment of similar degree of risk as a service provider supplying reference services.
- Incentivises service providers to seek the lowest cost financing (all else being equal).

Promoting an efficient competitive outcome would not necessarily entail assuming a benchmark efficient entity would conduct all of its activities as we would imagine an unregulated firm would. We must consider, after all, that our benchmark entity is 'efficient' in the context of the national electricity objective. It is investing efficiently, incurring costs efficiently, charging prices that are efficient, in a system where the use and provision of services is efficient and it earns an efficient return. As Partington and Satchell advise, an unregulated benchmark with monopoly power is not appropriate because, 'if the benchmark entity is an unregulated firm which has monopoly power, then it will be extracting economic rents'.[75] It will not be a benchmark 'efficient' entity. An unregulated monopoly service provider would therefore be unlikely to have the

[72] That is, standard control services as referred to in NER, cl. 6.5.2(c), prescribed transmission services as referred to in NER, cl. 6A.6.2(c), or 'reference services' as referred to in NGR, r. 87(3).

[73] Kahn, A.E., 'The economics of regulation: Principles and institutions', The MIT Press, Massachusetts, 1988, p. 45.

[74] In a competitive market, prices are theoretically constrained by entry or the threat of entry. See HoustonKemp, *Memo: Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 1. This is also implied in Chairmont, *Cost of debt comparative analysis*, November 2013, p. 4.

[75] Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 49.

characteristics of a benchmark efficient entity with a similar degree of risk as a service provider in the provision of its reference services.

3.3.4 Return on debt factors in the rules

The rules require that we must have regard to the following factors in estimating the return on debt:[76]

- The desirability of minimising any difference between the return on debt and the return on debt of a benchmark efficient entity referred to in the ARORO.[77] We understand this factor to mean the difference between the return on debt allowance and the cost of debt a benchmark efficient entity would incur in order to finance efficient investment in its regulated capital (i.e. regulated network) over the access arrangement period. For clarity, we do not consider this factor relates specifically to minimising the difference between the return on debt allowance and the actual cost of debt incurred by an actual service provider. The actual cost of debt of an actual service provider is relevant only to the extent it reflects the cost of debt incurred by a benchmark efficient entity having the relevant degree of risk.
- The interrelationship between the return on equity and the return on debt.[78]
- The incentives that the return on debt may provide in relation to capital expenditure over the regulatory control period, including as to the timing of any capital expenditure.[79]
- Any impacts (including in relation to the costs of servicing debt across regulatory control periods) on a benchmark efficient entity referred to in the ARORO that could arise as a result of changing the methodology that is used to estimate the return on debt from one regulatory control period to the next.[80]

We have taken each of these factors into account in reaching a decision about how to estimate the return on debt so that it will contribute to achieving the ARORO. Different options have different relative advantages and disadvantages. The AER has had regard to the revenue and pricing principles in assessing those advantages and disadvantages, with the goal of achieving both the ARORO and the NGO.

The options we have considered include:

1. The on-the-day approach

2. A combination of the on the day approach and a trailing average that is totally forward looking

76 NER, cl. 6.5.2(k) and cl. 6A.6.2(k); NGR, r.87(11).
77 NER, cl.6.5.2(k)(1) and cl.6A.6.2(k)(1); NGR, r.87(11)(a).
78 NER, cl.6.5.2(k)(2) and cl.6A.6.2(k)(2); NGR, r.87(11)(b).
79 NER, cl.6.5.2(k)(3) and cl.6A.6.2(k)(3); NGR, r.87(11)(c).
80 NER, cl.6.5.2(k)(4) and cl.6A.6.2(k)(4); NGR, r.87(11)(d).

3. A combination of the on the day approach and a trailing average that would be set partially based on historical costs

4. A trailing average of historical costs

We consider the on the day approach will meet the ARORO. Importantly, it best reflects the interrelationship between the return on debt and the return on equity (one of the factors we must have regard to). It provides for the cost of capital as a whole to be set at a prevailing rate, or the opportunity cost of capital in the market at the time of the decision. In this sense, it is the classic method for measuring the cost of capital. As the return on capital is set at the opportunity cost of capital investment decisions are not distorted. It provides effective incentives for investment and capital expenditure over the coming regulatory control period. It does not result in any impacts that might result from a change in methodology.

There is arguably however, some difference between the return on debt we estimate and the return on debt of a benchmark efficient entity with a similar degree of risk to APTPPL in the provision of its reference services, when adopting the on the day approach.

Options that are based on either the trailing average approach, or a combination of the on the day approach and a trailing average, help to minimise those differences. However, they potentially distort the relationship between the return on equity and the return on debt. They may also provide the wrong or ineffective incentives to promote efficient investment.

We also note that while all of these factors are potentially relevant, none of these factors override the requirements that the return on debt contributes to the achievement of the ARORO and that our decision contributes to the achievement of the NGO. For example, while we must consider the desirability of minimising mismatches but any such desirability must be seen in the context of the NGO, RPPs and ARORO. While we must consider impacts resulting from a change in methodology, we must ultimately set a return on debt that meets the ARORO, the NGO and has regard to the RPPs.

We accept that there is some desirability in changing methodology and moving to a trailing average approach. We consider that it is necessary to transition to that new methodology in order to meet the legislative requirements. Our transition between the two methodologies is 'revenue neutral' in a present value sense. It promotes efficient investment in new capital expenditure in future years without an incentive for either over or under investment. We note that it also restricts 'wealth transfer'[81] flowing between a benchmark entity and its consumers because of the change in methodology. This mitigates any impacts on a benchmark efficient entity that could

81 See Partington, G., Satchel, S., *Report to the AER: Discussion on the allowed cost of debt*, 5 May 2016, pp. 41, 52.

arise as a result of changing the methodology that is used to estimate the return on debt from one regulatory control period to the next.

If we change our method for estimating the return on debt without a transition, this would change the allowed return on capital cash flows relative to a continuation of the current (on-the-day) approach. This would change the present value of a benchmark efficient entity (which is based on the present value of these expected future cash flows), and this change would only arise due to a change in methodology. Changing the value of a benchmark efficient entity would only contribute to the achievement of the ARORO if it would be compensated inconsistently with its efficient financing costs and thereby would be under- or over-valued under the continuation of the current (on-the-day) methodology. There is no evidence before us to indicate the on-the-day approach would have, or would continue to, under- or over-value a benchmark efficient entity. Rather, we consider the on-the-day approach contributes to the achievement of the ARORO. This is because the use of the prevailing cost of capital for the allowed rate of return will result in the provision of the efficient opportunity cost of capital in the market. This will result in the benchmark efficient entity being correctly valued on its return on capital cash flows at the value of its regulated asset base. This means the on the day methodology would not have, nor would it continue to, under- or over-value a benchmark efficient entity. Rather, it will set an allowed return that results in the benchmark efficient entity being correctly valued and meets the ARORO and NEO. On this basis, we consider any transition must be revenue neutral relative to the continuation of the on-the-day methodology.

As noted earlier in this decision, we have considered the Full Federal Court decision handed down on 24 May 2017. Given that the reasons in this decision on debt transition differ from those in our NSW and ACT decisions, we consider our decision to apply a full (or reneue neutral) transition is not inconsistent with the Full Federal Court Decision.

Our reasoning in this decision for APTPPL (consistent with our reasoning in all decisions released post 2015) makes clear we consider past financing practices are largely neither relevant nor appropriate to our consideration of efficient financing costs of a benchmark efficient entity with a similar degree of risk as APTPPL in the provision of its reference services. Efficient financing costs must be seen in the context of the ex ante (or forward looking) nature of the regulatory scheme.[82]

We consider a full transition is required to meet the ARORO because we consider current debt costs in the market reflect efficient financing costs and we consider correct compensation in a present value sense (or an allowance that meets the NPV = 0 condition) is required to meeting the ARORO and to achieve the National Gas Objective. In reaching this conclusion we consider it important to note that

82 As noted in section 3.4.3 and 3.4.2, the only place we use observed past financing practices to determine efficient financing costs of the benchmark efficient entity is with respect to estimating the efficient gearing ratio, credit rating and term to maturity of debt for the benchmark efficient entity. However, these parameters are used in the estimation of the ex ante efficient financing costs of the benchmark efficient entity.

implementing the trailing average with anything other than a full (or revenue neutral) transition will not result in future expected cash flows with a present value equal to the regulatory asset base (i.e. the NPV = 0 condition will not be met) and investment will therefore be distorted. This is a critical factor. We consider a change in methodology that results in not meeting the NPV = 0 condition would not be consistent with the NGO, or indeed the underlining basis of the regulatory scheme set up under the NGL.

Further, the rules require that if the return on debt methodology results in an estimate that is, or could be, different for different regulatory years, then the resulting change to the service provider's total revenue must be effected through the automatic application of a formula that is specified in the decision for that regulatory control period.[83] We address this in our section on debt implementation.

3.3.5 Rate of return Guideline

This section sets out the role and key elements of the Guideline. The explanatory statement (and appendices) to the Guideline explain our proposed approach in detail which we adopt for this section.[84]

Role of the Guideline

Our task is to estimate an allowed rate of return that achieves the ARORO rather than to merely apply the Guideline. Nevertheless, the Guideline has a significant role because any decision to depart from the Guideline must be a reasoned decision.[85] Similarly, service providers must provide reasons for any proposed departures from the Guideline.[86] In practice, we have considered submissions on the rate of return made during this determination process anew so that we are satisfied that our estimate of the rate of return achieves the ARORO. Where we receive no new material or there is no reason to change our Guideline approach, we maintain our view and reasons set out in the Guideline.

Further, whilst the legislative framework allows us to depart from the Guideline, we would not do so lightly. This is because departing from it may undermine the certainty and predictability that stakeholders have said they value.[87] However, we would depart from the Guideline if we are satisfied that doing so would result in an outcome that better achieves the ARORO. We consider our approach is consistent with the AEMC's

[83] NER cl. 6.5.2(l) and cl. 6A.6.2(l), NGR, r. 87(12).

[84] The full suite of documents associated with the guideline including the explanatory statements, relevant appendices and expert reports are available at http://www.aer.gov.au/node/18859.

[85] NGR, cl. 87(18); NER, cl. 6.2.8(c); NER, cl.6A.2.3(c).

[86] NER, cll. S6.1.3(9),(9A),(9B); NER, cll.S6A.1.3.(4A), (4b), (4c); NGR r.72(1)(g)

[87] A group of investors and ENA again raised the importance of certainty in Financial Investors Group, *Submission on AER's equity beta issues paper*, 29 October 2013; ENA, *Response to the Draft Rate of Return Guideline of the AER*, 11 October 2013, p. 1.

view that, 'the regulator would, in practice, be expected to follow the guidelines unless there had been some genuine change in the evidence'.[88]

Consistent with the rules, we published the Guideline setting out the estimation methods, financial models, market data and other evidence that we propose to take into account in estimating the allowed return on equity, allowed return on debt and the value of imputation tax credits.[89] The Guideline specifies:[90]

- the methodologies we propose to use to estimate the allowed rate of return (derived from the allowed return on equity and debt) for electricity and gas network businesses
- the method we propose to use to estimate the value of imputation tax credits used to establish a benchmark corporate income tax allowance (see attachment on the value of imputation credits)
- how these methods will result in an allowed return on equity and return on debt which we are satisfied achieves the ARORO.

Due to this, the Guideline provides transparency and predictability for service providers, users and investors as to how we consider changes in market circumstances and make decisions. At the same time, it allows sufficient flexibility for us to account for changing market conditions at the time of each regulatory determination or access arrangement.

In developing the Guideline, we also undertook an extensive consultation process that resulted in addressing the relevant issues. We summarised this consultation process in several recent decisions.[91] Details of the Guideline development process are also on our website.[92]

Key elements of the Guideline

The Guideline provides transparency on how we propose to estimate key components of the allowed rate of return. We summarise these below. We note we have now departed from the Guideline in that we no longer define the benchmark efficient entity as regulated. Rather, we consider the benchmark efficient entity now faces a similar degree of risk as the service provider in the provision of its reference services. Changes to this effect are explained in brackets (now…) in the sections below.

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88 AEMC, *Final Position Paper, National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, 15 November 2012, p. 28.

89 NER, cl. 6..5.2 (n)(2); NER, cl. 6A.6.2(n)(2); NGR, cl. 87(14)(b). See http://www.aer.gov.au/node/18859.

90 NER, cl. 6.5.2 (n), NER, cl. 6A.6.2(n); NGR, cl. 87(14).

91 For example, see AER, *Final decision: Energex determination 2015–16 to 2019–20, Attachment 3—Rate of return*, October 2015, pp. 22–24.

92 The full suite of documents associated with the Guideline including the explanatory statements, relevant appendices and expert reports are available at http://www.aer.gov.au/node/18859.

Application of criteria for assessing information

We developed a number of criteria and applied these to inform our regulatory judgement when evaluating material put before us. The criteria are subordinate to the law, the rules and especially the ARORO. We developed them to provide stakeholders greater certainty as to how we intend to exercise our regulatory judgement whilst keeping sufficient flexibility to make decisions consistent with changing market conditions.[93]

We proposed to apply assessment criteria to guide our selection and use of estimation methods, models, market data and other evidence which inform our assessment of the overall rate of return. Not all the various estimation methods, financial models, market data and other evidence (information) will be of equal value in determining the rate of return by reference to a benchmark efficient entity with a similar degree of risk to the service provider in relation to the provision of its regulated (now reference) services. For example, some information may be more relevant, more feasible to construct, or more reliable than others. We considered that our decisions on the rate of return are more likely to contribute to the achievement of the ARORO because we use estimation methods, financial models, market data and other evidence that are:

(1) where applicable, reflective of economic and finance principles and market information

- (a) estimation methods and financial models are consistent with well accepted economic and finance principles and informed by sound empirical analysis and robust data

(2) fit for purpose

- (a) the use of estimation methods, financial models, market data and other evidence should be consistent with the original purpose for which it was compiled and have regard to the limitations of that purpose
- (b) promote simple over complex approaches where appropriate

(3) implemented in accordance with good practice

- (a) supported by robust, transparent and replicable analysis that is derived from available credible datasets

(4) where models of the return on equity and debt are used these are

- (a) based on quantitative modelling that is sufficiently robust as to not be unduly sensitive to errors in inputs estimation
- (b) based on quantitative modelling which avoids arbitrary filtering or adjustment of data, which does not have a sound rationale

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93 See AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, ch.2.

(5) where market data and other information is used, this information is

 (a) credible and verifiable

 (b) comparable and timely

 (c) clearly sourced

(6) sufficiently flexible as to allow changing market conditions and new information to be reflected in regulatory outcomes, as appropriate.

We applied these criteria in this decision to guide us in deciding on the merits of the material before us and the best place to employ the material (if at all).

Benchmark efficient entity

We generally see a benchmark efficient entity with a similar degree of risk as that applying to the service provider in respect of the provision of reference services as being 'a pure play energy network business operating within Australia' in the provision of regulated (now reference) services. We say 'generally' because these characteristics are set out for guidance. They are not applied as if amounting to a fixed rule. This includes the following components which we think assist in informing us about relevant benchmarks with a similar degree of risk to the service provider in the provision of regulated (now reference) services:[94]

- Pure play: An entity that offers services focused in one industry or product area. In this context, the industry is energy network services and, in particular the services are regulated energy network services (now services the provision of which carries a similar degree of risk as the service provider faces in the provision of its reference services)..
- Energy network business: Energy network refers to a gas distribution, gas transmission, electricity distribution or electricity transmission business.
- Operating in Australia: An entity operating within Australia as the location of a business determines the conditions under which the business operates. This includes the regulatory regime, tax laws, industry structure and broader economic environment.
- In the provision of regulated services (now in the provision of services where the provider faces a similar degree of risk as the service provider faces in the provision if its reference services): A service that is subject to economic regulation (that is, revenue or price cap regulation) that makes it comparable for the purposes of assessing risk in the provision of regulated (now reference) services. Comparable risk is an important component of the ARORO.

[94] See AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, ch.3; AER, *Better regulation: Rate of Return Guideline,* December 2013, section 3.

In response to the recent Full Federal Court decisions, we no longer define the benchmark efficient entity to be regulated and have departed from the Guideline in following the Federal Court Decision on this point. In following the Full Federal Court decision, we note that the benchmark efficient entity has a similar degree of risk as the service provider in the provision of its reference services. We apply this as follows:

- We consider the ARORO requires us to set the components of the allowed rate of return (the return on debt and the return on equity) equal to the ex ante efficient financing costs (of debt and equity) for a benchmark efficient entity with a similar degree or risk as APTPPL in the provision of its reference services.
- we benchmark the required return on capital of the benchmark efficient entity through benchmarking the inputs to its calculation (the required return on debt, required return on equity and gearing ratio) given the risk of the service provider in the provision of its reference services;

Gearing

We base the weight to give to the point estimates of the return on equity and the return on debt to derive the overall rate of return on our gearing ratio point estimate of 60 per cent. We give 60 per cent weight to debt and 40 per cent to equity.[95]

Return on equity

We estimate the allowed return on equity using the six steps set out in the flow chart in figure 3-2. For the reasons for adopting this process, see the documents and submissions considered during the different stages of developing the Guideline. These include our issues paper and consultation paper and draft and final explanatory statements to the Guideline.[96]

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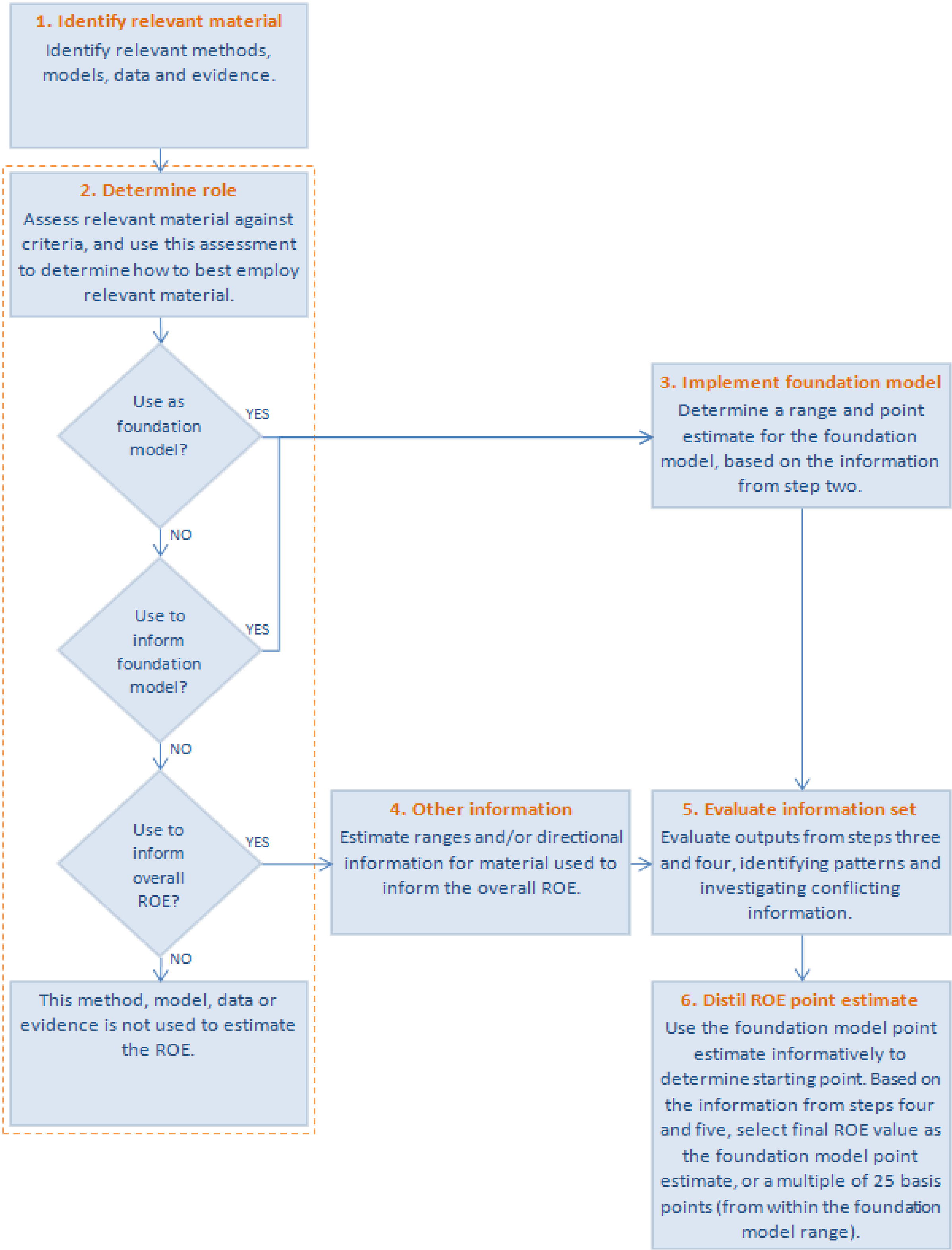
95 See AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, Appendix F.

96 Available at, http://www.aer.gov.au/node/18859.

Figure 3-2 Flowchart of the AER's proposed approach to estimating the allowed return on equity



Return on debt

We:

- estimate a return on debt using the on-the-day approach (that is, based on prevailing market conditions near the commencement of the regulatory control period) in 2017 of the 2017–22 regulatory control period, and
- gradually transition this approach into a trailing average (that is, a moving historical average) over 10 years by annually updating 10 per cent of the return on debt to reflect prevailing market conditions in that year.[97]

We also proposed to estimate the return on debt in each regulatory year by reference to:

- a benchmark credit rating of BBB+
- a benchmark term of debt of 10 years
- independent third party data series—specifically, a simple average of the broad BBB rated debt data series published by the RBA and Bloomberg, adjusted to reflect a 10 year estimate and other adjustments[98]
- an averaging period for each regulatory year of between 10 business days and 12 months (nominated by the service provider), with that period being as close as practical to the start of each regulatory year and also consistent with other conditions that we proposed in the Guideline.[99]

Mid period WACC adjustment

We annually update the overall rate of return estimate because we are required to update the return on debt annually.[100] We recently published amendments to the transmission and distribution post tax revenue model (PTRM) to enable applying annual updates.[101]

3.3.6 Interrelationships

[97] This draft decision determines the return on debt methodology for the 2017–22 period. This period covers the first five years of the 10 year transition period. This decision also sets out our intended return on debt methodology for the remaining six years. However, we do not have the power to determine in this decision the return on debt methodology for those years. Under the NGR, the return on debt methodology must be determined in future decisions that relate to that period.

[98] In the Guideline, we proposed to use one or more third party data series to estimate of the return on debt. However, at that time we had not formed a view on which data series to use. We form our view following a separate consultative process. This consultative process started with the release of an issues paper in April 2014. We do not propose estimating the return on debt by reference to the Reuters curve that was first proposed in the recent revised proposals. However, we will consider using this new source of information in future determinations following a proper period of consultation.

[99] AER, *Rate of return guideline*, December 2013, pp. 21–22; AER, *Explanatory statement—Rate of return guideline*, December 2013, p. 126.

[100] NER, cl. 6.5.2(i); NER, cl. 6A.6.2(i); NGR r. 87(9).

[101] Available at http://www.aer.gov.au/node/27616.

In determining the allowed rate of return, we must have regard to any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.[102] In this section, we discuss the key interrelationships in our rate of return decision. The Guideline also describes these interrelationships in detail where we have had regard to them in developing our approach. The manner in which we consider these interrelationships is also set out as part of our reasoning and analysis in appendices to this attachment.

We estimate a rate of return for a benchmark efficient entity which is then applied to a specific service provider, rather than determining the returns of a specific service provider based on all of its specific circumstances.[103] This is the same whether estimating the return on equity or return on debt as separate components. We set a rate of return that is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as the service provider in respect of the provision of reference services. This provides a reasonable opportunity to recover at least the efficient financing costs of providing those services.[104] The service providers' actual returns could differ from those of a benchmark entity depending on how efficiently it operates its business. This is consistent with incentive regulation. That is, our rate of return approach drives efficient outcomes by creating the correct incentive by requiring service providers to retain (fund) any additional income (costs) by outperforming (underperforming) the efficient benchmark.[105]

We apply a benchmark approach and an incentive regulatory framework. One should not view any component or relevant parameter adopted for estimating the rate of return in isolation. In developing our approach and implementing it to derive the overall rate of return we are cognisant of a number of interrelationships relating to the estimation of the return on equity and debt and underlying input parameters.

A benchmark

We note in response to the recently handed down Full Federal Court decisions that we do not consider there is by definition a single benchmark efficient entity. We acknowledge the benchmark efficient entity for a given firm may change depending on its risk in providing its reference services. However, we consider the risk of the five regulated businesses we are currently releasing decisions for are sufficiently similar in the provision of their reference services to warrant the same WACC input risk parameters being used across decisions (i.e. the same equity beta, credit rating, debt maturity term, and gearing ratio). That is, we consider our current benchmark will me the ARORO and NGO for all five businesses we are releasing decisions for. In deciding on a benchmark we considered the different types of risks and different risk drivers that may have the potential to lead to different risk exposures for different businesses in the provision of their services. We also noted that the rate of return

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[102] NER, cl. 6.5.2(e); NER, cl. 6A.6.2(e); NGR r. 87(9).
[103] See AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, ch. 3.
[104] NEL, s. 7A(2); NGL s. 24(2)(a).
[105] NEL, s. 7A(3); NGL s. 24(2)(b).

compensates investors only for non–diversifiable risks (systematic risks) while other types of risks are compensated via cash flows and some may not be appropriately compensated at all.[106] These interrelationships between the types of risk and the required compensation via the rate of return are an important factor.[107] Our view is that a benchmark efficient entity would face a similar degree of risk to each of the service providers irrespective of the:

- energy type (gas or electricity)
- network type (distribution or transmission)
- ownership type (government or private)
- size of the service provider (big or small).

Domestic market

We generally consider that the Australian market is the market within which a benchmark efficient entity for APTPPL operates, and this is appropriate to make it properly comparable in degree of risk to APTPPL. This recognises that the location of a business determines the conditions under which the business operates and these include the regulatory regime, tax laws, industry structure and broader economic environment. As most of these conditions will be different from those prevailing for overseas entities, the risk profile of overseas entities is likely to differ from those within Australia. Consequently, the returns required are also likely to differ. Hence, when estimating input parameters for the Sharpe-Lintner CAPM we place most reliance on Australian market data whilst using overseas data informatively.

Benchmark gearing

We apply a benchmark efficient level of gearing of 60 per cent, as noted above. This benchmark gearing level is used:

- to weight the allowed return on debt and equity to derive the overall allowed rate of return using the WACC formula
- to re-lever asset betas for the purposes of comparing the levels of systematic risk across businesses which is relevant for the equity beta estimate.

We adopt a benchmark credit rating which is BBB+ or its equivalent for the purposes of estimating the return on debt. To derive this benchmark rating and the gearing ratio, we reviewed a sample of regulated network providers (including providers of reference services). Amongst a number of other factors, a regulated service provider's actual gearing levels have a direct relationship to its credit ratings. Hence, our findings on the benchmark gearing ratio of 60 per cent and the benchmark credit rating are interrelated

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106 See AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, p. 33.

107 See AER, *Better regulation: Rate of return guideline explanatory statement,* December 2013, ch.3.3

given we derive the underlying evidence from a sample of regulated network service providers (including providers of reference services).[108]

Term of the rate of return

We adopt a 10 year term for our overall rate of return.[109] This results in the following economic interdependencies that impact on the implementation of our return on equity and debt estimation methods:

- the risk free rate used for estimating the return on equity is a 10 year forward looking rate
- the market risk premium (MRP) estimate is for a 10 year forward looking period
- we adopt a 10 year debt term for estimating the return on debt.

3.3.7 Consideration of relevant material

In making regulatory decisions, we are to have regard to information provided in regulatory proposals and submissions.[110] We also consider a broad range of material more generally. This is consistent with the rate of return framework that requires we have regard to a wide range of relevant estimation methods, financial models, market data and other evidence.[111] This is also consistent with statements of the AEMC that consider the rules are intended to permit us to take account of a broad range of information to improve the required rate of return estimate.[112]

In the following sections, we summarise how we have considered a large range of material. This includes, but is not limited to:

- service provider proposals
- expert reports
- stakeholder submissions
- recent Tribunal decisions.

Service providers' proposals

We observe two different approaches in service providers' proposals for the return on equity. AGN fully adopt the Guideline foundation model approach (that is, for all

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108 AER, *Better Regulation, Rate of return guideline explanatory statement*, December 2013, ch.8.34 and appendix F.

109 See AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, ch.4.3.4.

110 NER, cl. 6.11.1(b); NER, cl. 6A.13.1(a1). NGR, cl. 59(1), 62(1) states we are to consider submissions before making our regulatory decisions. NGR, cl, 64(2) states that our proposal for an access arrangement or revisions is to be formulated with regard to the service providers proposal (among other things).

111 NGR, r. 87(5)(a) and NER clause 6.5.2(e).

112 AEMC, *Rule determination: National electricity amendment (Economic regulation of network service providers) Rule 2012: National gas amendment (Price and revenue regulation of gas services) Rule 2012*, 29 November 2012, p. 67 (AEMC, *Final rule change determination*, November 2012).

parameters) in its regulatory proposal.[113] APA, AusNet, Multinet and APTPPL in their proposals,[114] claim reliance on our Guideline for estimating the return on equity. While they have departed from the multi-model approach proposed in previous regulatory determinations, they continue to challenge key aspects of the Guideline approach (and methods) to estimating the return on equity.[115] We have reviewed the material submitted and considered the reasons for the proposed departures from the Guideline. We have taken into account stakeholder submissions on our decisions, and on service providers' revised and initial proposals.

In doing so, we have undertaken two interdependent tasks as required by the rules:

- consider whether the proposed departures would better achieve the ARORO such that we should depart from the Guideline
- determine a rate of return that we are satisfied achieves the ARORO.

APA, AusNet, Multinet and APTPPL submitted a large volume of material in support of their proposals. We reviewed this and considered its implications in determining the return that meets the ARORO and whether we should depart from the Guideline. We also referred material to our consultants for their consideration prior to making our preliminary/draft and final decisions. Our considerations are set out throughout this rate of return attachment and relevant appendices.

While we consider each regulatory proposal afresh, much of the material currently before us is the same material we have considered in making our various decisions since 2015.[116]

For this decision, unless stated otherwise, we have built on the rate of return analysis and reasoning as set out in our recent decisions on rate return since 2015. These earlier decisions are still relevant to understanding the changes in approaches that

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113 AGN, Final Plan Attachment 10.1 Financing Costs, December 2016, p. 5.

114 AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016; APA VTS, *Victorian transmission system access arrangement submission*, 3 January 2017; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016; AGN, F*inal Plan Attachment 10.1: Financing Costs*, December 2016

115 AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016; APA VTS, *Victorian transmission system access arrangement submission*, 3 January 2017; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016; AGN, F*inal Plan Attachment 10.1: Financing Costs*, December 2016, Multinet, *Rate of Return Overview*, 16 December 2016

116 For material on an April 2015 decision (TransGrid), see https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/transgrid-determination-2014-18. For material on an October 2015 decision (Energex), see https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/energex-determination-2015-2020/final-decision. For similar material, see our decisions in 2015 on ActewAGL distribution, Ausgrid, Directlink, Endeavour Energy, Ergon Energy, Essential Energy, JGN, SAPN and TasNetworks. For 2016, see our decisions on AusNet Services (SP AusNet) distribution, Powercor, Jemena, CitiPower, and United Energy.

have been proposed by different service providers and stakeholders, and how our analysis and reasoning has developed.[117]

Expert reports

We commissioned expert advice from the following finance experts to assist us in making our decisions:

- Professor Michael McKenzie, University of Liverpool.[118]
- Professor Stephen Satchell, Trinity College, Cambridge University[119]
- Associate professor Graham Partington, University of Sydney.[120]
- Associate professor John Handley, University of Melbourne.[121]
- Dr Martin Lally, Capital Financial Consultants.[122]
- Chairmont, a financial market practitioner.[123]

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117 AER, *Final decision: United Energy determination 2016–20, Attachment 3—Rate of return*, May 2016; AER, *Final decision: AusNet Services 2016–20, Attachment 3—Rate of return*, May 2016; AER, *Final decision: Powercor determination 2016–20, Attachment 3—Rate of return*, May 2016; AER, *Final decision: Jemena determination 2016–20, Attachment 3—Rate of return*, May 2016; AER, *Final decision: CitiPower determination 2016–20, Attachment 3—Rate of return*, May 2016. Also see our final decisions on SA Power Networks, Ergon Energy and Energex; AER, *Final decision: AusNet, Attachment 3—Rate of return*, April 2017; AER, *Final decision: TasNetworks, Attachment 3—Rate of return*, April 2017; AER, *Final decision: Powerlink, Attachment 3—Rate of return*, April 2017

118 McKenzie, M., Partington, G., *Report to the AER Part A: Return on Equity*, October 2014.

119 Partington, G., Satchell, S., *Report to the AER: Discussion of submission on the cost of equity*, 8 June 2017; Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*, 9 April 2017; Partington, G., Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017; Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016; Partington, G., Satchell, S., *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016; Partington and Satchell, *Report to the AER: Analysis of criticisms of 2015 determination,* October 2015; Partington, G., Satchell, S., *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015.

120 Partington, G., Satchell, S., *Report to the AER: Discussion of submission on the cost of equity*, 8 June 2017; Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*, 9 April 2017; Partington, G., Satchell, S., *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017;Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016; Partington, G., Satchell, S., *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016; Partington, G., Satchell, S., *Report to the AER: Analysis of criticisms of 2015 determination,* October 2015; Partington, G., Satchell, S., *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015; Partington, G., *Report to the AER: Return on equity (Updated), April 2015*; McKenzie, M., Partington, G., *Report to the AER Part A: Return on Equity*, October 2014.

121 Handley, J., *Further* advice *on return on equity, April* 2015; Handley, J., *Advice on return on equity, Report prepared for the AER*, 16 October 2014; Handley, J., *Report prepared for the Australian Energy Regulator: Advice on the value of imputation credits*, 29 September 2014.

122 Lally, M., *Gamma and the ACT decision*, May 2016; Lally, M., *Review of submissions on implementation issues for the cost of debt*, October 2015; Lally, M., *Review of submissions on transition issues for the cost of debt*, October 2015; Lally, M., *Review of submissions on the cost of debt*, April 2015; Lally, M., *Transitional arrangements for the cost of debt*, November 2014; Lally, M., *Implementation issues with the cost of debt*, November 2014.

123 Chairmont, *Cost of debt: Transitional analysis*, April 2015; Chairmont, *Financial practices under regulation: past and transitional*, October 2015.

We received advice from Professor Olan Henry, University of Liverpool, on estimating the equity beta. We commissioned this during the Guideline development process and published the final report in April 2014.[124] We also received advice on return on debt estimation from the ACCC Regulatory Economic Unit (REU).[125] Additionally, we sought and received a substantial amount of expert advice during the Guideline development process including from the REU. These reports have also assisted us in making our decision.

Stakeholder submissions

In making this decision, we have also considered material that was submitted for the recent decisions published in April, June and October 2015, May 2016 and April 2017 that may remain relevant.[126] Overall, in making these decisions we received a large number of submissions. A range of submissions, including those on APTPPL's proposal had commentary relating to the rate of return.[127]

Consideration of recent Tribunal and Federal Court decisions

The NSW Tribunal reviewed several aspects of our approach to estimating the allowed return on debt in decisions for ActewAGL, Jemena Gas Networks and Networks NSW.[128] The Tribunal based on the facts in these cases:

- Found no error in our approach to estimating the return on equity by applying the Guideline approach referred to as the foundation model approach.[129]

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124 Henry, O., *Estimating β: An update*, April 2014.

125 REU, *Return on debt estimation: a review of the alternative third party data series*, August 2014.

126 Our most recent regulatory determinations are for the following service providers: AusNet electricity transmission, Powerlink and TasNetworks.

127 For example, CCP4 (David Headberry), R*esponse to the AER Draft Decision and Revised Proposal to Tasmania's electricity distribution network service provider (TasNetworks - TND) for a revenue reset for the 2017-2019 regulatory period*, 25 November 2016, p. 28; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Tasmania's electricity distribution network service provider (TasNetworks - TND) for a revenue reset for the 2017-2019 regulatory period*, 12 December 2016, p. 31; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Powerlink's electricity transmission network for a revenue reset for the 2017-2019 regulatory period*, 19 December 2016, p. 21; CCP4 (Hugh Grant), *Submission to the AER: AER draft 2018–22 revenue decision Powerlink revised 208–22 revenue proposal*, 23 December 2016; Cotton Australia, *Re: AER Draft Decision–Powerlink Electricity transmission revised revenue proposal 2017–2022*, 22 December 2016; Queensland farmers' federation*, Re: Response on Australian Energy Regulator (AER) Draft Decision on Powerlink 's revenue proposal for the 2017/18 –2021/22 regulatory period*, 30 November 2016.
Origin Energy, *Victorian Gas Access Arrangement Review- 2018-22: Response to Gas Distribution Business' proposals*, 17 February 2017; Red and Lumo Energy, *Re: Australian Gas Networks Access Arrangement*, 6 March 2017; CCP11, Victorian Gas Networks (AGN), *AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers*, 22 March 2017; CCP11, *Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers*, 22 March 2017; CCP11, *Australian Gas Networks (AGN), AusNet Services and Multinet*, 3 March 2017; CCP11, *Victorian Gas Access Arrangement Review (GAAR) for APA VTS*, 3 March 2017.

128 Ausgrid, Endeavour Energy and Essential Energy

- Found no error in our decision to adopt a benchmark credit rating of BBB+.[130]
- Found no error in our decision to use an average of the yields from the Bloomberg and RBA yields curves to calculate the debt risk premium. [131]
- Found error in our approach to debt transition and remitted the determination back to us to make the constituent decision on return on debt in relation to the introduction of the trailing average approach in accordance with several reasons outlined in its decision.[132] We note the Tribunal's decision in section 3.4.2 and Appendix A.

We sought judicial review of the Tribunal decision to the Full Federal Court, including in relation to our debt transition approach. On 24 May 2017 the Full Federal Court handed down its decision. The Full Federal Court found that the Tribunal did not commit error in its decisionin relation to debt transition. A key issue before the Full Federal Court was whether the AER was in error in concluding the Benchmark Efficient Entity was regulated. The Full Federal Court held that a benchmark efficient entity should not be characterised as either regulated or unregulated.[133]

Our decision on debt transition for SAPN was also appealed to the Tribunal.[134] In its SAPN decision, where the issue of whether a Benchmark Efficient Entity should be conceived as regulated was not in dispute, the Tribunal found there was no error in the AER's approach to debt transition.[135]

Following the NSW Tribunal decision handed down in February 2016 we reconsidered the economic and finance principles underpinning the NGL and the NGR, and the 2012 rule change that permitted the use of a trailing average. In undertaking this review we commissoned advice from finance experts.[136] Our review led us to depart from the reasoning we applied in our NSW decisions starting with our decisions released in May 2016.[137] The key change we made was we no longer considered efficient financing costs reflected the costs that came from efficient financing practices. In these decisions we found that efficient financing costs are an ex ante concept and reflect the prevailing

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[129] For example, see Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 725.

[130] For example, see Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 993.

[131] For example, see Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 983.

[132] For example, see Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 1,227. The Tribunal's reasons are set out in paras 870 to 940.

[133] Federal Court of Australia, *Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79*, May 2017. p. 164.

[134] *Application by SAPN [2016] ACompT 11.*

[135] *Application by SAPN [2016] ACompT 11.*

[136] Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016.

[137] See attachment 3 of our final decisions published in May 2016 for ActewAGL distribution (gas), AGN, APTNT, AusNet Services (distribution), CitiPower, Jemena Electricity Networks, Powercor, United Energy.

cost of funds in the market.[138] The the prevailing rate in the market reflects the opportunity cost of funds in the capital market.[139]

In its revised electricty transmission proposal lodged in December 2016 AusNet Services questioned the new economic reasoning and approach to the allowed rate of return objective that we applied in our May 2016 decisions.[140] In support of its preferred reasoning it provided an experts report by CEG Economics.[141]

While AusNet prior to our final decision indicated it no longer mainted its preferred approach to debt transition and would accept our proposed full transition, we nevertheless carefully considered the material with its revised proposal including the new experts report by CEG.[142] In doing this we commissioned further expert finance advice on the new material submitted by AusNet.[143] Our review concluded the position and reasoning we held in our May 2016 decision was correct as a matter of economic principle and law.[144] As a consequence our April 2017 decision for AusNet services, consistent with our May 2016 decisions, applied a full (or revenue netural) transition when changing the debt estimation methodology to apply to AusNet from the on the day methodology to the trailing average methodology.[145]

Following the Full Federal Court decision handed down on May 24 2017 we have again reconsidered our approach in the context of the NGR and NGO. In light of the Full Court's decision we do not maintain for this determination that the benchmark efficient entity is itself a regulated entity. Rather, we consider the benchmark efficient entity has a similar degree of risk as that which applies to APTPPL in the provision of reference services. However, given we consider efficient financing costs reflect the prevailing cost of funds in the market, we remain of the view that a full (or revenue neutral) transition is required when changing debt estimation methodology in order to achieve the ARORO and NGO.

We note to be explicit that we do not consider the position (that efficient financing costs reflects the revailing cost of fund in the market) we took in our May 2016 decisions and we have taken in all decisions since then precludes the use of a trailing average. However, our approach does require a revenue neutral transition when changing methodology to achieve correct compensation over the life of the investment and

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138 See for example, Final Decision Jemena distribution determination 2016 to 2020 Attachment 3 - Rate of Return, May 2016, pp 18-19, 277-278.

139 See for example, Final Decision Jemena distribution determination 2016 to 2020 Attachment 3 - Rate of Return, May 2016, p. 278.

140 AusNet Services, Transmission revised revenue proposal, 21 September 2016, p.166

141 CEG, The AER's current interpretation of the ARORO, September 2016.

142 Final Decision, AusNet Services transmission determination 2017-2022 Attachment 3 - Rate or return, April 2017, pp. 313-325.

143 Graham Partington and Stephen Satchell, Report to the AER: Issues in Relation to the Cost of Debt, 9 April 2017

144 Final Decision, AusNet Services transmission determination 2017-2022 Attachment 3 - Rate or return, April 2017, pp 307-308.

145 Final Decision, AusNet Services transmission determination 2017-2022 Attachment 3 - Rate or return, April 2017, p. 11.

thereby to not violate correct compensation in a present value sense and achieve the ARORO and NGO. We consider our reasoning and approach are entirely consistent with the objectives of the 2012 rule change, the current rules and law, and with minimising the cost of finance of the benchmark efficient entity over the life of its assets while managing refinancing risk and interest rate risk.

More recently AusNet Services electricity distribution, ActewAGL Gas Networks, and Jemena Distribution applied for review by the Tribunal of certain aspects of the approach to determining the return on debt for further consideration by the Tribunal.[146] Nothing raised in these matters, or in the SAPN Full Federal Court matter, has changed our view that our approach is correct as a matter of economic principle and law.

We will consider the Full Federal Court decision for SAPN and the Tribunal decisions for AusNet Services electricity distribution, ActewAGL Gas Networks and Jemena Distribution when these decisions are handed down.

Finally, we note the majority of regulated businesses we have made decisions for since the publication of the Guideline have now accepted our approach to transitioning to a trailing average to estimate the allowed return on debt.

3.4 Reasons for draft decision

Our allowed rate of return is a weighted average of the return on equity and debt determined on a nominal vanilla basis (that is, a vanilla WACC). It has been estimated consistently with the estimation of the value of imputation credits.[147]

In deriving the WACC, and the estimated efficient debt and equity financing costs, we have applied the benchmark efficient entity gearing ratio of 0.6 (debt):0.4 (equity) that we proposed in the Guideline. We have no reason to depart from this gearing ratio[148]

In making this decision, we accept (and agree with) AGN's adoption of the Guideline foundation model approach for estimate the allowed rate of return.

We have also considered issues that have been raised by AusNet, Multinet, APA and APTPPL as well as different service providers and stakeholders in our recently published regulatory determinations. While we have addressed matters specifically raised by AusNet, Multinet, APA , APTPPL and/or stakeholders in this decision process, much of our analysis and reasoning also addresses matters raised by other service providers and stakeholders in past and concurrent regulatory determination processes. We have also considered issues that have been raised by different service

146 http://www.competitiontribunal.gov.au/current-matters/tribunal-documents/act-8-2016; http://www.competitiontribunal.gov.au/current-matters/tribunal-documents/act-6-2016;

147 NER, cl. 6.5.2(d); NER, cl. 6A.6.2(d); NGR, r. 87(4).

148 All the NSPs whose proposals we are currently assessing have proposed a gearing ratio consistent with the Guideline.

providers and stakeholders in our recently published regulatory determinations.[149] All of this material informs our view on APTPPL's proposal and also underpins our decision on the returns on debt and equity that contributes to the achievement of the ARORO. That is, a return commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to APTPPL in respect of the provision of reference services.[150]

We discuss our reasons for the return on equity and return on debt under the separate subheadings 3.4.1, and 3.4.2, respectively. Subsections 3.4.3 and 3.4.4 set out the gearing ratio and our expected inflation rate for the 2017–2022 regulatory control period.

3.4.1 Return on equity

Our return on equity estimate is 7.2 per cent for this decision is based on an application of the Guideline foundation model approach (a more detailed discussion of why we use the Guideline foundation model approach to estimate the return on equity is in Appendix A).

We consider that 7.2 per cent is the best estimate to combine with a return on debt estimate to form an overall allowed rate of return that achieves the ARORO. We also consider that 7.2 per cent is consistent with the prevailing conditions in the market for equity funds.

We hold these views because:

- We derive our estimate using the Sharpe–Lintner CAPM as our foundation model, which:
    - transparently presents the key risk and reward trade-off[151] that is at the heart of our task[152]
    - is widely and consistently used for estimating the expected return on equity by financial market practitioners, academics, and other regulators[153]
    - has well-accepted and unbiased methods for estimating its parameters, and these parameters can be estimated with tolerable accuracy, unlike the alternative models that have been proposed in the past (such as the dividend growth model, the Black CAPM and the Fama-French model).
- We have regard to the prevailing market conditions for equity funds. We use the dividend growth model and conditioning variables to inform our estimate of the market risk premium. We use other relevant sources of information to cross-check the foundation model estimate. The triangulation of estimates from relevant market

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[150] NER, cl. 6.5.2(c); NER, cl. 6A.6.2(c); NGR, r. 87(3).

[151] That is, systematic risk priced via expected returns on equity.

[152] As set out in NER cl.6; NER cl. 6A; NGR.

[153] See AER, *Explanatory statement to the rate of return guideline (appendices)*, 17 December 2013, pp. 12–13.

participants broadly supports our foundation model estimate of the return on equity. (see Appendix E and F for more discussions).

- Our estimate is supported by comparison to estimates from the Wright specification of the CAPM, broker reports, valuation reports, and other regulators' decisions.
- The consistency over time of our Sharpe-Lintner CAPM estimation approach (reflective of a risk premium above a prevailing risk free rate) has been supportive of investment. While taking into account the downward trends in both our risk premium and the risk free rate,[154] service providers have continued to invest in their networks and propose to continue to grow their asset bases.[155]
- Our return on equity estimate is approximately 241 basis points above the prevailing yield-to-maturity on BBB-rated debt with a 10 year term-to-maturity. For a benchmark efficient entity with a similar degree of risk as APTPPL, we would not expect the return on equity to be a long way above the prevailing return on debt.[156]
- We have come to this estimate following the application of our foundation model approach, which:
    - involves consideration of all relevant material submitted to us, and the role for each piece of material that would best achieve the ARORO; and
    - was developed through extensive consultation during our Guideline review process.
    - Was reviewed and upheld by the Tribunal[157]

The Sharpe-Lintner CAPM provides that the return on equity can be calculated as the risk-free return and a premium for risk above the risk-free rate, with the risk premium calculated as the product of the market risk premium and equity beta.[158]

Our Sharpe-Lintner CAPM estimate is based on:

- a risk free rate estimate of 2.6 per cent
- a market risk premium estimate of 6.5 per cent, and

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154 Our regulatory determinations and rate of return guidelines since 2009 have set an equity risk premium ranging from 5.2 per cent to 4.55 per cent [AER, *Final Decision*, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters, 1 May 2009].

155 Between 2007–08 and 2013–14, the regulated transmission and distribution service providers across the national electricity market have invested in the order of more than $44 billion in capital expenditure. The annual capital expenditure has remained largely stable at around $6 billion per year.

156 Due to the regulatory regime and the businesses' monopoly positions shielding them from systematic risk; as well as the measured prevailing debt yields likely overstating the expected return on debt due to default risk. For more information, see section pages 96 to 99 of Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination.

157 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, paras 813, 993, 983; Australian Competition Tribunal, *Application by Jemena Gas Networks (NSW) Ltd [2016] ACompT 5*, 3 March 2016, paras 47, 49, 95.

158 For more information on the Sharpe-Lintner CAPM, see section B.

- an equity beta estimate of 0.7.[159]

Our derivation of these parameter estimates for APTPPL's decision is outlined in the subsections below.

The following aspects of our return on equity estimate have had broad agreement from both service providers and consumer groups:

- The Sharpe-Lintner CAPM, at least in combination with other relevant material, is valuable for estimating return on equity[160]
- The risk free rate should be estimated as the yield, averaged over a 20 business day averaging period, on Australian government securities with a ten-year term-to-maturity.[161]
- Market risk premium estimates should be informed by historical stock returns and (to some extent) dividend growth model estimates.[162]
- Equity beta estimates should be informed by regression estimates of the equity beta of relevant Australian and, to some extent, international energy network businesses.[163]

Multinet, AusNet, APA and APTPPL have submitted that the Wright specification of the CAPM is relevant material that can inform return on equity estimation which has been raised in previous regulatory processes.[164] Multinet and AusNet also submitted that

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159 Calculated as: 7.2% = 2.6% + 0.7 * 6.5%. For more information on the Sharpe-Lintner CAPM, see section B.

160 Service providers have consistently proposed the use of the Sharpe-Linter CAPM (either by itself or in combination with other equity models) for estimate the return on equity. For example, see CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 284; AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016. The current service providers have also proposed use of the Sharpe-Lintner CAPM as the foundation model for estimating the return on equity.
Consumer groups have either supported the use of the Sharpe-Lintner CAPM (through support for the Guideline foundation model approach) or have not opposed the use of the model. For example see: Origin Energy, *Submission on ActewAGL's revised access arrangement for 2016–21*, 4 February 2016, p. 2; Origin Energy, *Submission on AGN's revised access arrangement for 2016–21*, February 2016; Victorian Government, *Submission on the Victorian electricity distribution network service providers' revised regulatory proposals for 2016–20*, 12 February 2016, p. 1–2; EUCV, *A response to AusNet revenue reset proposal for the 2017–2022 period*, 9 February 2016; AGL, *Submission on the AER's draft decision on AGN's 2016–21 access arrangement*, 4 February 2016, p. 2; CCP11, Victorian Gas Networks (AGN), *AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers*, 22 March 2017, p. 9; Origin Energy, *Victorian Gas Access Arrangement Review- 2018-22 Response to Gas Distribution Business' proposals*, 17 February 2017; Red and Lumo Energy, *Re: Australian Gas Networks Access Arrangement*, 6 March 2017.

161 Confidential Appendix 0 sets out the averaging period used in this decision.

162 User submissions sometimes do not specifically mention the use of the dividend growth model. However, they generally propose a market risk premiums of 6.5 per cent or less which would be based on the use of historical returns (at least) and, to a lesser extent, the dividend growth model.

163 Where consumers groups have submitted specifically on how the beta should be estimated, they have generally proposed that the equity beta should be set with reference to empirical estimates from Olan Henry's 2014 study for the AER.

164 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 29–30; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016, pp. 198–202 ; APA VTS,

return on equity estimates from broker valuation reports, are relevant material that can inform return on equity estimation.[165]

There was also broad agreement from user groups on the application of our foundation model approach as set out in our Guideline. In applying our foundation model approach, some user groups supported our parameter estimates of 6.5 per cent for market risk premium and 0.7 for equity beta[166] while others submitted that these parameters should be lower.[167]

Victoraian transmission system access arrangement submission, 3 January 2017, pp. 144–173; ; APTPPL, 2017 - 2022 RBP Access Arrangement revision submission, 16 September, 2016, pp. 143–158.
For previous regulatory processes, see for example, see CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 284; AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016.

165 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 29–30; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016, p. 199.
For previous regulatory processes, see for example, see CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 284; AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016.

166 CCP (subpanel 5), *Response to AER draft decision on AusNet Services transmission revenue review*, September 2016, p. 20 ; CCP (subpanel 5), *Submission on AusNet transmission revised proposal*, October 2016, p. 8-9;; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Powerlink's electricity transmission network for a revenue reset for the 2017-2019 regulatory period*, 19 December 2016, p. 2; Cotton Australia, *Re: AER Draft Decision–Powerlink Electricity transmission revised revenue proposal 2017–2022*, 22 December 2016; Queensland farmers' federation, *Re: Response on Australian Energy Regulator (AER) Draft Decision on Powerlink 's revenue proposal for the 2017/18 –2021/22 regulatory period*, 30 November 2016; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Tasmania's electricity distribution network service provider (TasNetworks - TND) for a revenue reset for the 2017-2019 regulatory period*, 25 November 2016, p. 28; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Tasmania's electricity distribution network service provider (TasNetworks - TND) for a revenue reset for the 2017-2019 regulatory period*, 12 December 2016, p. 31; Red and Lumo Energy, Re: Australian Gas Networks Access Arrangement, 6 March 2017; Origin Energy, Victorian Gas Access arrangement Review- 2018-22 Response to Gas Distribution Business' proposals, 17 February 2017; CCP11, Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers, 22 March 2017; CCP11, Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers, 22 March 2017, p. 9.

167 CCP (subpanel 5*), Transmission for the Generations III–Response to: Revised revenue proposal by AusNet Services for Transmission Revenue Review 2017–22*, October 2016, pp. 9–11; CCP (subpanel 5), *Transmission for the Generations III–Response to: AER draft decision for AusNet Services' Transmission Revenue Review 2017–22*, October 2016, pp. 20–21; CCP4 (Hugh Grant), *Submission on Powerlink draft decision and revised proposal*, 23 December 2016, pp. 5 & 39-42; CCP4 (David Headberry), *Submission on Powerlink draft decision and revised proposal*, 23 December 2016, P21; CCP4 (Hugh Grant and David Headberry), *Submission to the AER, Powerlink Queensland 2018-22 revenue proposal*, June 2016, pp. 45-6; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Powerlink's electricity transmission network for a revenue reset for the 2017-2019 regulatory period*, 19 December 2016, p. 21; CCP4 (Hugh Grant), *Submission to the AER: AER draft 2018–22 revenue decision Powerlink revised 208–22 revenue proposal*, 23 December 2016, pp. 44–47;

We note some service providers have previously proposed the multi-model approach[168] (seen in previous regulatory processes)[169] for estimating the return on equity. We have consistently rejected this approach for a range of reasons including:

- Our foundation model approach uses the Sharpe-Lintner CAPM as the foundation model. This model is widely and consistently used, and has well-accepted and unbiased methods for estimating its parameters.
- Models other than the Sharpe-Lintner CAPM are not reliable and at risk of potential bias to be relied upon for determining the return on equity.
- And the Tribunal has upheld our approach.[170]

Following this, the current service providers' proposals all adopt (or claim guidance from) the Guideline foundation model approach for estimating the return on equity.[171] We discuss the current service providers' application of the Guideline approach below.

Service providers' proposed application of the Guideline

In applying the Guideline foundation model approach, we note only AGN has adopted the Guideline approach in full (that is, for all parameters). We observe departures from the Guideline arise at the parameter level in proposals from Multinet, AusNet, APTPPL and APA.

We note (and accept) that Multinet, AusNet, APA, APTPPL and AGN adopted the Guideline foundation model approach for the following parameters:

- the Sharpe-Lintner CAPM as the foundation model.[172] However, Multinet proposed to include an 'alpha' term of 1.14 per cent in the model to account for its low-beta bias. Having reviewed Multinet's supporting material, we reject the proposed alpha term as it is based on a number of incorrect assumptions, misinterpretations and issue we have previously considered.
- the risk free rate.[173]

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168 The multi-model approach estimates a return on equity by combining estimates from four equity models: Sharpe–Lintner, Black, Fama–French and Wright.

169 For example, AusGrid proposed a multi-model approach for estimating the return on equity in its distribution revenue proposal for the 2014–2019 regulatory period.

170 Australian Competition Tribunal, A*pplications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016.

171 Multinet Gas, *Rate of Return Overview*, 16 December 2016; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016; APA VTS, *Victoraian transmission system access arrangement submission*, 3 January 2017; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016; AGN, Final Plan Attachment 10.1: Financing Costs, December 2016.

172 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 7; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016, p. 188; AGN, Final Plan Attachment 10.1: Financing Costs, December 2016; APA VTS, *Victoraian transmission system access arrangement submission*, 3 January 2017; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016.

173 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 7; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016, p. 188; AGN, Final Plan Attachment

Although AGN, Multinet and AusNet all adopted the Guideline's equity beta of 0.7 (which we accept) they submitted a CEG report[174] suggesting a higher value. We discuss the CEG report in the equity beta subsection below.

We note Multinet and AusNet proposed a market risk premium of 7.5 per cent. However, this appears to be largely based on a mischaracterised (and mechanistic) application of the Guideline which we reject. We consider the correct application of the Guideline approach (as upheld by the Tribunal) results in a market risk premium of 6.5 per cent after considering all the relevant evidence in accordance with their relative merits and suitability for our regulatory task. We discuss this in the market risk premium subsection below.

APTPPL and APA also proposed parameters higher than those from the Guideline approach. Both proposed an equity beta of 0.8.[175] Both also proposed a market risk premium higher than the Guideline's 6.5 per cent (8.06 per cent for APTPPL and 7.76 per cent for APA VTS).[176] We do not consider that APTPPL and APA have provided satisfactory evidence in support of a material change in equity beta to warrant departure from our empirical range of 0.4 to 0.7 and a point estimate of 0.7. We note APTPPL's and APA's proposal for the market risk premium shares similarities with the Wright CAPM and appears to be a historical/alternative specification of the CAPM. We have consistently rejected such an approach because alternative specifications of the CAPM make certain unrealistic assumptions and are not theoretically justified. We discuss in the equity beta and market risk premium subsections below.

Overall, we are not satisfied that information submitted to us indicates that a departure from the Guideline would contribute to the achievement of the ARORO. In addition to the reasons outlined in the subsections below, we consider the importance placed by all stakeholders on predictability and transparency in contributing to the achievement of the ARORO.[177]

10.1: Financing Costs, December 2016; APA VTS, *Victoraian transmission system access arrangement submission*, 3 January 2017; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016.

174 AGN and AusNet Services submitted a September 2016 version of the report: CEG, *Replication and extension of Henry's beta analysis*, September 2016. Multinet submitted a November 2016 version of the report: CEG, *Replication and extension of Henry's beta analysis*, November 2016;

175 APA VTS, *Victoraian transmission system access arrangement submission*, 3 January 2017, p. 163; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September 2016, p. 157.

176 The difference is driven by the different indicative risk free rates in the proposals. Both service providers proposed the same methodology for estimating the market risk premium. APA VTS, *Victoraian transmission system access arrangement submission*, 3 January 2017, p. 163; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September 2016, p. 157.

177 We received many stakeholder submissions supporting our guideline approach including:; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Powerlink's electricity transmission network for a revenue reset for the 2017-2019 regulatory period*, 19 December 2016, p. 2; Cotton Australia, *Re: AER Draft Decision–Powerlink Electricity transmission revised revenue proposal 2017–2022*, 22 December 2016; Queensland farmers' federation, *Re: Response on Australian Energy Regulator (AER) Draft Decision on Powerlink 's revenue proposal for the 2017/18 –2021/22 regulatory period*, 30 November 2016; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Tasmania's electricity distribution network service provider (TasNetworks - TND) for a revenue reset for the 2017-2019 regulatory period*, 25 November 2016, p. 28;

We step through the six-step foundation model approach below.

Step one and two: identify relevant material and role

We have had regard to a large amount of material including estimation methods, financial models, market data and other evidence and determined the role we consider that each piece of material should play in estimating the return on equity. In previous regulatory decisions, we set out in detail the way in which the information is used either as the foundation model, to inform our foundation model input parameters, or as other information—other than as the foundation model, to inform our return on equity estimate.[178] We also discuss this in the subsections below and appendices B to H of this decision. We do not repeat these discussions here and progress to step three of the Guideline foundation model approach.

Step three: implementing the foundation model

Choice of equity models

We apply the Sharpe-Lintner CAPM as our foundation model. We consider the Sharpe-Lintner CAPM is the best model for estimating the efficient costs of equity financing because it:

- transparently presents the key risk and reward trade-off[179] that is at the heart of our task[180]
- is widely and consistently used for estimating the expected return on equity by financial market practitioners, academics, and other regulators[181]
- has well-accepted and unbiased methods for estimating its parameters, and these parameters can be estimated with tolerable accuracy, unlike the alternative models proposed by some service providers.

Our consultants have also agreed with our use of the Sharpe-Lintner CAPM as the foundation model. Handley stated:[182]

CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Tasmania's electricity distribution network service provider (TasNetworks - TND) for a revenue reset for the 2017-2019 regulatory period*, 12 December 2016, p. 31; CCP11, Victorian Gas Networks (AGN), *AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers*, 22 March 2017, p. 9; Origin Energy, *Victorian Gas Access Arrangement Review- 2018-22 Response to Gas Distribution Business' proposals*, 17 February 2017; Red and Lumo Energy, *Re: Australian Gas Networks Access Arrangement*, 6 March 2017.

178 AER, *Final decision SA Power Networks determination 2015–16 to 2019–20: Attachment 3–Rate of return*, October 2015, pp. 43–106.

179 That is, systematic risk priced via expected returns on equity.

180 As set out in NER cl.6; NER cl. 6A; NGR

181 See AER, *Explanatory statement to the rate of return guideline (appendices)*, 17 December 2013, pp. 12–13.

182 Handley, *Advice on the return on equity*, 16 October 2014, p. 4.

> [t]he AER's choice of the Sharpe-CAPM as foundation model is entirely appropriate and reasonable for this purpose. The Sharpe-CAPM is the standard (equilibrium) asset pricing model. It has a long established and well understood theoretical foundation and is a transparent representation of one of the most fundamental paradigms of finance - the risk-return trade off.

McKenzie and Partington indicated with respect to the Sharpe–Lintner CAPM:[183]

> With regard to the CAPM, its efficacy comes from the test of time. This model has been around for in excess of half a century and has become the standard workhorse model of modern finance both in theory and practice. The CAPMs place as the foundation model is justifiable in terms of its simple theoretical underpinnings and relative ease of application. The competing alternatives, which build upon the CAPM, serve to add a level of complexity to the analysis.

The current service providers have all adopted the Sharpe-Lintner CAPM as the foundation model for estimating the return on equity.

Multinet's alpha proposal

Multinet has proposed to include an additional 'alpha' term (of 1.14 per cent) in the Sharpe-Lintner CAPM to account for the low-beta bias for low beta stocks.[184]

We note that service providers have submitted on the low-beta bias in previous regulatory processes and it is appropriate to consider how such submissions may be viewed. We observe that the low-beta bias does not necessarily represent the Sharpe-Lintner CAPM underestimating the return on equity for benchmark efficient entity with a similar degree of risk as the service providers in providing regulated services. Partington and Sachell have also noted that:

> 'interpretation may be conditional on the lens through which the evidence is viewed. Consider, for example, a study of the returns obtained by shareholders in regulated utilities relative to the equilibrium returns according to the CAPM. Further suppose that the study showed that the returns subsequently realised by shareholders were greater than those determined by use of the CAPM. We suggest that consumers would likely interpret this as the regulators being too benign is setting allowed returns, resulting in regulated utilities earning more than was justified. Conversely, we expect that regulated utilities would either argue that they had been super-efficient, or as in the current case, that the CAPM underestimated the required rate of return.'

Multinet's proposal appears to be based on the following key submissions:

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[183] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 9. This position was also supported by Partington, *Report to the AER: Return on equity (updated)*, April 2015, p. 29; Partington and Satchell, *Report to the AER: Return of equity and comment on submissions in relation to JGN*, May 2015, p. 7; and Partington and Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 17, 21.

[184] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 14–26.

- The mean beta was 0.5 for the Guideline and was 'adjusted' to 0.7 to account for the low beta bias. The mean beta has now increased to 0.7 which requires adjustment per the Guideline as 0.7 'no longer represent the adjusted value found in the Guideline and endorsed by the Tribunal'.[185]
- The adjustment can be made through the equity beta or an 'alpha' term. Multinet has proposed use of the alpha term based on Partington and Satchell's advice to the ERA and the ERA's decision.[186]
- The Guideline approach for adjusting its equity beta is not clear. To avoid relying solely on judgement, ex-post data should be used to measure and estimate the adjustment required.[187]
- The AER adopts an expected equilibrium returns framework which prevents it from having regard to realised returns, is a 'retrograde' step for Australian regulators and is against the AEMC's intention.[188]
- Multinet proposed an alpha term of 1.14 per cent based on HoustonKemp's report.[189]

We disagree with Multinet's alpha proposal for the following reasons:

- Our analysis of the current service providers' material on equity beta does not provide satisfactory evidence to increase our range (0.4–0.7) and point estimate (0.7). We consider the material still show support for Henry's study.
- Multinet has mischaracterised the Guideline. We did not, and do not, adjust the equity beta.
- Multinet's proposal appears to stem from its consideration of the Black CAPM which we have assessed and determined to be unsuitable for directly estimating the return on equity.
- We disagree with the proposed alpha (and by extension beta) adjustments because there are a range of issues.
- Multinet's proposed use of realised returns is problematic because realised returns can differ from expected returns over a persistent period of time and capture myriad factors that can contribute to realised returns being higher than Sharpe-Lintner estimates.
- We do not adopt an expected equilibrium return framework.

We discuss each point in more detail below.

Increase in equity beta

[185] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 14.
[186] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 15.
[187] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 16.
[188] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 19.
[189] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 23–26.

Multinet proposal is premised on the assumption that empirical estimates of equity beta have increased which, following the Guideline approach, warrants an adjustment (of some sort) to account for the low-beta bias.

Specifically, it stated that 'if 0.7 is now the mean, unadjusted beta, it can no longer represent the adjusted value found in the Guidelines and endorsed by the Tribunal, and would in fact represent a departure from the Guidelines'.[190] It added that 'to maintain consistency with the Guidelines, we propose to make an adjustment, as the AER did, and not simply make use of a mean beta of 0.7'.[191]

We first disagree with Multinet's claim of a mean beta of 0.7. Multinet's proposal is largely based on a CEG report aiming to replicate and extend Henry's study.[192] We have reviewed service providers' material on equity beta which include a Frontier report.[193] While the material does display small changes in empirical estimates, we do not find satisfactory evidence of an increase to depart from our range and point estimate. Our analysis used data up to 28 April 2017, based on Henry's methodology, is consistent with Henry's results and supports our range and point estimate. There also appears to be conflicting information between the CEG report and Frontier report as Frontier's10 year average firm-level estimates suggest a decline in empirical estimates since Henry's study.

Partington and Satchell have reviewed service providers' new material on empirical beta estimates and concluded that they make a 'weak case that beta has increased in recent times' and continues to see 'little evidence of change'.[194]

Multinet also referred to the ERA's estimation to support a mean beta of 0.7.[195] However, the ERA's estimation is based on a sample of four firms and a period of five years. We note that short term data is more prone to one-off events, fluctuations and volatilities in the market–which may obscure the ‘true’ equity beta for a benchmark efficient entity. Therefore, we have most regard to longer term estimates and a large sample of firms when determining the equity beta.

Mischaracterising the Guideline approach for equity beta

We, and the Guideline, did not and do not 'adjust' the equity beta as Multinet has suggested.[196] Our range of 0.4–0.7 is based on Henry's study and our consideration that a benchmark efficient entity would have an equity beta less than one.[197] We select

[190] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 14.

[191] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 14.

[192] CEG, *Replication and extension of Henry's beta analysis*, November 2016.

[193] Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016.

[194] Partington and Satchell, Report to the AER: Discussion of submissions on the cost of equity, 8 June 2017, p. 8, 41.

[195] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 13.

[196] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 14.

[197] We consider a benchmark efficient entity would have an equity beta less than one because it would be relatively shielded from risks (such as demand risk).

towards a top-of-the-range value to account for the theoretical principles underpinning the Black CAPM and other relevant information.[198]

Second, the Tribunal did not endorse adjusting the equity beta or adopt an adjusted value.[199] In fact the Tribunal upheld our approach which determined a range of 0.4–0.7 and then selected towards a top-of-the-range value based on the relevant information.[200]

Third, we continue to apply the Guideline approach when estimating the equity beta. The Guideline determined a range of 0.4–0.7 based on Henry's empirical study and our consideration that a benchmark efficient entity would have an equity beta less than one.[201] Our 2017 study continues to support Henry's empirical range. We select toward a top-of-the-range value to account for the theoretical principles underpinning the Black CAPM and other relevant information.[202] Multinet's assumption of a mean beta of 0.7 and proposed adjustment represents a departure from the Guideline.

For more detailed discussion on equity beta, see section 3.4.1 ('estimating the equity beta'), G and H.

Consideration of the Black CAPM

Multinet's concern with the low-beta bias also appears to stem from Multinet's consideration of the Black CAPM for estimating the return on equity.[203] The Black CAPM was proposed by service providers in previous regulatory decisions to 'correct' the Sharpe-Lintner CAPM's low-beta bias. We do not consider that the Black CAPM is suitable for estimating the return on equity for the benchmark efficient entity or that it will contribute to the achievement of the ARORO for the following reasons:

- The empirical implementation of the Black CAPM is unreliable because, in contrast to the risk-free rate, the expected return on the zero beta asset is unobservable and there is no apparent consensus on methods for estimating this return. The lack of consensus on methodological choices is likely to increase the sensitivity of the model to such choices, reducing the reliability of the model and increasing the potential for bias.

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198 AER, *Better Regulation Explanatory Statement Rate of Return Guideline*, December 2013, p. 88.

199 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 14; Australian Competition Tribunal, a*pplications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, paragraph 749, 779.

200 Australian Competition Tribunal, *applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 201,6 paragraph 749, 779.

201 We consider a benchmark efficient entity would have an equity beta less than one because it would be relatively shielded from risks (such as demand risk).

202 AER, *Better Regulation Explanatory Statement Rate of Return Guideline*, December 2013, p. 88.

203 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 15.

- There is little evidence that other regulators, academics or market practitioners use the Black CAPM to estimate the return on equity.[204] In particular, regulators rarely have recourse to the Black CAPM.[205] This view was supported by Handley.[206]
- Implementation of the Black CAPM typically results in estimates of the zero beta return being less reflective of prevailing market conditions than risk free rate estimates.[207]
- Using a conservative estimate of beta in the Sharpe-Lintner CAPM can accommodate potential issues that arise from not estimating the Black CAPM.[208]

We explain our consideration of the Black CAPM in Appendix B.2 in more detail.

Alpha or beta

Multinet submitted that the low-beta bias can be adjusted through including an 'alpha' term or adjusting the equity beta.[209] It claimed its alpha proposal is consistent with Partington and Satchell's advice to the ERA and the ERA's 2016 final decision for the Dampier to Bunbury Natural Gas Pipeline.[210]

We first note that Multinet has mischaracterised Partington and Satchell's advice and the ERA's decision. Neither supported or advocated adjustments (in the form of an alpha or beta adjustment) to the Sharpe-Lintner CAPM. This has been acknowledged by Multinet.[211]

We note that the 'alpha' term represents an adjustment to the model.[212] It is typically derived from assessing Sharpe-Lintner estimates using realised returns. We disagree with the use of realised returns for assessing (and/or adjusting) equity models because it is not making the correct comparison.

204 For more detail, see the 'use in practice' subsection in section A.3.3 of Attachment 3 to our draft decision for AGN, which remains relevant here. No new material was submitted on this issue following our draft decision.

205 A recent study examined regulatory practices in 21 countries and did not point to any uses of the Black CAPM. See Schaeffler, S., and Weber, C., 'The cost of equity of network operators - empirical evidence and regulatory practice', *Competition and Regulation in network industries*, Vol. 14(2), 2013, p. 386.

206 Handley, *Advice on return on equity,* 16 October 2014, p. 12.

207 As the zero beta portfolio can take many years of data to estimate, while the current government bond rate is readily available. See: Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 20.

208 Handley found, 'The AER's choice in using the Black CAPM to inform the beta estimate, using the DGM to inform the MRP estimate and not using the Fama-French model is also appropriate and reasonable' in *Advice on the return on equity*, 16 October 2014, p. 5. McKenzie and Partington advised the theory underpinning the Black CAPM does not necessarily support an uplift to beta. McKenzie and Partington advised, 'the theory of the Black CAPM may have a role to play in choosing the equity beta, although exactly how is still not clear to us' in *Report to the AER part A: Return on equity*, October 2014, p. 24.

209 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 15.

210 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 15.

211 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 15.

212 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 29–30.

Realised returns can differ from expected returns over a persistent period of time and capture myriad factors that can contribute to realised returns being higher than Sharpe-Lintner estimates such as economic shocks and outperformance. Partington and Satchell have also advised that it is sensible to 'subtract alpha from the realised returns in order to provide an empirical measure of the required rate of return.[213]

We also note that Multinet's proposal to adjust equity beta bears resemblance to submissions in previous regulatory processes.[214] As noted above, our range and point estimate of the equity remain appropriate and our application of the Guideline does not adjust the equity beta. Partington and Satchell have also advised against changes to the equity beta:

- 'There is no theoretical justification for scaling beta in order to compute regulatory returns'.[215]
- If the source of the higher returns was systematic outperformance of stocks relative to their required returns, different adjustments would be required, rather than adjustments to beta.[216]
- A beta adjustment might be appropriate if bias in beta was causing any forecast error. However, we have not seen any convincing evidence that it is a bias in beta that is causing any forecast error.[217]
- We find no evidence in HoustonKemp, or elsewhere that any bias is due to a bias in the estimate of beta.[218]

Ex-post adjustment

Multinet acknowledged our Guideline and right to exercise judgement but claims that it is difficult to follow our approach when adjusting the new mean beta of 0.7.[219] It stated that realised returns should therefore be used to adjust the Sharpe-Lintner CAPM to avoid relying on sole judgement.[220] [221]

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213 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 9.
Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 19.

214 See for example Frontier, *The required return on equity under a foundation model approach*, January 2016, p. 55. Both HoustonKemp and Frontier use a return on equity that is deemed absent of low-beta bias to estimate an adjustment to the equity beta in the Sharpe-Lintner CAPM. HoustonKemp appears to use ex-post return on equity. Frontier uses a return on equity from its Black CAPM (which is derived using ex-post data).
HoustonKemp also uses ex-post return on equity to estimate an 'alpha' term to include in the Sharpe-Lintner CAPM.

215 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 25.

216 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 19.

217 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 24.

218 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 26.

219 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 16.

220 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 16.

221 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 16–19.

We disagree with a mean beta of 0.7 (as noted above). We have consistently and transparently explained our Guideline approach for estimating the equity beta as noted above, in our Guideline and previous regulatory decisions.[222] We did not, and do not, adjust the equity beta. For more detailed discussion on equity beta, see section 3.4.1 ('estimating the equity beta'), G and H.

We note the use of ex-post data to compute adjustments is not dissimilar to previous regulatory processes where service providers submitted on the empirical performance of the Sharpe-Lintner CAPM and proposed use (or elements) of the Black CAPM and Fama-French model for estimating the return on equity.[223] These models effectively use ex-post data (in combination with additional assumptions) to adjust the Sharpe-Lintner CAPM by including additional terms (for example, the Fama-French model adds size and value terms) or changing certain terms (for example the Black CAPM replaces the risk free rate with the zero beta rate).

We do not agree with Multinet's proposed use of ex-post data. Such a method assumes that 'markets are efficient and in equilibrium, hence realised returns are an appropriate benchmark'.[224] However, as noted above, expected returns can diverge from realised returns over a persistent period of time, markets can be in disequilibrium and expectations are not always realised even on average.[225] Partington and Satchell advised that 'the idea that markets are continuously efficient and in equilibrium is increasingly challenged by the proponents of behavioural finance and of course by practitioners who seek to profit by earning alpha (abnormal returns)'.[226]

Expected equilibrium return framework

Multinet claimed that we adopt an 'expected equilibrium returns' framework which limits consideration of empirical data and raises the following issues:[227]

- Rejection of information from realised returns[228]
- There is a range of equilibrium models and the AER should explain equilibrium it is aiming for when selecting models. The AER should also use models that are supported by historical data.[229]

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[222] AER, *Better Regulation Explanatory Statement Rate of Return Guideline*, December 2013, p. 88. For example, see: AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return,* May 2016, pp. 44-90.

[223] See for example Frontier, *The required return on equity under a foundation model approach*, January 2016, p. 55. Both HoustonKemp and Frontier use a return on equity that is deemed absent of low-beta bias to estimate an adjustment to the equity beta in the Sharpe-Lintner CAPM. HoustonKemp appears to use ex-post return on equity. Frontier uses a return on equity from its Black CAPM (which is derived using ex-post data). HoustonKemp also uses ex-post return on equity to estimate an 'alpha' term to include in the Sharpe-Lintner CAPM.

[224] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 17.

[225] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 30.

[226] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 17.

[227] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 19–21

[228] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 19–21

[229] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 19–21

- The regulatory task does not discuss requiring equilibrium returns or returns which are based upon the equilibrium forecast by a particular model.[230]
- The issue of choosing a parameter based on historical data if the return on equity is not in equilibrium over the same period. This would result in the AER setting the parameter from 'first principles' based on regulatory judgement which is unlikely to be the 'stable, predictable regulatory approach favoured by the AER.[231]
- A test to determine whether the market is in or out of equilibrium requires a joint test of equilibrium and a pricing model. It is difficult to conclude if the market is out of equilibrium or the model is untrue.[232]

We disagree with Multinet's mischaracterisations.

Multinet appears to have misinterpreted our regulatory task or misunderstood our approach.

We do not reject information from realised returns as Multinet alleges. However, we do not agree using it for assessing asset models.[233] Realised returns are typically submitted as part of tests of asset model performance.[234] Realised returns can diverge from expected returns myriad reasons (as noted above) and may not always be realised. This raises questions about adjustments based on realised returns.

We note that there are issues with empirical tests of asset model performance (see above and section B.1.2) which cast doubt on the usefulness of realised returns for assessing asset models. For example, Multinet is testing the model against actual outcomes which can capture a range of additional factors such as outperformance and economics shocks.

However, we do not disregard realised returns. We have assessed that historical excess return is suitable for estimating when estimating forward looking parameters for the Sharpe-Lintner CAPM and give it appropriate regard consistent with its merits.[235]

Just as Multinet has observed, our regulatory task is to estimate the required return on equity for the benchmark efficient entity with a similar degree of risk as Multinet in supplying the reference services.[236] This must provide ex-ante compensation for efficient financing costs as our regulatory regime is an ex-ante (forward looking) regime.[237] [238]

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[230] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 19–21

[231] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 19–21;

[232] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 19–21;

[233] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 28–30.

[234] We note that historical excess returns is considered in the estimation of the market risk premium.

[235] See for example: AER, *Final decision SA Power Networks determination 2015-16 to 2019-20: Attachment 3–Rate of return*, October 2015, pp. 43–106.

[236] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 20.

[237] The AEMC describes, 'allowed revenues for network businesses are now set using the expenditure required by prudent, efficient operators as a benchmark. Companies have incentives to beat the benchmarks so they can keep some of their savings and pass the rest on to customers'. See AEMC, *Overview 2014–15*.

We have consistently and transparently assessed a range of equity models based on their merits and suitability for our regulatory task when developing our Guideline and in subsequent regulatory decisions. We determined that the Sharpe-Lintner CAPM should be used as the foundation model for estimating the return on equity because it will contribute to the achievement of the ARORO.[239] The Tribunal has upheld our use of the Sharpe-Lintner CAPM. Expert advice from John Handley and Graham Partington supports our use of the Sharpe-Lintner CAPM.[240] The current service providers have also adopted the Sharpe-Lintner CAPM as the foundation model for estimating the return on equity.[241] Further, there are a range of issues with using data to test and adjust the Sharpe-Lintner CAPM noted above.

We agree that the regulatory task does not specify an equilibrium rate of return. Our assessment of the various equity models and material submitted to us is based on their merits and suitability for our regulatory task. To that end we deploy the Sharpe-Lintner CAPM for the reasons extensively discussed in this decision and all previous decisions including our Guideline. We have again considered its use in light of HoustonKemp's recent report and our considerations are set out in section A and B.

It is also not clear Multinet's concern with selecting parameters as it acknowledged that it could not truly test if the market is out of equilibrium.[242]

In terms of the equity beta, our approach of empirically estimating beta using historical data is widely used both in practice and in academic work. The fact that realised returns can diverge from expected returns for a long period of time do not invalidate the equity beta data during that period. That is, it still measures the sensitivity of an asset or business's returns to movements in the overall market returns at a given period/time.

Multinet's concern would also apply to every model including Multinet's proposal. The issue can be resolved by assuming that historical returns are equivalent to equilibrium expected returns. However, there are a range of issues with this assumptions and even Multinet has acknowledged the two are not equivalent.[243]

In all, Multinet's submission on the equilibrium expected return appears puzzling. Every model entails its own (and potentially unique) assumptions and equilibrium. Therefore, the use of any equity model entails (explicitly or otherwise) an 'expected equilibrium return'. Despite claiming otherwise, Multinet's model (implicitly) assumes markets are efficient and in equilibrium, historical/realised returns are an appropriate benchmark

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238 See section J.2.1.

239 See section B.

240 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, paragraph 735.

241 APTPPL, APA, Multinet, AusNet, AGN.

242 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 21.

243 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 16.

and an alpha term to account for statistically significant[244] differences between Sharpe-Lintner CAPM estimates and realised returns.[245] This ignores periods of disequilibrium and that expectations are not always realised even on average (due to shocks or other factors).[246]

Multinet itself acknowledged that it does not 'confuse realised returns with expected returns'.[247] It is not clear why it is adding its alpha estimate, which is constructued from realised returns, to the expected returns from the Sharpe-Lintner CAPM.[248]

HoustonKemp report

Multinet relied on a HoustonKemp report (dated November 2016) to estimate its proposed alpha term of 1.14 per cent.[249] Our consideration of the HoustonKemp report reveals that it effectively repeats a number of issues already considered in previous regulatory processes such as:

- empirical tests suggesting that the Sharpe-Lintner CAPM is downwardly biased[250]
- an exercise to 'correct' the low-beta bias using ex-post returns through changing the Sharpe-Lintner CAPM[251]

We disagree with HoustonKemp's conclusions. Partington and Satchell have advised that:

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[244] HoustonKemp deemed that statistically significant differences between realised returns and Sharpe-Lintner CAPM to be attributable to downward bias from the Sharpe-Lintner CAPM. See HoustonKemp, *The Cost of Equity and the Low-Beta Bias*, November 2016, p. 30.

[245] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 17.

[246] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 30.

[247] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 16.

[248] Multinet's proposed alpha term is estimated from the difference between the Sharpe-Lintner CAPM estimates from realised returns such that its inclusion would not lead to statistically different (at the five per cent level) differences to the realised returns. See HoustonKemp, *The Cost of Equity and the Low-Beta Bias*, November 2016, p. 30.

[249] HoustonKemp, *The Cost of Equity and the Low-Beta Bias*, November 2016.

[250] AusNet Services, *Revised regulatory proposal 2017-2022*, 21 September 2016, p.143; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 286–298; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 280–292; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 57–72; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–46; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 47–58; ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 45–54; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp 39–52; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, p. 70; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 115–120, 129–130.

[251] See for example Frontier, *The required return on equity under a foundation model approach*, January 2016, p. 55. Both HoustonKemp and Frontier use a return on equity that is deemed absent of low-beta bias to estimate an adjustment to the equity beta in the Sharpe-Lintner CAPM.
HoustonKemp also uses ex-post return on equity to estimate an 'alpha' term to include in the Sharpe-Lintner CAPM.

> the view that Sharpe-Lintner CAPM returns are biased are likely influenced by the idea that markets are efficient and in equilibrium, hence realised returns are an appropriate benchmark. They also take as given that the method used in the analysis conducted by the researchers was correct. With respect to the former, the idea that markets are continuously efficient and in equilibrium is increasingly challenged by the proponents of behavioural finance and of course by practitioners who seek to profit by earning alpha (abnormal returns)…With respect to the research methods used, these have been challenged and the literature critical of the tests used in relation to asset pricing models continues to grow.[252]

Our assessment of the empirical tests of the asset pricing models is set out in section B.1.2. We do not consider that tests of asset model performance provide compelling evidence that the Sharpe-Lintner CAPM, when used as our foundation model in our foundation model approach, is downwardly biased. We also have concerns with HoustonKemp's methodology for estimating its alpha and beta adjustments because it is mechanistic and open to data mining.

We discuss the HoustonKemp report in more detail in Appendix B.1.2.

Previous submissions on the multi-model approach

We note since publishing our Guideline some service providers have submitted that the use of additional models for estimating the return on equity, and various methods for combining the models, would result in an improved estimate. The additional models submitted by some service providers are the Black CAPM, Fama-French model, the dividend growth model, and the historical and Wright specifications to the Sharpe-Lintner CAPM.

We note that similar arguments have been raised in previous submissions and revenue determinations.[253] They effectively revolve around the following claims:

- That empirical evidence shows that the Sharpe-Lintner CAPM is downwardly biased and that there are alternative models available that can reliably address these biases,[254] specifically:

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252 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 17.

253 See, for example, CitiPower, *Regulatory proposal 2016–2020*, April 2015, p. 198–204 & 224; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 267, 284–286, 324–326; Powercor, *Revised regulatory proposal 2016–2020,* January 2016, pp. 261, 278–280, 318–320; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 52–72, 94–105; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 38–40, 77–78; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 81–82; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 43–45; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 38–46, 50–52; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 56, 69–73.

- the Black CAPM can address low beta bias in the Sharpe-Lintner CAPM (a tendency for the Sharpe-Lintner CAPM to estimate a downwardly-biased return on equity for stocks with an equity beta less than one), and
- the Fama-French model can address book-to-market bias in the Sharpe-Lintner CAPM (a tendency for the Sharpe-Lintner CAPM to estimate a downwardly-biased return on equity for stocks with low book-to-market ratios)

- The dividend growth model more accurately and reliably reflects investors' prevailing required return on equity, and provides a better consideration of prevailing market conditions, than the Sharpe-Lintner CAPM.

We are not satisfied that the previously proposed application of other equity models[255] will result in a return on equity that is commensurate with efficient financing costs (given the risk of APTPPL's reference services).[256] We consider there is overwhelming evidence that the Sharpe-Lintner CAPM is the current standard-bearer for estimating expected equity returns.

We considered the relative merits of this material in detail in section B of this attachment. Given the limitations of the other equity models proposed by some service providers, we consider that:

- These models should not form part of our approach, either as the sole model or as part of a multi-model approach.
- The Wright approach, the dividend growth model, and the theory underpinning the Black CAPM may provide some (albeit limited) insights. This material has been used to inform our overall return on equity estimate (Wright) or the estimation of Sharpe-Lintner CAPM parameters (Black CAPM and dividend growth model).[257]
- The Fama-French model and historical specification of the Sharpe-Lintner CAPM should not be used to inform our return on equity estimate in any capacity.

Consumers and other stakeholders have generally supported our use of the Sharp-Lintner CAPM and our foundation model approach.[258]

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254 For example, see CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 287; Powercor, *Revised regulatory proposal 2016–2020,* January 2016, p. 281;

255 For both the construction of individual models, and the quantitative and/or qualitative methods to give weight to the models.

256 For example, Partington noted that any return on equity estimate could be obtained from SFG's DGM construction through judicious choice of input assumptions [Partington, *Report to the AER: Return on equity (updated)*, April 2015, p. 54].

257 We note that our specification of these models (particularly the dividend growth model) may differ from that proposed by the service providers.

258 Victorian Government, *Submission on the Victorian electricity distribution network service providers' revised regulatory proposals for 2016–20*, 12 February 2016, p. 1–2; EUCV, *A response to AusNet revenue reset proposal for the 2017–2022 period*, 9 February 2016; AGL, *Submission on the AER's draft decision on AGN's 2016–21 access arrangement*, 4 February 2016, p. 2; Queensland farmers' federation, *Re: Response on Australian Energy Regulator (AER) Draft Decision on Powerlink 's revenue proposal for the 2017/18 –2021/22 regulatory period*, 30

Partington and Satchell has noted that the 'SLCAPM remains the premier model used to estimate the cost of capital in practice, by both industry and regulators' and has wide agreement as 'a model of equilibrium expected returns'.[259]

Partington and Satchell also noted that the parsimony and observability of the Sharpe–Lintner CAPM 'reduces opportunities for cherry picking and also provides the opportunity for a relatively transparent implementation'.[260]

We do not agree that our application of the Sharpe-Lintner CAPM, given our choice of appropriate parameters, is downwardly biased for either low beta bias or book-to-market bias. We do not consider that reliable estimates of the return on equity can be derived from the Black CAPM, Fama-French model, or dividend growth model.

We have considered these issues and the associated supporting material in our previous decisions and we repeat the key points in Appendix B .[261]

We also note that our consideration of the relative merits of the Sharpe-Lintner CAPM, Black CAPM, Fama-French model, and dividend growth model are supported by the widespread use of the Sharpe-Lintner CAPM over the other models by market participants including brokers, valuers, and other regulators.[262] Further, our application of the Sharpe-Lintner CAPM in our foundation model approach and our return on equity estimate are supported by a range of relevant material including market-based evidence (see 'Steps four and five: other information and evaluation of information set on overall return on equity' subsection).

Risk free rate

Applying the Sharpe-Lintner CAPM requires estimating the risk free rate.

The risk free rate compensates investors for the time value of money. That is, committing funds for a period of time and therefore forgoing the opportunity to

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November 2016; Shell, *Roma (Wallumbilla) to Brisbane Pipeline Access Arrangement 2017–22*, 27 October 2016; CCP11, Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers, 22 March 2017, p. 9; CCP11, Australian Gas Networks (AGN), AusNet Services and Multinet, 3 March 2017, p. 81; Origin Energy, Victorian Gas Access Arrangement Review- 2018-22 Response to Gas Distribution Business' proposals, 17 February 2017; Red and Lumo Energy, Re: Australian Gas Networks Access Arrangement, 6 March 2017.

259 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 47.

260 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 9.

261 For example, see: AER, Final decision SA Power Networks determination 2015–16 to 2019–20: Attachment 3–Rate of return, October 2015, pp. 257–323; AER, Final decision AusNet Services distribution determination 2016 to 2020: Attachment 3–Rate of return, May 2016, pp. 165–212.

262 McKenzie, Partington, *Report to the AER: Supplementary report on the equity market risk premium*, 22 February 2012, pp. 11–12.

immediately spend money or consume goods.[263] For the benchmark efficient entity, we estimate this period of time to be 10 years.[264] We are satisfied that the risk free rate is a suitable starting point of comparison for what other investments must beat, given risk is involved. While the risk free rate varies over time, it still indicates the rate that other investments must beat.

We consider 10 year CGS yields are the most suitable proxy for the risk free rate. CGSs are low default risk securities issued by the Australian Government, and are therefore an appropriate proxy for the risk free rate.[265] The three major credit rating agencies issued their highest possible ratings to the Australian Government.[266] There is broad consensus with this position. For instance, market practitioners widely use CGS yields to proxy the risk free rate.[267] Stakeholders also widely supported using CGS yields as a proxy during the Guideline development process.[268] We use 10 year CGS yields because we adopt a 10 year term. A 10 year term emphasises the long term nature of cash flows in equity investments and the long lived nature the benchmark efficient entity's assets.[269]

We apply a placeholder risk free rate of 2.6 per cent in this decision. This risk free rate is based on a 20 business day averaging period, from 29 March 2017 to 28 April 2017. We use this to inform our draft decision on the return on equity for APTPPL's regulatory period (2017–2022).

We are satisfied with our estimate of the risk free rate and how this informs our estimate of the return on equity for the draft decision. This is because of the following:

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263 AER, *Final decision SA Power Networks determination 2015–16 to 2019–20: Attachment 3–Rate of return*, October 2015, pp. 257–323; AER, *Final decision AusNet Services distribution determination 2016 to 2020: Attachment 3–Rate of return*, May 2016, pp. 139–190

264 AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 48–49.

265 Gregory also identifies the absence of re-investment risk and inflation risk and characteristics of a risk free rate. Gregory, *The risk free rate and the present value principle*, November 2012, p. 5. Lally discusses these risks in his report. Lally, *The present value principle*, March 2013, pp. 10–12.

266 Standard and Poor's, viewed 5 March 2013, http://www.standardandpoors.com/prot/ratings/entityratings/en/us/?entityID=268976&sectorCode=SOV; Moody's, viewed 5 March 2013, http://www.moodys.com/credit-ratings/Australia-Government-of-credit-rating-75300; Fitch Ratings, viewed 5 March 2013, http://www.fitchratings.com/gws/en/esp/issr/80442187. Also see AOFM, *Australian government securities: Major features of the AGS market*, last updated 12 February 2015, viewed on 15 October 2015, link http://aofm.gov.au/ags/.

267 See, for example, Lally, *The present value principle*, March 2013, p. 13, and Wright, *Review of risk free rate and Cost of equity estimates: A comparison of UK approaches with the AER*, October 2012, p. 3; RBA, *Letter regarding the CGS market*, July 2012; Treasury and AOFM, *Letter regarding the CGS Market*, July 2012.

268 For example, see ENA, *Response to the draft guideline*, October 2013, p. 30; APA Group, *Submission on the draft guideline*, October 2013, p. 23-24; NSW DNSPs, *Submission on the draft guideline*, October 2013, p. 18. Spark Infrastructure, *Response to the draft guideline*, October 2013, p. 4.

269 While we recognise there are also reasonable arguments to support using a five year term, we find the arguments for a 10 year term more persuading. For additional reasoning, see AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 48–49.

- We are satisfied that our risk free rate, based on an averaging period of 29 March 2017 to 28 April 2017 contributes to the achievement of the allowed rate of return objective.[270]
- The averaging period of 29 March 2017 to 28 April 2017 is consistent with the conditions set out in the Guideline.[271]
- Our approach to estimating the market risk premium and risk free rate is internally consistent because both are 10 year forward looking estimates.[272]
- We are satisfied that an estimate of 2.6 per cent is the best estimate of the risk free rate at this time (over the specified averaging period).

Our draft decision is to accept APTPPL's proposed risk free rate averaging period (specified in its 10 February 2017 letter) which will be used to update the risk free rate in the final decision.[273] We specify this period in confidential Appendix 0.

We will update this risk free rate for the final decision using the period nominated by APTPPL in its 10 February 2017 response to our request for a final averaging period.[274] This averaging period is consistent with the approach in our Guideline:

- short—specifically, 20 consecutive business days in length[275]
- as close as practicably possible to the commencement of the regulatory period.

We note APTPPL did not propose a final risk free rate averaging period in its regulatory proposal for the Roma to Brisbane Pipeline.[276] It responded with the above mentioned averaging period after we wrote to it on 25 January 2017 to give an opportunity to nominate an alternative averaging period and also proposed an averaging period consistent with the Guideline to APTPPL as a 'default' option.[277] We developed this approach because:

- Previously, the onus was on service providers to propose their own averaging period subject to our criteria. This approach facilitated service providers in organising their financial arrangements in advance.[278]

270 NER, cl. 6.5.2(f); NER, cl. 6A.6.2(f); NGR, r. 87(6).

271 AER, *Rate of return guideline*, 17 December 2013, p. 15, 74–82.

272 This was recognised in Australian Competition Tribunal, *Application by APA GasNet Australia (Operations) Pty Limited (No 2) [2013], ACompT 8*, 18 September 2013, paras 279, 302–308.

273 APTPPL, *Roma to Brisbane Pipeline proposed revised Access Arrangement – rate of return averaging periods*, 10 February 2017 (confidential).

274 APTPPL, *Roma to Brisbane Pipeline proposed revised Access Arrangement – rate of return averaging periods*, 10 February 2017 (confidential).

275 For clarity, service providers can select longer periods for estimating the risk free rate used in the return on debt.

276 APTPPL, *Rome to Brisbane Pipeline access arrangement submission*, September 2016, p. 137.

277 AER, *Roma to Brisbane Pipeline proposed revised Access Arrangement – rate of return averaging periods*, 25 January 2017 (confidential).

278 See AER, *Explanatory statement rate of return guideline,* 17 December 2013, p. 76.

- In the draft Guideline we proposed moving away from providing service providers with the flexibility to determine the exact dates of the risk free rate averaging period for the return on equity.[279] This was because our previous approach resulted in concurrent determinations having different return on equity allowances, without a particular economic reason for this occurring.[280]
- In the final Guideline, we had regard to the benefits and limitations listed above. We did not specify whether or not service providers would nominate their own risk free rate averaging period for the return on equity.[281]

We consider the risk free rate we will apply provides for a return on equity that contributes to the achievement of the allowed rate of return objective.[282] That is, it is a forward looking risk free rate commensurate with prevailing conditions in the market for funds at the commencement of the regulatory control period.[283] As such, this risk free rate also has regard to the prevailing conditions in the market for equity funds, as the rules require.[284]

We consider the averaging period will contribute to the achievement of the allowed rate of return objective and has regard to the prevailing conditions in the market for equity funds.[285] This is because:

- It is an unbiased estimate because the averaging period was chosen in advance of it occurring. [286] If an averaging period is chosen after the period occurs, the knowledge of the risk free rate at any past point of time influences the choice, creating an inherent bias. It would not matter if the period were chosen by the AER, the service provider, a user or consumer, the Australian Competition Tribunal or another stakeholder. This view has been recognised by consultants and in the Guideline.[287] We consider an unbiased estimate contributes to estimating a rate of return that is commensurate with the efficient financing costs of a benchmark efficient entity. Setting a risk free rate with foreknowledge of the outcome does not

279 AER, Explanatory statement to the draft rate of return guideline, August 2013, p. 211.

280 See, for example, AER, Final decision: APA GasNet, March 2013, Part 2, p. 55; AER, Final decision: Access arrangement final decision: SPI Networks (Gas) Pty Ltd 2013-17, March 2013, Part 2, p. 75; AER, Final decision: Access arrangement final decision: Envestra Ltd 2013-17, March 2013, Part 2, p. 114; AER, Final decision: Access arrangement final decision: Multinet Gas (DB No. 1) Pty Ltd, Multinet Gas (DB No. 2) Pty Ltd 2013-17, March 2013, Part 2, p. 97.

281 AER, *Explanatory statement rate of return guideline,* 17 December 2013, p. 76.

282 NER, cll. 6.5.2(f); NER, cll. 6A.6.2(f); NGR, rr. 87(6).

283 AER, *Explanatory statement rate of return guideline*, 17 December 2013, p. 74.

284 NER, cll. 6.5.2(g); NER, cll. 6A.6.2(g); NGR, rr. 87(7).

285 NER, cl. 6.5.2(f–g); NER, cl. 6A.6.2(f–g); NGR, r. 87(6–7).

286 In the Federal Court, the reference to 'an unbiased rate of return' was interpolated to involve, 'making a prediction about interest rates which although too high or too low at any particular point in time, is on average correct'. Federal Court of Australia, *ActewAGL Distribution v The Australian Energy Regulator [2011] FCA 639*, 8 June 2011, para 39.

287 AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 79–80; Lally, M., *Expert Report of Martin Thomas Lally*, 13 February 2011, pp. 9-10. See the Federal Court of Australia's observations of the views expressed by Houston and Lally in Federal Court of Australia, *ActewAGL Distribution v The Australian Energy Regulator [2011] FCA 639*, 8 June 2011, para 145.

reward efficient decision making or allow a comparison to benchmark performance. It does not provide the appropriate incentive for efficient investment, as contemplated in both the NEO/NGO and the revenue and pricing principles.[288] This is because regulated service providers are to use the forward looking allowed rate of return to value their investment decisions.[289]

- It is a fair estimate because we gave service providers the opportunity to submit different periods and to formalise any arrangements for their financing needs resulting from our determination. In this way, we consider this promotes efficient decision making in a manner that also fairly respects the interests of service providers and other stakeholders.
- This produces a risk free rate that informs a return on equity estimate that has regard to the prevailing conditions in the market for equity funds, as the rules require.[290] This is because:
    - It is based on a short term (20 consecutive business days) averaging period close to the time at which we make our decision.[291] We use a short term averaging period as a pragmatic alternative to using the prevailing rate.[292] This recognises that the prevailing risk free rate is the benchmark that returns on risky investments must outperform.[293] To estimate this, we use 10 year CGS yields because this is a suitable, easily observable proxy that reflects expectations of the risk free rate over a 10 year forward looking investment horizon.[294]
    - When using this estimate to inform our return on equity, we also had regard to a range of other prevailing market information. This included but was not limited to comparisons with the prevailing return on debt and a range of information to inform our MRP estimate, including DGM estimates and conditioning variables. Under step four and five of our foundation model approach, we have regard to other information when considering whether our return on equity estimate is reasonable. Further, our foundation model within our foundation model approach is a forward looking model.[295]

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[288] See sections 7 and 7A of the NEL for the NEO and RPP respectively. The NEO states: 'The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to price, quality, safety, reliability and security of supply of electricity; and the reliability, safety and security of the national electricity system'.

[289] See Mr Gregory Houston and Dr Martin Lally, *Joint report: Prepared in the context of proceedings between ActewAGL and the AER*, 16 March 2011, p. 1. These experts agreed that, 'economic theory says that the required rate of return to be used in evaluating an investment decision is the forward looking rate estimated as at the date of that decision'.

[290] NER, cl. 6.5.2(g); NER, cl. 6A.6.2(g); NGR, r. 87(7).

[291] For clarity, service providers can select longer averaging periods for estimating the return on debt.

[292] Lally, *The present value principle*, March 2013, p. 5; Lally, *Risk free rate and present value*, August 2012, p. 7.

[293] We discuss this in previous decisions. See for example, AER, *Access arrangement final decision: SPI Networks (Gas) Pty Ltd 2013–17, Part 2: Attachments*, March 2013, pp. 88–95.

[294] AER, *Explanatory statement rate of return guideline,* 17 December 2013, pp. 48–49.

[295] McKenzie and Partington, *Risk, asset pricing models and WACC*, June 2013, p. 23.

- The agreed averaging period ends as close as practically possible to the commencement of the regulatory control period given the uncertainty with the date the final decision would be released and the time needed for modelling to be completed.

Our practice is to keep the dates of averaging periods confidential until they have expired. This allows service providers to manage their financing arrangements without the possibility of the public announcement of the potential timing of their arrangements putting them in a disadvantaged bargaining position.

Estimating equity beta

Equity beta measures the sensitivity of an asset or business's returns to the movements in the overall market returns (systematic or market risk).[296]

We adopt an equity beta point estimate of 0.7 from a range of 0.4 to 0.7. Our equity beta estimate is required to be commensurate with a similar degree of risk as that which applies to APTPPL's provision of reference services.[297] We are satisfied that an equity beta of 0.7 reflects a similar degree of systematic risk as APTPPL is exposed to in providing reference services. We hold this view because:

- Our range and point estimate give most weight to direct measurements (that is, empirical estimates) of the equity beta that businesses with a similar degree of risk as APTPPL have exhibited in the past. We consider these are reliable indicators of the prevailing, forward-looking equity beta for an efficient business (or benchmark efficient entity) with a similar degree of risk as APTPPL.
- Our range and point estimate are consistent with our conceptual analysis. This suggests the systematic risk of APTPPL[298] would be less than the systematic risk of the market as a whole (that is, its equity beta would be less than 1.0). Our conceptual analysis is supported by McKenzie and Partington.[299]
- The theoretical principles underpinning the Black CAPM are reasonably consistent with an equity beta towards the upper end of our range. For firms with an equity beta below 1.0, the Black CAPM theory may support using a higher equity beta than those estimated from businesses with a similar degree of risk as APTPPL when used within a Sharpe-Lintner CAPM. This is a result of the Black CAPM

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296 McKenzie and Partington, *Risk, asset pricing models and WACC*, June 2013, p. 21; Brealey, Myers, Partington, Robinson, *Principles of Corporate Finance*, McGraw-Hill Australia: First Australian Edition, 2000, p. 187.

297 More precisely, standard control network services, see: NER, cl. 6.5.2(c). For transmission network service providers the rules refer to prescribed transmission services, see NER, cl. 6A.6.2(c). For gas network service providers the rules refer to reference services, see NGR, r. 87(3).

298 More precisely, an efficient business (or benchmark efficient entity) with a similar degree of risk as that which applies to APTPPL in the provision of reference services.

299 See: McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 10–12; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 31; Partington and Satchell, *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015, p. 6; Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015.

relaxing an assumption underlying the Sharpe-Lintner CAPM, which allows for unlimited borrowing and lending at the risk free rate.[300] However, we do not consider the theory underlying the Black CAPM warrants a specific uplift or adjustment to the equity beta point estimate. The reasons for our use of the Black CAPM theory are set out in more detail in section B.2.

- We recognise the importance of providing stakeholders with transparency and predictability in our rate of return decisions, which we consider is consistent with the achievement of the ARORO.[301] In this context, a point estimate of 0.7 is consistent with our Guideline (which was developed following extensive consultation) and is a modest step down from previous regulatory determinations.[302] It also recognises the uncertainty inherent in estimating unobservable parameters, such as the equity beta for a benchmark efficient entity.

Our direct measurements of the equity beta for businesses with a similar degree of risk as APTPPL are primarily based on an expert report from Professor Olan Henry (Henry), which uses data for a set of Australian energy network businesses up to 28 June 2013.[303] We have analysed equity beta using Henry's methodology and data up to 28 April 2017. Our finding is that empirical estimates continue to support Henry's empirical range of 0.3–0.8.[304]

We discuss our study in more detail in section G.

We have reviewed service providers' new material on equity beta which include a CEG report and a Frontier report.[305]

While the material does display small changes in empirical estimates, we do not find satisfactory evidence of an increase to depart from our range and point estimate. Our updated analysis remains consistent with Henry's range which supports our range (0.4–0.7) and point estimate (0.7). Further, there appears to be conflicting information between the CEG report and Frontier report as Frontier's10 year average firm-level estimates suggest a decline in empirical estimates since Henry's study.

Both CEG and Frontier have attempted extension of Henry's results and observed increases.[306] However, their observations are driven by its use of shorter-term

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[300] However, the Black CAPM replaces this with an assumption of unlimited ability to short sell stocks.

[301] Stakeholders, particularly service providers, sought greater certainty of process. See: AER, *Explanatory statement: Rate of return guideline*, December 2013, p. 51; AEMC, *Final rule determination*, November 2012, pp. 42–43, 45, 50; RARE Infrastructure Limited, *Submission to AER's rate of return guidelines consultation paper*, June 2013; The Financial Investor Group, *Response to the AER's rate of return guidelines consultation paper*, June 2013, p. 1; ENA, *Submission to AER's rate of return guidelines issues paper*, February 2013, p. 4; PIAC, *Submission to AER's rate of return guidelines issues paper*, February 2013, p. 17.

[302] That is, determinations prior to the 2012 Rule change. From 2010 to early 2014, all our regulatory determinations have applied an equity beta of 0.8. See: AER, *Review of the WACC parameters: final decision*, May 2009, p. v.

[303] Henry, *Estimating β: An update*, April 2014, p. 9.

[304] Henry, *Estimating β: An update*, April 2014, p. 63.

[305] Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016; CEG, Replication and extension of Henry's beta analysis, 21 September 2016; CEG. *Replication and extension of Henry's beta analysis*, November 2016.

estimates.[307] This can lead to results being prone to factors such as volatilities, fluctuations and one-off events which can obscure the 'true' equity beta for a benchmark efficient entity and is unlikely to provide a robust estimate. Further, Frontier itself recognised that short term data 'is insufficient to provide statistically reliable estimates of beta.'[308]

We discuss CEG's report in more detail in the 'CEG's replication and extension of Henry's results' below and Frontier's report in the 'APTPPL and APA proposal for equity beta of 0.8' below.

We also consider a number of other empirical studies of the equity beta of Australian energy network businesses. These empirical studies show a consistent pattern of equity beta estimates that is robust to the use of different econometric methods and time periods. From 2002 to 2016, these empirical studies present equity beta estimates that converge on the range of 0.4 to 0.7.[309]

We consider recent equity beta estimates for international energy businesses, which range from 0.3 to 1.0. However, the pattern of international estimates is not consistent and we consider international businesses are less likely than Australian businesses to have a similar degree of systematic risk as APTPPL. More information on empirical estimates can be found in section G.

We have considered international estimates which, in conjunction with considerations of the Black CAPM and investor certainty (as discussed above) support a higher estimate and an estimate at the upper end of our range.[310] Our equity beta point estimate also provides a balanced outcome given the submissions by stakeholders and services providers, as shown in Figure 3-3.

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306 CEG, Replication and extension of Henry's beta analysis, 21 September 2016; CEG. *Replication and extension of Henry's beta analysis*, November 2016; Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, pp. 16–21.

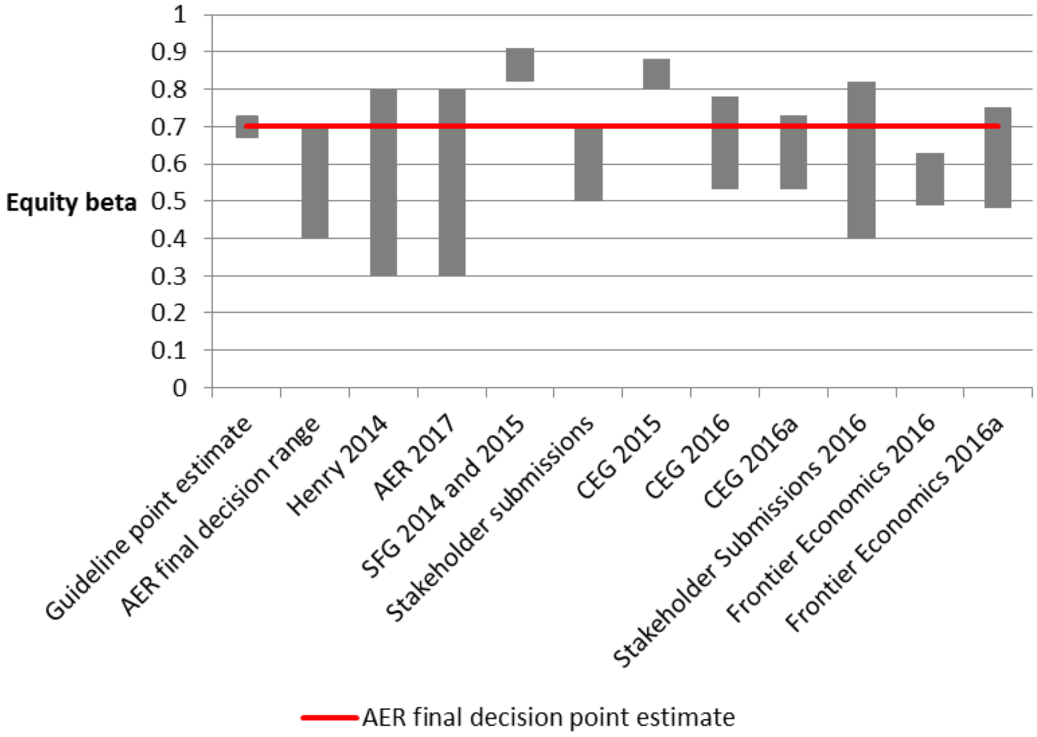
307 CEG, Replication and extension of Henry's beta analysis, 21 September 2016, pp. 2-3,14; CEG. *Replication and extension of Henry's beta analysis*, November 2016, pp. 2–5; Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, pp. 16–21.

308 Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, p. 18.

309 As discussed in detail in section G we do not consider individual firm equity beta estimates in isolation. This is because no particular energy network firm in our comparator set is perfectly representative of the benchmark efficient entity. We consider averages of individual firm estimates and estimates from various portfolios of firms are more likely to be reflective of the benchmark efficient entity. However, we place no material reliance on time varying portfolio estimates, as according to Henry, they are not grounded in financial theory and are prone to measurement error. See: Henry, *Estimating β: an update*, April 2014, p. 52.

310 But does not support an estimate beyond our range. We hold this view based on:
(1) the outcome of our conceptual analysis that a business with a similar degree of risk as AusNet Services (in providing regulated services) is likely to have an equity beta less than one;
(2) our assessment of the relative merits of the material, and conclusion that greater weight should be placed on Australian empirical estimates than international estimates or the theory of the Black CAPM.

Figure 3-3 Submissions on the value of the equity beta



Source: AER analysis[311]

Note: Henry 2014 presents the range specified in Henry's 2014 report (0.3 to 0.8). AER 2017 presents the range specified in our updated study of beta estimates in 2017. The stakeholder submissions range is intended to reflect the views of consumer groups and those who use/engage with the energy network (or pipeline). The lower bound of this range is based on CCP11's submission to Multinet, AusNet and AGN's regulatory proposal and the upper bound is based on Origin Energy's submission. The SFG 2014 and 2015 range lower bound is based on multiple model regression analysis of Australian and US firms and the upper bound is based on SFG multiple model based equity beta estimates (under its 'foundation model' approach for the return on equity). CEG 2015 figures are from CEG January 2015 paper on estimating the cost of equity, equity beta and MRP. CEG 2016 beta range is the result of CEG's re-estimation of the Henry 2014 paper

311 Based on our decision and the following reports: AER, *Rate of return guideline*, 17 December 2013, p. 15; Henry, *Estimating β: An update*, April 2014, p. 63; SFG/Frontier submitted 0.82 (under multiple model approach for return on equity) in SFG, *The required return on equity for the benchmark efficient entity*, 25 February 2015, p. 20; SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, p. 4; and Frontier, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 3. SFG/Frontier submitted 0.91 (under alternative 'foundation model' approaches for return on equity) in SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, p. 35; Frontier, *The required return on equity under a foundation model approach*, January 2016, p. 11; CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, pp. 2-3,14; CEG, Replication and extension of Henry's beta analysis, November 2016; Origin Energy, Victorian Gas Access Arrangement Review-2018-22 Response to Gas Distribution Business' proposals, 17 February 2017; CCP11, Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers, 22 March 2017, p. 8.

with extension to 30 June 2016 submitted with AusNet Services Revised revenue proposal in September 2016. CEG 2016a beta range is the result of CEG's update to its 2016 estimation using data to October 2016. Frontier Economics range is drawn from their January 2016 reports for Jemena, ActewAGL, AusNet Services, Australian Gas Networks, Citipower, Powercor and United Energy on beta estimations. Frontier 2016a is from its December 2016 report for APA.

CEG's replication and extension of Henry's results

We note Multinet, AGN and AusNet have accepted our Guideline equity beta of 0.7.

However, all three service providers submitted a report from CEG (AGN and AusNet submitted the September 2016 version and Multinet submitted the November 2016 version).[312] Both versions of the report attempted to replicate and extend results from the Henry (2014) paper to 2016 to show a material increase in beta estimates. CEG raised a number of issues in support of a higher equity beta, for example:[313]

- CEG's extension of Henry's estimates suggests that empirical estimates of equity have increased since Henry's 2014 report.
- CEG's more recent estimates (one year and five year estimates to 2016) for still listed firms indicate a more prominent increase in the equity beta.
- The increase in beta is consistent with the observation from a February 2016 CEG report which observed a structural break in average rolling beta at 2014/15.

Apart from updated estimates (due to inclusion of a further 4 months' of data), the key addition in the November 2016 version of the report is using the Quandt-Andrews test to identify structural breaks in August 2009 and August 2014.[314]

We have carefully considered CEG's report. We acknowledge there may be some change in empirical estimates of equity beta since 2014.

However, we do not consider CEG provide significant evidence of a material increase to warrant adjusting our empirical range of 0.4–0.7 or point estimate 0.7. In its September report for a number of reasons specified in section H and G.2.1. Partington and Satchell have advised that they are not ‘convinced that there has been material change in beta’ after reviewing CEG's September report.[315]

We also disagree with CEG’s November report for a number of reasons including:

- CEG's extension of firm level estimates does not indicate a significant change in empirical estimates of the equity beta. For example, the average re-levered firm-level estimate (using weekly data and Henry's longest sampling period extended

[312] CEG, *Replication and extension of Henry’s beta analysis*, 21 September 2016, pp. 2-3, 14; CEG. *Replication and extension of Henry’s beta analysis*, November 2016.

[313] CEG, *Replication and extension of Henry’s beta analysis*, 21 September 2016, pp. 2-3, 14; CEG. *Replication and extension of Henry’s beta analysis*, November 2016, p.

[314] CEG. *Replication and extension of Henry’s beta analysis*, November 2016, pp. 4–5.

[315] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017. p. 8, 14.

until October 2016) increased slightly (by 0.05) from 0.554 to 0.6.[316] If this is restricted to firms with additional data, then the average re-levered firm-level estimate is 0.488 which is a decrease compared to CEG's and Henry's estimates for 2013.

- The average re-levered portfolio estimates for both equally-weighted and value-weighted portfolios increased by a similar magnitude.[317]
- CEG did not report the standard error of its regressions. If we use Henry's standard errors as a proxy, CEG's extension of firm-level estimates (longest time period) falls within 2 standard deviations of Henry's results.
- CEG's observed increase is driven by short term estimates.[318] We consider that this is unlikely to provide a robust equity beta estimate and is of the view that estimate of equity beta using the longest possible data set would be better suited.
- Short term estimates (such as CEG's one year, two year and five year estimates) are not sufficiently robust to provide enough evidence of a change in beta or for the purpose of testing structural breaks. This is because the imprecise nature of short term estimates (due to one-off events, fluctuations and volatilities) may obscure the 'true' equity beta for a benchmark efficient entity.[319]
- Partington and Satchell have advised that they continue to see 'little evidence of change' in the November CEG report.[320]
- CEG's observed increases for the longest data period are driven by gearing. However, the underlying risk of supplying the regulated services appears relatively unchanged as there continues to be 'relatively little difference in the raw beta estimates'.[321]
- Re-levered equity beta can be sensitive to the gearing and leveraging assumptions. For example, five year estimates for APA are 0.71 (Frontier) and 0.81 (CEG) despite similar data period and use of Henry's methodology. Therefore, it may be that it is the choice of gearing assumptions that is driving the observed increases.[322]

We also consider that CEG has not provided satisfactory evidence to show that there are structural breaks in empirical estimates of equity beta in 2014. Our analysis does not support a break in 2014. Partington and Satchell have advised that:

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316 The average of Henry's re-levered equity beta for firm-level estimates was 0.52. CEG's replication (0.554) is different from Henry's result would be driven by the method we use for gearing to account for cross-holding. We compare CEG's extension with its replication of Henry's estimates to allow a like-for-like comparison.

317 We compare average portfolio-level estimates for P1 to P5.

318 CEG. *Replication and extension of Henry's beta analysis*, November 2016, pp. 1–5.

319 AER, *Better regulation: Explanatory statement rate of return guideline*, December 2013, p. 122;

320 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017. p. 8, 9.

321 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017. p. 8, 9.

322 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017. p. 10.

- There is no statistical test of the significance of the increase in re-levered betas.[323]
- CEG's observations are focused on portfolio 6 (P6) which contains the four still-listed comparator firms. P6 will be sensitive to the weightings for individual stocks and change in weighting. Frontier has also cautioned that a 'sample of four firms is insufficient to produce statistically reliable estimates of beta' which appears inconsistent with its conclusion which relies on observations from four firms.[324]

APTPPL and APA proposal for equity beta of 0.8

APTPPL and APA proposed an equity beta of 0.8 based on the following material:[325]

- The AER previously set a beta 0.8 for APTPPL and APA VTS based on the same empirical range as that used to set the Guideline's 0.7.
- Updated empirical estimates from a 2016 ERA decision indicate an increase in beta.
- CEG's February 2016 report (considered in the ERA's 2016 decision) concluded that there have been structural breaks since the Guideline was released.

APA also submitted a Frontier report (dated November 2016) in support of an equity beta of 0.8.[326]

We do not consider APTPPL and APA has provided material supportive of a beta higher than 0.7. We disagree with an equity beta of 0.8 and in particular note:

- We previously set a 0.8 equity beta (slightly above our range of 0.4–0.7) for APTPPL and APA in 2012 and 2013 to account for the precision of estimates.[327] However, the substantial increase in the number of data points at the time of the Guideline, and the fact that estimates across both relatively stable and volatile periods supported our range of 0.4–0.7, gave greater confidence in our range.[328] As result, we have greater confidence that the equity beta for the benchmark efficient entity is in the range of 0.4–0.7.
- The ERA's estimation is based on a period of five years. We note that short term data is more prone to one-off events, fluctuations and volatilities in the market– which may obscure the 'true' equity beta for a benchmark efficient entity. Therefore, we have most regard to longer term estimates and a large sample of firms when determining the equity beta.

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[323] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017. p. 12.

[324] Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, p. 18.

[325] APTPPL, *Roma to Brisbane pipeline access arrangement submission*, September 2016, pp. 135-141; APA, *Victorian transmission system access arrangement submission*, 3 January 2017, pp. 139–144.

[326] Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016.

[327] AER, *APT Petroleum Pipeline Pty Ltd Access arrangement final decision Roma to Brisbane Pipeline 2012–13 to 2016–17*, August 2012, p. 20; AER, Access arrangement final decision APA GasNet Australia (Operations) Pty Ltd 2013–17 Part 2 Attachments, March 2013, p. 93.

[328] AER, *Better Regulation Explanatory Statement: Rate of return guideline*, December 2013, pp. 84–85.

- The test in CEG's February 2016 report is based on short term estimates (three year and five year estimates). We do not consider this to be sufficiently robust to provide satisfactory evidence for the purposes testing structural breaks.
- Our own analysis using data up to 28 April 2017 do not support a structural break since Henry's study.

We have considered the Frontier report and do not consider that it provides satisfactory evidence of a material change in empirical estimates to warrant departure from our point estimate of 0.7 for the following reasons:

- Frontier's observations of increase are based on shorter-term (5 year) estimates of equity beta.[329] However, Frontier itself supports the use of longer term data and noted that ‘five years of data is insufficient to provide statistically reliable estimates of beta’.[330] This is consistent with our approach because longer-term data is less vulnerable to market volatility and one-off events which may mask the 'true' beta.
- Frontier's 10 year estimates of the equity beta betas does not support an increase to our range and point estimate:[331]
    - Frontier's average of firm-level re-levered beta estimates is 0.48 which is lower than Henry's estimate of 0.52 in 2014
    - Frontier's portfolio-level estimates are within 2 standard deviations of Henry's results. Given the relative imprecision of empirical estimates, this does not provide material evidence to justify moving from our range and point estimate.
- We do not consider that the re-levered equity betas of unregulated transport-related infrastructure firms can be used to inform the equity beta of a benchmark efficient entity with a similar level of risk as APTPPL in providing the reference services. This is because the risk characteristics of transport-related businesses such as Auckland International Airport would be very different to those of the benchmark efficient entity (for example, due to demand risk). Partington and Satchell also advised that unregulated transport-related infrastructure be 'given negligible weight'.[332]
- Partington and Satchell have advised that Frontier has provided a 'weak case that beta has increased in recent times' based on the following observations:[333]
    - There is no statistical test for a significant change in beta.

329 Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, pp. 16–18, 19–21.

330 Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, p. 18.

331 Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016, p. 18.

332 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 44.

333 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 41–42.

- Frontier has acknowledged concerns with the reliability of five-year estimates yet continues to use them makes its conclusions 'less than compelling'.[334]
- A comparison of the confidence intervals for Frontier's five-year and 10-year estimates shows many overlaps. It is not clear that five year estimates represent a recent increase in beta relative to a more reliable estimate (in Frontier's judgement) taken over a ten year period.
- Frontier's 10 year relevered equally-weighted portfolio estimates are very close to the AER's base estimate.
- The AER's value of 0.7 is 'well within the confidence interval' from Frontier's rolling average of value-weighted portfolio estimates.[335]

Other and previous submissions

We note some stakeholders have submitted on the equity beta. Submissions include we place too much reliance on some material, we did not have appropriate regard to information from other relevant sources and we made inappropriate methodological choices in our empirical analysis. Section H contains previous stakeholder views on our use of relevant material.

User group submissions to the current service providers' proposals have generally supported the use of our Guideline approach to estimate the equity beta and a point estimate of 0.7:

- Service providers have not provided substantial reasons for increasing the equity beta from 0.7 to 0.8[336] [337]
- Service providers reference the ERA's decision when arguing for a higher beta, but fail to acknowledge that the ERA still determined an equity beta of 0.7. [338]
- Service providers ignore their own consultant's recommendation of using 10-year estimates which result in estimates (0.52–0.57) close to Henry's estimates[339]
- Frontier’s preferred formulation results in a range of empirical equity betas for the 5-year data of 0.65 to 0.72. .[340] [341] This is consistent with the AER's point estimate.

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[334] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 41–42.

[335] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 44.

[336] CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS’s proposed Return on Equity, 22 March 2017, p. 14.

[337] CCP11, Victorian Gas Access Arrangement Review (GAAR) for APA VTS, 3 March 2017, p. 35.

[338] CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS’s proposed Return on Equity, 22 March 2017, p. 20.

[339] CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS’s proposed Return on Equity, 22 March 2017, p. 20.

[340] CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS’s proposed Return on Equity, 22 March 2017, p. 22.

[341] CCP11, Victorian Gas Access Arrangement Review (GAAR) for APA VTS, 3 March 2017, p. 32.

- There is no clear theoretical basis or substantive empirical rationale provided to explain the stated increases in the empirically derived equity beta of the regulated energy network businesses since 2014. This is particularly important given evidence of a relatively long period of stability in the empirically derived equity beta using data prior to 2014, despite the changes in the state of the economy over the historical assessment period. [342]
- Given the lack of any theoretical underpinning for a change in the empirical beta, consumers can have no confidence that the recent observations (using 5-year data) represent a longer term 'break' in the historical data analyses which have remained fairly consistent since Henry's 2008 study. The analysis referred to above by CEG appears to be similarly based on short term data (3-years). [343]
- There is no evidence provided that the market in general perceives a change in risk for regulated network assets. Nor does APA or other listed regulated gas networks appear to identify such a change in risk in their annual reports to shareholders. In fact, the listed networks continue to promote to investors the benefits of stable and predictable cash flows from their regulated businesses. [344]
- Multinet's proposal represents an implicit adoption of the theory of the Black CAPM and an attempt at quantification of the theory.[345] The theory of the Black CAPM is difficult to put into practice because of the well-known problems with quantifying the adjustment required.[346]

Having considered the overall information and all material currently before us, at this time we are not satisfied that an increase to our equity beta estimate of 0.7 will better contribute to the achievement of the ARORO and the NGO.[347]

Estimating the market risk premium

Our Guideline, developed after extensive consultation with stakeholders, sets out our preferred approach to estimate the market risk premium. We have consistently applied this approach since publication of the Guideline in 2013 which was upheld by the

342 CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS's proposed Return on Equity, 22 March 2017, p. 23.

343 CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS's proposed Return on Equity, 22 March 2017, p. 23.

344 CCP11, Australian Pipeline Association, Victorian Transmission Services (APA VTS): Supplementary Advice on APAP VTS's proposed Return on Equity, 22 March 2017, p. 23.

345 CCP11, Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers, 22 March 2017, p. 8.

346 CCP11, Victorian Gas Access Arrangement Review (GAAR) for APA VTS, 3 March 2017, p. 35.

347 NER, cl. 6.5.2(f); NER, cl. 6A.6.2(f); NGR, r. 87(6). NEL, s.16; NGL, s. 23.

Tribunal in its decision for AusGrid.[348] We also note the Tribunal upheld our use of and decision on the various relevant materials we relied upon in making our estimates.[349]

We have considered the current service providers' proposals to depart from the Guideline when estimating the market risk premium. We also note that Multinet's proposal is similar in some respects to those submitted previously by other service providers which we have previously rejected. For example, Multinet proposes a higher market risk premium by assigning more weight to dividend growth model estimates of the market risk premium than we consider appropriate.[350]

Additional material, that has not been considered by us in our previous determinations has, however, been submitted by stakeholders through the consultation process for making this decision. We have taken all of the relevant information obtained through the determination process into account in making our decision. Our estimate of the prevailing market risk premium for this decision is 6.5 per cent. We have applied the approach set out in the Guideline to derive that estimate. This is a forward-looking estimate of the risk premium – the derived market return above the risk free rate – on the market portfolio required by investors with a ten-year investment horizon. This is in line with the definition stated in the 2013 Guideline.

Having considered all the relevant material before us we do not consider there is satisfactory evidence to warrant departure from the Guideline approach and our 6.5 per cent point estimate. For example, the conditioning variables indicate there has not been a material change in market conditions to warrant adjusting the market risk premium.[351] We consider that the Guideline approach will best contribute to achieving the rate of return objective. Our reasons are set out below.

We consider 6.5 per cent to be the best estimate of the market risk premium to contribute to the achievement of the ARORO because:

- It is supported by our consideration of all relevant material submitted to us (following consideration and scrutiny of their relative merits)
- It is corroborated and verified by our cross-checks on the overall return on equity and equity risk premium. This further supports our estimate of the equity risk premium (of which the market risk premium is a component)
- It provides a balanced outcome between submissions by service providers and other stakeholders.

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[348] Australian Competition Tribunal, *Application by Public interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, p. 202, 221–222.

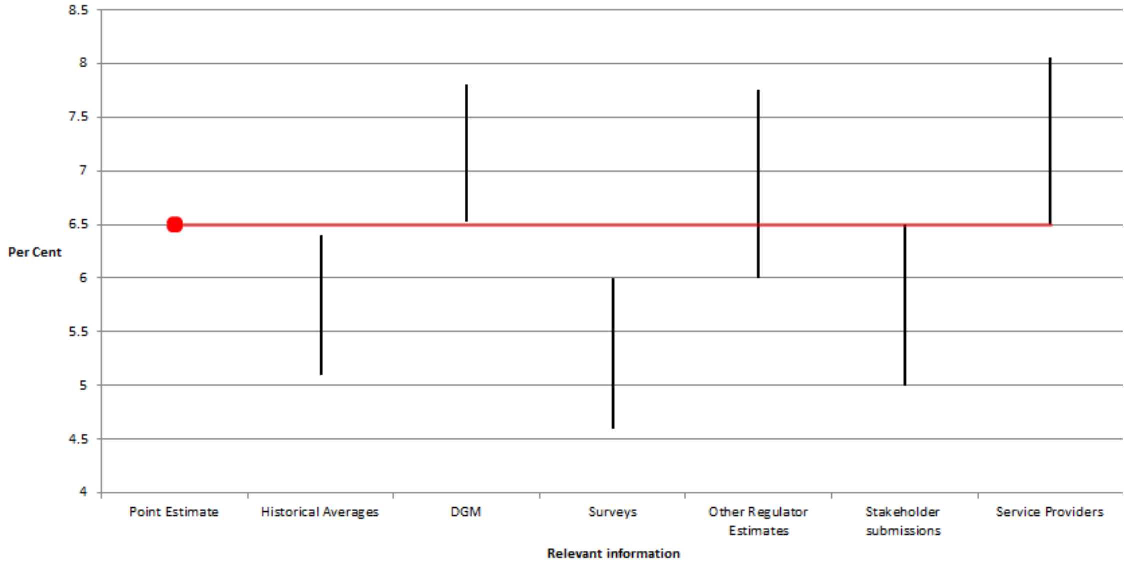
[349] Australian Competition Tribunal, *Application by Public interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, p. 221–222.

[350] AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016, p. 148-149; Frontier Economics, *The market risk premium*, September 2016, p. 71–73, 75–76; Multinet Gas, *Multinet Gas Rate of Return Overview*, 2016 December 2016, pp.26-28

[351] See 'other information and evaluation of information' subsection of section 3.4.2 and E.

The next figure shows the market risk premium estimates from the relevant material that we have used to inform our decision. These estimates range from a low of 5.1 per cent to a high of 7.8 per cent.

Figure 3-4 Comparison of estimates of the market risk premium



Source: AER analysis

Note: The range of regulator's decisions was formed from data from other regulator's most recent decisions. The Top of the range (7.75 per cent) is from IPART and the bottom of the range from ESCV and ESCOSA[352]. The stakeholder submissions range is intended to reflect the views of consumer groups and those who use/engage with the energy network or pipeline, and as such it does not include submissions from service providers. The bottom and top of the stakeholder range comes from the Consumer Challenger Panel subpanel 4 (CCP4 (Hugh Grant)), CCP5, CCP4 and Queensland Farmers' Federation.[353] The bottom and top of the service provider proposed range comes from submissions by AGN, AusNet, Multinet, APA and APTPPL.[354]

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352 IPART, *Maximum fees and charges for cruise ships in Sydney Harbour Final decision*, 25 November 2016; ESCOSA, *SA Water Regulatory Determination 2016 Final Decision*, June 2016; ESCV, *Goulbourn-Murray Water Price Review 2016*, 16 June 2016

353 CCP5, *response to AER draft decision on AusNet services transmission review*, September 2016; CCP5, *Transmission for the Generations III–Response to: Revised revenue proposal by AusNet Services for Transmission Revenue Review 2017–22*, October 2016, pp. 9–10; CCP4 (Hugh Grant), *Submission to the AER: AER draft 2018–22 revenue decision Powerlink revised 208–22 revenue proposal*, 23 December 2016, p. 44; CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Powerlink's electricity transmission network for a revenue reset for the 2017-2019 regulatory period*, 19 December 2016, p. 21; Queensland farmers' federation, *Re: Response on Australian Energy Regulator (AER) Draft Decision on Powerlink 's revenue proposal for the 2017/18 –2021/22 regulatory period*, 30 November 2016..

354 AusNet Services, *Access Arrangement 2018-22*, 21 December 2016; APA VTS, *VTS Revision Proposal Submission*, 03 January 2017; AGN, Access Arrangement Information for our Victorian and Albury natural gas distribution networks 2018-2022, 22 December 2016; Multinet Gas, *Rate of Return Overview*, 16 December 2016; APTPPL, *RBP Access Arrangement revision submission*, September 2016

We derive our point estimate from within this range by considering the relative merits of all of the relevant material. The application of our approach is set out as follows:

- Historical excess returns provide a baseline estimate and indicates a market risk premium of approximately 5.5–6.0 per cent from a range of 5.1 per cent to 6.4 per cent. We consider both geometric and arithmetic averages of historical excess returns when considering this result. However we are aware of evidence that there may be a bias in the geometric averages. We take this into account when forming our result and baseline estimate, and as such our range for historical returns is based on arithmetic averages and informed by the geometric averages.
- Dividend growth model estimates indicate a market risk premium estimate above this baseline with a range of 6.53 to 7.80 per cent, which when conducting sensitivity analysis expands to 5.97 to 8.88 per cent. We consider our dividend growth model is theoretically sound but that there are many limitations in practically implementing the model. As previously stated in our assessment of the dividend growth model, it may capture current conditions to a certain extent but fails to adequately provide a 'true' estimate of the forward looking MRP. We consider our, and other, dividend growth models are likely to produce upward biased estimates in the current market due to reasons provided in Section B.4. We also take into consideration that our model, and other models, may not accurately track changes in the return on equity for the market. For these reasons, we do not consider that the dividend growth model estimates are reliable on their own, but they do provide an indication for a point estimate above the range derived from the historical returns, as the guideline method shows. The guideline designated the dividend growth model to inform on whether the market risk premium may be above or below the historical estimates.[355] The substantial widening in the range of results from the sensitivity analysis is indicative of the unreliability stressed by the limitations we discuss in Section B.4.
- We also look at other regulator's decisions when considering our estimate of the market risk premium, after we have accounted for differences in objectives and approved calculation methods, as a cross check. Regulatory decisions over the past 12 months indicate a market risk premium of 6.5 is reasonable. The most recent regulatory decisions in 2017 have largely used an MRP value from 2016. Conditioning variables indicate that there has not been a material change in market conditions since our May and April 2016 decisions. See section F.4 for more detail on regulators' recent decisions and their estimations
- Survey evidence supports a market risk premium around 6.0 to 6.5 per cent.

Service user submissions have generally supported a market risk premium at or below the 6.5 per cent. We have considered the submissions and our analysis of the relevant evidence and all material before us indicate that the forward looking 10 year estimate

[355] AER, *Explanatory statement, Rate of Return Guideline*, December 2013, pp. 14;

of the market risk premium is 6.5 per cent. These submissions are summarised in table 3–5 below

Table 3-4: Stakeholder Submissions on the Return on Equity and market risk premium

Stakeholder	Submission Content
Consumer Challenge Panel (CCP5)	Any move from the recommended 6.5 per cent MRP to the service providers' new recommendation of 7.5 per cent would be a reactionary in light of "short term fluctuation in the risk return relationship".[356]
Asia Pacific LNG (APLNG)	MRP of 8.1% submitted in the RBP access arrangement decision was too high, and they had specific concerns over the "interpretation of the cost of equity method for the purposes of estimated the MRP and the subsequent departure from the AER's stated methodology in the Rate of Return Guideline which results in an upward revision of this estimate."[357]
QGC	This submission raised concerns about the higher WACC, of which the MRP is a significant part, that APTPPL have submitted in their recent decision claiming that there is no clear reason why "a high WACC is applicable to the RBP relative to other regulated infrastructure".[358]
Australian Energy council (AEC)	The AEC stated that APTPPL's given rate of return of 7.7 per cent seems high given the current risk free rate, the nature of APTPPL's operations on the RBP and the pass through costs that apply to the tariff. The AEC implies that with a rate of return this high the service providers are not baring the risks they should be expected to.[359]

[356] CCP (subpanel 5, *Submission on AusNet transmission revised proposal,* October 2016 P8-9.
[357] Asia Pacific LNG, *Submission on Roma to Brisbane access arrangement 2017-22*, 4 November 2016, p. 2
[358] QGC, *Submission on Roma to Brisbane access arrangement 2017-22,* 28 October 2016, p4
[359] AEC, *Submission on Roma to Brisbane access arrangement 2017-22*, 20 October 2016, p3

Consumer Challenge Panel-David Headberry (CCP4 (David Headberry))	CCP4 (David Headberry) submitted that with the rising risk free rate the previously acknowledged conservative parameters, namely MRP and Equity Beta, should be adjusted accordingly to take the rise into account.[360]
Consumer Challenge Panel-Hugh Grant (CCP4 (Hugh Grant))	CCP4 (Hugh Grant) also submitted that the AER should propose an MRP closer to 5 per cent.[361]
Cotton Australia	Cotton Australia were encouraged by the lower rate of return proposed in Powerlink's revised proposal and acknowledges that this is in line with the AER's proposal on the matter.[362]
Queensland Farmers' Federation	The QFA maintains its position that current utility regulation should be transitioned towards direct performance regulation in order to keep in line with the over-inflated revenue proposals presented.[363]
John Herbst	Mr Herbst submits that the AER is not holding the service providers to account in regards to applying the National Electricity Rules and setting a rate of return that allows consumers to pay for the value the network provides to them[364]
CCP11 – Beverly Hughson	Ms Hughson submitted that the AER should continue to stick to the guideline value of 6.5 per cent for the MRP in absence of evidence from the service providers. Ms Hughson also proposes further investigation into the DGM and conditioning variables and their impact on the MRP decision.[365]
CCP11 submission on APA VTS	The CCP submits that the AER should not diverge from the guideline to accept APA VTS's method of calculating the MRP, noting that the service provider quotes the ERA selectively in finding evidence for this method.[366]

360 CCP4 (David Headberry), *Submission on Powerlink draft decision and revised proposal*, 23 December 2016, P21

361 CCP4 (Hugh Grant), *Submission on Powerlink draft decision and revised proposal*, 23 December 2016, P5 & P39-42

362 Cotton Australia, *Submission on Powerlink revised proposal*, 22 December 2016, p2

363 Queensland Farmers' Federation, *Submission on Powerlink Draft Decision*, 30 November 2016, p3

364 John Herbst, *Submission on TasNetworks tariff structure statement*, December 2016, p1-3

365 Beverly Hughson, *Supplementary Advice on the proposed Return on Equity by Victorian gas network service providers,* 22 March 2017, pp.39-40; Beverly Hughs, *Supplementary advice on APA VTS's proposed Return on Equity*, 22 March 2017, p.7

366 CCP11, *Response to proposal from APA VTS for the 2018-22 access arrangement* ,3 March 2017, pp.32-35

CCP11 submission on AGN, AusNet and Multinet	The CCP submit that there is no reason for the AER to deviate from their proposed 6.5 per cent in the absence of evidence of a sustained change in the MRP provided by the service providers, and that the AER is placing the most reliance on the Historical Excess Returns[367]

The current service providers diverge in their proposed market risk premium:

- AGN adopts the Guideline.
- AusNet and Multinet depart from the Guideline foundation model approach by mischaracterising it in proposing a market risk premium of 7.5 per cent.
- APTPPL and APA VTS deviate from the Guideline method of estimating the market risk premium by using a method similar to the Wright Approach.

We discuss bottom two points below.

Mischaracterisation of the Guideline

Multinet and AusNet, relying on a Frontier report, claimed the December 2013 Guideline used the simple average of historical excess returns and dividend growth model estimates to set a market risk premium of 6.5 per cent while giving 'little' weight to other relevant material.[368] They argued a consistent application (based on excess return and dividend growth model data in the July 2016 AusNet Services Transmission draft decision) would lead to a market risk premium of 7.5 per cent.

This is a mischaracterisation of the Guideline approach:

- The Guideline approach is not to simply average estimates across historical excess returns and dividend growth models to inform point estimate selections.
- The mechanistic approach suggested by Frontier downplays issues with the reliability of dividend growth models, their suitability for our regulatory task and the consequent role/s the Guideline assigns them and the manner in which we take different evidence into account when exercising discretionary judgement.
- We have consistently outlined our considerations and methods in the Guideline, and application of the Guideline in regulatory decisions to date.[369] Our estimation of the market risk premium is informed by a range of relevant material:[370]

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367 CCP11, *Response to proposals from AGN, AusNet and Multinet for the 2018-2022 Access Arrangements*, 3 March 2017, pp.74-79

368 Frontier considers that we set a market risk premium of 6.5 per cent in the December 2013 Guideline by estimating the mid-point of historical excess returns and dividend growth model estimates. See Frontier Economics, *The Market Risk Premium*, September 2016, p. 25.

369 See: AER, *Final decision SA Power Networks determination 2015-16 to 2019-20: Attachment 3–Rate of return*, October 2015, pp. 33–144.

370 See for example: AER, *Final decision SA Power Networks determination 2015-16 to 2019-20: Attachment 3–Rate of return*, October 2015, pp. 43–106.

- We place most reliance on historical excess returns. Therefore, we use this information to determine a baseline estimate of the market risk premium. We consider 6.0 per cent (from a range of 5.1–6.4 per cent) is, at this time, a reasonable point estimate based on this source of evidence.
- We place less reliance on our dividend growth model estimates of the market risk premium. This information indicates whether we should select a market risk premium point estimate above or below the baseline estimate.
- We place some reliance on the other information (survey evidence and conditioning variables). This information, in conjunction with dividend growth model evidence, helps to indicate how far above or below the baseline estimate the market risk premium point estimate should be. We use other Australian regulators' market risk premium estimates as a cross check on how we consider information.

Our use of relevant material is informed by the roles assigned to them which are based on their relative merits and suitability for our regulatory task:[371]

Table 3-5: Role assigned to each source of relevant material in determining the market risk premium

Relevant material	Role	Reasons for chosen role
Historical excess returns	Given the most reliance	Meets most of the criteria. The main potential limitation is slow response to changes in market conditions. This is not a limitation if investor expectations of the 10 year forward looking market risk premium move similarly slowly. Further, considering other sources of evidence reduces this limitation.
Dividend growth models (AER's construction)	Given the second most reliance	Meets most of the criteria. The main limitation is its sensitivity to assumptions, which is significant. It is also likely to produce upward biased estimates.[372] Since it can readily reflect changes in market conditions, it complements our use of historical excess returns. However, its tracking ability is limited if it produces inaccurate results.
Survey evidence	Given some reliance (point in time estimate)	Its main strength is that it estimates investor expectations. However, limitations related to survey design and representativeness of

371 See for example: AER, *Final decision SA Power Networks determination 2015-16 to 2019-20: Attachment 3–Rate of return*, October 2015, pp. 43–106.

372 McKenzie and Partington, *Report to the AER: Part A, return on equity*, October 2014, pp. 26, 28–30; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 46–50, 59; Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 43–44.

Relevant material	Role	Reasons for chosen role
		respondents can reduce the value of these estimates. Triangulation of survey evidence may reduce these limitations.
Conditioning variables (dividend yields, credit spreads, implied volatility)	Given some reliance (directional information only)	Their main strength is their ability to detect changing market conditions. However, it is difficult to derive an MRP estimate from this information in a robust manner. Academic and empirical evidence on this information is mixed.
Other Australian regulators' market risk premium estimates	Cross check on how we consider information	This is indirect evidence of the market risk premium, which we do not use to estimate the market risk premium. However, we consider it useful to have regard to the approaches other regulators are taking to consider the evidence before them.
Dividend growth models (SFG's construction)	Does not inform our market risk premium estimate	We consider this dividend growth model is unnecessarily complex and produces unrealistic growth rates. We consider SFG overstates its benefits because it transfers where one makes assumptions, rather than reducing the need to make assumptions. (see appendix B—DGM)
Imputation credit adjustment (AER, Brailsford et al.)	Adjust market risk premium estimate under the dividend growth model and historical excess returns	This is consistent with economic and finance principles and empirical analysis. The adjustment is also transparent and replicable.
Imputation credit adjustment (SFG)	Does not inform our market risk premium estimate	This applies a formula (from Officer) differently to how we apply the Officer framework in the PTRM. Applying the formula, as SFG proposed could cause problems because it is based on perpetuity assumptions and assumes no capital gains.
Independent valuation reports	Does not inform our market risk premium estimate	More suitable for use at the overall return on equity level because writers of these reports can adjust individual parameters to obtain an overall result.
The Wright approach	Does not inform our market risk premium estimate	More suitable for informing the overall return on equity because it is designed to provide information at the return on equity level and does not use a direct estimate of the MRP.

Source: AER analysis.

Partington and Satchell advised against giving more weight to dividend growth estimates in the absence of reliable evidence reviewing the accuracy of dividend growth model estimates.[373] They noted that 'it is not clear that it is appropriate to apply equal weights' to historical excess returns and dividend growth model estimates.[374] Further, Partington and Satchell noted that issues with dividend growth forecasts, as well as bias within analyst reports,[375] are still valid and prominent in the current market conditions.[376]

Multinet effectively proposes to estimate the market risk premium using a (simple) average of historical excess returns and dividend growth model estimates. This bears some resemblance to the previously proposed "multi-model" approach[377] which estimated the return on equity and market risk premium using an average of four different sources.[378]

Our assessment of the relevant evidence in the Guideline and regulatory decisions indicates that the dividend growth model is most suited to inform whether the point estimate lies above or below the historical excess returns. Multinet's proposal gives insufficient consideration to the relative merits of the relevant evidence.

Partington and Satchell advised that we should not assign more weight to dividend growth model estimates (as Multinet seems to suggest) because of inaccuracy, upward bias of the estimates and sensitivity of the model to inputs and assumptions.[379] They concluded that it is 'very unlikely that the DGM will produce a forward looking MRP commensurate with the prevailing conditions in the market for funds'.[380] They also noted that 'DGM-based estimates of the MRP in a 10 year horizon context are probably better down-weighted than given more weight'.

Partington and Satchell advised that 'the DGM…is more useful as a conceptual tool than a forecasting model'.[381] This is consistent with our Guideline approach of using dividend growth model estimates to inform if a point estimate may be above or below the historical excess estimate. The AER has not changed its view on the DGM and how useful the information it provides is in forming a point estimate of the MRP.

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373 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 23.

374 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 26.

375 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 28-31.

376 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 24.

377 For the return on equity: the Sharpe Lintner CAPM, Black CAPM, Fama-French model and the dividend growth model. For the market risk premium: historical excess returns, Wright approach, dividend growth model and independent expert valuation reports.

378 SAPN, *Regulatory Proposal 2015-20*, p318-319; AGN, *Revised SA Access Arrangement Information January 2016*, P88-89; Frontier Economics, The Required Return on Equity Under a Foundation Model Approach, January 2016, P7-10,22

379 Partington and Satchell, Report to the AER: Discussion of estimates of the return on equity, 7 March 2017, pp. 23–24.

380 Partington and Satchell, Report to the AER: Discussion of estimates of the return on equity, 7 March 2017, p. 23.

381 Partington and Satchell, Report to the AER: Discussion of estimates of the return on equity, 7 March 2017, p. 24.

Multinet also submitted that its proposed (7.5 per cent) market risk premium is supported by 'prevailing conditions in the market' on the basis that:

- Frontier's construction of the historical excess returns and dividend growth model provides an estimate of 7.5 per cent, and
- Frontier's consideration of independent valuation reports, surveys, other regulators' decisions, conditioning variables and market participants support a point estimate of 7.5 per cent.

We disagree with Frontier’s view that prevailing market conditions support a market risk premium of 7.5 per cent for the following reasons:

- As noted above, Frontier has mischaracterised the Guideline approach for estimating the market risk premium. We did not and do not average estimates across historical excess returns and dividend growth model estimates. We have regard to a range of relevant evidence.
- Frontier's historical excess returns are based on computational decisions[382] that we have previously considered and rejected. We continue to consider that historical excess returns should be computed assuming a theta of 0.6, inclusion of the post 1980 averaging periods and without the NERA adjustment.[383] See section I for further discussion of this point.
- We do not consider the other materials referenced by Frontier support a 7.5 per cent market risk premium. For example, Frontier has claimed that survey evidence supports their estimate of 7.5 per cent because they state survey answers are ex-imputation estimates. However we have covered this argument before as to the ambiguity of survey estimates in relation to imputation credits, and it is discussed further in Appendix I.
- Frontier has continued to depart from the Guideline by using valuation reports to inform the market risk premium.[384] The reasons for departing from the guideline in this manner have not been robustly set out and as such we are not satisfied such a movement away from the Guideline is in accordance with the ARORO. This is discussed further in Appendix I.

Expert advice from Partington and Satchell supports our Guideline approach for estimating the market risk premium. They observe that the evidence provided by Frontier and Multinet is not convincing them that there should be a current increase in the market risk premium.[385] Moreover, many of the arguments regarding a stable return on equity since the 2013 Guideline are reforged arguments from previous Frontier

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[382] Frontier assumed a theta of 0.35, the NERA adjustment and excluded averaging periods that start in 1980 (that is it excluded the 1980–2015 and the 1988–2015 averaging periods).

[383] AER, Better regulation Explanatory statement rate of return guideline appendices, December 2013, p. 27;

[384] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 35–37; Frontier Economics, *The Required Return On Equity Under A Foundation Model Approach*, January 2016, pp. 32–34.

[385] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 14

submissions.[386] For example, Partington and Satchell noted Frontier's continued reliance on earnings yield and PE based evidence to argue the required return on equity has remained stable since the Guideline.[387] Partington and Satchell continue to show that the relationship between the earnings yield (and PE ratio) and the cost of equity is not a simple linear one but a complex one that does not allow for the assumptions Frontier have made.[388]

Multinet argues that the AER should not use conditioning variables when estimating the MRP, despite the information they provide. The service provider argues that in the absence of formal econometric mapping there should be no reliance placed on the information, but that if you were to place weight on their information they would support a stable return on equity.[389] However the AER has put forward in previous decisions that the information is useful for adding information to our decision as discussed in section I. We also note that other regulators such as the ERA use such conditioning variables as additional evidence. See section I for further details.

The report from Multinet also sets forward that the methods the AER use to estimate the overall return of equity have remained stable, which therefore indicate the MRP should have increased as the risk free rate has fallen.[390] However we have previously stated that the Wright approach, one of the two methods used by Multinet to demonstrate a steady return on equity, should not be used to form an opinion of the market risk premium.[391] This has also been restated by Partington and Satchell in their most recent advice.[392] The Guideline also states that the DGM, the other model used by Frontier, should not be used to directly calculate an estimate for the return on equity.[393]

APTPPL's and APAs Wright approach for the market risk premium

- APTPPL and APA proposed using the long term average of the return on the market and the prevailing risk free rate. This resulted in a market risk premium of 8.06 per cent for APTPPL and 7.76 per cent for APA VTS.[394]
- APTPPL and APA submitted that their proposals are:[395]

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386 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 18

387 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 18-21

388 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March 2017*, p. 20

389 Multinet, *Rate of Return Overview*, 16 December 2016, p. 29; Frontier, The market risk premium, September 2016, pp. 40–41.

390 Multinet, *Rate of Return Overview*, 16 December 2016, p. 31; Frontier, The market risk premium, September 2016, pp. 30–31.

391 AER, AER explanatory statement – appendices – rate of return guideline, December 2013, pp. 24-28

392 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017 pp. 27-28

393 AER, AER explanatory statement – appendices – rate of return guideline, December 2013, pp. 119-125

394 The difference between the two is due to the change in risk free rate between submission dates, and results in a higher Return on Equity estimate for APA VTS.

395 APTPPL, *2017-2022 RBP Access Arrangement revision submission*, September 16 2016, pp. 145–157; APA VTS, *VTS Revision Proposal submission*, 3 January 2017, pp. 144-150

- the 'correct' implementation of the Sharpe-Lintner CAPM and has not applied the Wright CAPM.
- supported by the 2016 ERA decision for Goldfields Pipeline

We disagree.

Partington and Satchell has advised that it 'is the risk premium that determines the market portfolio' and 'practitioners tend to treat the MRP as the exogenous variable' to the CAPM (instead of the return on the market as suggested by APTPPL).[396]

- We note that APTPPL and APA's approach shares similarities with a Wright CAPM, and appears to be a historical/alternative specification of the CAPM (if not a Wright CAPM, see Appendix B.5 for more discussion):
- It implies a perfectly offsetting relationship between the risk free rate and the market risk premium, which is similar to an assumption under the Wright CAPM.
- APTPPL and APA rely on the ERA's observations of (effectively) a Wright CAPM estimate of the return on market.
- It does not account for changing market conditions.
- It uses the AER's Wright CAPM estimate to estimate the market risk premium.

Partington and Satchell also advise that the method used by APTPPL and APA VTS is not as independent from the Wright CAPM as the service providers claim. They note that the service providers' method ‘assumes stability of the market rate of return over time’[397] (which both dispute) due to ‘heavy reliance on the long run historic average for the return on the market’[398] .[399] They also observed ‘an inverse relation between the equity risk premium and the interest rate [arise] as a consequence of assuming stability in the market return’,[400] which again contradicts APA’s table of assumptions.

We do not consider these alternative specifications of the CAPM (such as the Wright CAPM) when estimating market risk premium. Our assessment indicates that these materials contain limitations that make them unsuitable for our regulatory task. This is discussed further in section 3.4.1 and Appendix B.5.

It is also not clear that the ERA's 2016 decision for the Goldfields Gas Pipeline supports APTPPL and APA’s approach and their proposed market risk premiums.[401] We note the following:

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396 Partington and Satchell, Report to the AER: Discussion of estimates of the return on equity, 7 March 2017, pp. 16, 33.

397 Partington and Stachell, *Report to the AER: Discussion of submissions on the cost of equity*, 29 May 2017, p. 47

398 Partington and Stachell, *Report to the AER: Discussion of submissions on the cost of equity*, 29 May 2017, p. 47

399 APA VTS, *VTS Revision Proposal Submission*, 3 January 2017, p. 166

400 Partington and Stachell, *Report to the AER: Discussion of submissions on the cost of equity*, 29 May 2017, p. 47

401 APTPPL, *2017-2022 RBP Access Arrangement revision submission*, September 16 2016, p. 156.

- APTPPL appears to mischaracterise the ERA's decision.[402] The ERA noted itself that our market risk premium of 6.5 per cent is comparable with its market risk premium.[403]
- APTPPL noted that the ERA 'inverted the AER's approach to estimating the market risk premium, using the estimates for a set of dividend growth models, and using the average historical excess returns as a cross check'.[404] However, that is not the case. The ERA used historical excess return and dividend growth model estimates to inform a range for the market risk premium.[405] It also used other relevant material (such as conditioning variables) to inform its decision.
- The ERA concluded that its analysis indicated mean-reversion and not stationarity (which is what APTPPL and APA noted), so it is not clear they are equivalent characteristics.[406] It is not clear that a series displaying mean-reversion can be a proxy for a series (expected return on the market) that demands stationarity.
- APTPPL and APA have not provided robust evidence to show that its proposed long term return on market data series exhibits stationarity.
- We also note that APTPPL and APA 's proposals are a clear departure from the Guideline and common practice. We note the 2013 Guideline estimates the market risk premium independent of the risk free rate as it is a parameter that cannot be as readily observed as the risk free rate[407]. Partington and Satchell also advised that it is common market practice to 'treat the MRP as the exogenous variable' to the Sharpe-Lintner CAPM and 'it is the risk premium that determines the market portfolio'.[408]
- Further, APTPPL and APAS's approach leads to a market risk premium significantly above the historic average. Partington and Satchell has advised that 'it is more likely that the MRP is below the long run historic average than that it has risen'[409] and that the resulting MRP provided by the service providers is implausible.[410] They also consider recent evidence from the Credit Suisse Global

402 APTPPL submitted that the ERA's decision supported an expected return on the market of 10 per cent which results in a market risk premium of 8.06 per cent based on a placeholder risk free rate of 1.94 per cent. APA VTS do the same with a risk free rate of 2.24 per cent.

403 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, June 2016, pp. 239–240.

404 APTPPL, *2017-2022 RBP Access Arrangement revision submission*, September 16 2016, p. 146; APA VTS, *VTS Revision Proposal submission*, 3 January 2017, p. 148

405 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, June 2016, pp. 222–230.

406 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, June 2016, P216

407 AER, *AER Explanatory statement - rate of return guideline*, December 2013, P11

408 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P33

409 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, pp. 17–18.

410 Partington and Stachell, *Report to the AER: Discussion of submissions on the cost of equity*, 29 May 2017, p. 47

Investment Yearbook 2017 which indicates that the average risk premium for Australia has decreased over time.[411]

Issues addressed in previous decisions

We note that some stakeholders continue to submit on a range of issues we discussed and addressed in previous regulatory decisions. That is, they submitted that we place too much reliance on some material, that we did not have appropriate regard to information from other relevant sources, or that we made inappropriate methodological choices in our empirical analysis.

Section I sets out stakeholder views on our use of relevant material and our responses. We have considered the majority of these views in previous regulatory decisions.[412] Having considered these views, the overall information and all material before us, at this time we are not satisfied that these submissions indicate a departure from the Guideline would contribute to the achievement of the ARORO and the National Gas Objective.

Steps four and five: other information and evaluation of information set on overall return on equity

To inform the reasonableness of the Guideline's foundation model return on equity estimate, we estimate and evaluate values from other relevant sources of information (steps four and five of the foundation model approach).[413] In having regard to prevailing market conditions we have also examined recent movements in the relevant material.

Our task is to set the allowed rate of return to be commensurate with a similar degree of risk as that which applies to APTPPL with respect to the provision of reference services.[414] This requires us to consider the additional riskiness of APTPPL[415] relative to the risk free asset, and the commensurate return that equity investors require to take on this additional risk. Hence, the critical allowance is the allowed equity risk premium over and above the estimated risk free rate at a given time. Section E.3 and F compares our foundation model equity risk premium to other relevant material[416] that can inform our estimate of return on equity and equity risk premium.

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[411] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, p. 18.

[412] AER, *Final Decision SA Power Networks distribution determination - attachment 3 - rate of return,* October 2015; AER, *Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016

[413] This includes broker reports, independent valuation reports, other regulators' decisions, the Wright approach and comparison between the return on equity and return on debt.

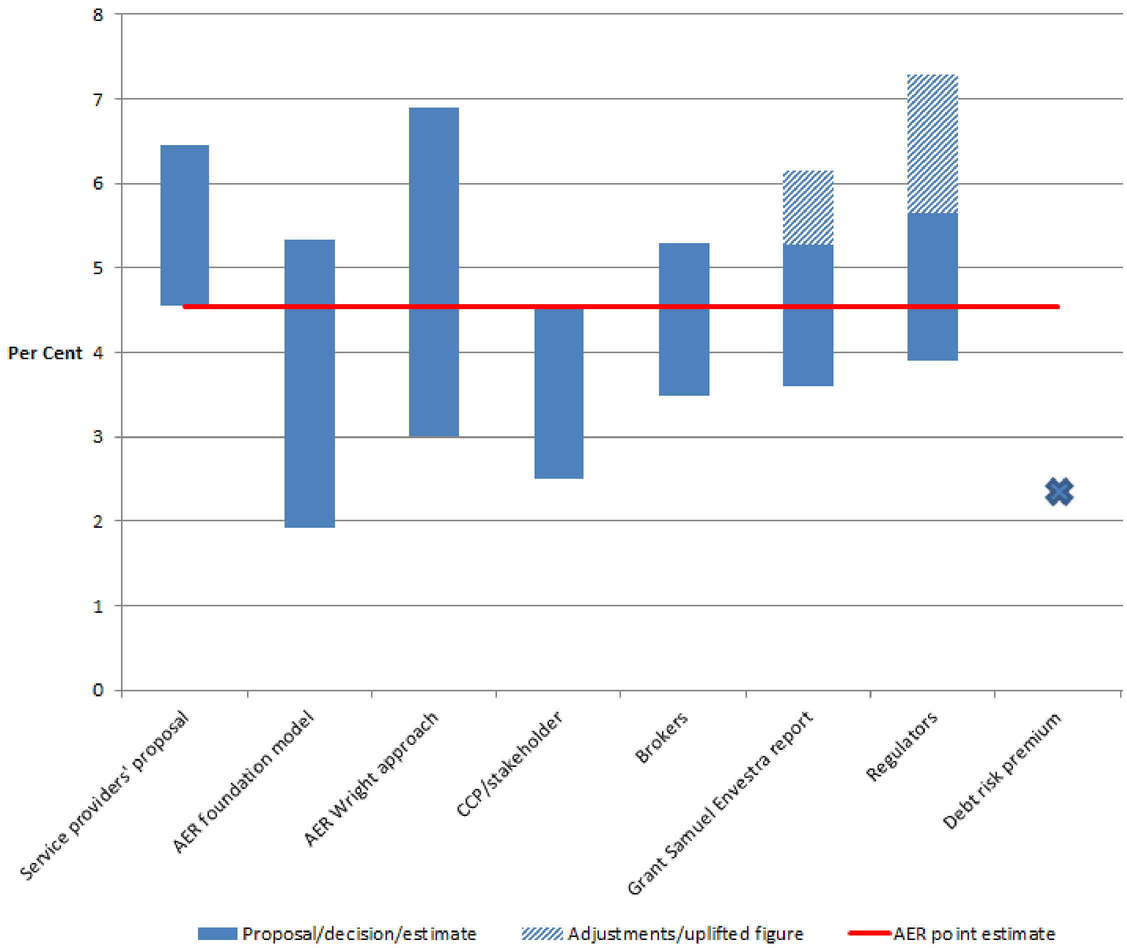
[414] In respect of the provision of network services. While there may be many various risks associated with providing regulated network or pipeline services, we consider that (consistent with modern portfolio theory) the rate of return will be commensurate with efficient financing costs if it reflects only non-diversifiable risks. Diversifiable risk can be addressed through other regulatory mechanisms, such as capex and opex allowances.

[415] Or more precisely, a benchmark efficient entity with a similar degree of risk as APTPPL in respect of the provision of reference services.

[416] The Rate of Return Guideline outlines the use of certain other material to inform our final estimate of the return on equity: the Wright approach, other regulators' estimates, broker returns, independent export reports and

We consider that, on the whole, the other material[417] broadly supports our foundation model estimate of the return on equity. Overall, we find that this information does not indicate a material, sustained change in market conditions since our July and August 2016 decisions sufficient to cause us to move away from our foundation model estimate.

Figure 3-5 Comparison of foundation model equity risk premium



Source: AER analysis and various submissions and reports.

Notes: The AER foundation model equity risk premium (ERP) range uses the range and point estimate for market risk premium and equity beta. The calculation of the Wright approach is set out in section C.2. The

comparison with return on debt. See: AER, *Better Regulation: Explanatory Statement, Rate of Return Guideline*, December 2013, p. 61.

417 The other material includes our construction of the Wright CAPM, other regulators' estimates, comparison with return on debt and relevant broker and independent expert reports.

calculation of brokers and other regulators ranges is outlined in Appendix F. The calculation of debt risk premium is in Appendix E.3.

Grant Samuel's final WACC range included uplift above an initial SLCAPM range. Grant Samuel made no explicit allowance for the impact of Australia's dividend imputation system. The upper bound of the range shown above includes the uplift and an adjustment for dividend imputation, while the lower bound does not. The upper shaded portion of the range includes the entirety of the uplift on return on equity and a full dividend imputation adjustment.[418]

The shaded portion of the other regulators range represents the impact of rail, transport and retail gas decisions on the range. We consider these industries are unlikely to be comparable to the benchmark efficient entity.

The service provider proposals range is based on the proposals from businesses[419] for which we will make decisions in June 2017. The lower bound of the CCP/stakeholder range is based on the CCP5 submission,[420] the upper bound is based on multiple submissions which accept the AER's MRP and equity beta.[421]

Our implementation of the foundation model approach results in a return on equity of 7.2 per cent and an equity risk premium of 4.55 per cent. This is consistent with equity risk premium ranges from broker reports, valuation reports, other regulators' decisions, and the Wright approach as shown in C, E and F. The range of equity risk premium estimates from valuation reports and other regulators' decisions have not materially changed since our May and August 2016 decisions. The estimated equity risk premium range from the Wright approach has increased since we made the October and November 2015 decisions as the risk free rate has fallen. As set out in section B.5, we do not agree with the underlying premise of the Wright CAPM that there is a clear inverse relationship between movements in the risk free rate and market risk premium. Consequently we place limited reliance on the Wright approach.

The return on debt material shown in the figure above does not support any change to our foundation model return on equity estimate. Our analysis indicates that the equity risk premium is about 234 basis points[422] above the prevailing return on debt. The return on debt is a relative indicator and we expect that, most of the time,[423] investors' expected return on equity will exceed the expected return on debt. For a benchmark

418 Grant Samuel, *Envestra: Financial services guide and independent expert's report*, March 2014, Appendix 3.

419 AusNet Services, *Access Arrangement 2018-22*, 21 December 2016; APA VTS, *VTS Revision Proposal Submission*, 03 January 2017; AGN, Access Arrangement Information for our Victorian and Albury natural gas distribution networks 2018-2022, 22 December 2016; Multinet Gas, *Rate of Return Overview*, 16 December 2016; APTPPL, *RBP Access Arrangement revision submission*, September 2016

420 CCP5, *Submission on AusNet transmission revised proposal*, October 2016.

421 Australia Pacific LNG, *Submission on Roma to Brisbane access arrangement 2017-2022*, 4 November 2016; AEC, *Submission on Roma to Brisbane access arrangement 2017-2022*, 20 October 2016; QGC, *Submission on Roma to Brisbane access arrangement 2017-2022*, 28 October 2016

422 Estimated as the difference between our estimate of the equity risk premium and the prevailing debt risk premium for April 2017.

423 We consider that the expected return on debt is likely to exceed the expected return on equity during periods of financial distress because holders of debt are typically ranked ahead of equity holders in the event of bankruptcy. We also consider that equity and debt may face different types of risk. Inflation risk is one risk that is likely to affect debt more significantly than equity. Movements in the risk premia for these different types of risk may, theoretically, result in an expected return on debt that exceeds an expected return on equity.

efficient entity with a similar degree of risk as APTPPL, we would not expect the return on equity to be a large margin above the prevailing return on debt.[424]

The spread between the equity and debt premiums has remained fairly constant in early 2017 after widening in the latter part of 2016 and it remains above the estimate at the publication of the Guideline in December 2013 (see Figure 3-11 in section E.3). It remains broadly consistent with those observed in previous regulatory decisions.[425]. Contrary to the service providers' assertions, we consider the current difference is not too low, given the low risk profile of a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services.[426] Further, measured debt yields likely understate the expected yield spread due to default risk.[427]

The regulatory regime to date has been utilising the Sharpe-Lintner CAPM to set the return on equity and has been supportive of investment. There is no evidence to suggest that the service providers we regulate have not been able to raise capital on reasonable terms to undertake extensive investment programs.[428] This suggests the allowances set in the past using the Sharpe-Lintner CAPM was at least adequate to recover efficient costs.[429] We also note that broker reports suggest that our recent determinations have not removed the ability for listed networks to maintain payment of dividends.[430] This provides confidence that our estimate for this decision, while taking account of the downward trends of equity beta and risk free rate, is likely to provide X a reasonable opportunity to recover at least the efficient costs of providing reference services.

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424 Due to the regulatory regime and the businesses' monopoly positions shielding them from systematic risk; as well as the measured prevailing debt yields likely overstating the expected return on debt due to default risk. For more information, see section pages 96 to 99 of Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination. And for example pages 78–80 of our final decision for AusNet Services (distribution) in May 2016.

425 For example, SAPN, Final decision, p. 509; AER*, Final Decision CitiPower distribution determination - attachment 3 - rate of return*, May 2016, P76

426 Due to the regulatory regime and the businesses' monopoly positions shielding them from systematic risk. For more information, see pages 96 to 99 of Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination. And for example pages 78–80 of our final decision for AusNet Services (distribution) in May 2016.

427 The debt risk premium to CGS is calculated as the extrapolated effective annual yield to maturity on BBB related debt with 10 years to maturity less the effective annual yield to maturity on CGS with 10 years to maturity. BBB bond yields have been used instead of BBB+ because the RBA and Bloomberg quote BBB yields to maturity.

428 See, for example, DUET, *Successful completion of DUET's $200 million placement offer*, 1 April 2016; DUET, *DUET completes $1.67 billion placement and entitlement offer*, 13 August 2015; DUET, *DUET completes $396.7 million entitlement offer*, December 2014; SP AusNet, *SP AusNet completes A$434 million Entitlement Offer*, 15 June 2012.
ASX & SGX-ST release, AusNet Services successfully prices HKD 1.2bn offer, 9 December 2016; ASX & SGX-ST release, AusNet Services successfully prices NOK 1bn offer, 10 January 2017; ASX & SGX-ST release, AusNet Services successfully prices USD 80m offer, 19 January 2017

429 RARE infrastructure submitted that "[t]here are many characteristics of the Australian Regulatory framework that makes its energy network potentially attractive investments" RARE Infrastructure, Letter to the AER, 13 February 2015;

430 For details, see section L.1 of Confidential Appendix L in Attachment 3 to our preliminary decision on AusNet Services' 2016-20 distribution determination.

In addition to the equity risk premium ranges shown in Figure 3-5To inform the reasonableness of the Guideline's foundation model return on equity estimate, we estimate and evaluate values from other relevant sources of information (steps four and five of the foundation model approach). In having regard to prevailing market conditions we have also examined recent movements in the relevant material.

Our task is to set the allowed rate of return to be commensurate with a similar degree of risk as that which applies to APTPPL with respect to the provision of reference services. This requires us to consider the additional riskiness of APTPPL relative to the risk free asset, and the commensurate return that equity investors require to take on this additional risk. Hence, the critical allowance is the allowed equity risk premium over and above the estimated risk free rate at a given time. Section E.3 and F compares our foundation model equity risk premium to other relevant material that can inform our estimate of return on equity and equity risk premium.

We consider that, on the whole, the other material broadly supports our foundation model estimate of the return on equity. Overall, we find that this information does not indicate a material, sustained change in market conditions since our July and August 2016 decisions sufficient to cause us to move away from our foundation model estimate.

, we have analysed movements in various conditioning variables (yield spreads, dividend yields, and the volatility index for the ASX200).[431] These conditioning variables can provide information about prevailing market conditions and whether or not the market is in a period of heightened risk aversion. Overall, the conditioning variables appear fairly stable and close to their long term averages. There was broad agreement from consumer groups on the application of our foundation model approach as set out in our Guideline.[432] We consider that this means applying the Guideline in its entirety including the overall approach, parameter estimation and use of other information[433] as relevant cross-checks.

In total, nine consumer groups[434] supported our approach during 2016 and early 2017, with some groups noting that they valued the predictability and transparency resulting

431 See section E for further discussion.

432 We received submissions from nine consumer groups that provided clear submissions on the approach for estimating the rate of return. No submission opposed the application of our Guideline for estimating the return on equity.

433 Broker reports, independent expert reports, other regulators' estimates, comparison with return on debt and our construction of the Wright CAPM.

434 Origin Energy, *Submission on the AER's preliminary decisions on the Victorian distribution network service providers for 2016–20*, 6 January 2016, p. 3; Origin Energy, *Submission on the Victorian networks' revised proposals (for 2016–21*), 4 February 2016; AGL, *Submission on the AER's draft decision on AGN's 2016–21 access arrangement*, 4 February 2016, p. 2; Victorian Government, S*ubmission on the Victorian electricity distribution network service providers' revised regulatory proposals for 2016–20*, 12 February 2016, p. 1–2; CCP (panel 5), *Transmission for the generations: Response to proposal by AusNet Services transmission group pty ltd and AER issues paper for AusNet Services transmission revenue review 2017–22*, February 2016, p. 41; CCP (panel 3), *Submission to the Australian Energy Regulator (AER): An overview Response to AER Preliminary*

from the application of our Guideline and foundation model approach.[435] Consumer groups also submitted support for the AER's implementation of the Guideline in their submissions on the AusNet Services' transmission regulatory process.[436] We note that applying the foundation model approach, as in the Guideline, results in an equity risk premium of 4.55 per cent.

While supporting our Guideline, some consumer groups have submitted that it reflects conservative choices[437] that may result in over-estimating the return on equity and that parameter estimates (and rate of return) can be lowered further.[438] Submissions also noted that we need to give more weight to market data and realised returns such as financial performance and asset sales when considering the overall return on equity.[439]

Decisions and revised proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period, 25 February 2016, p. 30; EUCV*, A response to AusNet revenue reset proposal for the 2017–2022 period*, 9 February 2016, p. 40; CCP (panel 8), *Advice to AER from Consumer Challenge Panel sub-panel 8 regarding the AER Daft Decision and Australian Gas Networks' (SA) revised access arrangement 2016–2021 proposal*, 32 March 2016, p. 2; CCP (panel 11), Response to proposal from APA VTS for the 2018-2022 access arrangement, 3 March 2017, p. 8.

435 Origin Energy, *Submission on ActewAGL's revised access arrangement for 2016–21*, 4 February 2016, p. 3; Origin Energy, *Submission on AGN's revised access arrangement for 2016–21*, February 2016; Origin Energy, *Submission on the AER's preliminary decisions on the Victorian distribution network service providers for 2016–20*, 6 January 2016, p. 3; Origin Energy, *Submission on the Victorian networks' revised proposals (for 2016–21)*, 4 February 2016; CCP (panel 5), *Transmission for the generations: Response to proposal by AusNet Services transmission group pty ltd and AER issues paper for AusNet Services transmission revenue review 2017–22*, February 2016;

436 QGC, *Submission on Roma to Brisbane access arrangement 2017-2022*, 28 October 2016; Australia Pacific LNG, *Submission on Roma to Brisbane access arrangement 2017-2022*, 4 November 2016; AEC, *Submission on Roma to Brisbane access arrangement 2017-2022*, 28 October 2016; CCP Panel 5, *Response to AER draft decision on AusNet transmission revenue review*, September 2016

437 CCP4 (David Headberry) - *Submission on Powerlink draft decision and revised proposal*, p21, 21 December 2016; CCP5*, Submission on AusNet transmission revised proposal,* October 2016 p10; AGL, *Submission on the AER's draft decision on AGN's 2016–21 access arrangement*, 4 February 2016, p. 2; ECCSA, *A response to the AER draft decision on AGN's AA2016 revenue reset*, February 2016, p. 36; EUCV, *A response to AusNet revenue reset proposal for the 2017–2022 period, 9 February 2016*, p. 40; CCP (panel 5), *Transmission for the generations: Response to proposal by AusNet Services transmission group pty ltd and AER issues paper for AusNet Services transmission revenue review 2017–22*, February 2016, p. 41; VECUA, *Submission on the AER: AER preliminary 2016–20 revenue determinations for the Victorian DNSPs*, 6 January 2016, p. 2; CCP (panel 3), *Submission to the Australian Energy Regulator (AER): An overview Response to AER Preliminary Decisions and revised proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, 25 February 2016. pp. 10 & 29–30.

438 CCP4 (Hugh Grant) - *Submission on Powerlink draft decision and revised proposal,* 23 December 2016, p39-42,; CCP5, *Submission on AusNet transmission revised proposal*, October 2016, p10; ECCSA, *A response to the AER draft decision on AGN's AA2016 revenue reset, February 2016*, p. 36–37; VECUA, *Submission on the AER: AER preliminary 2016–20 revenue determinations for the Victorian DNSPs*, 6 January 2016, p. 2, 12, 17; CCP (panel 5), *Transmission for the generations: Response to proposal by AusNet Services transmission group pty ltd and AER issues paper for AusNet Services transmission revenue review 2017–22*, February 2016, p. 40; CCP (panel 3), *Submission to the Australian Energy Regulator (AER): An overview Response to AER Preliminary Decisions and revised proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, 25 February 2016, p. 10 & 29.

439 VECUA, *Submission on the AER: AER preliminary 2016–20 revenue determinations for the Victorian DNSPs*, 6 January 2016, p. 2, 12, 17; EUCV, *A response to AusNet revenue reset proposal for the 2017–2022 period*, 9 February 2016, pp. 40–41; CCP (panel 3), *Submission to the Australian Energy Regulator (AER): An overview*

We note the service providers submitted that we did not have appropriate regard to information from other relevant sources. A summary of these submissions and our responses are provided in table 3–8 below. Having considered the overall information and all material before us, at this time we are not satisfied that this information indicates a departure from the Guideline would contribute to the achievement of the ARORO.

Some service providers continue to disagree with our cross checks on the overall return on equity. They submit material that is substantively similar to previous submissions which we have considered and responded to in previous determinations.[440] We respond to key issues service providers have resubmitted but see Attachment 3 of previous regulatory decisions[441] for more detailed discussions.

Table 3-6 Issues about overall return on equity cross-checks

Issue	Our response
Uplifts to market risk premium and risk free rate estimates from broker and valuation reports should be taken into account.[442]	Uplifts applied by brokers and valuers to initial estimates may be inconsistent with the ARORO. They may reflect non-systematic risks, or be designed to account for risks not addressed in cash flow forecasts, or (to the extent there is any) the expectation of outperformance of regulatory allowances. They may also reflect the term structure of the proxies used to estimate the risk free rate and/or market risk premium, the relevant investment period exceeding the term of the proxies, and the one-off nature of transactions on which they are advising (which differs from our regulatory task where the rate of return is re-assessed for each regulatory control period).[443] Partington and Satchell has also advised that due to the nature of these uplifts found worldwide in consultants' reports 'the approach seems too ad-hoc to be a regulatory tool.'[444] As a result, we prefer to have greater regard to estimates exclusive of these uplifts. For more detail, see sections E.3, E.4 and E.6 in Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination.
Service providers submitted that the relevant estimates from broker and valuation reports are the imputation-adjusted estimates.[445]	It is not clear that it is necessary to adjust broker and valuer estimates for imputation as it is unclear the extent to which these estimates may be based on third party estimates that already account for the value of imputation credits. There is insufficient information to support any precise adjustment for dividend imputation. The risk premium appropriately reflecting dividend imputation is likely somewhere between the adjusted

Response to AER Preliminary Decisions and revised proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period, 25 February 2016, p. 10; ECCSA, *A response to the AER draft decision on AGN's AA2016 revenue reset,* February 2016, pp. 36–37.

440 See for example, the October 2015 SAPN final decision and the May 2016 AusNet Services transmission draft decision

441 See for example, the October 2015 SAPN final decision and the May 2016 AusNet Services transmission draft decision

442 Frontier Economics, *The market risk premium*, September 2016, pp. 41-44. Previously covered in AER Final decision for Australian Gas Networks Access Arrangement, CitiPower distribution Determination and Jemena distribution determination all in May 2016

443 AER*, Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016, P82

444 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P14

445 Frontier Economics, *The market risk premium*, September 2016, p. 45; AusNet Services, *Transmission Revised Revenue Proposal*, 21 September 2016, p150; Multinet Gas, *Rate of Return Overview*, 16 December 2016, p32; Please see any one of: *AER Final decision for Australian Gas Networks Access Arrangement*, *AER's CitiPower*

	and unadjusted premiums and we take into account both values. For more detail, see sections E.3, E.4 and E.6 in Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination.
Service providers submitted that it is not appropriate to focus just on the equity risk premium from broker reports. [446]	This submission indicates a misunderstanding of our approach. We clearly have regard to both equity risk premium and overall return on equity estimates from broker reports. For more details see section F.2 of this attachment.[447]
Frontier submitted that the AER's cross checks at the equity risk premium level are ineffectual and are not fit for purpose[448]	We carry out cross-checks to supplement the information we have already considered in the formation of the market risk premium and equity risk premium. The cross check pass or fail adds to the weight of evidence on either side which we consider when putting forward a decision on the estimation. Partington and Satchell agree that cross-checks provide value by 'providing a pause for thought'.[449] To claim that our crosschecks are inadequate is to mischaracterise their use in the decision.
Frontier submitted that applying the cross checks at the equity risk premium level is misleading by ignoring uplifts to the risk free rate and the adjustments valuers use to account for prevailing conditions.[450]	We have consistently explained why we have greater regard to unadjusted estimates. Expert valuation reports carry a number of limitations that limits their use for our regulatory task. And adjustments by valuers and brokers may be inconsistent with the ARORO as noted above. For more detail, see sections E.3, E.4 and E.6 in Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination.
Frontier submitted that cross checks should be at the overall return on equity level and not at the equity risk premium level[451]	Our task is to set the allowed rate of return to be commensurate with a similar degree of risk as that which applies to APTPPL with respect the provision of reference services. This requires consideration of the additional riskiness of APTPPL relative to the risk free asset, and the commensurate return that equity investors require to take on this additional risk. Hence the critical allowance is the allowed equity risk premium over and above the estimate of the risk free rate at a given time.
Multinet submitted that the comparison between equity and debt risk premia is ineffectual and undefined[452]	We use cross checks against the debt risk premium to inform the overall return on equity as set out in the guideline.[453] Our use of and consideration of the cross-checks on the overall return on equity is

distribution Determination or AER *Jemena distribution determination* all in May 2016 for examples of where this material and argument has been considered before

446 Frontier, *The market risk premium*, September 2016, p. 44; AusNet Services, *Transmission Revised Revenue Proposal*, 21 September 2016, p154; Please see any one of: AER Final decision for Australian Gas Networks Access Arrangement, CitiPower distribution Determination and Jemena distribution determination all in May 2016 for examples of where this material and argument has been considered before

447 AER*, Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016, P84

448 Frontier Economics, *The market risk premium*, September 2016, p. 41; AusNet, *Service Revenue Proposal Revised - Public*, Nov 2015, P217; Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 32

449 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, p26

450 Frontier Economics, *The market risk premium*, September 2016, pp. 41-44; Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 32-34

451 Frontier Economics, *The market risk premium*, September 2016, p. 44; Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 32

452 ActewAGL, *Access arrangement information for the 2016–21 ACT, Queanbeyan and Palerang Access Arrangement, Appendix 8.05: Return on equity – detailed proposal*, June 2015, p. 48; Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 32

	based on the roles assigned to these materials. The roles are based on our consideration of the relative merits of each piece of material and suitability for our regulatory task. We are aware that the difference between the equity and debt risk premia to be the same from decision to decision, but as the businesses are relatively shielded from systematic/demand risk due to regulation. As a result, we do not expect the equity risk premium to be a large margin above the debt risk premium. This is also considered further in the final CitiPower distribution determination from May 2016[454]
Frontier conclude that the required return on equity has declined only slightly in the past few years and certainly nothing like 25 per cent[455]	Frontier arrive at this conclusion from a variety of sources which we tackle individually in the sections below, namely: • Use of the dividend growth model to estimate the overall return on equity • Over reliance on the P/E ratios to infer a relationship for the overall return on equity • The use of the Wright CAPM to arrive at an estimate of the market risk premium • Other market evidence used in a limited manner and discussed further below
Multinet propose that the overall return on equity is too low when compared with businesses of a similar risk[456]	Multinet proposed the real difference between the equity risk premium and debt risk premium should be around 364 basis points rather than the AER's allowed difference of around 200. However this is based on flawed assumption regarding an alpha adjustment and the low beta bias. We discuss this in more detail in section B. Multinet also ignores that the regulated businesses are largely shielded from systematic/demand risk and that cost pass-through reduces the risk associated to the business. Multinet appears to base this submission on Frontier's analysis, which we respond to in various sections below (namely regarding reliability of dividend growth models, the P/E relationship with the return on equity, and the use of the Wright CAPM).
The AER should not use other regulators as a check that their return on equity is satisfactory[457]	The AER considers other regulators as just part of informative material in their decision, both at the market risk premium and equity risk premium level. Our assessment of this material, as noted in the guideline[458], is that it is suitable for informing the market risk premium and equity risk premium in a small or complementary role.
The AER's own analysis shows Multinet's equity risk Premium of 639 basis points would not be above the range of other Australian regulators	We note Multinet's statement does not include all of the relevant evidence. The chart referred to by Multinet also contains regulatory decisions for rail and transport related businesses. 34 of 85 Australian regulatory decisions is for businesses in those two industries since the start of 2016. We note these businesses are unlikely to be comparable to a benchmark efficient entity with a similar degree of risk as Multinet for providing the reference services.

Movements in the risk free rate and the return on equity

Applying our foundation model approach, we estimate a return on equity of 7.2 per cent.

453 AER, *AER Explanatory statement – rate of return guideline*, December 2013, p.59
454 AER, *Final decision CitiPower distribution determination – Attachment 3 – Rate of Return*, May 2016, p.80
455 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p33
456 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p33
457 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p34
458 AER, *AER Explanatory statement – rate of return guideline*, December 2013, p.59

We consider capital—both equity and debt—should provide for a risk premium over a base (risk free) rate. When estimating the allowed rate of return for APTPPL, we consider the additional riskiness of APTPPL[459] relative to the risk free asset, and the commensurate risk premium that investors require to take on this additional risk.[460]

The service providers argue that there is an inverse relationship between the risk free rate and market risk premium. It is unclear why this risk premium would increase or decrease to entirely offset changes in the base risk free rate. We have not been provided with compelling evidence that the riskiness of APTPPL relative to the risk free asset has increased as the risk free rate has decreased. Service providers have not sufficiently explained why, in the absence of an increase in the relative riskiness of APTPPL, general risk aversion in equity investors would have risen as the risk free rate fell from November 2013, while over the same period it appeared to fall for debt investors. While required returns on equity are not directly observable, we have not been provided with compelling evidence for a clear inverse relationship between the long term forward looking risk free rate and the long term forward looking market risk premium.[461]

We consider that this is consistent with the required return on equity for prevailing market conditions for equity funds for the following reasons:

- We apply the foundation model approach and estimate a return on equity having regard to a range of relevant materials and their relative merits.
- We take into account the prevailing market conditions for equity funds. We use both the dividend growth model and conditioning variables to inform our estimate of the market risk premium. We also use other relevant sources of information to cross-check the foundation model estimate. The triangulation of estimates from relevant market participants broadly supports our foundation model estimate of the return on equity.
- Our comparison between the return on equity and return on debt supports the view that our estimated return on equity is not below efficient financing costs[462] under prevailing debt market conditions. We do not consider that the current X basis

459 Or more precisely, a benchmark efficient entity with a similar degree of risk as APTPPL in respect of the provision of reference services.

460 In accordance with our task under the NER and NGR. While there may be many various risks associated with providing regulated network or pipeline services, we consider that (consistent with modern portfolio theory) the rate of return will be commensurate with efficient financing costs if it reflects only non-diversifiable risks. Diversifiable risk can be addressed through other regulatory mechanisms, such as capex and opex allowances.

461 For a discussion, see AER, *Explanatory statement to the rate of return guideline (appendices)*, 17 December 2013, pp. 25–26. Also see CEPA, *AER: Victorian gas networks market evidence paper*, February 2013; McKenzie and Partington, *Review of the AER's overall approach to the risk free rate and MRP*, February 2013; Lally, *Review of the AER's methodology*, March 2013.

462 Efficient financing costs for a benchmark efficient entity with a similar degree of risk as that which applies to the distribution or transmission network service provider in respect of the provision of standard control services or prescribed transmission services, or reference services. See: NER, cl. 6.5.2(c); NER, cl. 6A.6.2(c); NGR, r.87(3).

points difference between the equity risk premium allowed in this decision and debt risk premiums[463] to be too low (see section E.3 for more discussion).

- We do not find conclusive evidence of a relationship between the market risk premium and risk free rate in any direction or size. This is supported by our consideration in the Guideline, previous regulatory decisions and advice from Partington.[464]
- We continue to be unsatisfied that there is evidence of a widespread 'flight to quality'[465] among investors in current market conditions that would have any impact on the market risk premium. This can be seen in our consideration of conditioning variables and survey evidence. Further, Partington and the RBA has noted that investors can engage in a 'search for yield' during periods of low interest rate, which can lead to a decrease in the market risk premium expected by investors whilst these conditions prevail.[466]

Partington has advised, '[t]he low bond rates tell us that the required return for low risk assets is low'.[467] Partington observed the market rose following the RBA cut to the cash rate on 3 February 2015. While he noted we should be cautious about making inferences based on singular instances, he observed this appeared in line with a fall in required returns. Specifically, he considered:[468]

> Rationally the market went up either because investors expected significant growth in company cash flows, or because their required return went down as a consequence of a lower interest rate. Given that the discussion at the time was about a slowing economy and reduced growth, a fall in required returns seems the more plausible explanation.

Partington and Satchell considered the submissions put forward by service providers and stated:[469]

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463 The debt risk premiums to CGS are calculated as the extrapolated effective annual yield to maturity on BBB rated debt with 10 years to maturity less the effective annual yield to maturity on CGS with 10 years to maturity). BBB bond yields have been used instead of BBB+ because the RBA quotes BBB yields to maturity.

464 See AER, *Explanatory statement: Rate of return guideline (appendices)*, 17 December 2013, pp. 104–110; AER, *Access arrangement draft decision: Multinet Gas (DB No. 1) Pty Ltd Multinet Gas (DB No. 2) Pty Ltd 2013–17—Part 2: Attachments*, September 2012, pp. 100–107; AER, *Access arrangement final decision: Multinet Gas (DB No. 1) Pty Ltd Multinet Gas (DB No. 2) Pty Ltd 2013–17—Part 3: Appendices*, March 2013, pp. 31–35; AER, *Access arrangement final decision: APA GasNet Australia (Operations) Pty Ltd 2013–17: Part 3—Appendices*, March 2013, pp. 32–38. AER*, Preliminary decision AusNet Services determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 268–270.
McKenzie and Partington, *Review of the AER's overall approach to the risk free rate and market risk premium*, February 2013, pp. 6, 24.

465 A 'flight to quality' or 'flight to safety' is usually associated with a view that there is increased risk aversion across the economy and therefore an increased MRP expected by investors.

466 Partington, *Report to the AER: Return on equity (updated)*, April 2015, p. 72.

467 Partington, *Report to the AER: Return on equity (updated),* April 2015, p. 72.

468 Partington, *Report to the AER: Return on equity (updated)*, April 2015, p. 74.

469 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 17.

> There is a possibility that current low interest rates could result in higher equity risk premiums, but we do not think this is likely and more importantly we have seen no convincing evidence that this is the case.

More recently, Partington and Satchell advised that the AER 'needs to be convinced why investors should require more compensation for the risk of holding equity' and why the expected market return on the market increases as interest rate falls.[470] They added that any change commensurate with the theory that the risk free rate and the market risk premium are inversely related would be inexplicably large:[471]

> We see that if there is no change in beta, the required value for $\Delta MRP = 3.14\%$, which seems an implausibly large change. Alternatively, suppose beta is allowed to increase by the maximum increase in the summary of CEG's (2016, Table 14) analysis of beta increases, then $\Delta B = .17$. The required change in the MRP is then 1.26%... This change in MRP is greater than the largest change for the Australian MRP listed in ATCO final gas decision, June 2015, Table2, page 32, which is $\Delta MRP = 1.1$. It is not clear to us that either beta or the MRP have changed, but even if we allow for the maximum claimed for such changes the return on equity goes down.

Frontier submitted the following new material to argue that the return on equity has remained relatively stable:[472]

- a 2015 paper by Duarte and Rosa[473]
- a 2014 paper by Strunk[474]
- Federal Energy Regulatory Commission (FERC) decisions for New England and New York

We do not consider that the new material provides satisfactory evidence of a stable return on equity, particularly in the Australian context, for the following reasons:

- The Duarte and Rosa paper uses US data and it is not clear that the Australian market would follow a similar experience. Partington & Satchell also advised that 'overseas regulators decisions are not likely to be convincing unless one can show great similarities in the economies considered'.[475] Further, the paper seems to focus on a forward looking one-year market risk premium whereas we estimate a forward looking ten-year market risk premium.

470 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P32
471 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P16
472 Frontier Economics, *The market risk premium*, September 2016, p. 47–54
473 Duarte and Rosa, *The Equity Risk Premium: A review of Models*, February 2015
474 Strunk, *The Decoupling of Treasury Yields and the Cost of Equity for Public Utilities*, 2014
475 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, p. 26.

- The 2014 Strunk paper references decisions by US-based regulators to support its conclusion. We know that certain US regulators[476] appear to use a dividend growth model to set the required return on equity. Service providers rely on dividend growth estimates in their proposals to argue a stable return on the market and an offsetting market risk premium. Therefore it is not surprising that the market risk premium display an inverse relationship to the risk free rate. We assessed the dividend growth model in detail in section B.4 and consider that there are a range of limitations with the dividend growth model which makes its results unreliable and unsuitable for directly estimating the market risk premium. We still believe it is useful for indicating, directionally, where the market risk premium should lie in relation to the historical excess returns as indicated in the Guideline.[477] We do not consider that any new material has been submitted to us that address the limitations of dividend growth models or cause us to depart from our use of dividend growth models.
- In recent papers FERC uses a dividend growth model to set the required return on equity when presented with such a model by service providers.[478] Our assessment of the dividend growth model shows a range of issues which means it is used to indicate, directionally, where the market risk premium should lie in relation to the historical excess returns. The FERC did not make conclusive statement on its approach for the required return on equity and its concern seems to be in using solely historic excess returns with a simple CAPM. [479]However, we use information from a range of relevant material, including forward looking material, to determine the forward looking return on equity and ten-year market risk premium.
- Partington and Satchell have advised that for the return on equity to remain stable requires implausibly large changes in the market risk premium and the return on market.[480]

Service providers also continue to submit that our estimate of the return on equity is too low as a result of our application of the Sharpe-Lintner CAPM moving in 'lock step' with the falling risk free rate, based on the following material:

- Dividend growth model estimates
- Wright approach
- Hurdle rates
- Price-to-earnings ratios (PE ratios)

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[476] The FERC effectively uses a dividend model to estimate a range for the required return on equity and then selects a point estimate based on movement in the government bond yields

[477] AER, *The Rate of Return Guideline*, December 2013, p. 14

[478] FERC, *Docket No.EL11-66-001*, June 2014 Paragraph 7 then page 13-43.
FERC, *Meeting Slides on Return on Equity*, June 19 2014, https://www.ferc.gov/industries/electric/indus-act/oatt-reform/e-7-presentation.pdf

[479] FERC, Docket No. EL13-48-001, February 2016

[480] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, pp. 16–17.

- Independent valuation report
- Foreign Regulators

We respond to these materials in the sections below. We note that we have considered much of this material in our October 2015, May 2016 and April 2017 decisions.[481] And, after reviewing the new materials which are substantively similar to previous submissions, our previous considerations remain valid for this decision.

For the reasons outlined, we consider that the foundation model estimate of the return on equity is consistent with the prevailing market conditions in the market for equity funds and the required return on equity for a firm facing similar risks as AusNet Services.

Further, our foundation model approach provides a flexible framework for estimating the required return on equity. It allows the identification of relevant materials and consideration of the roles each piece of material should play for estimating the return on equity. For example, our approach identified the relevant financial models (Sharpe-Lintner CAPM, Black CAPM, dividend growth model and Fama-French model) and, after assessing their merits, uses the theory of the Black CAPM for setting the equity beta estimate and outputs of the dividend growth model for setting the market risk premium estimate. We also consider our foundation model return on equity estimate against a range of other material independent to the foundation model (such as broker and valuation reports). We continue to consider that the service providers have not held appropriate regard to all available evidence, nor a complete consideration of the relative merits of each piece of evidence.

Dividend growth model estimates

Service providers continue to submit that our estimate of the return on equity is below dividend growth model-based estimates.[482] Frontier resubmitted material from previous reports to argue that dividend growth model-based estimates supported a stable return on equity and the resulting inverse relationship between the risk free rate and the market risk premium:[483]

- Reports from market practitioners[484]
- Other regulators' decisions[485]

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481 For example, see AER*, Preliminary decision AusNet Services determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 269–271; AER, Final Decision United Energy distribution determination 2016–2020 Attachment 3–Rate of return, p. 84–91; AER, Final Decision AusNet Services transmission determination 2017–2022 Attachment 3–Rate of return, April 2017, pp. 103–113;

482 APTPPL, *RBP Access Arrangement revision submission 2017–22*, 21 September 2016, p. 152.

483 Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016, pp. 21–25; Frontier Economics, *The market risk premium*, September 2016, pp. 46–54.

484 A 2015 report from the Federal Reserve Bank authored by Duarte and Rosa, a speech from Glenn Stevens of the RBA in April 2015, A report for NERA titled "*The decoupling of treasury yields and the cost of equity for public utilities*" by Strunk (2014)

Frontier also repeated that we continue to place less weight on the dividend growth model when considering the market risk premium.[486] And evidence (from the dividend growth model) show that returns on equity have remained steady despite the fall in the risk free rate.[487]

We assess the dividend growth model in detail in section B.4 and consider that there are a range of limitations with the dividend growth model which makes its results unreliable and unsuitable when arriving at an estimation of the market risk premium. We still believe it is useful for indicating, directionally, where the market risk premium should lie in relation to the Historical returns as indicated in the Guideline[488]. We do not consider that any new material has been submitted to us that address the limitations we have identified with dividend growth models. Given these limitations, we do not consider that the dividend growth models provide compelling evidence of an inverse relationship between market risk premium and risk free rate.

Frontier responded to our concerns about the dividend growth model's use in estimating the market risk premium by noting that it is 'highly unlikely for analysts to forecast dividend growth based on strong earnings over the short term if they considered those dividends to be unsustainable in the longer term'.[489]

We note that dividends may be forecasted to increase for a number of reasons, including absence of satisfactory projects for reinvestment of earnings, and not necessarily related to strong earnings. And it is not apparent that there is or will be strong earnings growth. In the RBA chart, while forecast earnings per share in 2016–17 is above that of 2015–16 as Frontier points out, both slow over time which has been the pattern since 2011–12.[490] We do not consider that this is indicative or supportive of strong earnings growth.

Frontier added that there is no evidence to indicate 'future dividends were likely to fall so materially as to make the current dividend unsustainable'.[491] . We note that the chartpack relates to one-year forecasts which would not provide conclusive evidence consistent with our 10-year time frame.

We are also not persuaded by Frontier's observation that ASX-20 firms have on average experienced actual earnings slightly above analyst forecast as evidence

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485 A 2014 decision by the Federal Energy Regulatory Commission (FERC) in the United States. FERC, *Docket No. ER14-500-000*, June 2014, pp. 71; ERA Decisions *ATCO Gas Final decision* June 2015 and *DBP Final Decision* June 2016; IPART, Semi-annual WACC update, February 2016, ESC Golburn Murray Water Draft Determination, February 2016; ESCOSA, *SA Water Final determination* June 2016; QCA, *DBCT Draft Decision*, June 2016; Ofgem (UK), *RIIO-ED1*, November 2014; FERC (US), *Baltimore Gas et al*, February 2016.

486 Frontier Economics, *The market risk premium*, September 2016, pp. 30–31,65-73 see AER, Jemena distribution determination 2016-2020: Rate of Return Attachment, May 2016 P60 where this was considered previously

487 Frontier Economics, *The market risk premium*, September 2016, pp. 30–31 see AER, Jemena distribution determination 2016-2020: Rate of Return Attachment, May 2016 P88 where this was considered previously

488 AER, *The Rate of Return Guideline*, December 2013, p. 14

489 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 61–62

490 RBA, *The Australian Economy and Financial Markets Chart Pack,* January 2017, p. 24

491 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 61–62

against analyst bias. This appears to be based solely on the 2016–17 financial year and does not appear indicative of a long term or sustained occurrence. Financial literature and our consultants have consistently observed and concluded that analysts over-forecast dividends.[492] Partington and Satchell has also advised that 'little weight' should be placed on a non-random sample of twenty firms, one year's observations and date of analyst forecasts.[493]

Wright approach and historical CAPM

Service providers have resubmitted that we place little weight on the Wright approach, specifically that the AER should use it for informing the market risk premium.[494]

Frontier, for AusNet Services, continued to argue for an inverse relationship between the risk free rate and market premium based on the stability of the Wright CAPM[495] estimates.[496] Frontier also referenced the model's usage by other regulators' for estimating the market risk premium.[497]

APTPPL and APA VTS dispute that they use the Wright approach. However, it estimated the market risk premium as the difference between the long term average return on market and the risk free rate which is a historical/alternative specification of the Sharpe-Lintner CAPM.[498]

We have reviewed again all material submitted on the Wright approach, historical/alternative CAPM and their results. And we consider that the new materials do not address the previous and on running concerns that we have detailed in decisions regarding the Wright approach and historical CAPM (see section B.5). For example, we note that both non-standard specifications of Sharpe-Lintner CAPM do not take into account changing market conditions and assumes a perfectly offsetting relationship between the risk free rate and the market risk premium.

Professor Martin Lally found that the estimated market risk premium series is more stable than the average real market return series when taking the Wright approach applied to Australian data.[499] Partington and Satchell, in their most recent report also

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492 Partington & Satchell, *Report to the AER: Cost of equity issues–Final decisions for the VIC DNSPs*, April 2016, , P31-32; Partington, *Report to the AER: Return on equity (updated),* April 2015, P32
See P325 of the AER's decision on SAPN from October 2015 (Attachment 3) for further references

493 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, p. 30.

494 APTPPL, *RBP Access Arrangement revision submission 2017–22*, 21 September 2016, pp. 152-154.

495 Frontier, *The Market Risk Premium,* September 2016, pp31

496 Frontier, *The relationship between government bond yields and the market risk premium*, January 2016, p. 13.

497 Frontier, *The Market Risk Premium,* September 2016, pp31–34

498 APTPPL, *Roma to Brisbane Pipeline access arrangement submission 2017-2022*, September 2016, pp. 152-155;

499 Lally found the standard deviation of average real market returns is 1.5 per cent. The standard deviation for the average real government bond yield is 1.4 per cent. For the estimate MRP time series, it is 0.9 per cent. These standard deviations imply the average real market return is considerably more volatile than that for the estimated MRP. Lally, Review of the AER's methodology, March 2013, pp. 12–16.

advised that the 'Wright approach has no support based on any clear evidence in the Australian context'.[500]

Hurdle rates

A hurdle rate is a rate of return that firms and managers use when deciding whether or not to invest in capital projects.

Frontier argued that there has not been a reduction in the expected return on equity and resubmitted the following material:

- McKinsey Inc considered that the required return on equity appeared to be quite stable as government bond yields declined, based on observations of hurdle rates.[501]
- The RBA's April 2015 speech which noted the return on equity has remained relatively stable with decreases in the risk free rate on the basis of 'sticky' hurdle rates and stable earnings.[502] Companies have not reduced their hurdle rates[503]

We consider hurdle rates are unlikely to be commensurate with the efficient financing costs of the benchmark efficient entity or reflective of prevailing conditions in the market for equity funds. We are not satisfied this provides sufficient evidence of an inverse relationship between the 10 year forward looking risk free rate and market risk premium in the current market.

The RBA and Deloitte have noted that Australian firms tend to have high 'hurdle rates' of return that are often well above the cost of capital and do not change very often.[504] Moreover, these statements by the RBA may not be applicable to the required rate of return in financial markets. Further, JP Morgan appears to indicate that hurdle rates may not be responsive to changes in market conditions. This could be because firms use hurdle rates as a capital rationing device,[505] to reflect uncertainty in cash flow forecasts,[506] to reflect strategic incentives,[507] because of an absence of competitive market pressures,[508] or due to immateriality of incremental changes if the firm has a high cost of capital.[509]

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500 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P26

501 McKinsey, *What effect has quantitative easing had on your share price*,2014, p. 17.

502 Frontier Economics, *The market risk premium*, September 2016, pp. 46–47.

503 Frontier Economics, *The market risk premium*, September 2016, pp. 47-50

504 RBA, *Bulletin - Firms' investment decisions and interest rates*, June quarter 2015; Deloitte, CFO Survey: Beyond the clouds, Q3 2014, P19 Chart 17: Frequency of hurdle rate updates

505 McDonald, *Real options and rules of thumb in capital budgeting*, Oxford University, 2000, p. 1.

506 RBA (Lane and Rosewall), *Bulletin: Firms' investment decisions and interest rates*, June 2015, p. 3; Driver and Temple, *Why do hurdle rates differ from the cost of capital?, Cambridge journal of economics*, 34(3), 2010, p. 516.

507 Driver and Temple, *Why do hurdle rates differ from the cost of capital?, Cambridge journal of economics*, 34(3), 2010, p. 517.

508 Driver and Temple, *Why do hurdle rates differ from the cost of capital?, Cambridge journal of economics*, 34(3), 2010, p. 516.

509 RBA (Lane and Rosewall), *Bulletin: Firms' investment decisions and interest rates*, June 2015, p. 4.

In response, Multinet submitted that the Deloitte material is not clear if firms have high hurdle rates relative to their cost of capital.[510] It noted graphs showing a third of firms use hurdle rates lower than their cost of capital and around two-thirds have a hurdle rate that is less than two percentage points above their WACC. However, these graphs may include both debt and equity, as acknowledged by Multinet, so they are unlikely to provide useful information on the return on equity.

Further, it is not clear how the hurdle rates and WACC are used by the CFOs surveyed by Deloitte. Specifically, the extent they make any firm-specific adjustments in the discount rate and/or in the cashflows.

We have considered companies' use of hurdle rates before. We are unpersuaded that hurdle rates provided by independent businesses provide reliable evidence of the expected cost of equity and our reasons from previous regulatory determinations remain applicable.[511]

See also Appendix C in Attachment 3 to the October 2015 final decision for SAPN's 2015–20 determination for more discussion.

Price-to-earnings ratios

We are not satisfied that price-to-earnings ratios provide evidence of a stable return on equity or an inverse relationship between the risk free rate and the market risk premium in the current market.

If investors reduce their required rate of return, and earnings expectations are unchanged, then market prices and the price-to-earnings ratio should increase.[512] Frontier again referenced RBA data and a McKinsey report[513] to argue that investors have not decreased their required rates of return, despite a decline in the risk free rate, because earnings ratios have remained 'within their long-term averages'.

However, the McKinsey report noted by Frontier analysed the US and UK markets, and it is not clear that the Australian market would follow a similar experience. In any case, it is not clear that earnings expectations have remained unchanged as the risk free rate has declined. McKinsey used a one-year-forward price-to-earnings ratio, but market prices likely reflect longer-term expectations, which may differ markedly from one-year forward expectations. Another market practitioner, JP Morgan, also acknowledged that the price-to-earnings ratio can also reflect growth expectations.[514] Further, we observe that JP Morgan and McKinsey Inc. drew different conclusions on the cost of equity due to using different data periods.

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510 Multinet, Rate of return overview, December 2016, pp. 38–39.

511 See section C.7.2 of Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination.

512 Assuming rational, well-functioning markets.

513 Frontier Economics, *The market risk premium*, September 2016, p. 48-49; Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016 ,P21-23

514 JP Morgan, *Musings on low cost of debt and high risk premia*, April 2012, p. 2.

In their report, Partington and Satchell observed that Frontier makes 'continuing and unqualified reliance on earnings yield and PE based evidence'.[515] They note that: [516]

> 'the behaviour of the required return on equity cannot be simply inferred from the behaviour of price earnings (PE) ratios, neither can it simply be inferred from the behaviour of the earnings yield (earnings price ratio)"[517] and " it is clear that inferences about the cost of equity based on plots of earnings yields or PE ratios are highly suspect."

Independent valuation report

Service providers submitted that independent valuation reports uplift the return on equity (at the parameter level or overall return level) to counter a historically low risk free rate.[518]

For reasons outlined in table 3–8, we consider that uplifts applied by brokers and valuers to initial estimates may be inconsistent with the ARORO. Therefore, we have greater regard to estimates exclusive of these uplifts.

Foreign Regulators

Multinet also submitted that the return on equity in other countries has remained more stable that allowed by the AER[519]. Multinet believes this shows the AER's allowed return on equity has fallen too far from previous levels.

We do not take foreign regulators into account when instigating our cross checks because of differences such as:

- Differences in regulatory objectives between regulators is only amplified when comparing different countries
- Differences in economic conditions between foreign countries and Australia can have a heavy influence on regulatory decisions
- Differences in approach to estimating the required rate of return between different regulators as well as different countries. For example the Ontario Energy Board looks at forecasts of government bonds as a placeholder for risk free rate which limits the impact of risk free rate movements. They also used a fixed Return on Equity figure in their calculations.[520]

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515 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P18

516 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P20

517 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017, P19

518 AusNet Services, p. 154.

519 Multinet, *Rate of Return Overview*, 16 December 2016, p. 38

520 Ontario Energy Board, *OEB Staff Report on Cost of Capital Review*, 14 January 2016, p.3

Our reluctance to accept evidence from foreign regulators is supported by Partington and Satchell as they noted that 'overseas regulators decisions are not likely to be convincing unless one can show great similarities in the economies considered'.[521]

Multinet noted a graph in their submission, showing US and Canadian gas and electricity distributors' authorised return on equity over the period of 2000-2015.[522] They claim this graph highlights that we are cutting the authorised ROE at a much faster rate than foreign regulators and as such we are not following our regulatory objectives.

However the graph only shows the annual median return on equity of US and Canadian regulated businesses. This is likely to obscure changes in the return on equity from movements in the risk free rate when the required return on equity is falling. The graph shows average daily yield for Concentric Energy Advisors' proxy for the risk free rate, rather than the risk free rate used in regulatory decisions. This may not accurately reflect actual risk free rate movements and can lead to misleading observations being drawn.

Step six: distil point estimate

We are satisfied that an expected return on equity derived from the Sharpe-Lintner CAPM should be the starting point for estimating the return on equity. We are also satisfied that the other information does not indicate that our equity risk premium estimate should be uplifted or downshifted to contribute to the achievement of the allowed rate of return objective.

Following our estimation approach and having considered and given the relevant material due weight on their merits, we are satisfied that an expected return on equity estimate of 7.2 per cent derived from our implementation of the Sharpe-Lintner CAPM will contribute to the achievement of the allowed rate of return objective. We are also satisfied that this estimate is consistent with prevailing market conditions.

[521] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, March 2017 p. 26.

[522] Multinet, *Rate of Return Overview*, 16 December 2016, p. 38, figure 12

3.4.2 Return on debt

The allowed return on debt provides a service provider with an allowance to cover its borrowing costs associated with funding investments in its network. Consistent with other components of the rate of return, we determine the allowed return by reference to a 'benchmark efficient entity' rather than the actual service provider.

Our decision is to adopt a return on debt of 4.79 per cent, rather than the 7.26 per cent proposed by APTPPL.[523]

This decision sets out how we arrived at the rate for APTPPL, and how we plan to update the return on debt in future regulatory years. That is, we set out:

- The return on debt approach. This sets out why we transition the entire return on debt from an on-the-day to a trailing average approach over 10 years (a full transition).
- Implementing the return on debt approach. This includes the benchmark term, benchmark credit rating, our choice and use of third party data series, extrapolation/interpolation issues, contingencies, averaging periods and the annual updating process.

We note the sections below respond extensively to material submitted by AusNet and other service providers (in earlier decisions) who have proposed departures from our current approach to estimating the cost of debt. We consider it is necessary to include this material given we have considered it in reaching our draft decision for APTPPL.

Return on debt approach

Our draft decision is to transition the entire return on debt[524] from an on-the-day approach in the first regulatory year to a trailing average by updating 10 per cent of the debt portfolio over 10 years (a full transition). This is consistent with the Guideline.[525] APTPPL and APA VTS in their proposal submitted an immediate transition to the trailing average approach.[526]

We have also considered the material they proposed in their proposals and a CEG report on the AER's current interpretation of the ARORO[527] submitted by AusNet with its revised proposal in making this draft decision for APTPPL. We have decided to adopt the full transition approach after the consideration of the material. Our decision is in many aspects the same on transition as our decisions released in April 2017, although we have considered the material submitted by the service providers for which

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523 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p.160.

524 For clarity, that is 100% of the base rate and DRP components of the allowed return on debt.

525 *Better regulation—Rate of return guideline*, December 2013, chapters 3, 6 and appendix B

526 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p.160; APA VTS, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.180.

527 CEG, *The AER's current interpretation of the ARORO*, September 2016.

we are currently releasing decisions in concluding this approach remains appropriate, as well as the more recent Full Federal Court decision. We note no new expert reports have been submitted by stakeholders, or completed for the AER, that were not considered in making our earlier April 2017 decisions.

We consider a full transition is required to meet the ARORO because we consider current debt costs in the market reflect efficient financing costs and we consider correct compensation in a present value sense (or an allowance that meets the NPV = 0 condition) is required to meeting the ARORO and to achieve the NGO. In the absence of a full transition the only other approach we have examined that we consider will satisfy the ARORO and achieve the NGO is the continuation of the on-the-day methodology.

Along with this draft decision for APTPPL, we are making four other constituent rate of return decisions for other service providers as a part of their draft deteminations. [528] We have considered these proposals together where they put substantially the same views and reasoning forward. While AusNet Services Gas Distribution, Multinet and AGN adopted our full transition approach, APTPPL and APA proposed an immediate transition to the trailing average approach.[529] We also note AusNet Services in its revised proposal proposed changing its preferred approach to dealing with the transition to a trailing average.[530] We have considered its revised proposal and a CEG report submitted by AusNet Services.[531] We remain convinced that a full transition is required if we use the trailing average approach if we are to meet the ARORO. We have estimated the proposed return on debt for the first regulatory year (% nominal) as 4.79% (noting this will be updated for the final agreed averaging period).

In this section, we:

- set out our overall return on debt approach (that is, the transition to a trailing average)
- set out APTPPL's proposal
- explain what approaches to estimating the return on debt can contribute to the ARORO and why (which includes our approach in this draft decision)
- explain why other approaches that have been suggested would not meet the requirements of the ARORO and NEO/NGO
- set out general problems with using historical data to estimate the allowed return on debt.

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528 That is AusNet Services Gas Distribution, APA, Multinet and AGN.

529 AGN, *Final Plan: Access Arrangement Information for our Victorian and Albury natural gas distribution networks 2018-22*, December, p. 121; AusNet Services Gas Distribution, *Access Arrangement Review 2018-22*, December 2016, p. 6; Multinet, *2018 to 2022 Access Arrangement Information*, December 2016, p. 128; RBP, *Access arrangement submission 2017-22*, 16 September 2016, p. 160; APA VTS, *Victorian Transmission System Access Arrangement Submission*, January 2017, p. 180.

530 AusNet Services, *Revised revenue proposal*, 21 September 2016, p.137.

531 CEG, *The AER's current interpretation of the ARORO*, September 2016.

Our approach to estimating the return on debt

Our draft decision is to start with an on-the-day approach for the first regulatory year and gradually transition into a trailing average approach over 10 years (a full transition).[532] Applied to APTPPL, this means our return on debt approach is to:

- estimate the return on debt using an on-the-day approach (that is, based on prevailing interest rates near the commencement of the access arrangement period) in the first regulatory year (2017) of the 2017–22 regulatory control period, and
- gradually transition this approach into a trailing average (that is, a moving historical average) over 10 years by annually updating 10 per cent of the return on debt to reflect prevailing market conditions in that year.[533]

In practical terms, our return on debt approach means that an on-the-day approach around the start of the 2017–22 access arrangement period is applied to:

- 100 per cent of the debt portfolio in the calculation of the allowed return on debt for the 2017 regulatory year
- 90 per cent of the debt portfolio in the calculation of the allowed return on debt for the 2018 regulatory year, with the remaining 10 per cent updated to reflect prevailing interest rates during APTPPL's averaging period for 2018. Consistent with the rules requirements, this annual update (and all future annual updates) will be affected through the automatic application of the return on debt methodology we set out in this decision.[534]
- 80 per cent of the debt portfolio in the calculation of the allowed return on debt for the 2019 regulatory year, with 10 per cent based on prevailing interest rates during APTPPL's averaging period for 2018, and 10 per cent updated to reflect prevailing interest rates during Multinet's averaging period for 2019, and
- so on for the subsequent regulatory years.

After the 10 year transition period is complete, the return on debt is a simple average of prevailing interest rates during APTPPL's averaging periods over the previous 10 years (a trailing average).

APTPPL's proposal

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532 This approach is consistent with the approach we proposed in the Guideline, and have maintained in determination processes since the Guideline. In the Guideline, we based our transition on the approach recommended by the Queensland Treasury Corporation (QTC) (see QTC, *Moving average approach–Detailed design issues*, 8 June 2012). We refer to this as 'the QTC approach'.

533 This decision determines the return on debt methodology for the 2016–20 regulatory control period. This period covers the first five years of the 10 year transition period. This decision also sets out our intended return on debt methodology for the remaining five years.

534 NER cl. 6.5.2(l) and cl. 6A.6.2(l) and NGR, r.87(12). The return on debt methodology for the purposes of the annual update is set out in appendix L of this attachment 3.

APTPPL in its proposal proposed to depart from the AER's Guideline transition in estimating the required return on debt and adopted an immediate transition to the trailing average approach.[535] In making the draft decision for APTPPL, we have taken the initial proposals of Multinet, APA VTS, AGN and AusNet gas and AusNet's revised electricity transmission proposal into consideration. We note that there is no substantial new material submitted by APA and APTPPL in support of their immediate trailing average approach.

Submissions on the cost of debt transition approach

We have received few submissions on cost of debt transition from consumer representatives. These are summarised below:

In October 2016, CCP5 (consumer challenge panel five) expressed its view on AusNet Services' Revised revenue proposal to use an immediate trailing average, prior to AusNet Services withdrawing that aspect of its proposal. We note the submission here for completeness. CCP5 expressed the view that the proposed cost of debt of 7.56% (under an immediate transition approach) was an opportunistic grab, given its initial proposal was much lower and the interest rates disclosed in its parents consolidated accounts were much lower.[536] CCP5 considered its genuine cost of debt is without doubt closer to 5.22% than 7.56%[537]and stated: [538]

> "Regulated networks must face an incentive to keep all costs as low as possible, including cost of debt, and it is incomprehensible to us that between AusNet Services' original proposal in October 2015 and this proposal in September 2016, their efficient cost of debt has risen by 200 basis points. It is in consumers' long term interests that the cost of debt included in the rate of return reflects current market conditions and motivates businesses to borrow in the most efficient and prudent way."

However, on 9 December 2016, AusNet Services wrote to the AER advising of its intent to propose a cost of debt transition consistent with the AER's Guideline and to withdraw the immediate transition cost of debt approach from its Transmission Revised Revenue Proposal for the 2017-22 regulatory control period.[539] Consistent with this intent, on 20 Dec 2016 AusNet Services provided a further letter indicating it was now proposing a full transition for its transmission determination and provided revised modelling consistent with the AER's full transition approach on 20 December 2016.[540]

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535 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p.160.

536 CCP (Panel 5), *Submission to the AER: Transmission for the Generations III, Response to: Revised revenue proposal by AusNet Services For: Transmission Revenue Review 2017-22*, October 2016, p.12

537 CCP (Panel 5), *Submission to the AER: Transmission for the Generations III, Response to: Revised revenue proposal by AusNet Services For: Transmission Revenue Review 2017-22*, October 2016, p.12

538 CCP (Panel 5*), Submission to the AER: Transmission for the Generations III, Response to: Revised revenue proposal by AusNet Services For: Transmission Revenue Review 2017-22*, October 2016, p.12

539 AusNet Services, *Letter to the AER: Removing uncertainty on the Cost of Debt transition*, 9 December 2016

540 AusNet Services*, Submission to the AER: AusNet Services' Transmission- Revised Revenue Proposal*, 20 December 2016

In March 2017, CCP11 (consumer challenge panel eleven) for APA VTS considered the evidence provided to date supports the AER's full transition approach.[541] It agreed with the AER that the trailing average without transition provides a significant increase to the allowed return on debt. They considered the allowed return on debt will not reflect the reasonable efficient cost of debt and is not in the long run interests of consumers. CCP11 suggested the AER to reject APA VTS's proposal on directly moving to a 10-year trailing average. [542]

Approaches that contribute to the achievement of the ARORO

We consider the ARORO requires that the allowed rate of return appropriately compensates investors for capital investments (in an ex-ante sense) and aims to minimise the long run cost of capital (all else being equal).[543] We consider ex-ante efficient compensation should result in the ex-ante allowed return on capital cash flows having a present value equal to the present value of the ex-ante efficient cost of capital cash flows required to finance the RAB. This means the allowed return on and of capital cash flows should have a present value equal to the statutory value of the RAB. This is a zero NPV investment condition, which underlies the regulatory framework, as discussed in section 3.3.3.[544]

A rate of return that achieves the ARORO should be consistent with the RPPs in the NEL/NGL, which indicate a service provider should be provided with a reasonable opportunity to recover at least efficient costs. These also require that we should provide service providers with effective incentives to promote economic efficiency and have regard to the economic costs and risk of the potential for service providers to under- or over-invest.[545]

We have formed our view that our decision to estimate the allowed return on debt by starting with an on-the-day approach for the first regulatory year and gradually transitioning into a trailing average approach over 10 years will result in an allowed return on debt that contributes to the achievement of the ARORO. The other option that we consider would achieve the ARORO is maintaining the on-the-day approach.

We have had regard to the requirement in the NGR that we consider the desirability of minimising any difference between the return on debt and the return on debt of a benchmark efficient entity in choosing between these two methods. We consider a full transition may better meet this requirement than the on the day approach although there are some relative advantages and disadvantages in both approaches.

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[541] CCP (Panel 11), *Submission to the AER: Response to proposal from APA VTS for the 2018-22 access arrangement*, 3 March 2017, p. 29.

[542] CCP (Panel 11), *Submission to the AER: Response to proposal from APA VTS for the 2018-22 access arrangement*, 3 March 2017, p. 29.

[543] By appropriate compensation we mean that the ex-ante return should be commensurate with the expected return in the capital market for an investment with a similar degree of risk as that of a benchmark efficient entity in the position of the service provider supplying reference services.

[544] See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 14.

[545] For the RPPs see NEL, s. 7A; NGL, s. 24.

Related to this, all else being equal, a trailing average (with transition) and on-the-day approach provide equivalent ex-ante compensation over the term of the RAB (see Appendix J.5.2 for a detailed discussion). We consider this position is consistent with the AEMC's observations about SFG's view:[546]

> SFG highlighted that for a given definition of the return on debt for an efficient benchmark service provider (in particular, the assumed credit rating and term to maturity) the average cost of debt will be the same over the long run. This is regardless of whether the return on debt estimate is based on the prevailing debt cost spot rate or an average of that spot rate. Changing to an averaging approach will not, in itself, systematically reduce or increase the allowed return on debt in the long run.

As noted above, we reconsidered our view on what will achieve the ARORO in light of the initial proposals of APTPPL, APA VTS, AGN and AusNet Gas and AusNet Services revised electricity transmission proposal and CEG's report on the ARORO submitted with AusNet Services' revised electricity transmission proposal. We also had our consultants consider this point.[547] Following a full review, and taking into account the Full Federal Court decision, we are of the view our approach taken in the draft decision (of using a trailing average with full transition) is appropriate and will contribute to an allowed rate of return that will achieve the ARORO for the reasons discussed throughout this decision. Responses to some specific criticisms that have been made of our approach are discussed in Appendix J.5.2.

Trailing average (with full transition) meets the ARORO

With a full transition, a trailing average approach would provide a benchmark efficient entity with a reasonable opportunity to recover at least efficient costs over the term of the RAB. It could therefore result in an allowed return on debt (and overall rate of return) that is consistent with the rules and NGL. Appendix J provides detailed reasons, including a mathematic description, for why this holds. Further, regarding adopting a trailing average approach more broadly:

- Compared to an on-the-day approach, a trailing average approach will lead to less volatile cash flows.[548]
- Some stakeholders submitted that a trailing average would reduce some of the risks faced by service providers, which would eventually flow to lower betas than what we have historically seen.[549] Frontier also advised that a trailing average approach would result in a smooth profile for the allowed return on debt.[550]

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546 AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 November 2012, pp. 74–75.

547 Partington, G., Satchell, S*., Report to the AER: Issues in relation to the cost of debt*,9 April 2017

548 AER, *Explanatory statement to the rate of return guideline (Appendices)*, December 2013, p. 38.

549 MEU, *Submission to beta issues paper*, October 2013, p. 5; PIAC, *Submission to beta issues paper*, October 2013, pp. 6–7, 9–10.

550 Frontier Economics, *Assessing risk for regulated energy networks*, July 2013, p. 74.

- A trailing average approach received broad stakeholder support.[551]

We consider the on-the-day approach would contribute to the achievement of the ARORO and is therefore open to us (see the following section). On this basis, the present value of a benchmark efficient entity's allowed revenues under the on-the-day approach would have been sufficient to compensate it for its efficient financing costs. That is, a benchmark efficient entity would not have been under- or over-valued when we calculated its debt allowance under the on-the-day approach, and continuing this approach will continue to provide correct compensation commensurate with efficient financing costs.

If this holds, then changing the present value of capital investments of the service provider would result in overcompensation (if we increase its value) or undercompensation (if we decrease its value). This would violate the NPV=0 condition and not meet the ARORO or be consistent with achieving the NGO having regard to the RPPs. As such, changing debt estimation methodologies must be revenue-neutral (in a present value sense) to avoid incorrectly compensating a benchmark efficient entity relative to its efficient financing costs.

Switching immediately from an on-the-day approach to a trailing average approach could only be revenue-neutral by chance. Specifically, this could occur if the average cost of debt over the last nine years equalled the current cost of debt in the market. However, if the nine year average was higher (lower) than the current cost of debt, then changing approaches would inappropriately increase (decrease) the present value of the capital investments made by the service provider to provide its reference services. This arises because the allowed return on debt is estimated using prevailing market data under the on-the-day approach and historical market data under the trailing average approach. As such, by construction, these two approaches will typically produce different estimates at given points in time.

For this reason, we have used our transition approach because it is approximately revenue neutral (in a present value sense).[552] That is, it aims to assist us in switching between methodologies to estimating the return on debt without changing the present value of a benchmark efficient entity's allowed revenues purely due to this switch. HoustonKemp provided support for a transition to avoid such changes to the present value of a benchmark efficient entity's allowed revenues and to limit 'regulatory risk' in its advice to ESCOSA.[553] We also note that SFG advised the AEMC that the type of transition mechanism we apply in this draft decision would be an effective means of transitioning between methodologies:[554]

551 AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 108–111.

552 Only a full transition is revenue neutral of the different transition paths before us. However, there are other possible revenue paths that are revenue neutral (in a present value sense) from the change in methodology. For example, this could include a lump sum transfer (see Appendix I).

553 HoustonKemp, *Appropriate objective to guide the setting the cost of debt allowance*, March 2015, p. 5.

554 SFG, Rule change proposals relating to the debt component of the regulatory rate of return, August 2012, p. 46.

> The type of "rolling in" arrangement [transition] that has been proposed by QTC [the full transition we adopted] would be an effective means of transitioning from the current Rules to the use of an historical average cost of debt approach

For completeness, changing approaches once from an on-the-day to a trailing average approach will only require one revenue neutral transition. If there was good reason to later readopt an on-the-day approach (or adopt an alternative approach that could also contribute to meeting the ARORO), this would require another once-off revenue-neutral transition. We consider this is consistent with the rules requirement to have regard to any impacts on a benchmark efficient entity referred to in the ARORO that could arise from a change of methodology, in the context of this particular approach.[555] The AEMC explained that the purpose of this aspect of the rules was:[556]

> for the regulator to have regard to impacts of changes in the methodology for estimating the return on debt from one regulatory control period to another. Consideration should be given to the potential for consumers and service providers to face a significant and unexpected change in costs or prices that may have negative effects on confidence in the predictability of the regulatory arrangements.

AusNet Services Electricity Transmission, APTPPL and APA VTS criticised our (full transition) approach arguing it will not contribute to a rate of return that will contribute to the ARORO.[557] This was supported by an experts report from CEG.[558] We and our consultants have considered the new material. Nothing in the new material submitted changes our views expressed above on why the continuation of the on the day regime will meet the ARORO. We maintain our decision of adopting a full transition if the trailing average approach is applied, otherwise, we would continue to use the on the day regime in the cost of debt calculation for APTPPL and also the other service providers. Our responses to the specific criticisms of our approach are covered in Appendix J.5.2.

Continuing the on-the-day approach meets the ARORO

An on-the-day approach provides service providers with a reasonable opportunity to recover at least efficient costs over the term of the RAB <u>and</u> over each access arrangement period. Appendix J.3 provides detailed reasons, including a mathematic

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555 NER, cl. 6.5.3(k)(4), states '(k) In estimating the return on debt under paragraph (h), regard must be had to the following factors… (4) any impacts (including in relation to the costs of servicing debt across regulatory control periods) on a benchmark efficient entity referred to in the allowed rate of return objective that could arise as a result of changing the methodology that is used to estimate the return on debt from one regulatory control period to the next. Also see NER, cl. 6A.6.2 (k) (4); NGR, cl. 87(12) (d).

556 AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 Nov ember 2012, p. 85.

557 AusNet Services, *Transmission revised revenue proposal*, 21 September 2016, p.166. RBP, *Access arrangement revision submission 2017-22*, 16 September 2016, p.160; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

558 CEG, *The AER's current interpretation of the ARORO*, September 2016, p.3.

description, for why this holds. On this basis, we consider continuing the on-the-day approach for estimating the allowed return on debt will achieve the ARORO and the NGO.[559] Further, as table 3-7 shows, we consider that neither an on-the-day nor trailing average approach would be clearly superior to the other. Rather, each of these approaches has its own benefits and limitations.

Some service providers and CEG have implicitly criticised our view that continuing the on the day approach will contribute to a rate of return that will meet the ARORO.[560] CEG submit that that our valuation analysis we use to show the on the day approach provides an appropriate return assumes a firm has no debt.[561] We and our consultants considered the new material. Nothing in the new material submitted changes our views expressed above on why the continuation of the on the day regime will meet the ARORO. Our responses to the specific criticisms of our approach are covered in Appendix J.5.2.

Given this, while we adopt a trailing average for this determination, we do not consider this change in methodology would be justified in the absence of a transition. Without a transition, the change to the trailing average would not be revenue neutral, but would rather increase the present value of a benchmark efficient entity's allowed revenues purely due to changing the debt estimation methodology (see the subsequent section). Consequently, in the absence of a transition, we would not consider a trailing approach will achieve the ARORO and we would instead maintain the on-the-day approach to estimating the return on debt. Our view is supported by our consultants who note that "[a]n immediate switch to the trailing average immediately gives risk to a regulated allowed return that exceeds the current required return. Consequently, it immediately gives rise to economic rents and an incentive to overinvest."[562] We agree with our consultants and consider such as outcome would be inconsistent with both achieving the ARORO and achieving the National Gas Objective.

Table 3-7: Benefits of different debt approaches

Benefits of a trailing average approach	Benefits of an on-the-day approach
A trailing average approach provides service providers with a regulatory benchmark that they can more readily match each access arrangement period.[563] As such, this provides a benchmark efficient entity with an enhanced	An on-the-day approach better reflects the prevailing cost of debt in the capital market near the commencement of the access arrangement period. Due to this, it: • Better reflects investors' opportunity cost of debt and expectations of future returns near the

559 As required under NER, cl. 5.5.2(h); NER, cl. 6A.6.2(h); NGR, cl. 87(8).

560 AusNet Services, *Transmission revised revenue proposal*, 21 September 2016, p.166; CEG, *The AER's current interpretation of the ARORO*, September 2016; RBP, *Access arrangement revision submission 2017-22, 16 September 2016*, p.160; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

561 CEG, *The AER's current interpretation of the ARORO*, September 2016, p. 36.

562 Partington, G., Satchell, S., *Report to the AER: In relation to the cost of debt*, 9 April 2017, p. 29.

563 See AER, *Final decision: TransGrid transmission determination, Attachment 3*, April 2015, p. 150.

opportunity to minimise any mismatch between actual costs and allowed revenues.[564] Nevertheless, it is important to note that this mismatch risk would not result in a benchmark efficient entity being ex-ante over- or under-compensated for its efficient debt financing costs for a access arrangement period or over the life of its assets.

All else being equal, this reduced risk and the reduced need to enter hedging arrangements might lower the efficient cost of financing for a benchmark efficient entity and increase productive efficiency.

A trailing average is likely to provide for a smoother price path than the on-the-day approach. Regulatory revenues adjust gradually to movements in interest rates. By contrast, the on-the-day approach can lead to large shifts in revenue at each reset if underlying interest rates have moved since the last reset.

commencement of the access arrangement period.[565] It therefore provides a better signal for efficient investment decisions that increase dynamic efficiency. This is consistent with the AEMC's view that the return on debt framework should minimise the risk of creating distortions in service providers' investment decisions:[566]

- Is more internally consistent with how we estimate other components of the allowed rate of return and the building block model more generally.
- Leads to an estimate that is commensurate with efficient financing costs and competitive market outcomes near the commencement of the access arrangement period. We expect prevailing market rates for capital finance to be competitive.[567] Moreover, a return on debt that reflects the current market rate more closely imitates the outcomes of a competitive market by representing the costs that other service providers will face to enter the market.[568]

Source: AER analysis.

An immediate adoption of a trailing average will not contribute to the achievement of the ARORO

We have carefully considered the no transition path immediate move to the trailing average put forward in APA VTS and APTPPL's initial proposal and AusNet's revised proposal.

The following sections set out why an immediate (historical) trailing average approach to estimating the cost of debt will not contribute to the achievement of the ARORO.

For the reasons discussed above in the section headed 'trailing average (with full transition) meets the ARORO', immediately moving to a trailing average by immediately adopting a historical cost of debt is likely to change the present value of a benchmark efficient entity's allowed revenues relative to a continuation of the on-the-day approach.

The current market cost of debt is considerably below the average market cost of debt over the past nine years. As such, in current circumstances, an immediate transition would lead to an excess positive return relative to the efficient return in the market. That is, it will set an allowed return that is above the efficient financing costs of a

564 HoustonKemp, *Memo: Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 4.

565 Peirson, Brown, Easton, Howard, Pinder, *Business Finance*, McGraw-Hill, Ed. 10, 2009, pp. 427, 434.

566 AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 November 2012, p. 73.

567 Kahn, A.E., 'The economics of regulation: Principles and institutions', The MIT Press, Massachusetts, 1988, p. 45.

568 In a competitive market, prices are theoretically constrained by entry or the threat of entry. See HoustonKemp, *Memo: Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 1. This is also implied in Chairmont, *Cost of debt comparative analysis*, November 2013, p. 4.

benchmark efficient entity given current market conditions. All else being equal, this will result in a material increase in the present value of a benchmark efficient entity's allowed revenues relative to its expected efficient costs to a value well above its RAB, thereby overcompensating it. We consider that setting a transition that leads to excessive positive returns (above current returns in the market) will set a return above efficient financing costs and that this will neither achieve the ARORO or the NGO. It is likely to promote inefficient investment, inconsistent with the NGO and the RPPs, will constitute a return that does not appropriately have regard to the regulatory and commercial risks, and which is likely to lead to overinvestment.

APA VTS, APTPPL and AusNet Services have not submitted material that satisfies us that materially increasing the present value of its allowed revenues from the change in methodology would contribute to the achievement of the ARORO or be consistent with the NEL/NGL.

It is worth noting that equally, the trend in interest rates could have been reversed (that is, if we had moved from a low to high interest rate environment). If this occurred, an immediate transition would have led to a material decrease in the present value of a benchmark efficient entity's allowed revenues relative to its expected efficient costs, thereby undercompensating it. That is, the allowed return would have been below the efficient financing costs of a benchmark efficient entity. Neither outcome would achieve the ARORO and would not lead to efficient investment and use of infrastructure, in the long term interest of consumers. We explain this and show this mathematically in detail in Appendix J.

Further, we consider that failing to implement a revenue neutral transition would undermine the ARORO and the NEL/NGL for the following reasons:

- The future return on debt allowance would have a different present value if we switched methodologies to estimating the allowed return on debt without a transition. In Appendix J, we establish that continuing the on-the-day approach would satisfy the ARORO. Given this, changing approaches must be revenue neutral or it would either over- or under-compensate a benchmark efficient entity for its efficient debt financing costs. We do not consider this outcome contributes to the achievement of the ARORO, NEO/NGO or RPPs.
- If switching to a trailing average approach is not revenue neutral, this would change the present value of a benchmark efficient entity's expected cash flows compared to the value of the expected cash flows that would be consistent with the investor expectations when they invested (under the on-the-day approach). This may increase expected regulatory uncertainty. This may undermine confidence in the predictability of the regulatory arrangements and lead to an inefficient increase in

financing costs (all else being equal).[569] This is consistent with SFG's advice to the AEMC that:[570]

> The lack of any transition arrangements in a setting whether the rule change exposes regulated businesses to risks that they did not previously face is likely to be viewed by the market for funds as a signal that a higher degree of regulatory risk should be priced into their provision of funds. Such an outcome is unlikely to be consistent with the NEO and RPP.

- Incentives on service providers to adopt efficient debt finance practices (and thereby minimise their long run cost of capital all else being equal) under the regulatory regime may be undermined.[571] For instance, we recognise service providers have made past decisions and would have expected particular consequences and to bear certain risk from their decisions in prior access arrangement periods. The basis on which past decisions were made should be acknowledged with our attention focused on future incentives to efficiently manage financial risk.

Hybrid transitions will not contribute to the achievement of the ARORO

Two alternative forms of hybrid transition have been proposed previously:

- Hybrid transition[572]—Start with an on-the-day approach for the base rate component and gradually transition into a trailing average approach over 10 years. This would be combined with a backwards looking trailing average DRP (that is, a base rate transition only).
- Hybrid transition under partial hedging[573]—Assume a benchmark efficient entity hedged only one third of the base rate under the on-the-day regime on the basis that this would have been ex-post optimal.[574] Gradually transition this portion of the base rate and apply an immediate trailing average to the other two thirds of the base rate and the entire DRP component.[575]

For completeness this section sets out our view on both of these hybrid transitions. We remain of the view a hybrid transition is not appropriate, will not meet the ARORO and

569 See HoustonKemp, *Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 5; Expert Panel on Energy Access Pricing, *Report to the Ministerial Council on Energy*, April 2006, p. 59.

570 SFG, *Rule change proposals relating to the debt component of the regulatory rate of* return, August 2012, p. 46.

571 The RPPs require we have regard to this effect on incentives. See NEL, s. 7A(3)(b); NGL, s. 24(3)(b).

572 This was proposed by ActewAGL, AGN, Amadeus, CitiPower, JEN and United Energy

573 This was proposed by ActewAGL, AGN, Amadeus, CitiPower, JEN and United Energy

574 ActewAGL, Access arrangement information, January 2016, p. 35; AGN, Attachment 10.26 response to draft decision: Rate of return, January 2016, p. 3; AusNet Electricity Services, Revised regulatory proposal, January 2016, p. 7-33; CitiPower, Revised Regulatory Proposal 2016—2020, January 2016, p. 266; JEN, Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs, January 2016, p. 28; Powercor, Revised regulatory proposal 2016–20, January 2016, p. 260; United Energy, 2016 to 2020 revised regulatory proposal, January 2016, p. 79.

575 In the revised proposals that put Option 5 before us, $x = 1/3$ based on CEG, Critique of the AER's approach to transition, January 2016, p. 2.

will not meet the NEO. These views, and our reasoning, have not changed since the final AER decisions that covered these issues released in May 2016.[576]

As table 3-8 highlights, both hybrid transitions are effectively different combinations of a 'full transition' and 'no transition'. On the basis that a full transition contributes to the achievement of the ARORO and no transition fails to achieve this, then both hybrid transitions would fail to achieve the ARORO. For this reason, our analysis above on why immediately moving to a trailing average approach will not contribute to the achievement of the ARORO also applies to the hybrid transitions that some service providers have previously proposed.

Table 3-8 Different transitions to a trailing average proposed by various service providers

Form of transition	Revenue-neutral transition by updating 10% per year over 10 years	Immediately move to a trailing average approach
Full transition	100% of base rate + DRP	-
Hybrid transition	100% of base rate	DRP
Hybrid transition under partial hedging	1/3 of base rate	2/3 of base rate + DRP
No transition	-	100% of base rate + DRP

Source: AER analysis.

For clarity, we also emphasise why the logic underpinning the use of a hybrid transition is problematic. By basing APTPPL's debt allowance on a 10 year historical DRP, a hybrid transition would effectively remove realised losses or gains from interest rate risk that it had previously borne. This reasoning also applies to an immediate transition.

As APTPPL operates under an ex-ante regulatory regime, we consider the ARORO requires us to provide ex-ante efficient compensation. This does not entail compensating for historically incurred costs. That would be cost of service, not incentive regulation. Investors have invested accepting the interest rate risk from the on-the-day approach, and we have already appropriately compensated APTPPL for bearing this risk. For both reasons, removing the outcomes of this risk ex-post would not contribute to the achievement of the ARORO.[577]

Further, we consider that we have appropriately compensated investors for the risks they faced when we set the allowed return on debt using the on-the-day approach. This is because:

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[576] See AER final decision for CitiPower distribution determination, AER final decision for Australian gas networks access arrangement. AER final decision for ActewAGL distribution access arrangement

[577] Lally, *Review of submissions on the cost of debt*, 21 April 2015, p. 25.

- We have set the allowed return on debt using the on-the-day approach for many years.[578] As such, when we applied the on-the-day approach, investors in a benchmark efficient entity would have expected us to reset the return on debt at the start of each access arrangement period and accepted any risks associated with this approach. When we proposed moving to a trailing average in the Guideline, this proposal was contingent on applying a transition so that the value of the firm aligned with previous investor expectations under the on-the-day regime.
- We benchmark the allowed rate of return (which requires consistently benchmarking the return on debt, return on equity and gearing) on observed data from service providers comparable to a benchmark efficient entity operating under an on-the-day approach. Therefore, the allowed rate of return should be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as a service provider in providing its reference services operating under this approach.[579]

Further, regarding the reasoning put forward for a hybrid transition under partial hedging, we consider a full transition is necessary to satisfy the ARORO and NEO/NGO even if firms partially hedged.

General problems with using approaches based on historical data

Both the immediate and hybrid forms of transition to the trailing average rely on using historical data to estimate the allowed return on debt. We consider this has the following problems:

- All of these transition paths would produce a return on debt allowance that effectively removes interest rate risk (to at least some extent) incurred in prior access arrangement periods. A benchmark efficient entity was required to bear and manage this risk under the on-the-day approach. As such, these transition paths would alter APTPPL's historic risk profiles after it had made decisions on how to manage its financial risk.

In our decisions for the Victorian Distribution Network Service Providers (DNSPs)[580], we observed there are practical problems with using historical data dating back nine years[581], and we maintain this is the case.

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[578] We have used the on-the-day approach to estimate the return on debt since 1998 where we interpreted our task as requiring us to derive a rate of return that was as up to date as possible at the time the access arrangement came into effect. See ACCC, *Victorian Gas Transmission Access Arrangements Final Decision*, 6 October 1998, p. 49.

[579] In particular, to the extent that the financial risks (including interest rate risk) arising from the on-the-day approach are systematic, they would be priced into investors' required return on equity. This would be compensated for in our equity beta estimate, which is calculated based on historical returns.

[580] That is CitiPower, Powercor, Jemena, United Energy and AusNet Serices

[581] For example, see AER, *Preliminary decision—AusNet Services determination, Attachment 3: Rate of return*, October 2015, pp. 196–9. Also see AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 166–167.

In the previous section, we set out our approach to estimating the allowed return on debt. This approach involves estimating the allowed return on debt using the on-the-day approach gradually transitioning into a trailing average approach over 10 years. This gradual transition will occur through updating 10 per cent of the allowed return on debt each year to reflect prevailing market conditions during APTPPL's averaging period for that year.

In this section, we set out our considerations on the implementation issues associated with estimating the allowed return on debt approach. These issues are:

- the term of debt issued by a benchmark efficient entity
- the credit rating of a benchmark efficient entity
- whether to use an independent third party data series or to construct our own data series (for example, based on an index of actual industry borrowing costs)
- the choice of third party data series (or combination of data series) to estimate the efficient debt financing costs of a benchmark efficient entity, based on the benchmark debt term and benchmark credit rating
- extrapolation and interpolation issues with adjusting our choice of data series
- contingencies associated with implementing our choice of data series, if the data series we have chosen to estimate the return on debt are unavailable or change in future regulatory years during the regulatory control period
- the new issue premium
- the averaging period used to estimate the return on debt for each regulatory year
- the annual process to update the return on debt.

Consistent with the analysis that supported the Guideline, we are satisfied that a return on debt estimated based on a 10 year benchmark debt term, BBB+ benchmark credit rating, and using an independent third party data series is commensurate with the efficient financing costs of a benchmark efficient entity for APTPPL.

In choosing that third party series (or combination of series), we are satisfied that adopting a simple average of the broad BBB rated RBA and Bloomberg Valuation Service (BVAL) curves, with the RBA data series extrapolated to a 10 year term, is commensurate with the efficient financing costs of a benchmark efficient entity.

Term

Our draft decision is to adopt a ten year term for the return on debt. This is consistent with the Guideline;.[582] This is also consistent with our April, October and November 2015 decisions, May 2016 decisions and our April 2017 decision.[583]

[582] AER, *Better regulation—Rate of return guideline*, December 2013, p. 21; AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017–2022 regulatory proposal*, 30 October 2015, p. 267; AusNet Transmission

We are satisfied that measuring the allowed return on debt by reference to a 10 year benchmark term is commensurate with the efficient financing costs of a benchmark efficient entity. Our reasons for adopting a 10 year benchmark debt term are:

- A long debt tenor is consistent with the long lived assets of a benchmark efficient entity and reduces refinancing risk.
- A 10 year term is similar to (though somewhat longer than) the industry average term at issuance of a sample of firms that are comparable to the benchmark efficient entity.
- Service providers' assets are long lived, and have asset lives that are longer than the terms commonly available for debt. Refinancing risk is the risk that a firm would not be able to refinance its debt at a given point in time due to this mismatch in terms. While conceptually we agree that businesses will seek to issue longer term debt to lower their refinancing risk, generally the cost of long term debt is higher than shorter term debt. This is because debt holders require compensation for the risks associated with holding debt over a longer time period. We consider a benchmark efficient entity would have regard to the trade-off between the higher cost of long term debt and the risk associated with refinancing and structure their debt holdings accordingly. Overall, these considerations suggest the average debt term of a benchmark efficient entity would be long term, but they do not provide clear guidance on what exactly that term should be.

For that reason, in our Guideline, we requested information from a range of privately owned service providers on the amount, type, term and credit rating of their debt issuances.[584] These service providers are comparable to a benchmark efficient entity for APTPPL. Based on observed practice, the weighted average term at issuance of the debt portfolio of these service providers was 8.7 years at the time of the Guideline. We observed that service providers are securing bank debt with an average term at issuance of 4.3 years, issuing Australian bonds with an average term at issuance of 9.6 years, and issuing offshore bonds with an average term of 9.7 years.[585] In circumstances where the yield curve for debt is upward sloping, our 10 year benchmark will be conservative compared against the 8.7 year observed average.

Credit rating

Group Pty Ltd, Transmission Revenue Review 2017–2022 regulatory proposal, 21 September 2016, pp. 159, 168; TasNetworks, *Tasmanian Distribution Regulatory Proposal 2017-2019*, 29 January 2016, p. 117. Powerlink*, 2018-2022 Revenue Proposal*, January 2016, p. 91.

583 For example, see AER, final decision-TransGrid Transmission determination 2015-16 to 2017-18, Attachment 3 - Rate of return, April 2015, p. 12-13; AER, *preliminary decision-AusNet Services distribution determination 2016 to 2020, Attachment 3: Rate of return*, October 2015, p. 11; AER, *final decision-AusNet Services distribution determination 2016 to 2020, Attachment 3: Rate of return*, May 2016, p. 11; AER, Attachment 3 – Rate of return, draft decision: AusNet Services transmission determination 2017–22 to 2021-2022, July 2016, p. 13.

584 Information was received from APA Group, AusNet Services, CitiPower, Dampier to Bunbury Pipeline, ElectraNet, Envestra, Jemena, Multinet, Powercor, SA Power Networks and United Energy.

585 AER, *Better regulation—Explanatory statement to the rate of return guideline*, December 2013, p. 136.

Our draft decision is to adopt a BBB+ benchmark credit rating to estimate the return on debt. This benchmark credit rating is the same rating we proposed in the Guideline and applied in our most recent decisions.[586] We also applied this credit rating to decisions that were upheld before the Tribunal.[587] We consider that a BBB+ benchmark credit rating to be appropriate given the information we have available and that is included in this decision.

In current regulatory processes, service providers have proposed implementation of the AER Guideline credit rating. However, AGN proposed that explicit consideration should be given to whether building block revenue provides sufficient cash flow to maintain the credit rating assumed by the AER.[588]

In previous decisions, different service providers, consultants and other stakeholders proposed different credit ratings for the benchmark efficient entity. In particular:

- AusNet Services proposed a credit rating of BBB to BBB+.[589]
- Powerlink and TasNetworks proposed to adopt a benchmark credit rating of BBB+[590]

These service providers did not submit any consultant reports on the benchmark credit rating. However, previous consultant reports we received were mixed. For instance:

- NERA and Houston Kemp (commissioned by TransGrid in a recent regulatory process) recommended a BBB+ credit rating.[591]
- Several service providers and CEG (commissioned by several service providers) recommended a BBB credit rating.[592]

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586 AER, *Better regulation—Rate of return guideline*, December 2013, p. 21; AER, *Better regulation—Explanatory statement to the rate of return guideline*, December 2013, pp. 152–157. See attachment 3 of our final decisions published in May 2016 for ActewAGL distribution (gas), AGN, APTNT, AusNet Services (distribution), CitiPower, Jemena Electricity Networks, Powercor, United Energy.

587 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para. 993; AusNet Transmission Group Pty Ltd, Transmission Revenue Review 2017–2022 regulatory proposal, 30 October 2015, pp. 191, 196; AusNet Transmission Group Pty Ltd, Transmission Revenue Review 2017–2022 revised regulatory proposal, 21 September 2016, pp. 137, 167.

588 AGN, *Final Plan: Access Arrangement Information for our Victorian and Albury natural gas distribution networks 2018-22*, December, p. 146-147.

589 AusNet Transmission Group Pty Ltd, Transmission Revenue Review 2017–2022 revised regulatory proposal, 21 September 2016, p. 159.

590 Powerlink, Queensland revenue proposal, January 2016; TasNetworks, Tasmanian distribution regulatory proposal: Regulatory control period 1 July 2017 to 30 June 2019, 29 January 2016. For our Guideline approach

591 Houston Kemp, *Response to the draft decision on the return on debt allowance*, January 2015, p. 4; NERA, *Return on capital of a regulated electricity network: A report for Ashurst*, May 2014, p. 10.

592 ActewAGL, *Revised regulatory proposal*, January 2015, pp. 431–432; Ausgrid, *Revised regulatory proposal and preliminary submission,* January 2015, pp. 70–71; AusNet Services, *Draft decisions NSW/ACT electricity distribution determination 2015–19*, February 2015, pp. 11–16; CitiPower/Powercor, *Submission in relation to the first round of regulatory determinations under the new rules*, February 2015;Endeavour Energy, *Revised regulatory proposal*, January 2015, pp. 104–105, Ergon Energy, *Appendix C: Rate of return, Regulatory proposal*, October 2014, p. 123;Essential Energy, *Revised regulatory proposal*, January 2015, p. 230; JGN, *Access arrangement: Response to the AER's draft decision and revised proposal, Appendix 7.10 — Return on debt response*, February

- Lally (commissioned by us) and the South Australian Centre for Economic Studies (SACES) recommended a credit rating for energy networks of BBB to BBB+.[593]

In contrast, consumer groups previously submitted the benchmark credit rating of BBB+ was too low. For instance:

- The CCP4 (DH) viewed the AER Guideline as conservative when setting point estimates for the rate of return model, expressing concern that a lower credit rating than BBB+ would inappropriately increase the return on debt allowance.[594] [595]
- The Chamber of Commerce and Industry Queensland (CCIQ) and Energy Consumers Coalition of South Australia (ECCSA) submitted that credit ratings of BBB and BBB+ are too low.[596] ECCSA specifically noted this was the case given benchmark firms' gearing levels.[597]
- The Victorian Energy Consumer and User Alliance (VECUA) referred to an analysis by the Energy Users Rule Change Committee (EURCC) in 2011 to support their view that we should recognise or have regard to service providers' actual credit ratings.[598] VECUA submitted that we provide higher debt allowances than appropriate by basing these on credit ratings that are lower than service providers' actual credit ratings.[599] Further, VECUA also submitted that by using debt in a broad BBB band to estimate the allowed return on debt, the debt allowance we provide is predominantly based on more expensive debt ratings.[600] We note that several service providers disagreed with this submission.[601]

2015, pp. 6–10; SAPN, *Regulatory proposal 2015–20*, October 2014, p. 305; United Energy, *Submission in relation to the first round of regulatory determinations under the new rules*, February 2015. CEG, *WACC estimates*, May 2014, p. 64; CEG, *Memorandum: Factors relevant to estimating a trailing average cost of debt*, 24 May 2014, pp. 12–15.

593 Lally, *Implementation issues for the cost of debt*, November 2014, pp. 28–3; SACES, *Independent estimates of the WACC for SAPN: Report commissioned by the SACOSS*, January 2015, pp. 13–14.

594 CCP4, David Headberry, Submission to the Australian Energy Regulator, Response to the Proposal from Tasmania's Electricity Distribution Network Service provider (TasNetworks - TND) for a revenue reset for the 2017-19 regulatory period, 4 May 2016, p. 44.

595 CCP4, Hugh Grant and David Headberry, Submission to the AER, Powerlink Queensland 2018- 22 Revenue Proposal, June 2016, pp. 4, 34, 46.

596 CCIQ, *Submission to the Australian Energy Regulator on Energex's regulatory proposal for the 2015-20 revenue determination*, January 2015; ECCSA, *AER review of SAPN application 2014: ECCSA response to AER's preliminary decision*, June 2015.

597 ECCSA, A response to the AER draft decision on AGN’s AA2016 revenue reset, February 2016, p. 34.

598 ECCSA, *AER review of SAPN application 2014: ECCSA response to AER's preliminary decision*, June 2015.

599 VECUA, *Submission to the AER: Victorian Distribution Networks' 2016-20 revenue proposals, January 2016.*

600 Victorian Energy Consumer and User Alliance (VECUA), *Submission to the AER - AER Preliminary 2016-20 Revenue Determinations for the Victorian DNSPs*, January 2016, p. 18.

601 ActewAGL, AusNet Services and United Energy disagreed that our use of a broad BBB curve to estimate the return on debt was conservative in their favour. See ActewAGL Distribution, *Attachment 3: Response to submission made to the AER by the VECUA dated 6 January 2016*, p. 4; AusNet Services, *Response to submissions on the Victorian EDPR preliminary decision (2016–20)*, 4 February 2016, pp. 22–7; United Energy, *Submission to the AER’s preliminary determination for United Energy (for 2016–20)*, 4 February 2016, pp. 4–9.

- The CCP submitted that we should account for the difference between service providers actual cost of debt and the BBB benchmark so the allowance better reflects service providers' actual debt costs.[602]

We are satisfied that a benchmark efficient entity for APTPPL would have a BBB+ credit rating. We formed this view, as well as our view on the benchmark term of issuance, from considering a set of firms that we consider comparable to a benchmark efficient entity with a similar degree of risk to APTPPL in the provision of its reference services.[603] We consider this is more consistent with incentive regulation than basing our allowance for individual service providers on their actual credit ratings or actual historical costs of debt.

APTPPL has adopted the Guideline approach and accepted a credit rating of BBB+.[604] Where financial data to be used in estimating the rate of return are not available for entities with that credit rating, APTPPL proposed ro use data for BBB rated entities.[605]We are satisfied that a benchmark efficient entity facing a similar degree of risk as APTPPL in providing reference services would face a BBB+ credit rating. In section K.4, we also address AusNet Services Electricity Transmission's submission given we have considered it in reaching our draft decision for APTPPL. In particular, we:

- Set out the comparator set we use to estimate the industry median and

Explain why we consider market data supports an industry median credit rating of BBB+, rather than BBB.

In a previous decision AusNet Services Electricity Transmission proposed to exclude itself and SGSP Australia Assets Pty Ltd (SGSP) from the comparator set. We addressed this issue in the previous decision.[606] This is not a current issue. We have included this argument in the current decision although it has not been expanded on in this decision.

Update of empirical evidence

Consistent with our estimate in the Guideline and preliminary decision, we have had regard to empirical evidence in applying a benchmark credit rating of BBB+.[607]

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602 CCP, *Bruce Mountain: Comments on the AER's Preliminary Decision on the Weighted Average Cost of Capital (WACC) for Energex, Ergon and SA Power Networks, July 2015, p. 8.*

603 See, for example, AER, *Explanatory statement: Rate of return guideline*, December 2013, pp. 152–157; AER, *Explanatory statement: Rate of return guideline (appendixes)*, December 2013, pp. 126–130.

604 APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 132,

605 APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September, 2016, p. 132,

606 AusNet Transmission, *Transmission Revenue Review 2017–2022 revised regulatory proposal*, 21 September 2016, p. 347-352.

607 AER, *Better regulation—Explanatory statement to the rate of return guideline*, December 2013, p. 156; AER, *Preliminary decision AusNet distribution determination - Attachment 3 - Rate of return*, October 2015, p. 214.

Table 3-9 sets out the median credit rating over historical periods of progressively longer length. For this draft decision, we present analysis up to 2016. As in our recent decisions for TasNetworks, Powerlink and AusNet electricity transmission, table 3-9 shows some support for a credit rating of BBB, however we consider it shows stronger support for a credit rating of BBB+. We note that the median credit rating for 2016 specifically is BBB+.

We also note that this estimate entails taking the median from the yearly medians. We could also take the median of all credit rating observations over these time periods. This gives BBB+ for the six most recent periods, BBB/BBB+ for the period 2010–2016 and BBB for the longer averaging periods (2006–2016 to 2009–16). Both median of yearly medians and median of all observations show stronger support for a BBB+ benchmark credit rating. Similarly, having considered our presentation of this data in recent determinations, the Tribunal observed that the more recent years firmly point towards a BBB+ credit rating for the benchmark efficient entity.[608]

Table 3-9 Median credit rating—Comparator set of firms

Time period	Median credit rating	Time period	Median credit rating
2016	BBB+		
2015–2016	BBB+	2010–2016	BBB/BBB+
2014–2016	BBB+	2009–2016	BBB
2013–2016	BBB+	2008–2016	BBB/BBB+
2012–2016	BBB/BBB+	2007–2016	BBB/BBB+
2011–2016	BBB/BBB+	2006–2016	BBB/BBB+

Source: Bloomberg (S&P), AER analysis.

As noted by Multinet, the return on debt is estimated using a broad BBB rated curve, including BBB-, BBB and BBB+ rated debt. As we remain satisfied that the appropriate benchmark credit rating is BBB+, use of a BBB rated yield curve is likely, holding other things constant, to overestimate the return on debt required by a BBB+ rated issuer.

Choice of third party data series (including adjustments)

In the previous section, we explained our decision is to use third party published data series to estimate the allowed return on debt, rather than deriving our own data series. In this section, we explain our choice of third party data series, including adjustments we have decided to make to those data series.

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608 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 993.

Our decision is to adopt a simple average of the debt data series published by the RBA and Bloomberg that match, as close as available, our benchmarks of a BBB+ credit rating and a 10 year debt term. Specifically, our decision is to adopt a simple average of:

- the 10 year estimate from the non-financial corporate BBB rated data series published by the RBA (the RBA curve),[609] and
- the 10 year yield estimate from the Australian corporate BBB rated Bloomberg Valuation Service (BVAL) data series published by Bloomberg (the BVAL curve).[610]

The RBA and BVAL curves are both 'broad BBB' rated data series in that they reflect bond pricing generally across the BBB+, BBB and BBB- rated spectrum of bonds.

Our decision is also to make certain adjustments to the RBA and BVAL curves so these rates are consistent with our 10 year benchmark debt term and also so they can be applied across the dates of a service provider's averaging periods. Those adjustments are:

- For the RBA curve, to extrapolate the data series from a 'target' 10 year term to an 'effective' 10 year term using the method recommended by Dr Lally (the Lally method),[611] to interpolate the monthly data points to produce daily estimates, and to convert the estimates from a semi-annual to an effective annual rate.
- For the BVAL curve, to convert the estimates from a semi-annual to an effective annual rate.[612]
- The above positions are consistent with the approach we adopted in the first round of decisions since the publication of the Guideline.[613]

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609 The RBA data series is available on the RBA's website in Statistical Table F3: http://www.rba.gov.au/statistics/tables/index.html#interest-rates

610 The BVAL data series is available through a licence service from Bloomberg under the code 'BVCSAB10 index'. As of 14 April 2015, Bloomberg had revised its methodology for the BVAL curve and had recommenced publishing a 10 year yield estimate.

611 While the RBA publishes an estimate for a 10 year 'target' term, the 'effective' term of the RBA's estimate is commonly less than 10 years, and so requires extrapolation to produce a 10 year term. This is because the RBA's method involves weighting bonds with less weight placed on bonds the further the term to maturity of the bond is from the 10 year target term. There are commonly more bonds with terms to maturity of less than 10 years than there are bonds with terms to maturity greater of than 10 years. As a result, the RBA's methodology places greater weight on the collective pool of bonds with terms of less than 10 years, which results in the 'effective' (or average) term being less than the 10 year 'target' term of the RBA curve: see ACCC Regulatory Economic Unit, *Return on debt estimation: A review of the alternative third party data series*, August 2014, pages 34–40. The Lally method of extrapolation is set out in Lally, *Implementation issues for the cost of debt*, 20 November 2014, pp. 38–44.

612 As of 14 April 2015, Bloomberg revised its methodology for the BVAL curve and has recommenced publishing a 10 year yield estimate. In the current round of decisions, only Energex and Ergon Energy have averaging periods which commenced before 14 April 2015. Before 14 April 2015, the longest tenor estimate published by Bloomberg was either 5 or 7 years, depending on the dates, and therefore required extrapolation to produce a 10 year estimate. Accordingly, for Energex and Ergon Energy we have also applied an extrapolation adjustment to the Bloomberg data before 14 April 2015.

613 AER, *Final decision—JGN access arrangement 2015-20—Attachment 3—Rate of return*, June 2015, pp. 3-201 to 3-216.

We are satisfied that a simple average of the two curves will result in a return on debt that contributes to the achievement of the ARORO. This is because:

- Based on analysis of the bond selection criteria (including approach for identifying outliers), we consider that both approaches employed by the RBA and Bloomberg have their unique strengths and weaknesses, but we are not satisfied that either is clearly superior.
- Based on analysis of the curve fitting (or averaging) methodologies, we consider that both approaches have their unique strengths and weaknesses, but we are not satisfied that either is clearly superior.
- Both curves require adjustments from their published form to make them fit-for-purpose, and we are not satisfied that either can be more simply or reliably adjusted to estimate the annual return on debt.[614]
- A simple average is consistent with expert advice from Dr Lally that we adopt a simple average of the BVAL curve and the RBA curve, subject to the necessary adjustments to each curve. [615] In particular, Lally concluded that based on analysis of the curves, it was reasonably likely that a simple average of the two curves would produce an estimator with a lower mean squared error (MSE) than using either curve in isolation. Lally also advised:

  > …on the question of which index better reflects the cost of debt for the efficient benchmark entity, there is no clear winner.[616]

- The two curves have regularly produced materially different results at particular points in time. Both curves have their strengths and shortcomings, but it is not clear to us that one approach is clearly superior. Consequently, when the curves depart, we consider it is not easily discernible which curve produces estimates that better reflect the efficient financing costs of a benchmark efficient entity. We also note that the BVAL curve has produced estimates both higher than, lower than, and similar to, the RBA curve, depending on the particular point in time. So there is no clear indication that one curve produces systematically higher or lower estimates than the other.
- A simple average of two curves, in these circumstances, is consistent with the Tribunal's decision in the ActewAGL matter where the Tribunal concluded that:

  > …if the AER cannot find a basis upon which to distinguish between the published curves, it is appropriate to average the yields provided by each

[614] As of 14 April 2015, Bloomberg has revised its methodology for the BVAL curve (BVCSAB10). It has correspondingly recommenced publishing a 10 year yield estimate. Therefore, in applying this curve it only requires an adjustment to convert it into an effective annual rate, as set out in the formula for automatic application. However, the RBA curve requires several adjustments from its published form.

[615] Lally, *Implementation issues for the cost of debt*, 20 November 2014, p. 3; Lally, *Review of submissions on implementation issues for the cost of debt*, 18 October 2015, 5.

[616] Lally, *Implementation issues for the cost of debt*, 20 November 2014, p. 5.

curve, so long as the published curves are widely used and market respected.[617]

- A simple average of the two curves will reduce the likely price shock if either curve becomes unavailable or produces erroneous estimates during the period.

In our previous decisions, we have explained each of these reasons in more detail.[618] This analysis included the following evidence.

Dr Lally used the report of the Regulatory Economic Unit to identify 11 points of distinction between the RBA and BVAL curves. Lally analysed each of those differences and concluded:

> In summary, eleven points of distinction have been identified between the BVAL and RBA indexes. Point (11) is irrelevant in view of the AER not requiring historical data. In respect of points (3), (4), (6), (7) and (8), it is not possible to express a preference for one of the two indexes. The BVAL is favoured in respect of points (1) and (9), but the advantage in respect of point (9) is small. The RBA is favoured in respect of points (2), (5) and (10), but the advantage in respect of point (5) is small. The most that can be said here is that neither index is clearly superior to the other.[619]

Based on this analysis, Lally recommended using a simple average of the two curves. Lally advised:

> Firstly, on the question of which independent third-party data service provider should be used to estimate the cost of debt … I … recommend that a combined estimator be used. Since the standard deviations of these estimators are similar and it is not possible to quantify any biases in these two indexes, I recommend that the two indexes be equally weighted. This will lower the Mean Squared Error (MSE) of the estimator relative to using only one of the indexes, and significantly so if the correlation between the indexes is low.[620]

Those 11 points of distinction, and Lally's assessment of those differences between the RBA and BVAL curves, are summarised in the following table.

617 In this decision, the issue before the Tribunal was the choice between the Bloomberg fair value curve (BFVC) and the CBASpectrum curve, neither of which are currently published. See: *Application by ActewAGL Distribution [2010] ACompT4*, 17 September 2010, paragraph 78.

618 AER, *Draft decision—JGN access arrangement 2015-20—Attachment 3—Rate of return*, November 2014, pp. 3-134 to 3-158, 3-301 to 3-308.

619 Lally, *Implementation issues for the cost of debt*, 20 November 2014, p. 19.

620 Lally, *Implementation issues for the cost of debt*, 20 November 2014, p. 3.

Table 3-10 Dr Lally's advice of the differences between the RBA and BVAL curves

No.	Points of distinction identified by REU[621]	Advice from Dr Lally[622]
1	The BVAL is available daily whilst the RBA is only available monthly.	BVAL favoured.
2	The BVAL is only available for terms up to seven years, and therefore would have to be extrapolated out to the desired ten years, whilst the RBA is at least notionally available for the desired ten year term.	RBA favoured. *Note: From April 2015, this point would have changed to "BVAL favoured" as Bloomberg commenced publication of a 10 year BVAL curve, which no longer requires any extrapolation adjustment.*
3	The BVAL sample of bonds is limited to those with a minimum pricing quality (liquidity measure), at least two months to maturity, and above retail size ($10m: see REU, 2014, page 20), whilst the RBA sample is limited to bond issues of at least $100mAUD and at least one year to maturity.	Not possible to express preference for one over the other.
4	The BVAL sample does not exclude financial corporations whilst the RBA's does.	Not possible to express preference for one over the other.
5	The BVAL sample is limited to unsecured bonds whilst the RBA's sample includes both secured and unsecured bonds.	RBA favoured, but advantage is small.
6	The BVAL sample is limited to bonds rated by either S&P or Moody's, whilst the RBA sample is limited to bonds rated by S&P or issued by a firm with an S&P rating.	Not possible to express preference for one over the other.
7	The BVAL sample is limited to AUD denominated bonds whilst the RBA sample also includes USD and Euro denominated bonds.	Not possible to express preference for one over the other.
8	The BVAL sample excludes bonds with call, put and conversion options, whilst the RBA sample does not exclude them.	Not possible to express preference for one over the other.
9	The BVAL methodology involves a par yield curve whilst the RBA's does not.	BVAL favoured, but advantage is small.
10	The BVAL methodology for curve fitting is (in large part) not disclosed whilst the RBA's methodology is disclosed.	RBA favoured. *Note: Bloomberg have now become more transparent and now* provide more detail in their Pricing Data: BVAL Issuer & Sector Curves sheet
11	The BVAL is only available back to February 2011 (continuously) whilst the RBA is available back to January 2005, and therefore there will be more problems obtaining	Not relevant, as AER does not require historical data.

621 Identified by REU, *Return on debt estimation: A review of the alternative third party data series: Report for the AER*, August 2014; and summarised by Lally, *Implementation issues with the cost of debt*, November 2014, pp. 7–8.

622 Set out by Lally, *Implementation issues with the cost of debt*, November 2014, pp. 8 to 19, and summarised on p. 19.

No.	Points of distinction identified by REU[621]	Advice from Dr Lally[622]
	a ten-year trailing average when using the BVAL.	

Source: Advice from Dr Lally.[623]

In our previous decisions, we explained each of these reasons in more detail.[624]

Recently, the Tribunal also upheld this approach, in relation to the NSW/ACT electricity distribution determinations and JGN gas access arrangement.

The Tribunal was satisfied that our approach of adopting a simple average of the information from both the RBA and Bloomberg data services in those reviews was legally open and appropriate, stating:[625]

> 983 … The AER had a choice to make as to what data services, or combination of data services, it should use. Its reasons for selecting the combination of data services are cogent, and reasonable. It is not shown to have misunderstood or overlooked material information. Although there are facts underlying the choice of the AER, the Tribunal is not persuaded of any particular material factual finding which is different from those made by the AER.

Similarly, in relation to the choice of a BBB+ credit rating, the Tribunal noted:[626]

> 993 The Tribunal is not satisfied that the AER's relevant Final Decisions on this topic disclose a ground of review. In the Final Decisions … is a table analysing the median credit ratings over time. The table itself is not apparently inaccurate. The more recent years point firmly towards a BBB+ credit rating for the BEE. The Tribunal does not consider that it was either factually wrong, or a wrong exercise of the discretion, to have regard to that material for the purpose of identifying the characteristics of the BEE.

The Tribunal went further, noting that even if it was wrong in these findings, it would not be persuaded that it was materially preferable and in the long term interests of consumers to adopt a different approach to that adopted by the AER, noting:[627]

> 995 In any event, the Tribunal would not take the step of being satisfied, in either respect, that to vary or set aside the relevant Final Decision would, or would be likely to, result in a materially preferable NEO decision under s 71P(2a)(c). While some aspects of the Tribunal's decision have been challenged in the Full Federal Court, this aspect of the Tribunal's decision has not been challenged by any party.

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623 Lally, *Implementation issues for the cost of debt*, 20 November 2014.

624 AER, *Draft decision—JGN access arrangement 2015-20—Attachment 3—Rate of return*, November 2014, pp. 3-134 to 3-158, 3-301 to 3-308.

625 [2016] ACompT 1 at 263.

626 [2016] ACompT 1 at 265.

627 [2016] ACompT 1 at 265-6.

We have assessed the new information received from AusNet Services, RBP and Multinet recommending that we depart from our previous position of adopting a simple average of the RBA and BVAL curves. That new information does not persuade us to depart from our position or reasons from recent decisions. We explain our reasons for this decision in the remainder of this section and in Appendix K.

We also requested Dr Lally review the recommendations from his previous report in light of the material submitted by service providers with recent proposals. As part of that analysis, we requested Dr Lally review both the AER's approach and the various alternative approaches proposed against a set of criteria drawn from the requirements of the law and the rules, including the ARORO. After reviewing that material, Dr Lally concluded:

> …the AER's proposed approach satisfies the criteria and these criteria are not satisfied by any other proposed approach.
>
> Finally, I have previously provided advice on these implementation issues to the AER and nothing in these submissions warrants any change in that advice.[628]

Further we note that a number of Service Providers have accepted our approach of adopting a simple average of the RBA and Bloomberg curves. AusNet, Multinet and RBP have not presented evidence that there is merit in adopting a unique approach compared to other Service Providers in similar positions.

Response to key issues raised by stakeholders

Table 3-11 sets out the service providers' proposals.

Table 3-11 Choice of data series and adjustments: Summary of current service provider proposals

Service provider	Choice of data series
Draft gas proposals	
AusNet Services	Use the RBA curve in exclusion of all other third party curves. If decide to continue using Bloomberg, then AER should use Thomson Reuters as well.
Multinet Gas	Simple average of the RBA, Bloomberg and Thomson Reuters curves.
Roma to Brisbane Pipeline	Use the RBA curve in exclusion of all other third party curves..
APA VTS	Simple average of the RBA and Bloomberg curves.
Australian Gas Networks (Victoria and Albury)	Simple average of the RBA and Bloomberg curves.

628 Lally, *Review of submissions on implementation issues for the cost of debt*, 18 October 2015, p. 5.

Source: Regulatory proposals.[629]

Having considered these proposals, our draft decision is to maintain our approach as adopted in previous decisions and upheld by the Tribunal.[630]

We have completed some initial work reviewing the Thomson Reuters curve.[631] However, in future we will commence a more comprehensive review. In particular, we have not been able to complete a comparative assessment of the curves or consider a range of practical issues with introducing a third curve.

For the reasons in this section and in Appendix K. we remain satisfied that a simple average of the BVAL and RBA curves will contribute to an estimate that will achieve the ARORO. We have not yet formed a definitive view on the suitability of the Reuters curve, and are open to further consideration of this curve in the future. However, there is currently insufficient evidence before us that the use of Reuters curve would contribute to an estimate that will achieve the ARORO.

- more specifically, we remain satisfied that the BVAL curve is fit-for-purpose, and combined with the RBA curve, are satisfied that it will contribute to an estimate which achieves the ARORO.
- We consider that our implementation of the return on debt estimate includes several conservative features: Specifically:
    - in the Guideline, we adopted a 10 year benchmark term based on a weighted average term at issuance of 8.7 years observed amongst service providers.[632] Ordinarily, this will lead to an upward bias in our benchmark compared to the sector's costs of debt. Using the RBA curve since 2005, this difference leads to an average upward bias of approximately 14 basis points.[633]
    - we adopt a benchmark credit rating of BBB+ but estimate the return on debt using the 'broad-BBB' rated curves published by the RBA and Bloomberg. This means that these curves are estimated based on a bond sample that includes lower rated BBB and BBB– rated bonds. To the extent that the estimates produced by these curves reflect those lower rated bonds, this would similarly introduce an upward bias.

629 Gas draft proposals— AusNet Services Group, *Gas Access Arangement Review 2018-2022: Access Arrangement Information,* December 2016, pp. 210-219; Multinet Gas, *2018 to 2022 Access Arrangement Information*, December 2016, p. 128; Roma to Brisbane pipeline, *Access Arrangement Submission*, September 2016, pp. 159-161; Victorian Transmission System, *Access Arrangement Submission*, 3 January 2017, pp. 182-183; Australian Gas Networks, *Final Plan Attachment 10.1*, December 2016, p. 21.

630 We recognise that this appeal considered our approach prior to Bloomberg publishing a 10 year BVAL estimate. However, we specified in our contingencies for the approach under appeal that we would adopt a 10 year estimate where Bloomberg resumed publication of it.

631 ACCC REU, *Thomson Reuters Credit Curve Methodology*, April 2017.

632 AER, *Rate of return guideline—Explanatory statement*, December 2013, p. 141.

633 AER analysis, calculated using the RBA F3 data release—'aggregate measures of Australian corporate bond spreads and yields: non-financial corporate bonds'.

In Appendix K, we have set out more detailed analysis on our responses to issues raised by key stakeholders, including:

- criticisms of our current approach
- the Thomson Reuters curve
- other issues.

Choice of data series—Extrapolation and interpolation issues

Our draft decision on extrapolation and interpolation issues is:

- extrapolation—where we need to extend a curve beyond its observed or published range. For example, before April 2015, Bloomberg publishes its BVAL curve to a maximum term of 7 years, whereas we require an estimate for a 10 year term.
- Interpolation—where we need a value for which there is no published estimate but it lies between two published estimates. For example, the RBA only publishes its curve estimates for one day each month, but we require estimates for each business day.

Specifically, we will make the following adjustments as set out in Table 3-12 and Table 3-13.

Table 3-12 Adjustments to the RBA curve

Adjustment type	Amendment made?	Comments
Interpolation to construct daily estimates	Yes	The RBA curve only provides an estimate for one business day at the end of each month. In our experience, averaging periods commonly start and/or end on dates during the month. We will address this issue by linearly interpolating between month end values where possible. While we are satisfied that interpolation over business days is also reasonable, we will interpolate over all days because: • this is consistent with our widely accepted approach to interpolate estimates of the risk free rate using CGS • interpolating over all days is simpler to implement • it is impractical to interpolate over business days for estimating the risk free rate, as this would require calculations relative to specific trading days 10 years in advance • the difference to the estimates between interpolating over business days or interpolating over all days is immaterial.[634] Where this is not practical due to timing, we will hold the last available RBA monthly estimate constant until the end of the averaging period. It would not be practical to linearly interpolate between two RBA monthly estimates where the allowed return on debt must be estimated and incorporated into the annual debt update process before the publication of the next RBA

[634] For example, the difference between approaches between 2 June 2014 to 30-June 2014 was 22 basis points, which means it would have changed the return on debt by 0.0022 per cent.

Adjustment type	Amendment made?	Comments
		monthly estimate after the end of the averaging period. Our draft decision on the annual debt update process is set out in this appendix.
Extrapolation to target term	Yes	The 'effective term' of the RBA bond sample is commonly less than 10 years. For this reason, Lally recommended that the spread component of the yield should be extrapolated from its effective term at publication to the benchmark term (10 years).[635] We agree with Lally's recommendation to extrapolate the spread component of the RBA's published yield in order to match it with the benchmark term of debt. However, we do not agree it is necessary to extrapolate the base component. As identified by the RBA and Lally,[636] the base component of the published 10 year yield already matches the benchmark term of debt. Therefore, extrapolating this component would result be erroneous and lead to overcompensation in most circumstances, where the yield curve is upward sloping.
Conversion to effective annual rate	Yes	The RBA's published methodology does not explicitly specify whether the published yields should be interpreted as effective annual rates. Effective annual rates are a consistent basis on which to compare bond rates and imply that the coupon payments compound during the year. We therefore consulted the RBA, who informed us that 'the spreads and yields in F3 can be best thought of as annual rates with semi-annual compounding'.[637] Therefore, this would require conversion into an effective annual rate, using the same approach as is applied to the BVAL yield estimate.

Source: AER analysis.

Table 3-13 Adjustments to the BVAL curve

Adjustment type	Amendment made?	Comments
Interpolation to construct daily estimates	No	Bloomberg publishes daily estimates.
Extrapolation to target term	Depends on maximum term published by Bloomberg	For most of the time that the BVAL curve has been published, it has had a maximum term of 7 years. However, between September 2014 and November 2014, it was published to a maximum 5 year term.[638] In April 2015, Bloomberg revised its methodology for the BVAL curve (BVCSAB10) and it now publishes a 10 year estimate.[639] For the periods where 7 years is the maximum term, we extrapolate the spread component of the 7 year yield estimate to the 10 year target term. We have done so

635 Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

636 See the 'notes' tab in RBA, *Aggregate measures of Australia corporate bond spreads and yields*, available at: http://www.rba.gov.au/statistics/tables/xls/f03hist.xls; Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

637 RBA, *Email in response to: AER follow up question on the basis of YTM quotations in RBA statistical table F3*, 16 October 2014.

638 Specifically, from 15 September 2014 to 3 November 2014.

639 Specifically, 14 April 2015.

Adjustment type	Amendment made?	Comments
		using the margin between the spread components of the extrapolated RBA 7 and 10 year yield estimates, converted to effective annual rates. We add to this extrapolation the difference between the base CGS estimates from 7 to 10 years. That is: BVAL yield 10 years = BVAL yield 7 years + difference in CGS from 7 to 10 years + difference in RBA extrapolated spread to CGS from 7 to 10 years As recommended by Lally,[640] we are satisfied this approach is comparably reliable to the more complex approaches submitted by other stakeholders,[641] but is simpler to implement and based on publicly available data. For the period where 5 years is the maximum term, we extrapolate the spread component of the 5 year yield estimate to the 10 year target term using an analogous methodology to that used to extrapolate from 7 to 10 years. For the period where 10 years is the maximum term, we do not extrapolate the estimate.
Conversion to effective annual rate	Yes	Bloomberg publishes its yield as annual rates with semi-annual compounding. This needs to be converted into an effective annual rate.

Choice of data series—Contingencies

Our draft decision is to largely maintain the set of contingencies as set out in our recent decisions.[642] We have made our draft decision based on the information and third party data that is currently available.[643] Nonetheless, in our experience it is common that the availability of third party data changes.

Our draft decision is to annually update the trailing average portfolio return on debt. Under the NER, the change in revenue resulting from the annual update must occur by automatic application of a formula that is specified in the decision.[644] This means our decision on how to apply these third party data sources must be fully specified upfront in the determination, and must be capable of application over the regulatory control period without the use of subsequent judgement or discretion.

For this reason, we have set out a series of contingencies in Table 3-14, below. These describe how we propose to estimate the annual return on debt in the event of

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640 Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

641 Incenta, *Methodology for extrapolating the debt risk premium*, June 2014, pp. 2–3.

642 For example, see AER, *Final decision—CitiPower determination, Attachment 3: Rate of return*, May 2016, pp. 359–61.

643 As of 14 April 2015, Bloomberg has revised its methodology for the BVAL curve (BVCSAB10). It has correspondingly recommenced publishing a 10 year yield estimate.

644 NER, cl. 6.5.2(l) and cl. 6A.6.2(l).

revisions in the RBA's or Bloomberg's methodologies or other changes to data availability.

Table 3-14 Contingency approaches to choice of data series

Event	Changes to approach
Either the RBA or Bloomberg ceases publication, temporarily or permanently, of Australian yield curves that reflect a broad BBB rating.	We will estimate the annual return on debt using the remaining curve.
A different third party commences publication of a 10 year yield estimate (or we are made aware of a different third party publishing a 10 year yield estimate)[645].	We will not apply estimates from a third party data provider that we have not evaluated and included in our final decision approach. We will consider any new data sources in future determinations.
Either Bloomberg or RBA substitutes its current methodology for a revised or updated methodology.	We will adopt the revised or updated methodology. Then, at the next regulatory determination, we will review this updated methodology. As noted above, we would also review any new data sources. However, if Bloomberg or the RBA backcasts or replaces data using a revised or updated methodology we will not use the backcasted data to re-estimate our estimates of the prevailing return on debt for previous years. This would be impractical and would create regulatory uncertainty over whether the allowed return on debt would at some point in the future be re-opened. Instead, we will continue to use the Bloomberg or RBA data that we downloaded at the time of estimating the prevailing return on debt for that point in time.[646]
Bloomberg reduces the maximum published BVAL term from 10 years	If Bloomberg still publishes the BVAL curve to 5 or more years, we will extrapolate the BVAL curve from the longest published term to 10 years using the corresponding yield margin from the RBA curve. [647] If Bloomberg no longer publishes the BVAL curve to 5 years, we will rely entirely on the RBA curve.

[645] Or we determine it is open to us to use the Reuters curve, following a proper assessment and period of consultation on this information.

[646] For example, for the current decisions we downloaded the RBA monthly data observation for August 2015 shortly after it was published (in September), and incorporated this data point into our prevailing return on debt estimates. After the RBA published its monthly observation for September (in October), we downloaded this data point too. This final data point is only relevant for estimation of AusNet's placeholder averaging period. In doing so, we noticed that it appears the RBA has revised its methodology (though does not appear to have explained this change), and has backcast its monthly observations for the entire data series which starts in January 2005. However, we have not incorporated this backcasted RBA data into our return on debt estimates. Instead, we have continued to use the data we downloaded at the time of estimation. We note that if we had incorporated the backdated RBA data this would have decreased the allowed return on debt for the Queensland, SA and Victorian electricity distributors by between approximately 1–2 basis points. Accordingly, in this instance, our approach of not using the backdated data is in this group of service providers' interests. Our approach will be symmetrical and consistent over time, so we will not use backcast data that results from a change in the RBA or Bloomberg's methodology regardless of whether it is in or against the interests of particular groups of service providers or particular groups of consumers.

[647] For example, where Bloomberg only publishes a 6 year curve, we will extrapolate it to 10 years using the 6 to 10 year yield margin from the RBA curve. Or, where Bloomberg only publishes a 7 year estimate, we will extrapolate it to 10 years using the 7 to 10 year yield margin from the RBA curve.

Event	Changes to approach
The RBA ceases publication of a 10 year yield estimate.	If the RBA ceases publication of a 10 year yield estimate, we will extrapolate the RBA estimate to 10 years using: • if available, the margin between spreads in the Bloomberg curve,[648] from the RBA's longest published target term to 10 years • otherwise, the actual CGS margin from the RBA's longest published estimate to 10 years, plus the average DRP spread for the same term margin over the last month prior to the end of its publication.
The RBA commences publication of daily estimates.	We will cease interpolating the RBA monthly yields. Instead, we will estimate both the RBA yield and the RBA year extrapolation margin (used with the BVAL curve) using these daily estimates.
Either Bloomberg or the RBA publishes a BBB+ or utilities specific yield curve.	We will adopt the BBB+ or utilities curve in place of the provider's existing curve, on the basis that it is a closer fit to a benchmark efficient entity for the service provider.

Source: AER analysis.

For this draft decision, we have re-worded the contingency for the scenario where either the RBA or Bloomberg ceases publication of Australian yield curves that reflect a broad BBB rating. Specifically, we have clarified that this contingency will apply whether the cessation of publication is temporary (i.e. not published for a period of days) or permanent. This does not change the meaning of the required change in response to this event, and remains consistent with the approach we adopted in decisions prior to Bloomberg publishing a 10 year BVAL estimate. However, we consider this explanation of the 'changes to approach' is clearer.

In general, we have decided on these contingencies based on a series of guiding principles. These are that the contingency must:

- Be practically implementable—the rules require the automatic application of a formula to update the trailing average portfolio return on debt. As a result, we will be unable to analyse changes to the approaches or new approaches during the regulatory control or access arrangement period. Therefore, it is important that any contingency be practical and easily implementable.
- Use the curve in a form as close as possible to its published form—for example, in April 2015 Bloomberg commenced publication of a 10 year BVAL curve. Accordingly, for averaging periods where the 10 year estimate is available, we will adopt this estimate rather than the 7 year BVAL curve extrapolated with RBA data.
- Where necessary, rely on the independent expert judgement of the RBA and Bloomberg—In particular, where the RBA or Bloomberg makes changes to its methodology, we would prefer to evaluate these changes before concluding we are satisfied the curve still meets the criteria set out in the Guideline.[649] However, this

648 Specifically, the spread to CGS.

649 AER, *Explanatory statement‑Rate of return guideline*, December 2013, pp. 23–24.

is not possible during the regulatory control or access arrangement period. In these circumstances, we therefore are faced with the two alternatives of ceasing to rely on the updated curve, or temporarily relying on the updated curve on the basis that we have assessed the data provider as credible. As we are satisfied that both the RBA and Bloomberg are credible and independent, but not that either curve is clearly superior, we consider it is preferable that we adopt the updated curve to limit stakeholders' exposure to the distinct characteristics of a single curve. This is consistent with our position of placing weight on both curves to minimise the mean squared error.

New issue premium

While we note the APTPPL did not propose a new issue premium, we note we do not agree with AusNet'scommentary in its transmission proposal that excluding a new issue premium makes its proposed return on debt 'conservative'.[650]

We continue to be satisfied our current approach, without providing an uplift for a new issue premium,[651] contributes to the achievement of the ARORO. In particular, we are satisfied it is commensurate with the efficient financing costs of a benchmark efficient entity.[652] The main reasons for our position are:

- Conceptually, we consider that a benchmark efficient entity would not face a new issue premium as part of its efficient financing costs.
- The evidence before us indicates that our return on debt allowance already appropriately compensates a benchmark efficient entity overall for its efficient financing costs.
- We consider that the empirical evidence on the new issue premium is inconclusive in general and that there is little consensus among experts on how to measure potential new issue premium.
- We are unaware of any academic literature on the new issue premium in the Australian market. On behalf of several service providers, CEG conducted an empirical analysis on the Australian market.[653] However, we have concerns with CEG's methodology, which we do not consider CEG has satisfactorily addressed.[654]

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650 AusNet Services, *Access arrangement information*, December 2016, p. 219.

651 AusNet characterises a new issue premium as ‘a cost "premium" to businesses issuing bonds into the primary debt market that is not accounted for in the data sources used by the AER to estimate the return on debt (being observations in the secondary debt market)' . See: AusNet Services, *Access arrangement information*, December 2016, p. 219.

652 NER, cll. 6.5.2(c) and 6.5.2(h); NGR, rr. 87(3) and 87(10).

653 CEG, *The New Issue Premium*, October 2014.

654 We raised some concerns in AER, *SA Power Networks Preliminary Decision - Attachment 3: Rate of Return*, April 2015, pp. 478–481. CEG responded to these concerns in CEG, *Critique of AER Analysis of New Issue Premium*, December 2015.

For a more detailed explanation of our reasons, see Appendix I of our final decision for United Energy.[655]

Averaging periods

Our draft decision is to accept APTPPL's proposed debt averaging periods for 2018 to 2022.[656]

We specify these averaging periods for the 2018 to 2022 regulatory years in confidential Appendix 0. This is because our practice is to keep the dates of averaging periods confidential until they have expired.

In the Guideline, we proposed that service providers could nominate averaging periods of 10 or more consecutive business days up to a maximum of 12 months.[657] We also proposed that an averaging period should satisfy certain conditions. We developed these conditions so that the application of the averaging period contributes to the achievement of the ARORO.[658]

In general, when assessing service providers' proposed averaging periods, we applied the conditions we proposed in the Guideline, except for one condition that we do not consider is necessary to achieve the ARORO. This condition was that averaging periods should be as close as practical to the commencement of each regulatory year. We remain of the view that the remaining Guideline conditions are important and necessary to promote the ARORO. Those conditions include that at the time the period is nominated all dates in the averaging period must take place in the future, and that all averaging periods should be specified prior to the commencement of the regulatory control or access arrangement period. These conditions, respectively, help to ensure that the return on debt resulting from the averaging period is unbiased and the annual debt update can be practically and automatically applied (as required by the rules).

Table 3-15 sets out why we consider an averaging period that meets the remaining conditions in the Guideline contributes to the achievement of the ARORO. It also summarises our assessment of APTPPL's proposed debt averaging periods against these conditions.

Table 3-15 Assessment of proposed averaging periods against Guideline

Condition	Reasons for condition	Condition met?
Observed over a period of 10 or more consecutive business days	Averaging daily estimates over a number of days smooths out short term volatility in the annually updated return on debt	Yes

655 AER, *Final decision: United Energy distribution determination - Attachment 3: Rate of return*, May 2016.

656 APTPPL, *Roma to Brisbane pipeline access arrangement submission. confidential attachment 7-1 – cost of debt averaging periods*, September; APTPPL, *Letter from Peter Bolding General Manager Strategy and Regulatory to Warwick Anderson General Manager AER - Roma to Brisbane Pipeline proposed revised Access Arrangement - rate of return averaging periods*, 10 February 2017;

657 AER, *Rate of return guideline*, December 2013, p. 21.

658 NER, cll. 6.5.2(c) and 6A.6.2(c); NGR, r. 87(3).

Condition	Reasons for condition	Condition met?
up to a maximum of 12 months	allowance.	
It should be specified prior to the commencement of the regulatory control period.	This allows us to substantively assess the service provider's proposal. This avoids the practical difficulties with either (1) creating a new process for approving averaging period proposals or (2) assessing averaging period proposals during the annual pricing process, which is meant to be a compliance check that takes place over a short time frame.	Yes
At the time it is nominated, all dates in the averaging period must take place in the future.	If a reference service provider can select an averaging period by looking at historical yields, it may introduce an upward bias.[659]	Yes
An averaging period needs to be specified for each regulatory year within a regulatory control period.	This allows for the annual debt update. The annual debt update reduces the potential for a mismatch between the allowed and actual return on debt for the benchmark efficient entity.	Yes
The proposed averaging periods for different regulatory years are not required to be identical but should not overlap.	This avoids double counting averaging periods. This would detract from our specification of the trailing average, which weights periods equally. Not requiring periods to be identical helps preserve confidentiality and provide service providers with a degree of flexibility.	Yes
The nominal return on debt is to be updated annually using the agreed averaging period for the relevant regulatory year.	This prevents a service provider from introducing bias by only updating annually using the agreed averaging period when it is advantageous for it to do so.	Yes
Each agreed averaging period is to be confidential.	This facilitates service providers organising their financing arrangements without market participants being aware of the averaging periods. Accordingly, in practice we keep averaging periods confidential until they expire.	Yes

Source: AER, *Rate of return guideline*, December 2013, pp. 21-22;.

Annual debt update process

The general process we propose to adopt for the annual debt update for APTPPL is set out in table 3-16.

Table 3-16 Annual debt update process

Step	Timing	Description of step	Reasons for timing
1	25 business days before a service provider submits its reference tariff variation proposal to us.	Averaging period ends on or before this date.	We determine the maximum practical end date of the averaging period from the timing of steps 2 and 3.

[659] Lally, *Expert Report of Martin Thomas Lally*, 13 February 2011, pp. 9–10.

2	10 business days before a service provider submits its reference tariff variation proposal to us.	So the distributor can factor this into its annual pricing proposal, we inform it of updates on the return on debt, annual building block revenue requirement and X factor that incorporates the updated return on debt.	15 business days between steps 1 and 2 provides sufficient time for us to calculate (and provide quality assurance checks on the updated return on debt, revenue and X factor.
	A service provider submits its reference tariff variation proposal to us on the date determined by the rules.	The service provider submits its reference tariff variation proposal to us for the relevant year.	10 business days between steps 2 and 3 is based on a service provider's advice regarding the minimum period it would require to factor the updated information into its prices. We are open to individual service providers requiring a longer period (or requesting a shorter period) to accommodate their internal processes.

Source: AER analysis.

We are open to individual service providers requiring a longer period (or requesting a shorter period) between steps 2 and 3 to accommodate their internal processes. We note that a longer (or shorter) time period would move back (or forward) the maximum practical end date of the averaging period by the same timeframe. For example, if a service provider requested 15 business days (instead of 10) for its internal processes, then its averaging period would need to end 30 business days (instead of 25) before the date the service provider must submit its reference tariff variation proposal to us.

The process outlined in table 3-16 does not apply to the first regulatory year in the regulatory control period. This is because the access arrangement decision will include the X factor for the first year, which will already incorporate the first year return on debt. Therefore, this process will generally apply to the subsequent years of an access arrangement period.

In section 3.4.2, we propose calculating the return on debt, annual building block revenue requirement, and X factor in accordance with the formula in the access arrangement decision. And we propose informing the service provider of our calculations before it submits its reference tariff variation proposal. We consider this preferable to the alternative approach, where we would assess updates the service provider calculated itself and submitted with its reference tariff variation proposal. This alternative approach could significantly complicate the tariff variation approval process if we identify calculation errors and require the service provider to revise all its proposed prices. On the other hand, our approach focusses the tariff variation process on how the service provider has incorporated the revised X factor into its prices, rather than also assessing the revised X factor itself.

3.4.3 Gearing ratio

Our decision is to adopt a 60 per cent gearing ratio. This is consistent with the Guideline and APTPPL's regulatory proposal.[660]

Overall, we are satisfied that a 60 per cent gearing ratio is commensurate with the efficient financing costs of a benchmark efficient entity. This is because a 60 per cent gearing ratio is supported by the industry average of a sample of firms that are comparable to the benchmark efficient entity.

Gearing is defined as the ratio of the value of debt to total capital (that is, debt and equity). There are benefits in using debt to fund investment. Debt is usually cheaper than equity and the use of debt also has tax advantages because borrowing costs are tax deductible. However, increased use of debt also increases the possibility that a business will experience financial distress, and in the worst case, bankruptcy. In theory, the optimal debt to equity ratio is the point at which business value is maximised, where the marginal benefits just offset the marginal cost of debt. While an optimal capital structure theoretically exists, the actual optimal value of debt and equity for any given business is dynamic and dependent on a number of business specific factors. Because of this uncertainty around the theoretically optimal gearing ratio, we primarily rely on the average of a sample of firms that are comparable to the benchmark efficient entity. In other words, we assume that the industry is, on average, efficient ant therefore use the industry average to guide our regulatory benchmark.

We consider that the empirical evidence supports a gearing of 60 per cent. Average gearing levels from the 2009 WACC review are presented in Table 3-17, as are the Bloomberg market valuations using more recent data and Standard and Poor's book valuations. We observe that the average level of gearing across the four different approaches has a range of 59 to 66 per cent. Accordingly, we propose to maintain the currently adopted benchmark efficient level of gearing of 60 per cent.

Table 3-17 Averaging gearing ratio—Comparator set of firms

Year	2009 WACC review 2002–2007[a]	Bloomberg (market value) 2002–2012 (full sample)[b]	Bloomberg (market value) 2002–2012 (refined sample)[c]	Standard and Poor's (book value) 2008–2012[d]
2002	65.1	54.5	65.8	N/A
2003	64.8	51.8	60.5	N/A
2004	61.7	51.2	55.1	N/A
2005	64.6	51.2	62.6	N/A

660 AER, *Rate of return guideline*, December 2013, p. 9. APTPPL, *Access arrangement submission 2017-22*, September 2016, p. 132.

2006	63.0	56.6	61.9	N/A
2007	60.5	57.6	57.6	N/A
2008	N/A	68.3	68.3	70
2009	N/A	68.8	68.8	69
2010	N/A	65.5	65.5	66
2011	N/A	63.2	63.2	62
2012	N/A	60.6	60.6	65
Average	63.3	59.0	63.1	66

Source: AER analysis.

Notes: (a) AER, *Final decision: Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters*, 1 May 2009, p. 124.

(b) Analysis including full sample of businesses.

(c) AGL, Alinta and GasNet excluded from the analysis.

(d) ERA, *Explanatory statement for the draft rate of return guidelines*, 6 August 2013, p. 49.

The benchmark gearing ratio is used:

- to weight the expected required return on debt and equity to derive a WACC
- to re-lever the asset betas for the purposes of comparing the levels of systematic risk across business, and
- as a factor in estimating the benchmark credit rating.[661]

3.4.4 Expected inflation rate

Our estimate of expected inflation is 2.45 per cent. It is an estimate of the average annual rate of inflation expected over a ten year period. We estimate expected inflation over this 10-year term to align with the term of the rate of return.

Our estimate of expected inflation is estimated as the geometric average of 10 annual expected inflation rates. We use the RBA's forecasts of inflation for the first two years of APTPPL's 2017–22 regulatory period as the first two annual rates. [662] We then use the mid-point of the RBA's inflation target band as the remaining eight annual rates.

Similarly, APTPPL proposed estimating expected inflation using an approach of combining short-term RBA forecasts with the mid-point of the RBA's target band. We accepted this aspect of APTPPL's proposal.

[661] That is if a service provider had a gearing ratio that was significantly different to the benchmark gearing ratio, then we would consider any implications of this for including that service provider within the sample used to estimate the industry median credit rating.

[662] For this draft decision, only the first annual rate is based on an RBA inflation forecast. By the time we make our final decision, an RBA forecast for the second annual rate will be available and will be used.

However, APTPPL's proposed revenue model included two separate and inconsistent estimates of expected inflation. One estimate appeared to be derived using the same RBA forecasts and target band approach as we have used in this decision. The second estimate involved separate inflation rates for each year of the regulatory period, with the rate being the RBA forecast for that year or, if no forecast is available, the mid-point of the RBA's target band. We do not accept this aspect of APTPPL's proposal for separate inflation rates for each regulatory year. We calculate a single value reflecting the average annual inflation rate expected over a ten year investment horizon.

Other service providers in concurrent and recently concluded regulatory processes proposed estimating expected inflation using the bond break-even approach. Under this approach, the inflation rate is implied by the difference between the yields-to-maturity on 10-year nominal Commonwealth Government Securities (CGS, also referred to as Australian Government Securities or AGS) and 10-year indexed (inflation-linked) CGS. The bond break-even approach results in an inflation estimate of 1.93 per cent.[663]

We consider that, based on the information before us in this determination process, that the RBA forecasts and target band approach is likely to result in the best estimate of expected inflation possible in the circumstances. We consider that the evidence currently available to us supports the view that long-term inflation expectations are relatively stable over time, relatively invariant to short-term inflation shocks, and anchored to the RBA's target band. This evidence supports the use of the RBA forecast and target band approach. We consider that estimates of expected inflation from the bond break-even approach are likely to be subject to various biases and risk premia that may distort break-even inflation estimates away from the true value of expected inflation. Our reasons for this decision are set out more fully in the below section titled 'Consideration of different methods for estimating expected inflation'.

Our estimated rate of (expected) inflation is 2.45 per cent. The methods for calculating the impact of this inflation rate on regulated revenues and asset values are contained in our post-tax revenue model and our asset base roll-forward model. We consider that, based on the information before us in this determination process, for calculating the impact of our inflation rate on regulated revenues and asset values, the use of these methods will best achieve the National Gas Objective.

APTPPL proposed alternate methods for calculating the impact of the inflation rate on regulated revenues and asset values. APTPPL also proposed that the estimate of expected inflation be updated annually. APTPPL's proposed revenue model included the following variations from our published post-tax revenue model:

- A second inflation series is added (in row 431 of the PTRM inputs page) in addition to the original expected inflation parameter that is also retained.

663 Calculated over a 20-day averaging period, using our return on equity risk free rate averaging period.

- The new inflation series is an annually-varying series, with separate rates identified for each year. This contrasts with the original expected inflation parameter which was a single annual figure applied across the whole access arrangement period.
- APTPPL proposes that the new inflation series is initially forecast and then updated with new forecasts annually.
- APTPPL proposes that the new inflation series is initially forecast, but then annually updated to reflect actual inflation outcomes as they become known.

We do not accept APTPPL's modifications to our post-tax revenue model for the following reasons:

- APTPPL's proposed revenue model includes two separate and inconsistent estimates of expected inflation. We do not consider that this approach reflects the best forecast or estimate available in the circumstances.
- The end result of APTPPL's proposed amendments to our post-tax revenue model appears to be that the real value of the aggregate revenue determined in our access arrangement determination and annual tariff variations is not set but will vary as actual inflation outcomes vary. This may materially alter the risk profile of APTPPL and allocation of risk between APTPPL and consumers, with consequences for determining a rate of return that is commensurate with these risks.

We also consider that alternative methods for modelling the impact of inflation on regulated revenues and asset values raise a number of matters that require robust testing. These matters may include the interaction between the proposed revenue model with the asset base roll-forward model and annual tariff variation mechanisms. They may also include considerations of risk-sharing between service providers and end users and interrelationships with the allowed rate of return. We do not consider that the implications of alternative methods have been sufficiently discussed in APTPPL's regulatory proposal. We consider the research, analysis and reasoning submitted to us should be subject to review through a comprehensive process. This will allow for the effective engagement with all stakeholders.

Our reasons are further detailed in section M.6.

It is important to note that we are currently conducting a broader industry-wide review of our method for estimating expected inflation and the treatment of inflation in our revenue models. That review is yet to be finalised and so findings from the review cannot therefore be included in this decision.

The discussion set out here is necessarily based on the information available to us at the time of making this determination. In the context of that wider industry review, we expect we will have additional submissions and more complete analyses available to us. Our conclusions set out here therefore do not indicate the result of the review we are currently undertaking.

That said, for the purposes of this determination, on the basis of the information currently available to us, we consider the RBA forecasts and target band approach:

- reflects our best estimate of expected inflation possible in the circumstances,
- is a recognised method that arrives at estimates of expected inflation on a reasonable basis,
- is consistent with the objective of a rate of return commensurate with the efficient financing costs of a benchmark efficient service provider,[664]
- contributes to the achievement of the National Gas Objective.

Review of inflation and the post-tax revenue model

We have applied the RBA forecasts and target band approach in all of our regulatory determinations since 2008. This approach is also the method that is contained in the current version of the post-tax revenue model.

Since around mid-2015, some service providers have proposed departing from the RBA forecasts and target band approach contained in the post-tax revenue model and adopting the bond break-even approach.[665] This has not been universally proposed. A number of other stakeholders have submitted that we should retain the RBA forecasts and target band approach.[666]

On 15 December 2016 we indicated our intention to review of our method for estimating expected inflation and the treatment of inflation in our revenue models. On 18 April 2017 we released a discussion paper to initiate our review.

We are required by the National Electricity Rules to apply the method for estimating expected inflation that is set out in our published post-tax revenue model in our electricity determinations. [667] We are also required to follow the transmission and distribution consultation procedures when reviewing and/or amending the post-tax revenue model.

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664 With a similar degree of risk as that which applies to the service provider in the provision of regulated energy network services.

665 Including ActewAGL, *Appendix 5.01: Detailed response to rate of return, gamma and inflation*, January 2016, p. 135; AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 178-194; AusNet Services, *Revised regulatory proposal*, January 2016, pp. 7-96–7-102; AGN, *Attachment 9.3 Response to draft decision: Inflation*, January 2016, p. 6.; JEN, *Revocation and substitution submission, Attachment 6-1 Rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, p. 111; SA Power Networks, *Revised Regulatory Proposal 2015-20*, 3 July 2015, pp. 393-399; United Energy, *Regulatory Proposal*, April 2015, p. 105; United Energy, *Response to AER preliminary decision re: rate of return and gamma*, 6 January 2016, p. 103.
CitiPower and Powercor proposed the RBA forecasts and target band approach, but also submitted that the break-even approach would be 'superior' and would result in the 'best estimate' (CitiPower, *Revised regulatory proposal*, January 2016, pp. 376–383; Powercor, *Revised regulatory proposal*, January 2016, p. 377).

666 TasNetworks, *Tasmanian Distribution Regulatory Proposal Regulatory Control Period 1 July 2017 to 30 June 2019*, 29 January 2016, p. 117; Powerlink Queensland, *2018–2022 Powerlink Queensland revenue proposal*, 31 January 2016, p. 95.

667 See: Application by SA Power Networks [2016] ACompT 11, para 614.

Under the National Gas Rules, we are not required to apply (but are also not prohibited from applying) the post-tax revenue model or the method for estimating expected inflation set out in the post-tax revenue model. However, we recognise that inflation is a parameter that applies ubiquitously across the entire economy. Having regard to the Revenue and Pricing Principles, we consider there are benefits in a consistent approach to forecasting an estimate of an industry wide measure as it potentially affects investment decisions across the energy sector. This may be one factor to take into account in determining the best estimate in all the circumstances.

It is in this context that we have also initiated an industry-wide review of our method for estimating expected inflation and the treatment of inflation in our revenue models.

The CCP supported initiating a review on estimating inflation, stating:[668]

> There has been little stakeholder consultation about changing from a methodology that has been in place for eight years, and changing methodologies at the request of a network when it is so significantly advantaged by the change that it looks like cherry-picking. In the interests of good administrative practice, our view is that more stakeholder consultation and a far wider analysis by the AER is required before any change in methodology.

AusNet Services electricity transmission, AusNet Services gas distribution, AGN, and MultiNet all supported our industry-wide review of inflation.[669] CCP sub-panel 11, Uniting Communities, and Red Energy and Lumo also supported an industry-wide review of inflation.[670]

Consideration of different methods for estimating expected inflation

Consistent with our industry-wide review of inflation and the universal application of our inflation estimate, we have taken a broad view to our assessment of approaches to estimating expected inflation. That is, our assessment is not restricted to the two methods currently proposed by stakeholders (the RBA forecasts and target band approach and the bond break-even approach). This ensures that we arrive at the best estimate of expected inflation. Consequently, we have also considered approaches

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668 CCP, *Response to AusNet Services Revised Revenue Proposal for 2017-2022*, October 2016, p.17.

669 AusNet Services electricity transmission, Submission on AusNet Services' Transmission Revised Revenue Proposal, 20 December 2016, p. 2; AusNet Services gas distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, p. 233; Australian Gas Networks, *Final Plan: Access Arrangement Information for our Victoria and Albury natural gas distribution networks 2018:2022*, December 2016, p. 112; Multinet Gas, *2018-22 Access Arrangement Information: rate of return overview*, December 2016, p. 46.

670 CCP sub-panel 11, Response to proposals from AGN, AusNet and Multinet for a revenue reset / access arrangement for the period 2018 to 2022, 3 March 2017, pp. 71-72; Uniting Communities, No Shocks AA Proposal, 19 April 2017, pp. 8-9; Red Energy and Lumo, Re: Australian Gas Networks Access Arrangement, 6 March 2017, p. 3.

based on zero-coupon inflation swaps and survey measures which are both well-recognised methods for estimating expected inflation.[671]

As expectations are unobservable, direct comparison of the relative accuracy of these four approaches is not possible. Comparison of estimates from the different approaches against inflation outcomes may provide some insight—though expectations and outcomes may not be equivalent, an approach that can accurately predict outcomes may inform future expectations.

Because direct comparison of accuracy is limited, we are left to examine academic studies of proxy measures and undertake qualitative consideration of the reliability, replicability, sensitivity, and susceptibility to bias of different estimation methods. ACCC Working Paper #11, published on 18 April 2017, comprehensively surveyed the available evidence on estimating inflation expectations and considered these issues. ACCC Working Paper #11 considered the relative merits of estimating expected inflation via the RBA forecasts and target band approach, the bond break-even approach, zero-coupon inflation swaps, and surveys.

We consider the benefits and detriments of the different approaches in the information we have had access to in this determination process, and have ranked each approach as follows, noting that this is solely based on the information before us in this determination process. It will be subject to further and more comprehensive review with full stakeholder input in the upcoming PTRM review process.

1. RBA forecasts and target band

   We consider this approach the simplest to apply, most transparent and easily replicable. Estimates from this approach tend towards the mid-point of the RBA's inflation target band, and the available evidence suggests that long-term inflation expectations are anchored to the RBA target band, relatively stable over time, and do not respond to surprises in short-term inflation outcomes. While the RBA's inflation targeting is perceived to be effective, and inflation expectations are anchored to the target band, this estimation method is likely to be unbiased.[672]

   CEG submitted that the RBA forecasts and target band approach is unrealistically stable, may implausibly result in a negative real risk free rate, and will be biased upwards when inflation expectations are not anchored to the RBA target band (as CEG submits is currently the case). We consider that expectations most likely remain anchored to the RBA target band, resulting in relatively stable inflation expectations. We disagree that negative real risk free rates are implausible or that they cast doubt on the reliability of our approach. Our response to these issues is detailed further in appendix M.

2. Inflation swaps

[671] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, p. 5.

[672] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, paragraphs 200-204.

We consider inflation swaps may be a suitable method that is based on transactional market data (rather than survey data, such as the RBA inflation target method). However, there are a number of potential biases and risk premia that may be embedded into the swap-implied inflation rate that need to be considered when using this method. There are studies of US and UK inflation swaps which find that potentially the largest biases may be small or insignificant. There is some uncertainty whether biases and risk premia such as hedging costs in Australian inflation swaps are insignificant. There are no known decomposition studies of Australian inflation swap prices which may resolve this uncertainty.[673] In the absence of addressing these issues, it may not be better than the RBA target band approach. More detail on the issues with estimating inflation-swap implied inflation rates is in the below section titled 'Consideration of inflation estimates implied from zero-coupon inflation swaps'.

3. Bond break-even

   We consider bond break-even estimates contain a number of potential biases and risk premia that must be considered before using this method. There appear to be a greater number of potential biases and risk premia in bond break-even estimates than swap-implied estimates, and bond breakeven estimates are generally more volatile than swap-implied estimates. There is a lack of consensus on how to adjust for these risk premia.[674] Without addressing these issues, it may not be better than the RBA target band approach. More detail on the issues with estimating bond break-even inflation rates is in the below section titled 'Consideration of bond break-even inflation estimates'.

4. Surveys

   Publicly available survey data is limited to 2-year forecasts. Further, long-term inflation expectations appear anchored to the RBA's target band, therefore as long as this anchoring remains, a simpler and transparent approach would be to simply use the RBA target band.[675]

   We also note that consideration of survey estimates at longer horizons may be possible in the future and may rank above other methods since there is strong evidence that surveys closely reflect inflation expectations.

Many studies of breakeven estimates use inflation swap rates or survey estimates as a benchmark to estimate the size of the liquidity premia in breakeven estimates.[676] This

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673 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, paragraphs 214-221.

674 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, paragraphs 213.

675 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, paragraphs 222-223.

676 Carolin Pflueger and Luis Viceira (2015), 'Return Predictability in the Treasury Market: Real Rates, Inflation, and Liquidity', Working Paper, p. 12 and p. 16, Table IIA; Matthias Fleckenstein, Francis Longstaff and Hanno Lustig (2014), 'The TIPS-Treasury Bonds Puzzle', The Journal of Finance, 69(5), October, pp. 2151-2197; Zhuoshi Liu, Elisabeth Vangelista, Iryna Kaminski and Jon Relleen (2015), 'The informational content of market-based

suggests that researchers hold an a-priori view that survey estimates and/or swap rates are a better estimate of market expected inflation than bond break-even estimates.[677]

We also consider that the modelling and estimation required to adjust breakeven and swap-implied estimates for potential biases and risk premia may be complex, contentious, and difficult to scrutinise.[678] In that case, these methods may be subject to higher potential for bias (than the RBA inflation target method) in proposed model specifications. In any case, it emphasises the importance of fuller industry wide consultation before changing an approach to what is an industry wide measure.

Consideration of bond break-even inflation estimates

The bond break-even inflation rate is calculated from the Fisher equation. The Fisher equation provides that:

$$(1 + interest\ rate_{nominal}) = (1 + interest\ rate_{real})(1 + expected\ inflation) - 1$$

Therefore:

$$expected\ inflation = \frac{1+interest\ rate_{nominal}}{1+interest\ rate_{real}} - 1$$

The yield to maturity (as a proxy for the interest rate) on the risk free asset (nominal and indexed CGS) is typically used to calculate breakeven inflation rates via the Fisher equation.

The Fisher equation may not hold true (or may need to be adjusted) if there are risk premia, biases, or other distortions affecting the difference between nominal and real interest rates. The ACCC working paper #11 identified a number of potential biases, risk premia, and other issues that may affect bond breakeven inflation rates. These issues are outlined in

measures of inflation expectations derived from government bonds and inflation swaps in the United Kingdom', Staff Working Paper No. 551, Bank of England, pp. 1-36; Stefania D'Amico, Don Kim and Min Wei (2016), 'Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices', Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, pp. 28-29 and p. 59.

677 This point is also noted by CEG, see: CEG, *Best Estimate of Expected Inflation*, September 2016, p. 45.

678 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper #11, April 2017, paragraph 213, 219-220.

Table 3-18.

Table 3-18 Issues with bond breakeven estimates

Issue	Explanation
Fitting a yield curve	The approximate matching of 10 year maturities of nominal and indexed CGS is necessary for the calculation of the 10 year break-even inflation rate. However, a match of such maturities is unlikely to occur given the relatively few tenors of outstanding indexed CGS. Therefore, calculations of break-even estimates may require yield curve models to interpolate estimates of yields obtained from indexed and nominal CGS with different tenors. The consequence of using yield curve models is that the break-even estimates are unlikely to reflect mark-to-market expectations of inflation, and the estimates are likely to vary depending on the yield curve models chosen. Deacon and Derry (1994) and Deacon et al. (2004) find that break-even estimates may vary considerably depending on the yield curve models employed.
Liquidity premia	Indexed CGS are likely to be substantially less liquid than nominal CGS. This implies that liquidity premia included in the yields on indexed CGS may be greater than the liquidity premia included in the yields on nominal CGS. The difference between liquidity premia, or the differential liquidity premia, is likely to drive a wedge between the bond break-even inflation estimates and inflation expectations. The differential liquidity premia are likely to be greater during periods of uncertainty when investors' appreciation of liquidity risk may have changed. In such a situation, the yield spread between nominal bonds and inflation indexed bonds is likely to narrow – a narrowing that is caused by greater uncertainty, growing differential liquidity premia, and not necessarily a fall in inflation expectations.
Inflation risk premia	The inflation risk premia arise because holders of nominal bonds are exposed to inflation risk, where there is a probability that the actual inflation rate will not match the expected inflation rate. As a result, nominal bondholders may demand compensation for bearing this risk. Inflation risk premia may be positive or negative, depending on whether there are concerns about inflation or deflation.
Convexity Bias	Bond prices are a convex function of their respective yields. Therefore, if yields are volatile, giving effect to gains being larger than the losses, bond prices may rise. The rise in the bond prices push down their forward yields, below their expected future yields. The difference between forward yields and expected future yields on a bond is the 'convexity effect'. The size of the convexity effect is likely to be different for nominal and indexed bonds. The difference in the magnitude of the convexity effect for nominal and indexed bonds may result in the bond break-even inflation estimates departing from market expectations of inflation by the amount of a 'convexity bias' (other things unchanged). Convexity bias is sensitive to the relative volatility of forward yields on nominal and indexed bonds. Therefore, the scale of convexity bias estimates may change if relative forward yield volatilities change over time.
Inflation indexation lag	A perfectly indexed CGS would pay a real coupon amount that is adjusted by the increase in the CPI between the issue date and the time of payment. However, there are unavoidable lags between the actual movements in the CPI and adjustments of indexed bond cash flows. Indexation lag may result in the forward yields on indexed CGS being calculated on the basis of both historical inflation rates and expected future short term inflation rates. The effect of indexation lag on indexed CGS yields may be significant during periods of significantly above and below-trend inflation.
Inflation risk premia (indexation lag premia)	As a result of indexation lag, the real return on indexed bonds may be exposed to some inflation risk. There is research which finds that inflation risk premia may be embedded in indexed bond yields to compensate investors for such risk. This is known as indexation lag risk premia. Risa (2001) finds that the yields on UK 10 year indexed bonds included an indexation lag risk premium of approximately 3.3 basis points. However, Risa considers that this premium is not economically relevant in size. D'Amico et al. (2016) find an indexation lag premium on the yields on 10 year TIPS varies between –5 and 3 basis points.
Inflation risk premia (post-tax variability of indexed bond cash flows)	Tax regimes in existence tend to cause post-tax real returns to remain uncertain even if pre-tax real yields are known. Since tax is levied on the nominal yield, not the real yield, the tax system reintroduces inflation risk for indexed bonds. Post-tax real yields may become uncertain and variable if inflation is uncertain. If the demand for bonds is a function of their expected post-tax returns, pre-tax indexed bond yields may include inflation risk premia to compensate investors for the potential uncertainty of post-tax real returns. The existence of inflation risk premia in indexed bond yields may result in bond break-even inflation estimates departing from market expectations of inflation.
Mismatched pattern of cash flows	Christensen et al. (2004) argue that even if nominal and indexed bonds have the same maturity, differences in the pattern of coupon payments (resulting in differences of duration and convexity of each bond) may expose each bond to different discount factors. In real terms, the coupon payments on

Issue	Explanation
	indexed bonds are fixed, while the coupon payments on nominal bonds decline in real terms over their maturity. Since cash flows that arrive later in time are discounted more heavily, the price of the indexed bond will be lower and therefore the BBIR may produce downwardly biased estimates of expected inflation. Christensen et al. note that the size of this bias will not be constant through time since it is a function of the coupon and maturity of nominal and indexed bonds and the term structure of interest rates. They find that observed volatility of bond break-even estimates may be due to mismatched cash flows and not to changes in inflation expectations.
Sensitivity of coupons to short term inflation	When bond break-even estimates are calculated from the yields on coupon-paying bonds, the estimates may become more sensitive to changes in short term inflation expectations compared to an approach that is calculated from yields on zero coupon bonds. As a result, if the term structure of inflation expectations is not flat, relatively volatile short term inflation expectations may change the bond break-even estimates, even if the long term market expectations of inflation are unchanged.
Changes to the demand and supply of expectations	There may be changes to the demand for and supply of nominal and indexed CGS that are unrelated to changes in inflation expectations. As a result, relative yields and bond break-even inflation estimates may change even if the term structure of inflation expectations is unchanged. For example, changes to the relative supply of nominal and indexed CGS, changes to investor risk aversion, slow moving capital and capital availability may result in a movement of the relative yields that may be unrelated to changes in inflation expectations.
The effect of the deflation floor on the yields of indexed CGS	Indexed CGS have a 'deflation floor' – coupon interest payments will not be based on a capital value less than the face value and payment of the principal cannot fall below the face value. If deflation becomes a concern, the deflation protection of indexed CGS becomes valuable, pushing up indexed CGS prices and reducing indexed CGS yields. During such episodes, the effect of the deflation floor on indexed CGS may influence bond break-even estimates. For the US, D'Amico et al. (2016) identify the effect of the deflation floor as a potential driver of bond break-even estimates. They find that the deflation floor affects the yields on 10 year TIPS by about 5 basis points during normal times but widening to -20 basis points during the recent crisis.
Personal price indices and the substitution effect	In their estimates of the bond break-even inflation rate for the US, Christensen and Gillan (2012) find that the inflation risk premium in the estimates remained negative even after maximally correcting for the liquidity premium. Christensen and Gillan argue that this may be due to TIPS yields being higher than they otherwise would be for two reasons. Firstly, the CPI may overstate true inflation outcomes because the substitution effects have not been considered. Secondly, the personal price index of investors may be different to the CPI and therefore TIPS are only a partial hedge for inflation risk. Consequently, investors may demand a risk premium for the remaining exposure to an imperfect inflation hedge. The influence of the substitution effect and personal price indices on indexed bond yields may result in bond break-even inflation estimates departing from market expectations of inflation.

Source: ACCC Working Paper # 11, pp. 68-69.

CEG submitted that:

- Bond break-even estimates provide a more direct market measure of expected inflation than the RBA forecasts and target band approach,
- Academic literature suggests that biases and risk premia in bond break-even estimates are likely to be immaterial, and
- Inflation outcomes suggest that the bond break-even approach is more accurate predictor of outcomes, and therefore a greater influence on expected inflation, than the RBA forecasts and target band approach.

Our response to these issues is contained in appendices M.2, M.3, M.4, and M.5.

Overall, we consider that the scale and sign of potential biases and risk premia are unlikely to be robust to different study parameters, resulting in uncertainty over their net effect. The modelling and estimation required to adjust breakeven estimates for these potential biases and risk premia is likely to be complex, contentious, and difficult to scrutinise. Even if relevant data is available to estimate the historical impact of biases and risk premia on breakeven inflation rates, the time-varying nature of many of these make it difficult to ascertain if the historical magnitude of the biases and risk premia is prevalent in current bond prices.

The differences in the approaches to estimating premia and biases in breakeven estimates across studies may be due to limited data availability, but also be because the premia and biases are not yet well understood. For example, D'Amico et al. (2016) conclude that a better understanding of the determinants of liquidity premia and the sources of its variation is a topic for future research.[679] Zarazaga (2010) states:

> *Current understanding of the determinants of government bond prices is too limited to establish with any confidence which fraction of the relatively large variations in inflation expectations indicators based on forward rates [implied from bond prices] can be attributed to actual changes in long-run inflation expectations and which to time-varying risk premia.*

Consideration of inflation estimates implied from zero-coupon inflation swaps

In an inflation rate swap, counterparties agree to exchange payments that are linked to a predetermined fixed inflation rate and actual inflation outcomes. Counterparty A pays Counterparty B the pre-determined fixed rate (multiplied by an agreed base amount) at the maturity of the swap agreement. Counterparty B pays Counterparty A the actual CPI inflation rate (multiplied by the base amount) that occurred over the term of the swap agreement.[680]

There are a number of inflation-linked swaps that may be traded in Australia. However, only data on zero coupon inflation swaps is currently available for the calculation of swap-implied expected inflation rates. In Australia, the published zero coupon inflation swap rates are available for many more tenors than tenors for indexed CGS (used in the calculation of breakeven estimates). The published zero coupon inflation swap prices are available for 3 months, 6 months, 9 months and each year up to 10 years, and every 5 years from 10 years to 30 years. While there are many tenors for currently traded nominal CGS, there are only 7 outstanding tenors for indexed CGS up to approximately 24 years. On this basis, inflation swaps may provide a better decomposition of market-implied forward inflation rates than the breakeven method.

However, the ACCC working paper #11 also identified a number of potential biases and premia that may affect swap-implied inflation rates. These potential biases and premia are outlined in Table 3-19.

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679 Stefania D'Amico, Don Kim and Min Wei (2016), 'Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices', Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, p. 37.

680 In practice, only one cash payment is actually made, being the difference between the pre-determined fixed rate and the actual CPI.

Table 3-19 Issues with swap-implied inflation rates

Bias	Explanation
Hedging costs	Likely to result in potential overestimates of expected inflation. If there is greater demand for the fixed leg (those wishing to pay the fixed and receive the floating) than the floating leg (those wishing to pay the floating and received the fixed), dealers may hedge their short exposure in the swap market by taking offsetting exposures in other markets, such as bond markets. In taking these positions dealers are likely to incur hedging costs. Hedging costs include all costs associated with opening, maintaining and closing positions in the market. The zero coupon inflation swap rate may be affected by the hedging costs incurred by swap dealers. Swap dealers may pass on these hedging costs in the form of higher inflation swap rate quotes. In this case, hedging costs may drive a wedge between the inflation swap rate and the market-expected inflation rate. The ACCC working paper #11 submits that academic literature suggests that hedging costs may be minor, but there are not many studies to support drawing robust conclusions. As the demand for the fixed and floating leg will change under different market conditions this bias is likely to be time varying.
Inflation risk premium	Likely to result in potential overestimates of expected inflation. There may be a number of arbitrage and transaction costs associated with hedging the short exposure in the inflation swap market. Hedging may also be imperfect because there may be mismatches in the timing, size and maturity of the cash flows. Hedgers seldom create a perfect hedge because the marginal cost of hedging rises sharply as the risk minimising hedge ratio is approached. The hedger will select a hedge that is less, perhaps substantially less, than the risk-minimising hedge ratio.[681] As a result, swap dealers short in inflation swaps may still require an inflation risk premium to compensate them for inflation uncertainty that persists due to imperfect hedges, and this premium may be included in the published inflation swap rate. This potential bias is likely to be time-varying when inflation expectations are more uncertain.
Inflation indexation lag	Likely to result in potential underestimates or overestimates - potentially small for 10 year zero coupon inflation swaps. Inflation rate swaps are also subject to indexation lag, which may influence the inflation swap rate such that the raw inflation swap rate may depart from the expected inflation rate. The floating leg of the zero coupon swaps is explicitly linked to the reference CPI date.[682] The lag on the Australian zero coupon inflation swap is moderate. Bloomberg and Zine-eddine (2014) identify the lag as 3 months.[683] Because the swap inflation rates are not adjusted for indexation lag, the swap contract is referenced to inflation for a period that starts before the date on which the contract is priced and ends before the contract matures. Therefore, the estimated forward inflation curve from inflation swaps will not entirely capture forward inflation rates, but also include some historical inflation determined by the extent of the indexation lag.[684]This bias is potentially small due to the short lag on indexed CGS and is not likely to be time varying.
Counterparty default risk	The risk associated with an inflation swap is that the counterparty will fail to fulfil its obligations outlined in the swap agreement. This default risk is known as counterparty risk and as such, default risk premia may be included in inflation swap rates. While the presence of this risk premia is a relatively well-known, the effect of counterparty default risk on zero coupon inflation swap rates may not be significant. This premia could result in overestimates of expected inflation and is not likely to be time-varying.
Liquidity premia	Likely to result in potential overestimates of expected inflation. Zero coupon inflation swap rates may also contain liquidity premia, which may drive a wedge between the raw inflation swap rate and expected inflation rate. A-priori liquidity premia may be near zero since swaps can be created as

681 Charles Howard and Louis D'Antonio (1994), 'The Cost of Hedging and the Optimal Hedge Ratio', The Journal of Futures Markets, 14(2), pp. 237-238.

682 Kieran Davies, Felicity Emmett and Denise Wong (2010), 'Submission to the 16th Series Consumer Price Review' Australia/NZ Strategy and Economics, The Royal Bank of Scotland, 12 March, p. 9.

683 Arroub Zine-eddine (2014), OpenGamma Quantitative Research, 'Inflation: Instruments and curve construction', January, p. 2.

684 Matthew Hurd and Jon Relleen (2006), 'New information from inflation swaps and index-linked bonds', Bank of England Quarterly Bulletin, Spring, p. 27.

Bias	Explanation
	required and there is no supply limitation. Observations of Australian data suggest that this liquidity premia may be negligible.[685] If the inflation swap method includes a liquidity premium it is likely to produce overestimates of the expected inflation rate. Furthermore, the liquidity premium is likely to be greater during periods of uncertainty when investors' appreciation of liquidity risk may have changed.

Source: ACCC Working Paper # 11, pp. 68 - 69.

Despite these potential biases, the ACCC working paper #11 notes a number of studies that suggest that inflation swaps may provide better estimates of expected inflation than the breakeven method.[686]

3.5 Revisions

We require the following revisions to make the access arrangement proposal acceptable:

Revision 3.1: Make all the necessary amendments to the access arrangement proposal to give effect to this draft decision.

685 See Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper #11, April 2017, paragraphs 174-178.

686 See also: Richard Finlay and David Olivan (2012), 'Extracting Information from Financial Market Instruments', RBA Bulletin, March Quarter, pp. 45-46; Reserve Bank of Australia (2015), Statement on Monetary Policy, February, p. 50; Joseph Haubrich, George Pennachi and Peter Ritchken (2012), 'Inflation Expectations, Real Rates, and Risk Premia: Evidence from Inflation Swaps', The Review of Financial Studies, 25(2), p. 1590; Zhuoshi Liu, Elisabeth Vangelista, Iryna Kaminski and Jon Relleen (2015), 'The informational content of market-based measures of inflation expectations derived from government bonds and inflation swaps in the United Kingdom', Staff Working Paper No. 551, Bank of England, p. 2; Carolin Pflueger and Luis Viceira (2015), 'Return Predictability in the Treasury Market: Real Rates, Inflation, and Liquidity', Working Paper, p. 12, p. 16 and Table IIA; Stefania D'Amico, Don Kim and Min Wei (2016), 'Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices', Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, pp. 28-29 and p. 59.

A Our foundation model approach

We determined the allowed return on equity by applying the Guideline foundation model approach. The foundation model approach was developed after extensive consultation during the formation of our Rate of Return Guideline in December 2013.

We note that AGN has fully adopted the Guideline foundation model approach for estimating the return on equity.[687]

We note AusNet, Multinet, APA and APTPPL have proposed to apply 'the foundation model approach and estimates the return on equity using the Sharpe-Lintner CAPM'.[688] However, we consider that these service providers are not fully appreciative of the features of the foundation model approach and provide the following for clarification:

- The foundation model approach identifies one model as the foundation model, but this is just a starting point and does not prevent other models, or combinations of multiple models, from being adopted. As set out in the Guideline:[689]

  > The use of regulatory judgement may also result in a final estimate of the return on equity that is outside the foundation model range. This recognises that, ultimately, our rate of return must meet the allowed rate of return objective. In these circumstances, we may reconsider the foundation model input parameter estimates, or more fundamentally, we may also reconsider the foundation model itself.

- The foundation model approach has six steps, but this does not mean that material considered in earlier steps are given more weight than material considered in later steps.
- Identifying material as being valuable in the estimation of one parameter (e.g. market risk premium) does not prevent us from considering the value of that parameter for the estimation of other parameters (e.g. overall return on equity). However, in using certain material to inform the estimation of multiple parameters, it is important to consider that the weight being afforded to the material reflects the relative merits of the material and is not in effect being 'double-counted'.
- We do not consider that having regard to relevant material requires running all the equity models put before us. Rather, the need to run these models depends on how valuable we consider they are in estimating a return on equity commensurate

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687 AGN, *Final Plan Access arrangement information for our Victorian and Albury natural gas distribution networks: 2018 to 2022–Attachment 10.1: Financing Costs*, December 2016, pp. 5, 17.

688 Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 7; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016, p. 187; APA VTS, *Victoraian transmission system access arrangement submission*, 3 January 2017, p. 132; APTPPL, *2017 - 2022 RBP Access Arrangement revision submission*, 16 September 2016, p. 133.

689 AER, *Better regulation Rate of Return Guideline: Explanatory Statement*, December 2013, p. 62.

with the efficient financing costs given the systematic risk associated with APTPPL's reference services.

Our approach was endorsed by the Tribunal, which stated recently:

> 649 The AER has appropriately extracted from the 2012 Rule Amendments the following propositions summarising how [the AEMC] intended the 2012 Rule Amendments, in particular r 6.5.2 of the NER and r 87(2) of the NGR, to operate:
>
> (a) the RoR Objective has primacy in any estimation of the rate of return on equity (pp 18, 36 and 38-39);
>
> (b) the AER's obligation to "have regard to" the material referred to in NER 6.5.2(e) when determining the allowed rate of return is subject to its obligation under NER 6.5.2(b) to determine the allowed rate of return such that it achieves the RoR Objective (and equally under NGR r 87(3) and 87(2)) (pp 36-37);
>
> (c) the AER must actively turn its mind to the factors listed, but it is up to the regulator to determine whether and, if so, how the factors should influence its decision (if at all) (pp 36-37);
>
> (d) it is important that the AER be given flexibility to adopt an approach to determining the rate of return that is appropriate to market conditions (p 44);
>
> (e) it is important for the AER to be transparent in its approach to determining the rate of return in order to maintain the confidence of service providers, investors and consumers in the process (pp 23 and 24);
>
> (f) it is important that all stakeholders (including consumers) have the opportunity to contribute to the development of the RoR 2013 Guideline and its evolution through periodic review every three years (pp 45-46);
>
> (g) the RoR 2013 Guideline should include details as to the financial models that the AER would take into account in making a determination, and why it has chosen those models over other models (p 70);
>
> (h) the RoR 2013 Guideline should provide a service provider with a reasonably predictable, transparent guide as to how the AER will assess the various estimation methods, financial models, market data and other evidence in meeting the overall RoR objective. The Guideline should allow a service provider to make a reasonably good estimate of the rate of return that would be determined by the AER if the Guidelines were applied (p 71); and
>
> (i) while the RoR 2013 Guideline are not determinative, these should "provide a meaningful signal as to the regulator's intended methodologies for estimating return on equity" and be capable of being given "some weight" to narrow the debate about preferred methodologies and models. They should be used as a starting point in making a regulatory determination (p 71).

Ultimately, as the Tribunal has emphasised, we must exercise our regulatory judgement about the weight that should be attached to different models, data, methods and other evidence that may be available to us when making our decision.[690] We recognise that there are potential weaknesses in the different models and estimation methods. Nevertheless, we are charged with deciding from the available evidence, a return on equity that we consider contributes to the rate of return objective. The Australian Competition Tribunal has described the way in which the AER should carry out this task as follows:[691]

> 713 …The Tribunal takes the obligation on the AER so expressed as requiring it to give consideration to the range of sources of evidence and analysis to estimate the rate of return. It need not give particular weight to any one source of evidence, and indeed it might treat particular evidence as having little or no weight in the circumstances. It is for the AER to make that assessment. It may also have regard to other factors. ….
>
> 714 The AER accepted that it did not itself "run" other models than the SL CAPM. It had presented to it the outcome of other models, through various expert reports provided to it. It considered, but did not adopt, those outcomes. It is said by the Network Applicants that the AER's approach was based upon an incorrect step – both non-compliant with the Rules and in fact – that the SL CAPM was a superior model and so an appropriate "foundation model" for the purposes of the RoR 2013 Guideline.
>
> 715 The relevant textual features, in the view of the Tribunal, are the breadth and generality of the words "relevant estimation methods, financial models, market data and other evidence". They do not suggest a prescriptive obligation to consider particular methods, models or data. If that were intended, one would expect it to be more prescribed. Rather, it is left to the AER to decide what is "relevant" and a dispute about relevance is not itself a basis for asserting error of the character now asserted. In fact, the AER did have regard – in the sense of considering – the material put forward by the Network Applicants. The same reasoning suggests that the obligation to "have regard to" certain material is to consider it and to give it such weight as the AER decides. Again, if a more sophisticated obligation were intended, it is likely it would have been differently expressed. …

This means that when we consider conflicting evidence, we must come to a conclusion that we consider fits the regulatory requirements. This has been recently emphasised again by the Tribunal:[692]

> 802 … The mere existence of competing views or of reasons why a particular piece of information might point in one or other direction will not of itself mean that the Tribunal should or will reach a view different from that of the AER. That

690 [2016] ACT 1 at 180–222.

691 [2016] ACT 1 at pp. 200–201

692 [2016] ACT 1 at 219–221

is particularly so where there are competing expert opinions. In the universe of the NEL and the NGL (as in other areas of decision making) it is a feature of the qualitative decision making process that competing materials, including competing expert opinions, may be available to the AER. It must make its decisions under, and in accordance with, the legislative and regulatory instruments having regard to that material. …

B Equity models

As part of the rate of return guideline (the Guideline) process, we focused on four key models that may be used to estimate the return on equity, or to inform the implementation of our foundation model approach:

1. The Sharpe–Lintner Capital Asset Pricing Model (Sharpe-Lintner CAPM)
2. The Black Capital Asset Pricing model (Black CAPM)
3. The Fama French Three Factor Model
4. The Dividend Growth Model

We have considered all models that have been proposed. In this sense, all of the models are relevant. In addition to these models, we have considered information submitted in relation to non-standard versions of the Sharpe-Lintner CAPM — the Wright and historical specifications.

The current service providers including Multinet proposed using the Sharpe-Lintner CAPM to estimate the return on equity.[693] However, Multinet has proposed to include an additional 'alpha' term in the Sharpe-Lintner CAPM to account for the model's low-beta bias for low beta stocks.[694] We consider this proposal in more detail in Appendix B.1.

In previous regulatory processes, service providers proposed using empirical estimates from the Black CAPM, Fama-French model, and dividend growth model. They proposed to use the estimates from these models to inform the overall return on equity through either:[695]

- estimating their proposed return on equity as part of a multi-model approach, or to inform input parameters into the Sharpe-Lintner CAPM, and/or
- providing evidentiary support that their estimate of the return on equity is reasonable and will contribute to the achievement of the ARORO.

While we have considered all proposed models, we are not persuaded that they are all of equal value. This appendix sets out our assessment of the relative merits of the

693 AusNet Services, Multinet, AGN, APA VTS, APTPPL.

694 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 14–26.

695 For example see: AusNet Services, *AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 239–266; ActewAGL, *Access Arrangement Information for the 2016-21 ACT, Queanbeyan and Palerang Access Arrangement, Appendix 8.02: Return on equity-detailed proposal*, June 2015, p. 45–50; APTNT, *Amadeus Gas Pipeline: Access Arrangement Revision Proposal*, August 2015, p. 136–138; AGN, *2016/17 to 2020/21 Access Arrangement Information, Attachment 10.1: Rate of Return*, July 2015, p. 43–44; AusNet Services, *Regulatory proposal 2016-20*, 30 April 2015, p. 331–333; United Energy, *2016 to 2020 Regulatory Proposal,* April 2015, pp. 117–120; CitiPower, *Regulatory proposal 2016-2020*, April 2015, p. 221–224; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 267, 281–326.

models for estimating the return on equity, either directly through a foundation model or multi-model approach, or through informing other parameters of the return on equity.

B.1 Sharpe-Lintner CAPM

The Sharpe-Lintner CAPM is an equilibrium asset pricing model. It is based on the well accepted finance principle that rational investors will seek to minimise risk (as measured by portfolio variance) for a given expected return.[696]

We consider the Sharpe-Lintner CAPM will, as the foundation model in our foundation model approach and with reasonably selected input parameters, result in a return on equity commensurate with the benchmark entity's efficient financing costs. We consider our cross checks[697] on the return on equity provide supporting evidence that the return on equity derived using the Sharpe-Lintner CAPM-based foundation model approach will contribute to the achievement of the allowed rate of return objective.

We consider this is the case for the reasons set out in this decision and in the Guideline's explanatory statement and its appendices.[698] In coming to this conclusion, we and our consultants have considered the material submitted to us after publishing the Guideline. This has included consideration of proposals from service providers' and submissions on these proposals.[699]

The Sharpe-Lintner CAPM is the dominant model used to estimate firms' cost of capital by providers of capital to firms (that is, investors).[700] We consider the model:

- is reflective of economic and finance principles and market information
- is fit for purpose as it was developed for estimating the cost of capital
- can be implemented in accordance with good practice
- is not unduly sensitive to errors in inputs or arbitrary filtering
- uses input data that is credible and verifiable, comparable and timely and clearly sourced
- is sufficiently flexible to allow for changing market conditions and new information to be reflected in regulatory outcomes, as appropriate.

While a range of challenges to the Sharpe-Lintner CAPM have been raised over many years, the model remains the dominant asset pricing model used for capital

696 Many university texts cover the model. See for example: Peirson, Brown, Easton, Howard and Pinder, *Business Finance*, McGraw-Hill, Ninth edition, 2006, pp. 200–207.

697 See the 'Overall return on equity' subsection in section 3.4.1.

698 AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, pp. 10–14.

699 We are concurrently assessing regulatory proposals from three different service providers. We are also assessing revised regulatory proposals from eight different service providers. We take these businesses' different adaptations into account.

700 See Brealey, Myers, Partington and Robinson, *Principles of corporate finance*, McGraw Hill Australia, 2007, p. 216.

budgeting.[701] The model—estimated as the sum of the risk free rate and the product of the equity beta and market risk premium—is relatively simple to implement. We consider these input parameter estimates are based on robust, transparent and replicable analysis. We consider its use in this context will lead to a predictable estimate of the return on equity, and this will be valuable in ensuring reference service providers can efficiently raise equity.

In relation to the Sharpe-Lintner CAPM, McKenzie and Partington found the following:[702]

- As the foundation model it, 'provides a starting point, which is firmly based in a mature and well accepted theoretical and empirical literature'.
- Its efficacy comes from surviving the test of time. They noted the 'model has been around for in excess of half a century and has become the standard workhorse model of modern finance both in theory and practice'.
- Its 'place as the foundation model is justifiable in terms of its simple theoretical underpinnings and relative ease of application'.
- The majority of international regulators primarily base their decision on the Sharpe-Lintner CAPM framework.

Further, McKenzie and Partington have expressed that the foundation model approach, using the Sharpe-Lintner CAPM as the foundation model, would be expected to:[703]

- lead to a reasonable estimate of the return on equity
- lead to a rate of return that meets the allowed rate of return objective
- not lead to a downward biased estimate of the cost of equity for a benchmark efficient entity.

In relation to the Sharpe-Lintner CAPM, Partington and Satchell noted:[704]

- The model is 'ubiquitous in relation to the estimation of the cost of equity' and 'the same cannot be said for the alternative models proposed by the regulated businesses.[705]

[701] McKenzie and Partington note, 'no framework is perfect, the foundation model has its weaknesses, but these are well-documented and in many cases can either be diagnosed or perhaps compensated for in empirical practice…This model has been around for in excess of half a century and has become the standard workhorse model of modern finance both in theory and practice. See *Report to the AER part A: Return on equity*, October 2014 p. 9.

[702] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 9–10.

[703] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 13–14.

[704] Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 17–21.

[705] We acknowledge the study by Stephan Schaeffler and Christoph Weber that examined the use of other models in regulatory practices in 21 countries [Stephan Schaeffler and Christoph Weber, 'The Cost of Equity of Network Operators – Empirical Evidence and Regulatory Practice', *Competition and Regulation in Network Industries*, 14(4), 2013, p. 386]. The same study also concluded that the, 'standard model for determining capital costs' for

- It is 'widely used and understood'.
- The model has passed the test of time and 'has had several decades of widespread practical use in estimating the cost of capital'.

Handley indicated that our use of the Sharpe-Lintner CAPM as foundation model was entirely appropriate and reasonable.[706] He noted: [707]

> '[t]he Sharpe-CAPM is the standard (equilibrium) asset pricing model. It has a long established and well understood theoretical foundation and is a transparent representation of one of the most fundamental paradigms of finance – the risk-return trade off.

A substantial amount of the material submitted to us after publishing the Guideline commented on our conclusions and choice of Sharpe-Lintner CAPM as the foundation model. The majority of stakeholders other than service providers supported the use of the model as the foundation model.[708] These submissions are detailed in section B.1.1.

Service providers have submitted that the allowed return on equity for a benchmark efficient entity from the foundation model approach (using the Sharpe-Lintner CAPM as the foundation model) is likely to be downward biased in previous regulatory processes. In their proposals, these service providers submitted that we should use different models and additional information to the information in the foundation model approach.[709]

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energy businesses is the SLCAPM. We also note the prevalence of the Sharpe-Lintner CAPM in recent valuation reports. In all the reports we examined, only one did not use the model. All other reports used the model as the initial or primary estimation method. Only five of the reports examined utilised an alternative estimation model (the dividend growth model), and four of these five reports used the alternative model as a cross-check on the primary estimate from the Sharpe-Lintner CAPM. Ten reports noted the theory size premiums associated with the Fama-French three-factor model, but none took the further step to estimate the Fama-French model. No reports discussed the Black CAPM. We consider that the current evidence from independent valuation reports supports our view that the Sharpe-Lintner CAPM is the clearly superior model to use as the foundation model.

706 Handley, *Advice on return on equity,* 16 October 2014, p. 4.

707 Handley, *Advice on return on equity,* 16 October 2014, p. 4.

708 For example, Mr Bruce Mountain, *CCP2, Advice on AER preliminary decisions and revised proposals from Energex, Ergon Energy and SA Power Networks*, July 2015, p.11; Consumer Utilities Advocacy Centre, Re: Victorian electricity distribution pricing review (EDPR), 2016 to 2020, 13 July 2015, p. 2; Victorian Energy Consumer and User Alliance, Submission to the AER, Victorian Distribution Networks' 2016-20 Revenue Proposals, July 2015, p. 3; Business SA, *Submission to AER on their preliminary decision, 3 July 2015*, p.2; Alternative Technology Association, ActewAGL Access Arrangement Proposal, 10 August 2015, p. 10; Energy Retailers Association of Australia, *Preliminary Decisions for Ergon Energy and Energex determinations 2015-16 to 2019-20*, 3 July 2015, p.1; Energy Consumers Coalition of South Australia, *AER SA Electricity Distribution Revenue Reset, The AER preliminary decision - A response*, 3 July 2015, p.38.

709 For example, see: ActewAGL, *Access Arrangement Information for the 2016-21 ACT, Queanbeyan and Palerang Access Arrangement, Appendix 8.02: Return on equity-detailed proposal, Submission to the Australian Energy Regulator*, June 2015, p. 1; APTNT, *Amadeus Gas Pipeline: Access Arrangement Revision Proposal*, August 2015, p. 137; AGN, *2016/17 to 2020/21 Access Arrangement Information, Attachment 10.1: Rate of Return*, July 2015, p. 8; AusNet Services, *Regulatory proposal 2016-20*, 30 April 2015, p. 331; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 267, 286–326; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 239–266.

These service providers appear to have submitted that the downward bias is (in part) due to improper consideration of the Black CAPM, Fama-French model, and dividend growth model. These service providers appear to have submitted that these other models should be used to either directly estimate the return on equity[710] or used to inform appropriate parameter values to use in applying the Sharpe-Lintner CAPM. [711] A number of service providers appear to have submitted, directly or implicitly, that the parameters we select for the Sharpe-Lintner CAPM under the foundation model approach are insufficient to overcome the downward bias in the Sharpe-Lintner CAPM.[712]

The key information that service providers have previously used to support these propositions included:

- Studies of ex post performance of the Sharpe-Lintner CAPM.[713] Frontier and NERA submitted that empirical tests reject the model and that it performs poorly relative to the other models.[714]
- Other direct estimates of the return on equity from the Black CAPM, Fama-French model, and dividend growth model:[715]
    - the Black CAPM as evidence that the Sharpe-Lintner CAPM displays low beta bias
    - the Fama-French model as evidence that the Sharpe-Lintner CAPM displays book-to-market bias
    - the dividend growth model as evidence that the Sharpe-Lintner CAPM, as applied by the AER, is not reflective of prevailing market conditions.

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710 ActewAGL, Jemena Electricity Networks, AusNet Services (Distribution and Transmission), CitiPower/Powercor, APTNT, Australian Gas Networks (AGN) and United Energy.

711 For example, see: Jemena Electricity Networks, AusNet Services, CitiPower/Powercor, APTNT, ActewAGL, Australian Gas Networks (AGN) and United Energy; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 267, 286–326; *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 68–77; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 239–266.

712 For example, see: ActewAGL, *Access Arrangement Information for the 2016-21 ACT, Queanbeyan and Palerang Access Arrangement, Appendix 8.02: Return on equity-detailed proposal, Submission to the Australian Energy Regulator*, June 2015, p. 2; AusNet Services, *Regulatory proposal 2016-20*, 30 April 2015, p. 311; United Energy, *2016 to 2020 Regulatory Proposal,* April 2015, p. 113; CitiPower*, Revised regulatory proposal 2016–2020*, January 2016, pp. 286–292APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, p. 130. AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 195, 230–231; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022: Revised Revenue Proposal*, 21 September 2016, pp. 143 & 146;

713 For instance, several service providers submitted the consultant report, NERA, *Empirical performance of Sharpe–Lintner and Black CAPMs*, February 2015.

714 Frontier Economics, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, pp. 7–10; NERA, *The Cost of Equity: Response to the AER's Final Decisions for the NSW and ACT Electricity Distributors, and for Jemena Gas Networks*, June 2015, p. ii.

715 For instance, the majority of service providers submitted that the return on equity estimated using the FFM, Black CAPM and DGM was higher than under the SLCAPM. For recent reports, see Frontier, *An updated estimate of the required return on equity*, June 2015.

These submissions are detailed further in sections B.1.3 and B.1.2 below.

The key submissions on these points were considered in our final decision for SAPN, and this material remains relevant. We have reviewed the new material before us. While we recognise all models have strengths and weaknesses, we consider the Sharpe-Lintner CAPM to be the superior model before us for the purpose of estimating the allowed return on equity. We do not consider that these arguments support any further adjustment to our Sharpe-Lintner CAPM input parameters. We are satisfied that we have had significant regard to prevailing market conditions in estimating the return on equity for a benchmark efficient entity.[716] We are satisfied that our return on equity estimate would fairly compensate a benchmark entity facing a similar degree of risk to AGN for its efficient equity financing costs.

Services providers have previously submitted that the AER has "erred in finding that the SL-CAPM is the clearly superior model" in previous regulatory determinations,[717] submitting that no evidence (such as expert reports) is cited in support of this statement. We note that the Tribunal recently found no error in our approach to estimating the return on equity, including the use of the Sharpe-Lintner CAPM in our foundation model approach.[718]

Multinet relied on a HoustonKemp report to support its proposal with the following key arguments:

- Ex-post returns should be used to empirically test and adjust asset model performance[719]
- Empirical tests of asset model performance indicate that the Sharpe-Lintner CAPM produces downward biased estimates of the return on equity (low-beta bias)[720]
- Either an additional 'alpha' term or an uplifted equity beta should be used to 'correct' the Sharpe-Lintner CAPM's low beta bias[721]

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716 NER clauses 6A.6.2 (g) and 6.5.2(g) and NGR rule 87 (7).

717 CitiPower, *Revised Regulatory proposal 2016–2020*, January 2016, p. 286–289; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, p. 280–283; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 57–60; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–43; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 47–49 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp 46–48; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 68–77; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 204–223, 239–266.

718 For example, see: Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, paragraphs 713–717, 735, 757; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 68–73.

719 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 16–19, 21–22; HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 3–17, 35–51.

720 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 14–18, 22–26; HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 3–35.

We discuss these issues in Appendix B.1.2.

B.1.1 Submissions supporting the use of the Sharpe-Lintner CAPM as the foundation model

The majority of stakeholders (other than service providers) supported using the Sharpe-Lintner CAPM as the foundation model.[722] However, a number of them submitted we should consider lowering our input parameters used in the model relative to those published with the Guideline.[723] Table 23 summarises a number of these submissions.

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[721] Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 14–18, 22–26; HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 3–35.

[722] For example, Mr Bruce Mountain, *CCP2, Advice on AER preliminary decisions and revised proposals from Energex, Ergon Energy and SA Power Networks*, July 2015, p.11; Consumer Utilities Advocacy Centre, Re: Victorian electricity distribution pricing review (EDPR), 2016 to 2020, 13 July 2015, p. 2; Victorian Energy Consumer and User Alliance, Submission to the AER, Victorian Distribution Networks' 2016-20 Revenue Proposals, July 2015, p. 3; Business SA, *Submission to AER on their preliminary decision, 3 July 2015*, p.2; Alternative Technology Association, ActewAGL Access Arrangement Proposal, 10 August 2015, p. 10; Energy Retailers Association of Australia, *Preliminary Decisions for Ergon Energy and Energex determinations 2015-16 to 2019-20*, 3 July 2015, p.1; Energy Consumers Coalition of South Australia, *AER SA Electricity Distribution Revenue Reset, The AER preliminary decision - A response*, 3 July 2015, p.38; Origin Energy, *Submission on ActewAGL's revised access arrangement for 2016–21*, 4 February 2016, p. 3; Origin Energy, *Submission on AGN's revised access arrangement for 2016–21*, February 2016; Origin Energy, *Submission on the AER's preliminary decisions on the Victorian distribution network service providers for 2016–20*, 6 January 2016, p. 3; Origin Energy, *Submission on the Victorian networks' revised proposals (for 2016–21*), 4 February 2016; AGL, *Submission on the AER's draft decision on AGN's 2016–21 access arrangement*, 4 February 2016, p. 2; Victorian Government, S*ubmission on the Victorian electricity distribution network service providers' revised regulatory proposals for 2016–20*, 12 February 2016, p. 1–2; CCP (panel 5), *Transmission for the generations: Response to proposal by AusNet Services transmission group pty ltd and AER issues paper for AusNet Services transmission revenue review 2017–22*, February 2016, p. 41; CCP (panel 3), *Submission to the Australian Energy Regulator (AER): An overview Response to AER Preliminary Decisions and revised proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, 25 February 2016, p. 30; EUCV*, A response to AusNet revenue reset proposal for the 2017–2022 period*, 9 February 2016, p. 40; CCP (panel 8), *Advice to AER from Consumer Challenge Panel sub-panel 8 regarding the AER Daft Decision and Australian Gas Networks' (SA) revised access arrangement 2016–2021 proposal*, 32 March 2016, p. 2.

[723] For example, Alliance of Electricity Consumers, *Submission to the AER's Preliminary Decision Queensland*, 3 July 2015; Alliance of Energy Consumers, *Submission to Energex and Ergon Energy's Revised Regulatory Proposals (Qld)*, 24 July 2015, p.9; QCOSS, *Response to Australian Energy Regulator Preliminary Decision for Queensland distributors 2015-2020*, 3 July 2015, p.20; Total Environment Centre, S*ubmission to the AER on the Preliminary Decisions on the QLD distributors' Regulatory Proposals 2015-20,* 3 July 2015, p.8; Cotton Australia, *AER Determination Ergon Energy*, 3 July 2015, p.2; Energy Users Association of Australia, *Submission to AER draft determination and Energex's revised revenue proposal 2015 to 2020*, 24 July 2015, p.11; Victorian Energy Consumer and User Alliance, *Submission to the AER Victorian Distribution Networks' 2016-20 Revenue Proposals*, 13 July 2015, p.11; QCOSS, *Response to Australian Energy Regulator Preliminary Decision for Queensland distributors 2015-2020*, 3 July 2015, p.21; Energy Users Association of Australia, *Submission to AER draft determination and Energex's revised revenue proposal 2015 to 2020*, 24 July 2015, p.11; Canegrowers, *AER Draft Determination: Ergon Energy and Energex - Network Distribution Resets 2015-2020, 3 July 2015*, p.2; ECCSA, *A response to the AER draft decision on AGN's AA2016 revenue reset,* February 2016, p. 32–37; VECUA, *Submission on the AER: AER preliminary 2016–20 revenue determinations for the Victorian DNSPs*, 6 January 2016, p. 2; CCP (panel 5), *Transmission for the generations: Response to proposal by AusNet Services transmission group pty ltd and AER issues paper for AusNet Services transmission revenue review 2017–22*,

Table 3-20 Submissions supporting the SLCAPM

Stakeholder	Submission
Consumer Challenger Panel 5 (CCP5)[724]	The theme of AusNet Services' Revised Proposal for rate of return, value of imputation credits and forecast inflation is to pick what suits the network best. It is not in the best interests of consumers that a high rate of return, low gamma, or low inflation is applied. Neither is it in the long term interests of consumers that networks can pick and choose methodologies and inputs that achieve the aforementioned rates, from time to time. Given that world, including Australian, interest rates are currently low, the AER's WACC of 6.16% and risk free rate of 2.57% are high when looking at the current global financial realities. This is coming off a period of high interest rates related to uncertainty as a result of the global financial crisis. Since the GFC, Australian energy consumers have endured high and rising electricity prices. Interest rates flow through into the WACC as the basis for both cost of debt and cost of equity, and we reiterate that our view is that the AER must allow the current low interest rates to be reflected in the Return On Capital now, and in the future, as a matter of policy, in the long term interests of consumers[725]
CCP4 (David Headberry)[726]	The current parameters should be applied to the PLQ decision.
Queensland Farmers' Federation (QFF)[727]	The QFF commends Powerlink on the approach taken in the preparation of its proposal in applying the AER's Guidelines with regards to its proposed Rate of Return for the next regulatory period.
CCP (11)	The AER should apply the Sharpe-Lintner CAPM and reject the proposal by Multinet to include an adjustment to the return on equity for the claimed 'low beta bias' in the SL CAPM formulation.[728]
Origin Energy	Origin supports AGN's stance of adopting parameters from the Guideline and basing cost of capital decisions on previous AER approvals, but understands each business will interpret variables according to its own independent advice and review.[729]
Red Energy and Lumo Energy	AGN's proposal to adopt the Rate of Return Guideline is satisfactory.[730]

Source: AER analysis of submissions.

February 2016, p. 41; CCP (panel 3), *Submission to the Australian Energy Regulator (AER): An overview Response to AER Preliminary Decisions and revised proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, 25 February 2016, pp. 10, 30–31, 33.

724 CCP5, Transmission for the Generations III–Response to: Revised revenue proposal by AusNet Services for Transmission Revenue Review 2017–22, October 2016, p. 18.

725 CCP5, Transmission for the Generations III–Response to: AER draft decision for AusNet Services' Transmission Revenue Review 2017–22, October 2016, pp. 20–21.

726 CCP4 (David Headberry), *Response to the AER Draft Decision and Revised Proposal to Powerlink's electricity transmission network for a revenue reset for the 2017-2019 regulatory period*, 19 December 2016, p. 21

727 Queensland farmers' federation, *Re: Response on Australian Energy Regulator (AER) Draft Decision on Powerlink's revenue proposal for the 2017/18 –2021/22 regulatory period*, 30 November 2016.

728 CCP11, *Victorian Gas Networks (AGN), AusNet Services and MultiNet: Supplementary Advice on the proposed Return on Equity by Victorian Gas Distribution Network Service Providers*, 22 March 2017, p. 9.

729 Origin Energy, *Victorian Gas Access Arrangement Review- 2018-22 Response to Gas Distribution Business' proposals*, 17 February 2017

730 Red and Lumo Energy, *Re: Australian Gas Networks Access Arrangement*, 6 March 2017

We consider the submissions in Table 3-20 generally support our use of the Sharpe-Lintner CAPM as the foundation model in our foundation model approach. However, we do not agree with submissions to lower the input parameters from those published in the Guideline. Our reasons for this position are set out in section 3.4.1.

B.1.2 Empirical tests of the Sharpe-Lintner CAPM

Some service providers have previously submitted that empirical tests indicate that the Sharpe-Lintner CAPM performs poorly compared to the Fama-French model and Black CAPM.[731]

At this time, we conclude that the evidence is unclear given the empirical limitation of the tests. Given the available evidence and the limitations of this evidence, we consider that there is no strong basis to conclude that the Black CAPM and/or Fama-French model provide materially better estimates of expected return on equity. Notwithstanding potential limitations with the empirical tests, we consider that our implementation of the Sharpe-Lintner CAPM in our foundation model approach recognises any potential empirical limitations.

On the empirical performance of the Sharpe-Lintner CAPM, McKenzie and Partington found the following which remain applicable:[732]

- The fact some work appears to show other models better explain the cross section of realised average returns does not invalidate the use of the model for several reasons. For instance, the cross section of returns is only one dimension of interest.[733]
- The evidence against the Sharpe-Lintner CAPM may not be as robust as once thought when more appropriate statistical tests are used.
- The empirical evidence against the model does not invalidate its use for estimating the cost of capital for projects when making capital budgeting decisions.

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[731] CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 281–289; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 275–283; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 57–72; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp.41–45; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 46–49 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 46–49; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 41–49; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 68–73; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, p. 110–130.
AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 214, 250–260.

[732] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 9–10.

[733] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 9.

Partington and Satchell made the following observations for testing empirical performances of asset pricing models:

- Testing of an asset pricing model involves how well it describes ex-ante expected returns when security prices are in equilibrium. Empirical work attempts to examine how well the asset pricing model explains ex-post realised returns which 'may not be a particularly good test'.[734]
- The results are dependent on the method used to conduct the test (for example the characteristics used in sorting stocks into portfolios when testing model performance), was also noted by Kan, Robotti and Shanken. [735]
- Fischer Black has previously suggested that testing of model performance using ex-post realised returns 'might be telling…more about the shocks to the expected returns (volatility) rather than the equilibrium expected returns'.[736]
- NERA referred to the work of Kan, Robotti and Shanken for the superior performance of the Fama-French model compared to the Sharpe-Lintner CAPM.[737] Partington and Satchell stated that they "are not persuaded at this time as there is no conclusive evidence of the superior performance of the FFM–as Kan, Robotti and Shanken also found the conditional CAPM and ICAPM to be the best performing models if the portfolios are formed by ranking stocks on size and CAPM beta instead of by book-to-market and size".[738] Partington and Satchell noted that Lewellen, Nagel and Shanken have cautioned that 'none of the models provides much improvement over the simple or consumption CAPM when performance is measured by the GLS[739] R2 or q'.[740]

Some service providers have previously submitted an empirical test of the Sharpe-Lintner CAPM and the Black CAPM by NERA that was considered in the JGN final decision.[741] We continue to observe that the results in NERA's report appear counterintuitive. For instance, NERA's in-sample tests indicated there was a negative relation between returns and beta—which is not consistent with the theory underpinning the Sharpe-Lintner CAPM or the Black CAPM.[742] NERA also provided an estimate of the zero-beta premium of 10.75 per cent.[743] It has been acknowledged that it is implausible for the zero beta premium to be equal to or greater than the market risk

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734 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 20.

735 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, pp. 23–24.

736 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 20.

737 NERA, *The Cost of Equity: Response to the AER's final decisions for the NSW and ACT Electricity Distributors, and for Jemena Gas Networks*, June 2015, p. 33 & 37

738 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 24.

739 Generalised least squares,

740 Partington and Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 21.

741 NERA, *Empirical performance of Sharpe–Lintner and Black CAPMs*, February 2015.

742 NERA, *Empirical performance of the Sharpe–Lintner and Black CAPMs*, February 2015, pp. 25, 31.

743 NERA, *Empirical performance of the Sharpe–Lintner and Black CAPMs*, February 2015, p. 29.

premium.[744] Further, having reviewed this report in relation to its results on the Black CAPM, Partington advised:[745]

> the results of NERA's various empirical analyses (most recently NERA, 2015) show that the reference portfolio they use is not on the efficient set ex-post. If it were, then there would be a perfect linear relation between the returns on securities and their betas calculated relative to the reference portfolio. Empirically, however, this is not the case. Therefore, the reference portfolio is not on the efficient set.
>
> The implication of a reference portfolio that is not on the efficient set is that there is an infinite set of zero beta portfolios with differing returns that can be associated with the reference portfolio. In this case, the zero beta return can be more or less arbitrarily chosen. NERA (2015) and SFG (2015) restrict the choice by fitting a regression model to the data in order to obtain a single estimate.

McKenzie and Partington considered that the empirical results for the Black CAPM and Sharpe-Lintner CAPM were not directly comparable.[746]

Further, there are a number of possible explanations (for example, economic conditions) that do not imply a bias in beta. These explanations were noted by Partington and Satchell as well as Handley.[747] For example, Muijsson, Fishwick and Satchell (2014) found that beta for a given portfolio remains relatively constant despite changes in the interest rate and market movements. More discussion of these potential explanations is in sections B.2.2 and B.3.2.

In response to the AER's statement that results from NERA's February 2015 report are counterintuitive, HoustonKemp submitted that the results are not unusual and that many others have produced very similar results.[748] HoustonKemp noted that over the period 1979 through 2014 there has been a negative rather than a positive relation in Australia between average returns and estimates of their betas.[749] HoustonKemp submitted that Kan, Robotti and Shanken show that the GLS R2 associated with the CAPM exceeds zero because of a significant negative relation between the mean returns and betas.[750]

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[744] NERA, *Return on Capital of a Regulated Electricity Network: A report for Ashurst*, May 2014, p. 92; SFG, *Cost of Equity in the Black Capital Asset Pricing Model*, 22 May 2014, p. 3.

[745] Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 25.

[746] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 22–23.

[747] Partington and Satchell, *Report to the AER: Return of equity and comment on submissions in relation to JGN*, May 2015, p. 16; Handley, *Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks*, 20 May 2015, p. 5.

[748] HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, p. 21.

[749] HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, p. 14.

[750] HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, p. 27.

Partington and Satchell have noted that 'a relatively flat or inverted relation between beta and realised returns is quite common in empirical work'.[751] However, they also noted that it is not clear that this is evidence that other models are better at estimating expected return on equity, stating: [752]

> What this shows is that low beta shares have had realised returns that outperformed and high beta shares have had realised returns that underperformed relative to the CAPM equilibrium expected return benchmark. This may or may not be because the CAPM is a poor model of equilibrium returns and some examples of varying explanations are given in Handley (2014). Harvey, Liu and Zhu (2015) report more than 300 variables have been found significant in explaining the cross section of realised returns. Possibly one or several of these variables might explain the divergence of realised returns from the CAPM. The question is do any of these variables determine equilibrium expected returns and that is a question that is unresolved.

We consider the empirical information submitted in relation to the ex post performance of the different models does not show that our application of the Sharpe-Lintner CAPM will undercompensate the benchmark efficient entity for its efficient cost of equity. The benchmark firm is not average risk and its risk is not expected to change given its regulated monopoly nature. Empirical evidence by Professor Henry supports this and shows no clear evidence of mean reversion of risk towards the average risk of the market. Partington also observed Henry's result in advising that a Vasicek adjustment was not valid. He advised:[753]

> we note the work of Henry (2008), who finds no evidence that would support the use of the Vasicek model for Australian data. The results of the Henry (2008) study:
>
>> "… suggest that there is little convincing evidence of regression to unity in this data. Therefore, it is difficult to justify the application of the Blume or Vasicek adjustments." (p. 12)

HoustonKemp responded that an absence of mean reversion in betas will not guarantee that the use of the Sharpe-Lintner CAPM will generate estimates of the cost of equity capital for a benchmark efficient entity that are not downwardly biased.[754] In response, Partington and Satchell clarified their statements on mean reversion in beta. They noted that the absence of mean reversion indicates that measurement error in empirical tests is unlikely to be a source of low beta bias.[755]

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751 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 51

752 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 51.

753 Partington, *Report to the AER: Return on equity (updated), April 2015*, pp. 33–34.

754 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, p. 22.

755 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, pp. 45–46.

HoustonKemp November 2016 report

HoustonKemp's report for Multinet also noted the Sharpe-Lintner CAPM's performance and made the following key submissions:

- Ex-post returns should be used to empirically test and adjust asset model performance[756]
- Empirical tests of asset model performance indicate that the Sharpe-Lintner CAPM produces downward biased estimates of the return on equity (low-beta bias)[757]
- Either an additional 'alpha' term or an uplifted equity beta should be used to 'correct' the Sharpe-Lintner CAPM's low beta bias[758]

Our consideration of the HoustonKemp report reveals that it effectively repeats a number of issues already considered in previous regulatory processes such as:

- empirical tests using ex-post returns shows that the Sharpe-Lintner CAPM is downwardly biased[759]
- an exercise to 'correct' the low-beta bias using ex-post returns through changing the Sharpe-Lintner CAPM (through an additional 'alpha' term or uplifting the equity beta)[760]

We acknowledge that the Sharpe-Lintner CAPM tests poorly using ex post returns data, and appears to underestimate the ex post returns for businesses with an equity beta less than one.

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756 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 16–19, 21–22; HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 3–17, 35–51.

757 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 14–18, 22–26; HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 3–35.

758 Multinet Gas, *Rate of Return Overview*, 16 December 2016, pp. 14–18, 22–26; HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 3–35.

759 For example, see: AusNet Services, *Revised regulatory proposal 2017-2022*, 21 September 2016, p.143; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 286–298; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 280–292; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 57–72; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–46; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 47–58; ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 45–54; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp 39–52; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, p. 70; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 115–120, 129–130.

760 See for example Frontier, *The required return on equity under a foundation model approach*, January 2016, p. 55. Both HoustonKemp and Frontier use a return on equity that is deemed absent of low-beta bias to estimate an adjustment to the equity beta in the Sharpe-Lintner CAPM. HoustonKemp appears to use ex-post return on equity. Frontier uses a return on equity from its Black CAPM (which is derived using ex-post data).
HoustonKemp also uses ex-post return on equity to estimate an 'alpha' term to include in the Sharpe-Lintner CAPM.

However, it is not clear that low beta bias is a priced risk not already captured by the Sharpe-Lintner CAPM.[761] Handley has noted that our understanding of the low beta bias is still far from clear.[762] There is also considerable difference in CAPM estimates of the return required on a low-beta asset being lower than subsequent returns and a downward bias in CAPM estimates of required returns.[763]

Partington and Satchell have noted that 'low beta bias' represents a tendency for low beta stocks to over perform and high beta stocks to underperform relative to the CAPM. Partington and Satchell noted that one possible interpretation is not necessarily that the Sharpe–Lintner CAPM gives a downward biased estimated of required returns but that low beta stocks have positive 'alphas'.[764] We note that a myriad factors can contribute to the under and over performance of a stock. Partington and Satchell noted that the question of whether any of these variables determine equilibrium expected returns is currently unresolved.[765]

Further, tests of asset model performance are contingent on the methodology used and can be 'spurious'.[766] Partington and Satchell have advised that the choice of methodology (such as the method of portfolio formation) influences whether or not the CAPM is rejected and there are substantial problems in correctly conducting tests of asset pricing models.[767]

We also have a number of concerns with HoustonKemp's methodology and results, including:

- HoustonKemp's method assumes that 'markets are efficient and in equilibrium, hence realised returns are an appropriate benchmark'.[768] However, expected returns can diverge from realised returns over a persistent period of time, markets can be in disequilibrium and expectations are not always realised even on average.[769]
- HoustonKemp's test is equivalent to perfect foresight on the part of the regulator with regard to the expected market risk premium and also assumes the regulator's ability to generate unbiased estimators of the time-varying beta.[770] Setting the challenge of perfect forecasting aside, perfect foresight will reduce variability in most cases. Partington and Satchell advised that when assessing 'this reduction in

[761] Handley, *Advice on return on equity,* 16 October 2014, p. 11.

[762] Handley*, Report prepared for the AER: Further advice on the return on equity*, April 2015, p. 6.

[763] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 19.

[764] Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 9.

[765] Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 51.

[766] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 18.

[767] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 18.

[768] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 17.

[769] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 30.

[770] Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 23.

volatility will lead to rejecting unbiasedness too often' which raises doubt on the validity of the empirical work in section 3 of HoustonKemp.[771]

- HoustonKemp's results suggest that some low beta `portfolios have positive forecast errors'. Partington and Satchell noted that 'is a positive forecast error evidence of outperformance which does not require any regulatory adjustment to the CAPM, or it is evidence of downward bias in the CAPM estimates of required returns in equilibrium'. They also point out that tests based on industry sorted portfolios could give, and have previously given, no evidence of significant bias.[772]
- HoustonKemp's estimation of alpha captures a range of factors such as outperformance and may not be bias with respect to the CAPM's estimation of equilibrium returns.[773]
- Partington and Satchell derived a result which shows that estimates of alpha and beta are negatively correlated. In other words in CAPM tests the results for low beta stocks would be biased towards positive alphas.[774] Partington and Satchell observed that 'sorting into high/low beta portfolios creates negative and positive alphas respectively and has little to do with any need to compensate utility companies'.[775]
- HoustonKemp seems to (implicitly) assume that returns cannot be out of equilibrium over an extended period because arbitrage will equalise expected and required returns.[776] As a result historical return data can be reliably used to measure expected returns. Partington and Satchell have advised against using realised returns to measure expected returns because 'even if expected and require returns are equal, there can be persistent differences between realised returns and equilibrium expected returns'.[777] This may be for a number of reasons such as economic shocks, changing equilibrium and individual investor preferences. Further there are barriers to arbitrage which can prevent the equalisation of expected and required returns.[778] In addition, it is the required return that determines the cost of capital and not expected return.[779]
- Partington and Satchell have identified a range of statistical problems with the two-pass methods such as that used by HoustonKemp for assessing model performance.[780]

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771 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 36.

772 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 24.

773 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 23.

774 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 36–37.

775 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 39.

776 HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. 39–40.

777 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 27–29.

778 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 27.

779 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 27.

780 Partington and Satchell, *Report to the ERA: the cost of equity and asset pricing models*, 15 May 2016, p. 18.

On HoustonKemp's exercise to compute an uplift to the equity beta for the low-beta bias, we note this is based on a mischaracterisation of the Guideline. The Guideline does not take a weighted average of empirical Australian estimates and 1 as HoustonKemp claims. As noted in previous determinations, we give most consideration to empirical Australian estimates of suitable comparator firms (Australian energy network firms) which indicate a range of 0.4–0.7.[781] Our consideration of the theory of the Black CAPM and international estimates (which we give less consideration) suggest a point estimate towards the upper range. These considerations along with our consideration of investor certainty lead us to set a point estimate of 0.7.

Partington and Satchell have also advised against HoustonKemp's beta uplift:

- A beta adjustment might be appropriate if bias in beta was causing any forecast error. However, we have not seen any convincing evidence that it is a bias in beta that is causing any forecast error.[782]
- We find no evidence in HoustonKemp, or elsewhere that any bias is due to a bias in the estimate of beta.[783]

ERA also considered (and rejected) the case for an alpha adjustment in its 2016 final decision for Dampier to Bunbury Natural Gas Pipeline (DBP):[784]

- The theory of the Sharpe-Lintner CAPM does not include the alpha term.
- Presence of alpha relates to the differences between the required returns (or expected or equilibrium) and realised returns.

We note that HoustonKemp has misinterpreted some of Partington and Satchell's previous advice. Partington and Satchell have provided the following clarifications in response:

- Partington and Satchell did not find evidence against the Sharpe-Lintner CAPM as HoustonKemp has noted, but have reported that other researchers believe the evidence is against the CAPM.[785]
- Satchell's work with Muijsson and Fishwick is not inconsistent with his advice to the ERA and the AER.[786] This work focused on how interest rate changes in the US might be able to explain the low-beta anomaly in the US, but does not suggest that holders of such assets need to be compensated by regulators, nor that there is a downward bias in the CAPM.[787] The purpose was not to test the CAPM or compare

781 We use Professor Olan Henry's 2014 report to inform empirical Australian estimates.

782 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 24.

783 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 26.

784 ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016–2020: Appendix 4 Rate of Return*, June 2016, p. 65.

785 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 26.

786 HoustonKemp, *The Cost of Equity and the Low-Beta Bias,* November 2016, pp. .

787 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 32–35.

it with other asset pricing models.[788] The purpose was to examine an anomaly with a view to explaining it. Partington and Satchell added that 'the title of the proposed book by MFS that Houston Kemp reports: The Low Beta Anomaly and Other Mysteries, clearly shows that [Muijsson, Fishwick and Satchell] do not believe the results they find are a consequence of failure of the CAPM'.[789]

- As stated in Partington and Satchell (2013) Isakov's work serves to illustrate the problem in testing asset pricing models when realised returns are inconsistent with expectations.[790]
- Where the data gives substantially varying and ambiguous answers, considerable weight should be given to the theory in deciding the reasonableness of the results from the data. Harvey (2017) stresses the importance of priors and strongly argues against reliance on the statistical significance of p-values, particularly where they may be subject to p-hacking. He also provides a very clear example of the importance of theory in interpreting the validity of results, which we commend to the reader.[791] In situations where the empirical work is unconvincing and the theory is transparent, relatively ungameable and rigorous (such as the SLCAPM), we would be inclined to assign a higher weight to the model.

B.1.3 Evidence from estimates of other models

Some service providers have previously submitted:

- the Black CAPM as evidence that the Sharpe-Lintner CAPM displays low beta bias (that is, downward biased for stocks with a beta of less than one)
- the Fama-French model as evidence that the Sharpe-Lintner CAPM displays book-to-market bias
- the dividend growth model as evidence that the Sharpe-Lintner CAPM, as applied by the AER, is not reflective of prevailing market conditions.

We note that the usefulness of the evidence provided from the Black CAPM, Fama-French model, and dividend growth model about possible bias in the Sharpe-Lintner CAPM is predominately in conjunction with empirical tests of these asset pricing models. That is, where multiple models are considered capable of providing appropriate estimates, tests of the relative performance of the models may be needed to determine if one model outperforms another. For example, empirical tests may be needed to determine if estimates from the Black CAPM (on their own) suggest downwards bias in the Sharpe-Lintner CAPM, or if they suggest upwards bias in the Black CAPM.

788 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 35.

789 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 35.

790 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 35.

791 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, pp. 31–32.

Our assessment of the empirical tests of the asset pricing models is set out in section B.1.2. Notwithstanding this assessment, we consider that there are significant limitations to the Black CAPM, Fama-French model, and dividend growth models. Given these limitations, we do not consider that these models provide compelling evidence that the Sharpe-Lintner CAPM, when used as our foundation model in our foundation model approach, is downwardly biased. Our assessment of the Black CAPM, Fama-French model, and dividend growth model are contained in sections B.2, B.3, and B.4 respectively.

B.2 Black CAPM

Fischer Black developed a version of the CAPM with restricted borrowing (the Black CAPM).[792] Black's model relaxes one of the key assumptions of the Sharpe-Lintner CAPM — that investors can borrow and lend unlimited amounts at the risk free rate. He developed two versions of the model; one with a total restriction on borrowing and lending and one that only restricts borrowing at the risk free rate. However, while he relaxes the Sharpe-Lintner CAPM assumption of unlimited borrowing and lending at the risk free rate, in its place he assumes investors can engage in unlimited short selling.[793] Unlimited short selling does not hold in practice either.[794]

In the place of the risk free asset in the Sharpe-Lintner CAPM, Black substitutes the minimum variance zero-beta portfolio. This zero beta portfolio faces no market (systematic) risk and is formed through the utilisation of short selling. Black shows in his model that the return on every asset is a linear function of its equity beta (as it is in the Sharpe-Lintner CAPM). Further, in the CAPM (security market line) equation, Black finds the expected return on the zero beta portfolio replaces the risk free asset.[795] Relative to the Sharpe-Lintner CAPM that can utilise observable proxies for the risk free rate, the Black CAPM requires estimating an additional parameter — the zero beta expected return.

We have reviewed the material submitted to us[796] on the Black CAPM and we do not consider that estimating the Black CAPM will result in a return on equity commensurate with the efficient financing costs given the risk of APTPPL's reference services. We

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792 Black, F., 'Capital market equilibrium with restricted borrowing', *The Journal of Business*, 45(3), 1972, pp. 444–455; McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 20.

793 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 22.

794 This assumption does not accord with how the stock lending markets work because short sellers are required to post collateral when lending stock in the form of cash and/or equity. See McKenzie and Partington, *Risk, asset pricing and WACC*, June 2013, p. 25.

795 Black, F., 'Capital market equilibrium with restricted borrowing', *The Journal of Business*, 45(3), 1972, pp. 446–450.

796 Frontier Economics, The *required return on equity under a foundation model approach – Report prepared for Jemena Electricity Networks, ACTEWAGL Distribution, AusNet Services, Australian Gas Networks, CitiPower, Powercor and United Energy*, January 2016; HoustonKemp, *The Cost of Equity: Response to the AER's draft decisions for the Victorian Electricity Distributors, ActewAGL Distributors and Australian Gas Networks*, January 2016; Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016.

maintain our reasons for this position as set out in the Guideline's explanatory statement and its appendices.[797]

Therefore, our approach is to:

- use the theory behind the Black CAPM to inform the equity beta estimate in the Sharpe-Lintner CAPM.
- not use the Black CAPM to empirically estimate the return on equity for the benchmark efficient entity.

Our use of the Black CAPM is due to the following reasons:

- The empirical implementation of the Black CAPM is unreliable because, in contrast to the risk-free rate, the expected return on the zero beta asset is unobservable and there is no apparent consensus on methods for estimating this return. The lack of consensus on methodological choices is likely to increase the sensitivity of the model to such choices, reducing the reliability of the model and increasing the potential for bias.
- There is little evidence that other regulators, academics or market practitioners use the Black CAPM to estimate the return on equity.[798] In particular, regulators rarely have recourse to the Black CAPM.[799] This view was supported by Handley.[800]
- Implementation of the Black CAPM typically results in estimates of the zero beta return being less reflective of prevailing market conditions than risk free rate estimates.[801]
- Using a conservative estimate of beta in the Sharpe-Lintner CAPM can accommodate potential issues that arise from not estimating the Black CAPM.[802]

We elaborate on our reasons for these positions in sections B.2.1 to B.2.3 below.

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797 AER, *Rate of return guideline*, 17 December 2013, p. 13; AER, *Explanatory statement rate of return guideline*, 17 December 2013, pp. 57–72; AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, pp. 18–23.

798 For more detail, see the 'use in practice' subsection in section A.3.3 of Attachment 3 to our draft decision for AGN, which remains relevant here. No new material was submitted on this issue following our draft decision.

799 A recent study examined regulatory practices in 21 countries and did not point to any uses of the Black CAPM. See Schaeffler, S., and Weber, C., 'The cost of equity of network operators - empirical evidence and regulatory practice', *Competition and Regulation in network industries*, Vol. 14(2), 2013, p. 386.

800 Handley, *Advice on return on equity,* 16 October 2014, p. 12.

801 As the zero beta portfolio can take many years of data to estimate, while the current government bond rate is readily available. See: Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 20.

802 Handley found, 'The AER's choice in using the Black CAPM to inform the beta estimate, using the DGM to inform the MRP estimate and not using the Fama-French model is also appropriate and reasonable' in *Advice on the return on equity*, 16 October 2014, p. 5. McKenzie and Partington advised the theory underpinning the Black CAPM does not necessarily support an uplift to beta. McKenzie and Partington advised, 'the theory of the Black CAPM may have a role to play in choosing the equity beta, although exactly how is still not clear to us' in *Report to the AER part A: Return on equity*, October 2014, p. 24.

Some service providers previously proposed that empirical estimates from the Black CAPM should be used for estimating the return on equity.[803] In support of using empirical return on equity estimates from the Black CAPM, it has been argued that:

- Empirical evidence indicates that the SL-CAPM will lead to downwardly biased estimates of the return on equity for low-beta stocks.[804]
- The AER cannot reject the use of the Black CAPM based on concerns with reliability without testing SFG's zero-beta premium or 'seeking a reliable estimate' of the premium[805]
- The AER stated that the zero beta portfolio is hard to estimate but Gray and Hall (SFG) have provided an estimate.[806]
- The AER's return on equity estimate is below those from other relevant return on equity models.[807]
- Consultant reports and US regulators show that the Black CAPM is used in rate of return regulation cases.[808]

Having considered these submissions, we do not find them compelling and we remain satisfied with our position in the Guideline and draft decision. We consider that the Black CAPM is too sensitive to implementation choices for which there is no general

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[803] For example, see: CitiPower, *Regulatory proposal 2016-2020*, April 2015, p. 205–212; CitiPower, Revised r*egulatory proposal 2016-2020*, January 2016, p. 325–326; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 73, 75–77.
AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 263–266

[804] For example, see: CitiPower, Revised r*egulatory proposal 2016-2020*, January 2016, p. 286–289; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 115–120.
AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 250–255.

[805] For example, see: CitiPower, *Revised* r*egulatory proposal 2016-2020*, January 2016, p. 293–294; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp.70 ; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 115–120.

[806] For example see: AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, p. 257.

[807] For example see: CitiPower, *Revised regulatory proposal 2016-2020*, January 2016, p. 285 APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 73–77.
AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, p. 239.

[808] CitiPower, *Revised regulatory proposal 2016-2020*, January 2016, p. 296; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, p. 290; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 69–70; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp.50–51; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, p. 56 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 54–56; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, p. 50; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 257–259.

consensus. This may also explain its lack of use. We do not consider that Black CAPM estimates would contribute to a return on equity commensurate with efficient financing costs given APTPPL's risk in providing regulated services. We elaborate on our response to these submissions in sections B.2.1 to B.2.3 below.

B.2.1 Empirical reliability of the Black CAPM

We consider that there appears no consensus on the methodological choices required to construct a zero-beta portfolio.

McKenzie and Partington indicated that the Black CAPM can be very sensitive to implementation choices.[809] Partington and Satchell noted that, irrespective of the name and framework (the Black, Vasicek and Brennan versions of the CAPM), the major issue with zero beta CAPMs is determining the return of the zero beta portfolio.[810] They noted Beaulieu, Dufour and Khalaf's conclusion that the estimate of the zero beta return is unstable and unreliable over time.[811] Partington recommended against using empirical estimates of the Fama French model and Black CAPM in the Australian context because many of the issue are 'virtually intractable and estimates, such as those of the zero beta return are so problematic and unreliable as to render them virtually worthless'.[812]

The instability of the Black CAPM is highlighted in NERA's report for TransGrid's revenue proposal. This report lists the following prior estimates of the zero beta return for the Australian market:[813]

- CEG (2008) reports zero beta premium estimates between 7.21 and 10.31 per cent per annum.
- NERA (2013) reports zero beta premium estimates between 8.74 and 13.95 per cent per annum.

NERA also acknowledged that:[814]

> estimates of the zero-beta premium produced by studies that use long time series of Australian data are generally larger than estimates of the MRP that the AER has in the past used.

NERA also acknowledged the implausibility of the zero beta premium being equal to the market risk premium. However, NERA claimed the result simply reflects that there is no relationship between systematic risk and return.[815] Similarly, SFG submitted that

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809 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 25; Partington, *Report to the AER: Return on equity (updated), April 2015*, pp. 44–45.

810 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, pp. 25–26.

811 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, pp. 19 & 26.

812 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 18.

813 NERA, *Return on Capital of a Regulated Electricity Network: A report for Ashurst*, May 2014, p. 91

814 NERA, *Return on Capital of a Regulated Electricity Network: A report for Ashurst*, May 2014, p. 91.

815 NERA, *Return on Capital of a Regulated Electricity Network: A report for Ashurst*, May 2014, p. 92.

imprecise estimates of the zero beta premium arose from the imprecision in the relationship between beta and stock returns.[816] We do not find these submissions compelling. As stated by Handley, NERA's results that the zero beta premium equals the market risk premium have an unsettling implication that, 'there is a minimum variance portfolio that has no exposure to the risk of the market but is still expected to yield the same return as the market portfolio.'[817] We also question the validity of applying an asset pricing model that prices assets on the basis of equity beta, in a situation where one does not consider there is a relationship between equity beta and required return.

Partington and Satchell also noted that Shanken has cautioned using the method by Litzenburger and Ramaswamy and Shanken (used by NERA) to estimate the zero-beta premium because such procedures can lead to unreliable estimates.[818]

NERA’s 2012 submission further illustrates the unreliability of the Black CAPM. This presented estimates of a Black CAPM that implied a negative market risk premium.[819]

SFG acknowledged that one might expect the zero beta return to lie below the expected return on the market.[820] SFG estimated an estimate of the zero beta premium of 3.34 per cent per annum.[821] It then attempted to reconcile its estimate with NERA's and stated:[822]

> When we formed portfolios to measure the relationship between beta estimates we formed portfolios that had approximately the same industry composition, market capitalisation, and book-to-market ratio. So we isolated the relationship between stock returns and beta estimates that was largely independent of other stock characteristics that are associated stock returns. We repeated our analysis after forming portfolios entirely on the basis of beta estimates and found that the zero beta premium was 9.28%. This estimate of the zero beta premium is almost identical to the portfolio return of 10.03% reported by NERA for the 19-year period from 1994 to 2012.

We consider SFG's latest estimate of the zero beta premium appears more plausible, as it is not negative and is below the market risk premium. However, we remain of the view that the large range of zero beta estimates by consultants indicates that the model is unsuitable for estimating the return on equity for the benchmark efficient

816 SFG, *Beta and the Black CAPM*, February 2015, p. 8; SFG, *The foundation model approach of the Australian Energy Regulator to estimating the cost of equity*, March 2015, p. 24.

817 Handley, *Advice on return on equity,* 16 October 2014, p. 12. Handley does indicate the plausibility of this would depend on the variance of this portfolio and notes the minimum variance zero beta portfolio may bear unsystematic risk.

818 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 26.

819 NERA, *The Black CAPM: A report for APA Group, Envestra, Multinet and SP AusNet*, March 2012. For a response to this submission, see McKenzie and Partington*, Review of NERA report on the Black CAPM*, 24 August 2012.

820 SFG, *Cost of Equity in the Black Capital Asset Pricing Model*, 22 May 2014, p. 3.

821 SFG, *Cost of Equity in the Black Capital Asset Pricing Model*, 22 May 2014, p. 3.

822 SFG, *Cost of Equity in the Black Capital Asset Pricing Model*, 22 May 2014, pp. 3–4.

entity. McKenzie and Partington also considered SFG's and NERA's submissions and remained of the view that the model is empirically unstable. They stated:[823]

> Our point that 'what you get depends very heavily on what you do' is well illustrated by the SFG estimate of the zero beta premium, which is quite different to the NERA estimate

SFG later characterised this logic as not placing reliance on a 'plausible' estimate simply because different approaches produced implausible estimates.[824] Having reviewed SFG's report, Partington advised:[825]

> There are a great number of practical difficulties to be confronted when implementing the Black CAPM such that McKenzie and Partington (2014) do not recommend any weight be given to the estimates provided in the network service providers' consultants reports. This is an important point as McKenzie and Partington (2014) do not suggest that the Black model cannot be estimated. Indeed, the consultant's reports clearly show that it can be done. What they do say however, is that it is unclear what those estimated represent.

We received a number of submissions from other service providers and their consultants on the Black CAPM in previous regulatory processes. However, they largely surround issues previously considered in our Guideline and/or previous decisions.[826] We focus on key aspects of these submissions below. In response to our concern with the reliability of the zero beta premium, service providers submitted that the AER has not sought to test SFG's proposed zero-beta premium and instead dismissed this estimate on the basis that there are other differing estimates, some of which are 'implausible'.[827] AusNet Services also argued against the zero-beta portfolio being hard to estimate.[828]

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823 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 24; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 44.

824 SFG, *Beta and the Black CAPM*, February 2015, pp. 19–20.

825 Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 12.

826 AER, *Preliminary decision: CitiPower determination 2016–2020: Attachment 3–Rate of return*, October 2015, pp. 306–316; AER, *Powercor Preliminary Decision - Attachment 3: Rate of Return*, October 2015, pp. 306–316; AER, *Draft decision ActewAGL distribution determination 2016 to 2021: Attachment 3 – Rate of return*, November 2015, p. 320; AER, *Preliminary decision United Energy determination 2016 to 2020: Attachment 3 – Rate of return*, October 2015, pp. 308–318; AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, pp. 16–18; AER, *Draft decision Australian Gas Networks access arrangement 2016 to 2021–Attachment 3: rate of return*, November 2015, pp. 313–322; AER, *Preliminary decision Jemena distribution determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 307–317; AER*, Preliminary decision AusNet Services determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 306–316; AER, *Draft decision Amadeus Gas Pipeline access arrangement 2016 to 2021: Attachment 3¬–Rate of return*, November 2015, pp. 74–78.

827 CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 293; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, p. 287; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 66–67; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 44–46, 51–52; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 54–58 ; JEN (Vic), *2016–20*

Some service providers previously submitted that, given the Black CAPM is a relevant model, a proper examination should be undertaken for the best estimate for the zero-beta premium and this value should be used instead of effectively assuming this to be zero (by relying solely on the Sharpe-Lintner CAPM to estimate the return on equity).[829] AusNet Services have also submitted that the Black CAPM should be used as part of the multi-model approach for estimating the required return on equity.[830]

Partington and Satchell continue to note a range of issues (some of which are long-standing) with the Black CAPM in their latest report:

- Examinations of important academic research on the Black CAPM show that it is based on a number of unrealistic assumptions, such as unrestricted short-selling.[831] In particular, the 1971 Brennan paper indicates that the Black CAPM is unsuitable for regulatory use due to its assumption of two Markowitz portfolios as we cannot be certain what the properties of the market portfolio actually are.
- There are a range of issues with implementing the Black CAPM.[832] For example, the zero-beta premium is not observable and different methods and assumptions can lead to very different estimates of the zero-beta premium. In particular, the variability in zero-beta premiums is evident in SFG's estimate (10.75 per cent) and NERA's estimate (3.43 per cent).
- The zero beta premium estimates is not current nor observable and the standard errors of the estimates are substantial.[833]

Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs, 6 January 2016, pp. 53–54; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 48–49; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, p. 70.

828 AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, p. 257.

829 CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 290–293; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, p. 285–287; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 66–67; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp.45–46, 48–49; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 44, 47–52 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 53–54; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 38–39; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 69–73.

830 AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 217, 239–244, 255–259.

831 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 34-37.

832 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 39–45.

833 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 44–45.

After reviewing the material submitted to us, we are satisfied that we do not need to estimate the Black CAPM.

In response to Partington and Satchell's October 2015 advice, HoustonKemp submitted analysis showed that none of the estimates are either extremely large and negative or extremely large and positive. HoustonKemp submitted that the recursive estimates of the zero-beta premium have been relatively stable for the last 30 years and do not appear to be either problematic or unreliable.[834]

Based on a visual interpretation of its figure 4 in HoustonKemp's report, more than half of the zero beta premium estimates are concentrated in the 5% bar. HoustonKemp's recursive estimate of the zero beta premium (figure 5) indicates a value around 7–8% in 2014. We consider that both charts indicate a large and positive premium, relative to our estimated range for the market risk premium. Further, we note that the 95% confidence interval captures a range of approximately 4–13% which suggests not insignificant uncertainty regarding the zero beta premium estimate.

HoustonKemp made the following submissions on Beaulieu, Dufour and Khalaf's conclusion that the estimate of the zero beta return is unstable and unreliable over time:[835]

> Beaulieu, Dufour and Khalaf's finding relates to unreliable zero-beta rate estimates for assets with true betas that are close to one. HoustonKemp has used data from the largest stocks[836] to compute its zero-beta premium and it is unlikely that all of these stocks have true betas that are close to one.

Partington and Satchell noted that the estimation problems set out in Beaulieu, Dufour and Khalaf remain relevant even for assets with estimated betas not close to one. Partington and Satchell stated:[837]

> [Beaulieu, Dufour and Khalaf (2012) states that] even if estimated betas are not close to one, irregularities associated with WI [weak identification] are not at all precluded [in view of (1) and (2) above]…
>
> [Their statement states that] even if the estimated betas are not close to one, this is not a sufficient condition to preclude problems of estimation and inference.
>
> The implicit argument [by HoustonKemp] is that any instability in estimates of the zero beta return is due to variation in the risk free rate. Thus eliminating the risk free rate fixes the stability problems in the zero beta rate by transforming it

834 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. viii, 25–28.

835 Houston Kemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. 26.

836 HoustonKemp used the largest 100 stocks from 1963 to 1973 and the largest 500 stocks from 1974 to 2014

837 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 42–43.

to a zero beta premium. This is a dubious proposition, which we find completely unconvincing.

HoustonKemp submitted that Partington and Satchell's finding of Kan, Robotti and Shanken's zero-beta estimate being implausibly high ignores the fact that there is no sign the authors consider their estimate unreliable. [838]

We note Partington previous and latest advice regarding issues with implementing the Black CAPM, including the unreliable nature of (and wide range for) the zero beta estimate.[839] We also consider that Kan, Robotti and Shanken's caution reinforces our view that the model is not empirically reliable.[840] Partington and Satchell advise that the Black CAPM is based on a number of unrealistic assumptions and can lead to a wide range (and unreliable) estimates depending on the method used.[841]

HoustonKemp submitted in respect of the asset pricing tests in Lewellen, Nagel and Shanken:[842]

- Lewellen, Nagel and Shanken find that there is little relation between mean return and beta, and that estimates of the zero-beta premium are large and both economically and statistically significant.
- Lewellen, Nagel and Shanken find statistically significant evidence that the Sharpe-Lintner CAPM will deliver downwardly biased estimates of the returns required on low-beta portfolios of stocks.

However, Partington and Satchell cautioned use of results from asset pricing tests:[843]

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838 Houston Kemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. 28.

839 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 24; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 44; October 2015, p. 19; Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations,* April 2016, pp. 39–46.

840 AER, SAPN final decision: Attachment 3–Rate of return, October 2015, p. 76–79; AER, *Preliminary decision: CitiPower determination 2016–2020: Attachment 3–Rate of return*, October 2015, pp. 306–316; AER, *Powercor Preliminary Decision - Attachment 3: Rate of Return*, October 2015, pp. 306–316; AER, *Draft decision ActewAGL distribution determination 2016 to 2021: Attachment 3 – Rate of return*, November 2015, p. 316–325 ; AER, *Preliminary decision United Energy determination 2016 to 2020: Attachment 3 – Rate of return*, October 2015, pp. 308–318 ; AER, *Draft decision Australian Gas Networks access arrangement 2016 to 2021–Attachment 3: rate of return*, November 2015, , pp. 313–322; AER, *Preliminary decision Jemena distribution determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 311–313; AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, pp. 16–18; AER*, Preliminary decision AusNet Services determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 75–78, 306–316; AER, *Draft decision Amadeus Gas Pipeline access arrangement 2016 to 2021: Attachment 3¬–Rate of return*, November 2015, pp. 74–77, 310–319..

841 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 34-37, 44–45.

842 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. 18.

843 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 38–39.

> we have also pointed out (see for example, Partington and Satchell 2015a and 2015b) that there is well regarded research which shows that there are substantial methodological and statistical problems associated with asset pricing tests, for example, that results depend on how the portfolios used in the tests are formed.
>
> These papers also illustrate that the tide of academic opinion is divided about the evidence from realised returns, both for and against the CAPM. In short there is ongoing debate about how asset pricing tests should be conducted, what test statistics are appropriate, and what such tests actually mean.

B.2.2 Low beta bias may not reflect ex ante priced risk

Some service providers previously submitted that the Sharpe-Lintner CAPM underestimates the return on equity for businesses with an equity beta less than one ('low beta bias'). They submitted that low beta bias is evidenced by the return on equity estimates from Black CAPM and the empirical performance of the Sharpe-Lintner CAPM using ex post data.[844]

The empirical performance of the Sharpe-Lintner CAPM using ex post data is discussed in detail in section B.1.2. We acknowledge that the Sharpe-Lintner CAPM tests poorly using ex post returns data, and appears to underestimate the ex post returns for businesses with an equity beta less than one. However, we do not consider that this result is evidence that the set of assumptions underpinning the Black CAPM are more realistic than those underpinning the Sharpe-Lintner CAPM.

Handley stated that the Black CAPM and low beta bias are not equivalent concepts. As such, the empirical results of Black Scholes and Jenson (1972) and Fama and French (2004) are not direct tests of the Black CAPM.[845] It is unclear that low beta bias is a priced risk not already captured by the Sharpe-Lintner CAPM.[846] Handley later reiterated that our understanding of the low beta bias is still far from clear.[847]

[844] AusNet Services, *Revised regulatory proposal 2017-2022*, 21 September 2016, p.143; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 286–298; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 280–292; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 57–72; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–46; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 47–58; ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 45–54; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp 39–52; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, p. 70; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 115–120, 129–130; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 222–223, 250–255.

[845] Handley, *Advice on return on equity,* 16 October 2014, p. 10.

[846] Handley, *Advice on return on equity,* 16 October 2014, p. 11.

[847] Handley*, Report prepared for the AER: Further advice on the return on equity*, April 2015, p. 6.

McKenzie and Partington indicated that the Black CAPM is not based on more realistic assumptions than the Sharpe-Lintner CAPM. In fact, Partington and Satchell show that the Black CAPM is based on a number of unrealistic assumptions, such as unrestricted short-selling.[848]

The Black CAPM cannot be directly compared to the Sharpe-Lintner CAPM as they each involve very different investment strategies.[849] As such, any attempt to compare the two models must be done with great care.[850]

Partington and Satchell noted that 'low beta bias' represents a tendency for low beta stocks to overperform and high beta stocks to underperform relative to the CAPM. Partington and Satchell noted that one possible interpretation is not necessarily that the Sharpe–Lintner CAPM gives a downward biased estimated of required returns but that low beta stocks have positive 'alphas'.[851] We note that a myriad factors can contribute to the under and over performance of a stock. Partington and Satchell noted that the question of whether any of these variables determine equilibrium expected returns is currently unresolved.[852]

B.2.3 AER's role for the theory of the Black CAPM

We consider that the Black CAPM cannot be reliably estimated and we should not place weight on return on equity estimates from the model. However, we consider the theoretical underpinnings of the model remain a relevant consideration.

The theoretical principles underpinning the Black CAPM demonstrate that market imperfections could cause the true (unobservable) expected return on equity to vary from the Sharpe-Lintner CAPM estimate. This is a result of slightly different starting assumptions between the models.[853] The resulting variation in expected return on equity is (in the theoretical principles) larger for businesses with equity betas further from one. We have also considered the empirical evidence that the Sharpe-Lintner CAPM tends to underestimate returns on low beta stocks when examined using ex-post data.

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848 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 34-37.

849 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 22–23.

850 Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 16.

851 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 9.

852 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 51.

853 Fischer Black's 1972 paper on the Black CAPM develops two model specifications. The base specification assumes no risk free asset exists (no risk free borrowing or lending). The second specification assumes that the representative investor can lend but not borrow at the risk free rate. In the base specification, the return on the zero beta portfolio can be above the risk free rate. In the second specification, the return on the zero beta portfolio must be above the risk free rate. See: Black, *Capital market equilibrium with restricted borrowing*, Journal of Business 45(3), July 1972, pp. 452–454.

Our empirical and conceptual analysis of equity beta for businesses with a similar degree of risk as APTPPL (in the provision of reference services) indicates an equity beta less than one, and within the range of 0.4 to 0.7.[854] In this case, where initial considerations indicate an equity beta materially below one, the theory of the Black CAPM may be relevant. As the importance of the theory of the Black CAPM is relative to considerations of the business' equity beta estimate, we consider it is appropriate for the theory of the Black CAPM to inform our equity beta estimate.

However, it is important to note that:

- All models with simplifying assumptions will likely be affected by market imperfections when they are applied in a practical setting. The key theoretical difference between the Black CAPM and the Sharpe-Lintner CAPM relates to borrowing and lending. The Sharpe-Lintner CAPM assumes that investors can access unlimited borrowing and lending at the risk free rate. The Black CAPM relaxes this assumption, and instead assumes that investors can access unlimited short selling of stocks, with the proceeds immediately available for investment. Either of these assumptions might correctly be criticised as being unrealistic, and it is not clear which assumption is preferable.
- We consider that we cannot reliably estimate the Black CAPM.
- The empirical tests of the Sharpe-Lintner CAPM using ex-post data do not provide conclusive evidence that the Sharpe-Lintner CAPM has 'low beta bias'.

Our use of the Black CAPM in informing the equity beta point estimate is supported by recent advice from our expert consultants, McKenzie and Partington and John Handley.

John Handley noted our use of the Black CAPM to inform the beta estimate, as well as our roles for the dividend growth model and the Fama-French model, as 'appropriate and reasonable'.[855]

McKenzie and Partington considered that while the empirical implementation of the Black CAPM is problematic, the theory underlying the Black CAPM may have a role in informing the equity beta estimate.[856] McKenzie and Partington noted there is considerable uncertainty in how the Black CAPM theory should be applied to a Sharpe-Lintner CAPM equity beta estimate. However, they considered the theory underlying the Black CAPM does not necessarily support an uplift to the equity beta estimate used in the Sharpe-Lintner CAPM.[857]

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[854] For more detail, see section 3.4.1.

[855] John Handley, *Advice of the return on equity*, October 2014, p. 5

[856] McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 24–25; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 44–45.

[857] McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, p. 24; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 44.

We agree with McKenzie and Partington that the Black CAPM (of itself) does not justify an uplift to the equity beta used in the Sharpe-Lintner CAPM.[858] However, we have had regard to it when exercising our regulatory judgment in selecting the equity beta. We consider the Black CAPM does demonstrate that market imperfections could cause the true (unobservable) required return on equity to vary from the Sharpe-Lintner CAPM-based estimate. We consider this a relevant consideration in selecting the equity beta.

Some service providers have previously submitted that we have adjusted the equity beta for the Black CAPM in order to provide a correction for low beta bias.[859] Other service providers submitted that it is not clear whether our equity beta estimate is intended to correct for bias in the Sharpe-Lintner CAPM.[860] We do not consider that it has been shown that low beta bias exists on an ex ante basis and that it reflects a priced risk factor that would contribute to the allowed rate of return objective. We also note that the theory of the Black CAPM is only one consideration informing our equity beta point estimate (for more detail, see the 'estimating equity beta' subsection in section 3.4.1).

SFG, Frontier, and Houston Kemp submitted it is not possible to have proper regard to the Black CAPM without estimating it, and that we have essentially computed an unspecified estimate of the zero-beta premium.[861] We do not consider that the Black

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858 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 24; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 44.

859 CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 290–292; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 284–286; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 62–64; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–46, 51–52; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp.51–52 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 50–51; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 45–47; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, p. 223.

860 CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, p. 290; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, p. 284; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 62–64; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 45–46; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 51 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016,pp. 50–51; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 45–47; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 74–75.

861 SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, p. 23–24, 35; SFG, *The required return on equity: Initial review of the AER draft decisions*, 19 January 2015, pp. 16–17; SFG, *The required return on equity for the benchmark efficient entity*, February 2015, p. 19; Frontier Economics, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, p. 7; HoustonKemp, *The cost of equity: response to the AER's*

CAPM can be reliably estimated, and therefore consider that proper regard to the model requires that we do not place weight on estimates from the model and do not estimate the zero-beta premium.

HoustonKemp submitted that we adjust upwards an estimate of 0.55 – the midpoint of the range of 0.4 to 0.7 – to 0.7 by placing a weight of two thirds on an unadjusted estimate of beta (0.55) and one third on one.[862]

We note that our equity beta estimate of 0.7 is informed by a range of relevant evidence[863] and based on exercise of our regulatory judgment. It is not determined in any mechanistic manner as suggested by HoustonKemp.

In its June 2015 and January 2016 reports, Frontier maintained its disagreement with our use of the theory underlying the Black CAPM to inform the equity beta point estimate.[864] We do not consider that Frontier have raised any substantive new evidence to support their views. Therefore, we maintain the position and reasoning set out above.

The Consumer Challenge Panel agreed with our view on the difficulties with empirically implementing the Black CAPM. However, it disagreed with our use of the theory underlying the Black CAPM to inform the equity beta point estimate.[865] The Consumer Challenge Panel stated:[866]

> We have discussed our concerns with the Black CAPM above and do not consider it is an appropriate basis for the AER to select an equity beta that is higher than the median of the empirical observations.

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draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks, January 2016, p. 10.

862 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. 9.

863 AER, SAPN final decision: Attachment 3–Rate of return, October 2015, p. 94–96. ; AER, *CitiPower Preliminary Decision - Attachment 3: Rate of Return*, October 2015, pp91–93, 127–133; AER, *Powercor Preliminary Decision - Attachment 3: Rate of Return*, October 2015, pp. 92–94, 127–133; AER, *Draft decision ActewAGL distribution determination 2016 to 2021: Attachment 3 – Rate of return*, November 2015, pp. 94–97, 130–136; AER, *Preliminary decision United Energy determination 2016 to 2020: Attachment 3 – Rate of return*, October 2015, pp. 92–94; AER, *Draft decision Australian Gas Networks access arrangement 2016 to 2021–Attachment 3: rate of return*, November 2015, pp. 93–95; AER, *Preliminary decision Jemena distribution determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 92–94; AER*, Preliminary decision AusNet Services determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 92–94; AER, *Draft decision Amadeus Gas Pipeline access arrangement 2016 to 2021: Attachment 3¬–Rate of return*, November 2015, pp. 93–95.

864 Frontier, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, pp. 48–50, 61; Frontier, *The required return on equity under a foundation model approach*, January 2016, pp. 40–41.

865 CCP3, *Response to proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, August 2015, pp. 64–67, CCP2 (Bruce Mountain), *Submission on the AER's preliminary decisions for the Qld/SA distribution network service providers (2015-20)*, 29 July 2015, p. 10. QCOSS similarly disagreed with our use of the theory underlying the Black CAPM to inform the equity beta point estimate (see QCOSS, *Response to Australian Energy Regulator Preliminary Decision for Queensland distributors 2015-2020*, 3 July 2015, pp. 22–24).

866 CCP3, *Response to proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, August 2015, p. 67.

We consider the Consumer Challenge Panel's submission merely reflects a difference in opinion on the usefulness of qualitative evidence from one model to inform a parameter estimate in another model.[867] We note that the theory of the Black CAPM was only one factor that informed our equity beta point estimate.

In submissions on service providers' proposals, there was broad agreement from consumer groups on the application of our foundation model approach as set out in our Guideline.[868] We consider that this refers to the Guideline in its entirety, including our role for the theory of the Black CAPM.

B.3 Fama-French model

The Fama-French model is a three factor model of asset returns.[869] It incorporates the following three risk factors:[870]

- the return on the market (thus it incorporates the CAPM's systematic risk factor by having the return on the market as a factor)
- firm size (measured by market capitalisation)
- the ratio of book value to market value.

We have reviewed all the material submitted to us[871] on the Fama-French model and decided to give the model no role in informing our return on equity estimate (either directly or through informing parameter estimates). We maintain our reasons for this position as set out in the Guideline's explanatory statement and its appendices.[872] We do not consider that using the Fama-French model will result in a return on equity commensurate with the efficient financing costs given the risk of APTPPL's regulated services.

Our reasons for giving the Fama-French model no role are:

867 In the Guideline we clearly explained why we use the theory underlying the Black CAPM to inform the equity beta point estimate. See AER, *Explanatory statement to the rate of return guideline (appendices)*, December 2013, pp. 71–72.

868 We received submissions from nine consumer groups that provided clear submissions on the approach for estimating the rate of return. No submission opposed the application of our Guideline for estimating the return on equity.

869 Fama, E.F., French, K.R., 'The cross section of expected stock returns', *The Journal of Finance*, 47, 1992, pp. 427–66.

870 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 15–16.

871 Frontier Economics, The *required return on equity under a foundation model approach – Report prepared for Jemena Electricity Networks, ACTEWAGL Distribution, AusNet Services, Australian Gas Networks, CitiPower, Powercor and United Energy*, January 2016; HoustonKemp, *The Cost of Equity: Response to the AER's draft decisions for the Victorian Electricity Distributors, ActewAGL Distributors and Australian Gas Networks*, January 2016; Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016.

872 AER, *Rate of return guideline*, 17 December 2013, p. 13; AER, *Explanatory statement rate of return guideline*, 17 December 2013, pp. 57–72; AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, pp. 18–23.

- Empirical implementation of the Fama-French model is relatively complex and opaque, with no apparent consensus on the factors to be included or the construction of portfolios for the factors. Its estimates are sensitive to the chosen estimation period and methodological assumptions.
- The ex-post (backward looking) observation of apparently priced risk factors does not mean these factors are priced ex-ante (on a forward looking basis).
- There is a lack of agreed-upon theoretical foundation for the factors and the instability of parameter estimates. This may be a contributing factor to the lack of consensus on the empirical implementation of the Fama-French model. It also increases the difficulty associated with ascertaining whether the ex post observation of apparently priced risk factors are priced ex ante. [873]
- There is little evidence of companies or regulators using the Fama-French model to estimate the return on equity.[874]

There is no single correct application of the Fama-French model. There are numerous specifications of the model that produce different estimates of the return on equity. The lack of consensus on both the relevant factors and methodological choices is likely to increase the sensitivity of the model to such choices, reducing the reliability of the model and increasing the potential for bias. It is unclear that any of the different return on equity estimates from the different model specifications reflect an ex ante required return for risk. It is also unclear if any of the different specifications would be capable of estimating the required return on equity of investors in a business with a similar degree of risk as APTPPL's in providing reference services, even if they were capable of estimating required returns for the average firm. We set out these issues in more detail in the subsections below.

McKenzie and Partington have also previously supported our decision to not use the model.[875] We consider Handley's comments on the model also support our decision to not use the Fame-French model.[876]

The Energy Consumers Coalition of South Australia (ECCSA) agreed with the role we assign to the Fama–French model. ECCSA rejected the associated proposal by the

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[873] For more discussion of the theoretical foundations of the Fama-French model, see the 'theoretical foundations' subsection in section A.3.2 of Attachment 3 to our draft decision for AGN, which remains relevant here.

[874] For more detail, see the 'use in practice' subsection in section A.3.2 of Attachment 3 to our draft decision for AGN, which remains relevant here. No new material was submitted on this issue following our draft decision.

[875] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 15–19. Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 11; Partington & Satchell, *Report to the AER: return on equity and comment on submissions in relation to JGN*, May 2015, p. 6.

[876] Handley, *Advice on return on equity,* 16 October 2014, pp. 7–10. We reengaged Handley to consider material submitted with service providers' revised proposals. It does not appear that this material caused Handley to change his earlier positions. See Handley, *Further advice on the return on equity*, March 2015, pp. 3–4; Handley, *Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks*, 20 May 2015, pp. 24, 28.

networks to use multiple models to assess the outcomes then weighting these models to arrive at a point estimate.[877]

The Consumer Challenge Panel was also unconvinced by arguments from various service providers previously for the AER to use models other than the Sharpe-Lintner CAPM for estimating the cost of equity. The Consumer Challenge Panel considered that these alternative models are currently not being utilized by academics nor valuation practitioners.[878] Similarly, the Victorian Energy Consumer and User Alliance (VECUA) considered that our approach to estimating return on equity is more appropriate than the distributors' proposed approaches that adopt weighted averages of different return on equity models. These proposed departures have not been subjected to any rigorous analysis or stakeholder consultation.[879]

Some service providers responded to our reasons for giving the Fama-French model no role, submitting that:[880]

- The Fama-French model performs better than the Sharpe-Lintner CAPM.[881]
- All models requiring parameter estimates are sensitive to those estimates, including the Sharpe-Lintner CAPM, and the Fama-French model is not materially more sensitive to input choices than the Sharpe-Lintner CAPM.
- The Fama-French model was developed to address mis-pricing on low-cap and value stocks.[882]

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877 ECCSA, *Submission on Australian Gas Networks' Access Arrangement Proposal 2016-2021*, 16 August 2015, p.58.

878 Mr Bruce Mountain, *CCP2, Advice on AER preliminary decisions and revised proposals from Energex, Ergon Energy and SA Power Networks*, July 2015, p.113

879 Victorian Energy Consumer and User Alliance, ***Submission to the AER Victorian Distribution Networks' 2016-20*** *Revenue Proposals*, 13 July 2015, p.10.

880 CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, p. 289, 292, 294-295; Powercor, *Revised regulatory proposal 2016–2020,* January 2016, pp. 283, 286, 288–289; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 57–72; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–52; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 45–58 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 46–57; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp.41–50; APTNT*, Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision*, January 2016, pp. 68–72; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 126–128.
AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 204–223.

881 Frontier Economics, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, pp. 18–19; NERA, *The Cost of Equity: Response to the AER's final decisions for the NSW and ACT Electricity Distributors, and for Jemena Gas Networks*, June 2015, pp. 34 & 37; Frontier Economics, The *required return on equity under a foundation model approach – Report prepared for Jemena Electricity Networks, ACTEWAGL Distribution, AusNet Services, Australian Gas Networks, Citipower, Powercor and United Energy*, January 2016,p. 58-65

HoustonKemp submitted that, in examining the performance of a five factor model, Fama and French do not suggest that they consider the three-factor model to provide estimates of the returns required on equities to be inferior to those produced by the Sharpe-Lintner CAPM.[883]

We are not satisfied with these arguments. Partington and Satchell's latest report also advised against using the Fama-French model:[884]

> 'one reason why regulators should be wary of the Fama-French approach is that there is considerable possible variation in the ways these factors can be constructed, which is one of the reasons that these factors are favoured by the financial sector; they can be customised. Also, there is no theory attached to such a model; this has the implication that we do not really know if these factors represent risks, alpha opportunities, or behavioural anomalies. By contrast, the CAPM is a simple but self-contained theory of equilibrium pricing; the single factor, the market, is clearly identifiable as a risk factor and this makes it much harder to manipulate once we agree upon the market portfolio and the choice of riskless asset.

Further, Partington and Satchell noted that the Fama-French model is a model that that is still to gain acceptance in the world of practice and is also being increasingly questioned.[885]. They advised that the model has not established itself in the role of estimating the cost of capital, it is increasingly being challenged and currently it is in a state of flux with Fama and French having moved on to a new model.[886]

We have discussed the relative empirical performance of the Sharpe-Lintner CAPM in section B.1 above. We set out our response to the other issues in the following sections.

B.3.1 Sensitivity to methodological choices

There appears to be no consensus, and, indeed, nothing approaching a consensus, on the appropriate factors to use in factor modelling. McKenzie and Partington highlighted a vast array of models that add further factors to the Fama-French model. They pointed to one academic article that used over 50 variables to predict stock returns, and another that showed over 330 different predictive return signals.[887] They identified

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882 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, p. 5; AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 259–263.

883 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. 27.

884 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 33–34.

885 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 47.

886 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 47.

887 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 16–17; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 36.

that Fama and French have proposed a five factor version of the model that they claim provides a better description of returns than their original three factor model.[888]

In addition to the appropriate factors to us in the model, there appears to be no consensus on the methodological choices for constructing the portfolios to proxy the chosen factors.[889] This lack of consensus on both the relevant factors and methodological choices is likely to increase the sensitivity of the model to such choices, reducing the reliability of the model and increasing the potential for bias and regulatory gaming.

Partington and Satchell noted that the Fama-French model can be manipulated through varying the number of factors and their definitions to choose a form that is most favourable to certain arguments.[890] They noted that two advantages of the Sharpe-Lintner CAPM are its parsimony and greater observability which reduces opportunities for cherry picking and also provides the opportunity for a relatively transparent implementation.[891]

A recent study in the UK by Michou, Mouselli and Stark (2014) supports this conclusion.[892] A principal conclusion of Michou, Mouselli and Stark was that the results of the model are highly sensitive to the methodology chosen, so that 'factor construction methods can matter in the use of factor models and, as a consequence, factor construction methods need to be considered carefully in empirical settings'.[893] The Australian work of Brailsford, Guant and O'Brien (2012) noted that, regarding the Fama French model's specification choices, 'what appears to be relatively innocuous choices in portfolio construction can lead to substantially different conclusions'.[894] In contrast, we have a higher degree of confidence in our Sharpe-Lintner CAPM input parameters and resulting return on equity estimates.

Given the large range of potential factors used in factor modelling, as well as the contested and technical nature of this emerging body of research, we consider (at this time) factor modelling is unlikely to produce suitably reliable and unbiased estimates of the return on equity.

SFG did not consider the Fama-French model complex to implement, as it simply required estimating three factors instead of the one factor in the Sharpe-Lintner

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888 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 16; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 36.

889 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 32–34.

890 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 34.

891 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 9.

892 Michou, M., Mouselli, S., Stark, A., 'On the differences in measuring SMB and HML in the UK - Do they matter?', *British Accounting Review*, Volume 30, 2014, pp. 1–14.

893 Michou, M., Mouselli, S., Stark, A., 'On the differences in measuring SMB and HML in the UK - Do they matter?', *British Accounting Review*, Volume 30, 2014, p. 12.

894 Brailsford, T., Guant, C., and O'Brien, M., 'The investment value of the value premium', *Pacific-Basin Finance Journal*, 20, 2012, p. 417.

CAPM.[895] We do not agree. We consider that there is a much greater degree of consensus among academics and market practitioners on the methods and data sources for estimating the market risk premium and equity beta than there is for estimating the size and value factors in the Fama-French model.[896] Further, estimating the market risk premium and equity beta in the Sharpe-Lintner CAPM has resulted in a large amount of material being submitted by service providers, consultants and consumer groups.[897] This material adds a large amount of complexity to the task of estimating a return on equity that contributes to the achievement of the allowed rate of return objective. Given this, we have no reason to consider that estimating two additional premiums and correlation coefficients would not add considerable complexity to our task.

Regarding sensitivity, SFG and Frontier considered all models requiring parameter estimates are sensitive to those estimates, including the Sharpe-Lintner CAPM.[898] While we recognise that all models can be sensitive, we are not satisfied that the sensitivity of the Fama-French model is comparable to the Sharpe-Lintner CAPM.

SFG appears to suggest that the sensitivity arising from the Sharpe-Lintner CAPM is due to the market factor. We have no reason to expect that adding arguably more sensitive factors (the size and value factors) would produce a model with a comparable level of sensitivity. We consider our empirical analysis of equity beta shows that businesses in our comparator set generate a consistent pattern of empirical estimates that is robust across different sample periods and econometric techniques.[899] We have confidence in our proxy for the risk free rate, which would be the same if we were to apply the Fama-French model.

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895 SFG, *Using the Fama–French model to estimate the required return on equity*, February 2015, p. 2, 17–18.

896 AER, *Explanatory statement: Rate of return guideline*, 17 December 2013, pp. 90–91; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 14; Partington & Satchell, *Report to the AER: return on equity and comment on submissions in relation to JGN*, May 2015, p. 6; Academic literature and reports submitted by service providers recognise that the available evidence for estimating the expected return on equity is imprecise and subject to varied interpretations. See for example R. Mehra and E. C. Prescott, The equity premium, A puzzle, *Journal of Monetary Economics*, 15, 1985, pp. 145–161; A. Damodaran, *Equity Risk Premiums (ERP), Determinants, Estimation and Implications*, September 2008, p. 1; J. S. Doran, E. I. Ronn and R. S. Goldberg, *A simple model for time–varying expected returns on the S&P 500 Index*, August 2005, pp. 2–3. For an example report from regulated entities, see: Officer and Bishop, *Market risk premium, a review paper*, August 2008, pp. 3–4.

897 A sample of the most recent material includes: CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, pp. 1–58; NERA, *Memo: Revised estimates of the MRP*, November 2014, pp. 1–3; SFG, *the required return on equity for the benchmark efficient entity*, February 2015, pp. 17–36; SFG, *Beta and the Black CAPM*, February 2015, pp. 1–45; NERA, *Historical estimates of the MRP*, February 2015, pp. 1–51; SFG, *The required return on equity: Initial review of the AER draft decisions*, January 2015, pp. 25–44.

898 SFG, *Using the Fama–French model to estimate the required return on equity*, February 2015, p. 2, 11–14; Frontier Economics, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, p. 7.

899 AER, *Explanatory statement to the rate of return guideline (appendices)*, December 2013, p. 49.

Partington did not agree with SFG's submission that all models are sensitive to different estimation periods and methodologies. He advised:[900]

> We do not agree with SFG however, that “this applies to all models”. We agree that estimated values may vary over data sets, the question is do they vary moderately or do they vary so much as to be considered unstable and/or unreliable? In this context we note that Henry (2008, 2009, 2014) tests for, and finds no evidence of, structural instability in the estimates of the equity beta in the SL-CAPM.

NERA submitted that the Fama-French model produces a less precise estimate than the Sharpe-Lintner CAPM, ‘because it requires beta estimates relative to, not one, but three factors’. However, there may be a trade-off between precision (low standard deviation) and bias — the Fama-French model should be considered given its relative lack of bias.[901] We accept that a more complex model may be preferred over a less complex model where it offers a better estimate. However, we do not consider the Fama-French model provides a better estimate than the Sharpe-Lintner CAPM. As noted above, we do not consider that the Fama-French model provides compelling evidence that a book-to-market bias exists in the Sharpe-Lintner CAPM.

SFG submitted the variation between Fama-French model estimates arises because the studies that produce them are of different quality. We should only consider estimates from the best studies.[902] Further, NERA previously submitted:[903]

> [t]his criticism is puzzling because tests of the null that an unconditional risk premium is constant through time typically lack power. In other words, uncovering evidence of instability in risk premiums is generally difficult. This is because realised risk premiums are noisy.

We do not consider there are clear objective grounds to distinguish the 'best' studies. McKenzie and Partington supported this view.[904] While SFG argued that one methodology to estimating the Fama-French model is superior to other methodologies, we disagree.[905] We consider there is no agreed best methodology. McKenzie and

900 Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 25. Partington reviewed submissions made after this report and concluded that they do not change his conclusions (see: Partington & Satchell, *Report to the AER: return on equity and comment on submissions in relation to JGN*, May 2015, p. 6).

901 NERA, *The Fama-French Three-Factor Model: A Report for the ENA*, October, 2013, p. 24; NERA, *Return on Capital of a Regulated Electricity Network: A report for Ashurst*, May 2014, pp. 99–103.

902 SFG, *Using the Fama–French model to estimate the required return on equity*, February 2015, p. 2; SFG, *The Fama-French model*, 13 May 2014, p. 24. SFG suggests that the AER should use an approach akin to that in Brailsford, Tim, Clive Gaunt and Michael O’Brien (2012a), ‘Size and book-to-market factors in Australia’, *Australian Journal of Management*, 37, pp. 261–81.

903 NERA, *The Fama–French Three–Factor Model A report for the ENA*, October 2013, p. 31.

904 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 18; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 38.

905 SFG, *The Fama-French model*, 13 May 2014, p. 24.

Partington supported our position by questioning what the objective criteria to determine the best studies are.[906]

B.3.2 Fama-French factors may not reflect ex ante priced risk

The Fama-French model estimates average returns in the cross-section. McKenzie and Partington made the important point that, "the FFM is used to estimate the average return in the cross section and the benchmark regulated network service provider is not average given its relatively low economic risk".[907]

We are not satisfied the Fama-French model is helpful for our regulatory task because:

- We consider that whether factors are priced in the cross-section is unresolved. SFG referred to a number of possible explanations for why the value factor could be genuinely priced in average returns in the cross section.[908] However, none of the possible reasons is commonly accepted.[909]
- Even if we accepted that the factors were priced in the cross-section, McKenzie and Partington question the appropriateness of applying average returns in the cross-section to the benchmark efficient entity. Even if factors are priced in the cross-section, this does not necessarily imply that the benchmark efficient entity requires compensation above the level provided for under the Sharpe-Lintner CAPM.

Some service providers previously noted our concern that the Fama-French model is not clearly estimating ex ante required returns is 'curious'.[910] Frontier added that the

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906 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 18; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 38.

907 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, p. 18.

908 These include the risk of financial distress, exposure to changes in expected economic growth and asymmetric exposure to market conditions. See SFG, *The Fama–French model*, 13 May 2014, pp. 30–32.

909 SFG observed that these three theories, 'is not an exhaustive list of specific theoretical explanations for the performance of the Fama-French model. It represents three prominent theories that have empirical support. In the two decades since the publication by Fama and French (1993) an exhaustive literature has been devoted to theoretical explanations for the explanatory power of SMB and HML'. See SFG, *The Fama–French model*, 13 May 2014, p. 32. McKenzie and Partington discussed this in *Report to the AER, Part A: Return on equity*, October 2014, pp. 15–19, where they referenced Lewellen, Nagel and Shanken's observation that, 'one gets the uneasy feeling that it seems a bit too easy to explain the size and B/M effects'. See Lewellen, Nagel and Shanken, ''A sceptical appraisal of asset pricing tests', *Journal of Financial Economics*, 2010, 96, p. 175.

910 CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 294; ; Powercor, *Revised regulatory proposal 2016–2020,* January 2016, p. 288; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 69; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 50; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 55–56 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 55; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp, 49–50; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 126–128.

rationale for using the Fama-French model is no different to the rationale for using the Sharpe-Lintner CAPM or Black CAPM - that is, to explain the cross-section of stock returns, based on explanatory factors that have been observed to correlate with stock returns in the past. HoustonKemp also noted that the Fama-French model was developed to address mis-pricing on low-cap and value stocks.[911]

We note that some service providers and their consultants' criterion for selecting an asset pricing model appears to be how well it forecasts subsequent realised returns using asset pricing tests.[912] However, Partington and Satchell advised that it is the equilibrium expected returns that we want to measure when determining the cost of capital.[913] They added that forecasting stock returns and determining equilibrium expected returns (asset pricing) are two different tasks.[914]

We also note that the results of asset pricing tests such as those by Kan, Robotti and Shanken depend upon the characteristics used in sorting stocks into portfolios when undertaking asset pricing tests.[915] Partington and Satchell noted that in multiple model comparisons, the Fama-French model is rejected in tests using portfolios sorted by size and beta.

B.4 Dividend growth model

Dividend growth models use forecasts of a business' dividends to derive the return on equity by making the assumption that the present value of these dividends is equal to

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AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 210–211.

911 HoustonKemp, *The cost of equity: response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks,* January 2016, p. 5.

912 CitiPower, *Revised Regulatory Proposal 2016–2020*, January 2016, p. 286, 292; Powercor, *Revised regulatory proposal 2016–2020,* January 2016, pp. 280, 286; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp.57–60, 66–67; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 41–45, 50; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 46–50, 54–55 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 46–51, 54–55; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 41–50; APTNT, *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 68–73. AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 214–215, 217, 250–263.

913 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 40.

914 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 38. Partington and Satchell noted that , for example, adding a momentum factor to the Fama and French three factor (FF3) model improves the power of the model to forecast returns, but the regulated businesses while arguing for the FF3 model do not suggest that momentum determines the cost of capital for long term projects. Since momentum is short lived it is not appropriate as a determinant of equilibrium expected returns in the long term.

915 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 46-48.

the business' market value of equity. Dividend growth models may come in many different forms. Our preferred construction of the dividend growth model is set out in section D.3. Dividend growth models typically require forecasts of dividends for a defined future period, and a rate at which dividends are forecast to grow in the long-term after the forecast period has ended.

We consider the point estimates of the return on equity from dividend growth models are currently unsuitable for:

- estimating the return on equity for the benchmark efficient entity
- performing a cross check on whether other models (including the Sharpe-Lintner CAPM) are producing reasonable estimates of the return on equity.

Our reasons for this position are:

- There is insufficient data on dividend forecasts to form robust estimates of the required return on equity for Australian energy network service providers.[916] As such, there are practical difficulties in constructing credible datasets for implementing industry specific dividend growth models.[917] Also, there are too few Australian businesses to estimate dividend growth models on an individual business level.[918] However, a sufficiently robust data series exists for dividend yields for the Australian market as a whole.
- We do not consider that there is a sufficiently robust method for estimating the long-term dividend growth rate for Australian energy network service providers.[919] However, there are developed methods for estimating the long-term growth rate of dividends for the Australian market as a whole.[920]
- Dividend growth models can have limited robustness given they are highly sensitive to input assumptions regarding short and long-term dividend growth rates. This makes the models highly sensitive to potential errors in inputs. Further, dividend growth models may generate counter-intuitive results. For example, we have observed that, over extended periods of time, dividend growth models generated significantly higher average returns on equity for Australian energy network businesses than for the Australian market as a whole. We consider this fails a sanity test as the systematic risk of network businesses is likely less than the overall market.[921]
- Dividend growth model estimates may be upwardly biased due to:

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916 AER, *Explanatory Statement to the rate of return guideline (appendices)*, December 2013, p. 15.

917 AER, *Explanatory statement rate of return guideline (appendices)*, December 2013, p. 77.

918 AER, *Explanatory statement rate of return guideline (appendices)*, December 2013, p. 119.

919 AER *Explanatory statement rate of return guideline (appendices)*, December 2013, p. 15.

920 For example, see: M. Lally, *The dividend growth model*, 4 March 2013; CEG, *Response to AER Vic gas draft decisions internal consistency of MRP and risk free rate*, November 2012; and CEG, *Update to March 2012 report: On consistency of the risk free rate and MRP in the CAPM*, November 2012.

921 AER, *Explanatory statement rate of return guideline (appendices)*, December 2013, p. 120-122.

- The well-understood upwards bias in analyst forecasts.[922]
- Slow-changing dividends, which is a well-understood phenomenon in financial theory and empirically supported by survey evidence.[923] There is likely to be an asymmetry in the effects because of a greater reluctance to cut dividends than increase dividends.[924]
- The currently relatively low risk free rate. Lally observed that if dividend growth models do not incorporate a term structure, these will produce upwardly biased estimates when the risk free rate is low relative to its long term average, and expected to increase in a future period.[925]
- Financing arrangements. Where there is significant financing of dividends and/or where substantial investment demand for funds is anticipated, there is a risk that dividend growth will slow or even turn negative for a period. This is likely to result in the model producing upwardly biased estimates.[926]

The first two concerns listed above are not relevant when using the dividend growth model to estimate the market risk premium. We therefore consider that dividend growth model estimates may be more useful for informing our estimate of the market risk premium. However, in doing so, we note that the other limitations set out above are likely to remain relevant. For these reasons, we place only limited reliance on dividend growth model estimates of market risk premium.

We note much of this material was considered in our April and June 2015 decisions and reviewed by McKenzie, Partington, and Satchell (Partington and Satchell maintained the positions set out by McKenzie and Partington).[927] They were resubmitted for our decisions in May, July and August 2016.

Having reviewed all this material, McKenzie and Partington supported our decision to not use the dividend growth model to directly estimate the return on equity on the benchmark efficient entity. They also supported limiting the use of the dividend growth model to informing the estimate of the market risk premium.[928] However, they raised

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922 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 26, 31; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 46, 51; McKenzie and Partington, *The DGM*, December 2013, pp. 8–9. Also see Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 43.

923 See, A. Brav, *Payout policy in the 21st century*, May 2005.

924 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 29–30; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 49–50.

925 Lally, *Review of the AER's proposed dividend growth model*, 16 December 2013, pp. 11–12.

926 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 27–29; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 47–49.

927 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 26–40; Partington, *Report to the AER: Return on equity (updated), April 2015*, p. 12; Partington & Satchell, *Report to the AER: return on equity and comment on submissions in relation to JGN*, May 2015, p. 6; Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations,* October 2015, p. 15.

928 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 39–40; Partington, *Report to the AER: Return on equity (updated), April 2015*, pp. 58–59.

the concerns around the reliability of dividend growth model that we have outlined above.[929] While we use the dividend growth model to inform the estimate of the market risk premium, we also take these concerns into account.

Handley also reviewed submissions on the dividend growth model and stated that the model involves estimating an unobservable expected growth rate:[930]

> Notwithstanding the solid DCF [discounted cash flow] foundation upon which it is based, DGMs are not a panacea for the challenges associated with using an asset pricing model to estimate the return on equity. Arguably DGMs simply transfer the uncertainty and difficulties in estimating the parameters in an asset pricing model to uncertainty and difficulties in estimating the expected future dividend stream and in particular in estimating the expected growth rate in dividends

Handley showed that the return on equity estimated using a constant-growth version of the dividend growth model simply equalled the expected dividend yield next period plus the growth rate.[931] Handley then stated that he considered it unclear whether the return on equity estimates from two and three stage models would be any more meaningful.[932]

Malko submitted that the wide acceptance of dividend growth models in the US demonstrates that this model is sufficiently robust to be useful in economic regulatory decision making.[933] However, we note Malko's admission that current corporate and academic practices are less supportive of the use of dividend growth models alone in estimating a rate of return and consider that other information should also inform the decision'.[934]

During our previous tranche of regulatory decisions, we did not receive any substantively new evidence to alleviate our concerns that the dividend growth model cannot reliably estimate return on equity for individual firms or sectors.[935] There was no

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929 McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 26–36; Partington, *Report to the AER: Return on equity (updated), April 2015*, pp. 46–56.

930 Handley, *Advice on the return on equity*, 16 October 2014, pp. 13–14.

931 Handley, *Advice on the return on equity*, 16 October 2014, p. 14.

932 Handley, *Advice on the return on equity*, 16 October 2014, p. 15.

933 Malko Energy Consulting, *Statement of Dr J. Robert Malko*, June 2015, pp. 4–5.

934 Malko Energy Consulting, *Statement of Dr J. Robert Malko*, June 2015, pp. 4–5.

935 CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 286–298; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 280–292; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 64–72; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 47–52; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 52–58 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 52–58; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 39–40, 46–52; APTNT, *Amadeus Gas Pipeline access arrangement revision proposal*, August 2015, pp. 120–123.; Frontier Economics, The *required return on equity under a foundation model*

compelling evidence that dividend growth model estimates of market risk premium are not upwardly biased. AusNet Services has not provided any substantively new evidence.[936]

We consider that dividend growth models are likely to be biased in the current market, due to concerns about slow-changing dividend forecasts, bias in analysts' forecasts, and to the extent that there is a term structure for the return on equity. Partington and Satchell also share our concerns on these issues.[937]

Our response to submissions on bias in the dividend growth model is set out in section D.4.

SFG's construction of the dividend growth model and approach to using the model to estimate return on equity has been supported by some service providers in the past. [938] We consider that SFG's dividend growth model approach is unlikely to provide reliable estimates of the return on equity or market risk premium. Our concerns are detailed in section B.4.1 below.

B.4.1 SFG's construction of the dividend growth model

SFG and several service providers have previously criticised our position in the Guideline and our April and June 2015 decisions to limit the role of the dividend growth model to informing the market risk premium, rather than also considering dividend growth model to inform the overall return on equity.[939] SFG submitted its construction

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approach – Report prepared for Jemena Electricity Networks, ACTEWAGL Distribution, AusNet Services, Australian Gas Networks, CitiPower, Powercor and United Energy, January 2016, pp. 17-20 & 28–31. Service providers instead submitted that our foundation model approach prevents us from having any real regard to the dividend growth model and to conclude erroneously that the Sharpe-Linter CAPM is the superior return on equity model and produces unbiased estimates. We respond to this submission in section A. Service providers also submitted that SFG's construction of the dividend growth model is robust, we assess SFG's model in section B.4.1. AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 200–223, 244–250.

936 AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022: Revised revenue proposal*, 21 September 2016, pp. 147–154.

937 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, pp. 27–28.

938 Service providers submitted several SFG reports on this DGM construction. For the most recent report, see SFG, *Share prices, the DDM and the cost of equity for the market and a benchmark energy network*, February 2015.

939 ActewAGL, *Access Arrangement Information for the 2016-21 ACT, Queanbeyan and Palerang Access Arrangement, Appendix 8.02: Return on equity-detailed proposal, Submission to the Australian Energy Regulator*, June 2015, p. 45–50; APTNT, *Amadeus Gas Pipeline: Access Arrangement Revision Proposal*, August 2015, p. 136–138; AGN, *2016/17 to 2020/21 Access Arrangement Information, Attachment 10.1: Rate of Return*, July 2015, p. 43–44; AusNet Services, *Regulatory proposal 2016-20*, 30 April 2015, p. 331–333; United Energy, *2016 to 2020 Regulatory Proposal,* April 2015, pp. 117–120; CitiPower, *Regulatory proposal 2016-2020*, April 2015, p. 221–224; Powercor, *Regulatory proposal 2016-2020*, April 2015, p. 229–232; Energex, *2015-20 revised regulatory proposal*, July 2015, p. 96–97 & 101–103; Ergon Energy, *Regulatory Proposal 2015-20 (revised), Appendix C: Rate of Return*, July 2015, p. 146–147; SAPN, *Revised Regulatory Proposal 2015-20*, July 2015, p. 368; Jemena Electricity Networks (Vic) Ltd, *2016-20 Electricity Distribution Price Review Regulatory Proposal, Attachment 9-2, Rate of return proposal,* April 2015, p. 81–85.

of the dividend growth model could produce estimates that we could use for the Australian market as a whole, and at the industry level.[940] However, we consider SFG has overstated the ability of its dividend growth model to provide robust return on equity estimates at the industry level.

In SFG's 2014 analysis, there are 99 return on equity estimates using analyst forecasts for the network businesses over the period 2002 to 2014, based on a six month averaging period.[941] This is a small sample size, relative to the sample size for estimating the return on equity for the market as a whole. There are few analyst data because there are few network businesses listed on the Australian stock exchange. There is also limited analyst coverage of Australian network businesses. Given the relatively small sample of analyst forecasts available on Australian network businesses, we consider it is difficult to derive a sound return on equity estimate for these businesses using dividend growth models.

In SFG's 2015 report, it changed its approach to use a two month averaging period. In SFG's 2015 analysis, there are 235 return on equity estimates using analyst forecasts for the network businesses over the period 2002 to 2014.[942] This is a larger sample size than that used in its 2014 analysis. However, we consider it is still a small sample size relative to the sample size for estimating the return on equity for the market as a whole. We also maintain our above considerations on SFG's average risk premium ratio (or effective equity beta). Moreover, we consider SFG's new approach of using a two month averaging period may introduce errors because of a lack of data. For example, in SFG's sample, there are six two month periods where there were no analyst forecasts for energy network businesses.[943]

SFG estimates the return on equity for an energy network firm in a given two month period by averaging over all the return on equity estimates implied by all analyst forecasts for that firm over the two month period. If a particular analyst made more than one forecast for that firm in the two month period, then the use of a simple average means that analyst will be given more weight in the return on equity estimate compared to an analyst that makes only one forecast on that stock in a two month period. Further, firms that have more analyst coverage will have more two–monthly return on equity estimates and hence will receive more weight than firms that have less analyst coverage. Therefore, we consider that SFG's dividend growth model gives energy network firms with more analyst coverage greater weight.

AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 196–223.

940 SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, 15 May 2014, p. 2; SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015, pp. 30–33.

941 SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, 15 May 2014, p. 58.

942 SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015, pp. 30–31.

943 SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015, pp. 40–41.

We also note that SFG's approach does not entail directly estimating the return on equity for the using the dividend growth model. Rather, SFG applies its dividend growth model to produce a market risk premium estimate and a ratio of energy networks' risk premiums relative to the market risk premium (an indirect equity beta estimate). The method used to estimate the average risk premium ratio is not aligned with the definition of equity beta. The equity beta is the covariance between the return on the market and the return on a business divided by the variance of the market. We consider that, in doing so, SFG has overstated the ability of its dividend growth model to reliably estimate the return on equity directly. SFG is effectively using its dividend growth model to estimate the market risk premium to incorporate into a Sharpe-Lintner CAPM.

McKenzie and Partington also raised specific concerns about the simultaneous estimation approach applied by SFG for the service providers. They indicated that this application of a dividend growth model could generate virtually any return on equity estimate through model specification choices.[944]

SFG submitted its dividend growth model is more reliable and less volatile than our model.[945] However, this perception of stability is subjective and we do not agree with it. Figure 3-6 illustrates this point by showing three time series:[946]

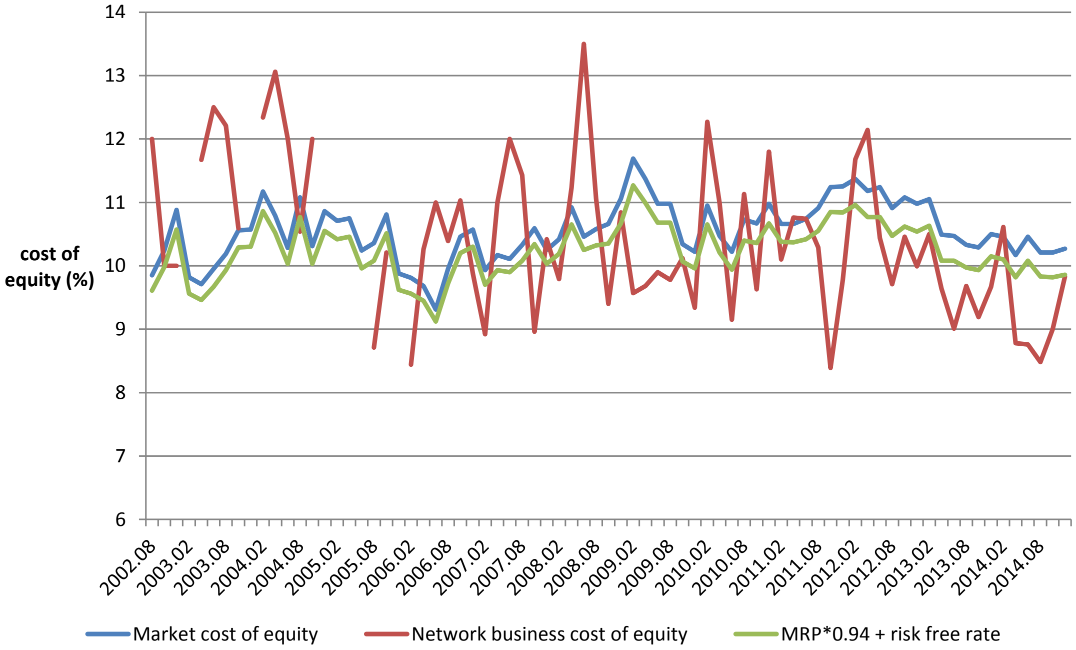
- the return on equity for the market determined by SFG's model (blue line)
- the return on equity for network businesses determined by multiplying the market risk premium from SFG's model by 0.94 then adding the prevailing risk free rate (green line)
- the return on equity for network businesses determined by directly applying SFG's model (red line).

[944] McKenzie and Partington, *Report to the AER part A: Return on equity*, October 2014, pp. 34–36; Partington, *Report to the AER: Return on equity (updated), April 2015*, pp. 53–56.

[945] SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, 15 May 2014, pp. 48, 57, 65; SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015, pp. 24, 27, 31.

[946] This is based on SFG's 2015 analysis, which uses a two month averaging period. A similar chart based on SFG's 2014 analysis can be found in our November draft decisions. For example, see: AER, *Draft decision: ActewAGL distribution determination 2015–16 to 2018–19—Attachment 3: Rate of return*, November 2014, p. 231.

Figure 3-6 Movements in SFG's dividend growth model



Source: SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015, pp. 40–41; AER analysis.[947]

Note: SFG calls the market value return on equity, the 'cost of equity'. This is the concept we refer to throughout this decision as the 'return on equity'.

The gaps in the red line are the result of periods where there were no analyst forecasts for energy network businesses. Therefore, the return on equity for network businesses could not be estimated for these periods.

Figure 3-6 illustrates that direct estimates of the return on equity for network businesses using SFG's dividend growth model (red line) are volatile. Whereas, by construction, SFG's indirect estimates of the return on equity for network businesses using a hybrid CAPM / dividend growth model are more stable (green line). SFG and service providers only proposed indirect estimates. SFG's indirect approach results in a return for the industry that precisely mirrors movements in the market. SFG's indirect approach is predisposed to this outcome because of its construction. It is not clear to us that this outcome is a reasonable reflection of expected returns for the industry.

B.5 Wright CAPM and historical CAPM

947 We were unable were unable to replicate SFG's market risk premium, network risk premium and risk premium ratio series in Table 3 of its report because there appears to be an error in the risk free rate series presented by SFG. In Table 3 of SFG's report, the risk free rate series is identical to the market risk premium series. See: SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015, pp. 40–41 (table 3). We also note that this figure does not contain any more recent data as SFG has not updated its dividend growth model since its February 2015 report.

The Wright CAPM is an alternative implementation of the Sharpe-Lintner CAPM. This is where the return on the market portfolio and the risk free rate are estimated as separate components of the market risk premium. The following equation represents this relationship:

$$ke = rf + \beta e \times (rm - rf)$$

Where: ke is the expected return on equity

rf is the risk free rate

βe is the equity beta

rm is the expected return on the market

Typically, under the Wright approach the return on the market is estimated using historical data, while a prevailing risk free rate is estimated. Under an historical specification of the CAPM, both the return on the market (or market risk premium) and the risk free rate is estimated by reference to long-run historical data.[948]

APTPPL and APA estimated the market risk premium as the difference between the current risk free rate and the long term historical average of the return on market.[949]

We note APTPPL and APA dispute that they use the Wright CAPM. However, they use historical data to estimate the return on the market and prevailing data to estimate the risk free rate. Their use of the long term average of market returns is based on the ERA's observation about the Wright approach being mean reverting.[950] Their approach implies a perfectly negative relationship between movements in the risk free rate and the market risk premium which is similar to that under the Wright CAPM. They also use our Wright CAPM's return on market estimate to determine the market risk premium.

Partington and Satchell have also observed inconsistencies in APA's proposal where it adopts aspects of the Wright approach despite claiming otherwise. For example:[951]

- APA assumes stability of the market rate of return over time.
- APA assumes there is an inverse relatonship between the market rate of retrun and the intererst rate.

As a result, we consider that APTPPL's and APA's approach shares similarities to a Wright CAPM and is at the very least a historical/alternative specification of the CAPM (if not a Wright CAPM). Many other service providers previously proposed using the

948 For example, see: Ausgrid, *Regulatory proposal 1 July 2014 to 30 June 2019*, 30 May 2014, p. 79.

949 APTPPL, *2017-22 RBP Access Arrangement revision submission*, September 2016, p. 156-157;

950 APTPPL stated that the ERA found stationarity in the market return on equity series. However, the ERA actually found the series to be mean reverting. APTPPL, *Roma to Brisbane Pipeline access arrangement submission 2017-2022*, September 2016, pp. 157; ERA,

951 For example, the inverse relationship between the equity risk premium and the interest rate and assuming stability of the return on the market over time. Partington and Satchell, *Report to the AER: Discussion of submission on the cost of equity,* 8 June 2017, pp. 45–47.

underlying premise of the Wright CAPM and historical CAPM– that the market return is relatively constant – when estimating market risk premium.[952]

We consider the point estimates of the return on equity from these non-standard specifications of the Sharpe-Lintner CAPM are currently unsuitable for:

- estimating the return on equity for the benchmark efficient entity
- performing a cross check on whether other models (including the Sharpe-Lintner CAPM) are producing reasonable estimates of the return on equity.

Our reasons for this position are:

- The models are not theoretically justified. The Sharpe-Lintner CAPM is a forward-looking equilibrium asset pricing model and therefore requires forward looking input parameters.[953]
- The models do not take into account changing market conditions. Therefore, they are unlikely to (at a given point in time) estimate an unbiased forward-looking estimate of the required return on equity. Historical data may be used as a basis for estimates of the model's parameters where they are good evidence of forward-looking parameters. However, we do not consider using historically based estimates that are clearly not representative of the forward looking rate will result in an unbiased estimate of the return on equity.[954]

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952 For example, see: CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 309–310; AER, *Preliminary decision: CitiPower determination 2016 to 2020: Attachment 3 – Rate of return*, October 2015, p. 507–510; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 303–304; AER, *Powercor Preliminary Decision - Attachment 3: Rate of Return*, October 2015, p. 507–508; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 82–83; AER, *Draft decision ActewAGL distribution determination 2016 to 2021: Attachment 3 – Rate of return*, November 2015, pp. 520–522; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, p. 61; AER, *Preliminary decision United Energy determination 2016 to 2020: Attachment 3 – Rate of return*, October 2015, p. 510–512; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, p. 66; AER, *Draft decision Australian Gas Networks access arrangement 2016 to 2021– Attachment 3: rate of return*, November 2015, pp. 516–518; AER, *Draft decision Amadeus Gas Pipeline access arrangement 2016 to 2021: Attachment 3–Rate of return*, November 2015, pp. 519–522; See also: CEG, *WACC estimates: A report for NSW DNSPs*, May 2014, pp. 6–10; CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015; NERA, *Return on Capital of a Regulated Electricity Network: A report for Ashurst*, May 2014, p. 81; Frontier, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, pp. 10, 28–32, 54–55; Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, p. 34.; APTPPL, *2017-22 RBP Access Arrangement revision submission*, September 2016; Frontier Economics, *The Market Risk Premium*, September 2016; AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revenue review 2017–22*, 21 September 2016

** Bringham and Daves state, 'The CAPM is an ex-ante model, which means that all of the variables represent before-the-fact, expected values'. See Bringham and Daves, *Intermediate financial management*, Ed. 10, Cengage Learning, 2010, p. 53.

954 McKenzie and Partington advised 'the current market return on equity, as given by the CAPM, requires estimates of the current risk free rate and the current market risk premium. The current risk free rate is readily estimated as the current yield on CGS of appropriate maturity'. See McKenzie and Partington, *Review of the AER's overall approach to the risk free rate and MRP*, February 2013, p. 30.

- We consider that no compelling empirical evidence is before us to support the use of the models. We do not agree with the underlying premise of the Wright CAPM that there is a clear inverse relationship between movements in the risk free rate and market risk premium. Frontier submitted that empirical evidence from Wright & Smithers indicates that the return on the market using U.S. data has been relatively stable over time.[955] However, applying Wright's approach to Australian data, Lally found the estimated market risk premium series is more stable than the average real market return series.[956]
- Market practitioners, academics or regulators do not generally accept these models.[957] For example, an analysis of 78 suitable independent valuation reports over May 2013 to January 2016 indicates there are no reports that appear to use the Wright CAPM.

Handley considered the Wright CAPM and stated:[958]

> It appears to be based on two main ideas. First, a claim that the standard approach is internally inconsistent as it purportedly uses a different estimate of the risk free rate for the purposes of estimating the MRP.[959] But this is not correct. As discussed above, the item being estimated under the standard approach and the item being substituted into (6) is the MRP. It is a single estimate of a single item. It is not an estimate of the expected return on the market and an estimate of the risk free rate. Second, Wright draws on previous work by Wright, Mason and Miles (2003) which in turn draws on work by Siegel (1998) to conclude that:
>
> > "regulators should work on the assumption that the real market cost of equity is constant … as a direct consequence, whatever assumption is made on the risk free rate, the implied equity premium must move point by point in the opposite direction.[960]
>
> The theoretical justification for such an assumption is far from clear whilst the empirical evidence that is presented is not compelling. More importantly, this is a proposition whose widespread use and acceptance is yet to be established. Until then (if at all), there is no compelling reason to move from the standard approach to estimation.

955 Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016, pp. 13-14.

956 Lally found the standard deviation of average real market returns is 1.5 per cent. The standard deviation for the average real government bond yield is 1.4 per cent. For the estimate MRP time series, it is 0.9 per cent. These standard deviations imply the average real market return is considerably more volatile than that for the estimated MRP. Lally, *Review of the AER's methodology*, March 2013, pp. 12–16.

957 For example, the Wright CAPM's main use appears to be for regulatory purposes in the UK. See Wright, *Review of risk free rate and cost of equity estimates: A comparison of UK approaches with the AER*, October 2012.

958 Handley, *Advice on the return on equity*, 16 October 2014, pp. 17–18.

959 CEG, *WACC Estimates: A report for NSW DNSPs*, May 2014, pp. 3–4.

960 Wright, S., 2012, *Review of risk free rate ad cost of equity estimates: A comparison of UK approaches with the AER*, 25 October 2012, pp. 2–3.

We note that Handley's comments appear equally applicable to the 'long term' Sharpe-Lintner CAPM specification proposed by a number of service providers.

While we have used a range from the Wright CAPM to inform the overall return on equity, we have placed little reliance on this information given our concerns outlined above.[961]

AusNet resubmitted that the Wright CAPM is relevant to the estimation of the market risk premium, rather than the overall return on equity.[962] We compare our foundation model equity risk premium to the Wright CAPM equity risk premium. This provides for consideration of both market risk premium and equity beta estimates, as the equity risk premium is the product of both estimates. We do not consider the Wright CAPM when estimating market risk premium. We consider that doing so would be unnecessary, and may place too much weight on the Wright CAPM given our concerns with it as set out above.

Partington and Satchell advised that they are 'unconvinced by the Wright approach' for estimating the market risk premium and recommend that we give it little weight.[963] The noted that the Wright CAPM is has no 'well accepted theoretical support', 'does not seem to be much used, if at all, in practice' and 'runs contrary to the well accepted view that asset prices are inversely related to interest rates'.

Partington and Satchell, in advised that the 'Wright approach has no support based on any clear evidence in the Australian context'.[964]

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961 This is for the same reasons stated in the appendices to the Guideline's explanatory statement and in our subsequent decisions. AER, *Explanatory statement to the rate of return guideline (appendices)*, 17 December 2013, pp. 24–28; AER, *Final decision JGN Access arrangement 2015–20, Attachment 3*, June 2015, pp. 83–88, 284–289.

962 CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 307, 309–310; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 301, 303–304; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 82–83; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, p. 61; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 66; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 66–67; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp.59–60; APTNT stated that it did not make submissions about the Wright approach in its original October 2015 submission. However, we note that APTNT's explanation of its original proposal for estimating the MRP is effectively an implementation of a Wright CAPM, see: *Amadeus Gas Pipeline Access arrangement revised proposal: response to Draft Decision,* January 2016, pp. 65–68.
AusNet Services*, AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022*, 30 October 2015, pp. 226, 232, 250, 252, 254 & 263.
AusNet Services, *AusNet Transmission Group Pty Ltd transmission revenue review 2017–2022: Revised revenue proposal,* 21 September 2016, p. 151

963 Partington and Satchell, *Report to the AER: Cost of equity issues–2016 electricity and gas determinations*, April 2016, p. 31.

964 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 28.

Further, Partington and Satchell observed the Wright approach leads to 'implausible' estimates of the market risk premium (due to its unlikely assumptions) which 'seems unlikely' when market volatility is particularly low as it currently stands.[965]

[965] Partington and Satchell, *Report to the AER: Discussion of submission on the cost of equity,* 8 June 2017, pp. 45–47.

C Historical stock returns

This appendix examines realised returns to Australian listed equity (stocks) as a proxy for the historical return on the portfolio of all equity in the market. We examine both total returns and excess returns. Excess returns are the realised returns[966] that stocks have earned in excess of the returns on government bonds with a ten-year term-to-maturity.

Our dataset and methodology is based on Brailsford, Handley, and Maheswaran (Brailsford et al).[967] A detailed discussion on data and methodology can be found in Brailsford et al, our Guideline, and attachment 3 to our draft decision for AusNet Services' 2016-20 distribution determination.

In the remainder of this section we examine:

- Prevailing estimates for both excess returns and total returns.
- The relative merits of arithmetic and geometric averages of historical returns.
- The relative merits of the ASX's adjustment and NERA's adjustment to historical stock returns data.

C.1 Prevailing estimates: excess returns

Table 3-21 sets out our estimates of historical excess returns, measured using both arithmetic and geometric averages, and estimated over different sample periods up until the 2015 calendar year end.[968] Arithmetic average measures range between 5.8 and 6.4 per cent and geometric average measures range between 4.1 and 4.9 per cent.

Table 3-21 Historical excess returns (per cent)

Sampling period	Arithmetic average	Geometric average
1883–2016	6.3	4.9
1937–2016	5.9	4.1
1958–2016	6.4	4.1

966 The Sharpe-Lintner CAPM is an equilibrium pricing model and hence the market risk premium parameter of the model should reflect the premium that investors require in a market in equilibrium. In this section, we examine returns that have been realised in practice, over periods in which the market may not have been in equilibrium. This data is used for practical reasons - the ex-ante required return of investors is not observable. We consider that realised returns remain a reliable indicator of investor expectations in market equilibrium.

967 Brailsford, Handley, Maheswaran, 'Re-examination of the historical equity risk premium in Australia', *Accounting and Finance*, Vol. 48, 2008, pp. 76–77, 85–86.

968 We have traditionally taken historical excess returns as a calendar year-end estimate. For consistency, and given these change slowly throughout time, we maintain this convention.

1980–2016	6.3	4.1
1988–2016	5.8	4.3

Source: Handley, *An estimate of the historical equity risk premium for the period 1883 to 2011*, April 2012, p. 6. AER update for 2012–2016 market data.

Notes: Based on a theta of 0.6.

C.2 Prevailing estimates: total returns

Table 3-22 sets out our estimates of historical returns on the market portfolio. The nominal return ranges from 10.0 to 12.5. We use a range because the estimated return on the market will vary depending on the time period used.[969]

Table 3-22 Historical returns on the market portfolio (per cent)

Sampling period	Market return (real)	Market return (nominal)
1883–2015	8.6	11.3
1937–2015	7.3	10.0
1958–2015	8.8	11.5
1980–2015	9.8	12.5
1988–2015	9.1	11.8

Source: Handley, *An estimate of the historical equity risk premium for the period 1883 to 2011*, April 2012, p. 6. AER update for 2012–2016 market data.

Notes Historical market returns are estimated using arithmetic averages, assuming a theta value of 0.6, and assuming an inflation rate of 2.5 per cent. Nominal figures calculated by the AER using the Fisher equation: $1+i=(1+r)\times(1+\pi)$ where r denotes the real return, i denotes the nominal return and π denotes the inflation rate.

We estimate a return on equity under the Wright CAPM[970] by combining the historical nominal market return with our prevailing risk free rate estimate[971] and equity beta estimates.[972] As shown in Table 3-23, our estimated range for equity beta and market return results in Wright CAPM return on equity estimates ranging from 5.5 to 9.6

969 AER, *Explanatory statement: Rate of return guideline (appendices)*, December 2013, pp. 26–27.

970 See section B.5 for details on the Wright CAPM.

971 Our risk free rate estimate is 2.52 per cent.

972 Our estimated range for equity beta is 0.4 to 0.7. For more detail, see section 3.4.1.

C.3 Arithmetic and geometric averages

Table 3-23 Wright CAPM return on equity (per cent)

AER equity beta estimate	Wright CAPM return on equity based on 10.0 market return	Wright CAPM return on equity based on 12.5 market return
0.4	5.6	6.6
0.7	7.8	9.5

Source: AER analysis.

Notes: Based on a placeholder risk free rate estimate of 2.6 per cent.

Historical excess market returns are sensitive to the method of averaging returns over multiple periods. The arithmetic average return is the simple average annual return. The geometric average return is the average compounded annual return.[973]

In estimating the market risk premium, we have regard to both arithmetic and geometric average historical excess returns. We set out our reasoning in our final decision for Jemena Gas Networks (JGN), and this material remains relevant.[974] We also note that Partington and Satchell support our position to have regard to both types of average historical excess returns.[975] Overall, our decision is informed by the following considerations:

- We consider the arithmetic average of 10-yearly historical excess returns could be an unbiased estimator of a forward looking 10 year return. However, to obtain a sufficiently large dataset, historical excess returns are estimated as the arithmetic or geometric average of annual returns. Since annual historical excess returns are variable, their arithmetic average will overstate the arithmetic average of 10 year historical excess returns. Similarly, the geometric average of annual historical excess returns will understate the arithmetic average of 10 year historical excess returns.[976]

[973] The arithmetic average is measured as the sum of N numbers divided by N. The geometric average is measured as the Nth root of the product of N numbers.

[974] AER, *Jemena Gas Networks final decision 2015-20: Attachment 3—Rate of return*, June 2015, pp. 333–338.

[975] Partington and Satchell, *Report to the AER: Cost of equity issues–Final decisions for the VIC DNSPs*, April 2016, pp. 51–52.

[976] For an additional example, see AER, *Draft decision: SPI Networks access arrangement*, September 2012, Appendix B.2.1.

- We have previously considered arithmetic and geometric averages relevant when estimating a 10 year forward looking market risk premium using historical annual excess returns.[977] The Tribunal found no error with this approach.[978]
- In their 2014 review for the Office of Gas and Electricity Markets (Ofgem), Wright and Smithers advocated using geometric average returns, adjusted for return volatility on the arithmetic average. Wright and Smithers based their reasoning on the distortions introduced by direct arithmetic averaging.[979] While we do not adopt this approach, this indicates that experts and other regulators consider geometric averages valuable.
- McKenzie, Partington, and Satchell recommended the consideration of both arithmetic and geometric averages, tempered by an understanding of their inherent biases.[980]

In a series of reports, NERA recommended we give no weight to geometric average historical excess returns.[981] In June 2015, NERA submitted a further report on this issue.[982] In January 2016, HoustonKemp submitted a similar report to NERA that also recommended that no weight be given to geometric average historical excess returns.[983]

We consider NERA and HoustonKemp's submissions take a narrow view of the issue. As Partington and Satchell stated in their October 2015 report:[984]

> NERA (2015, History) makes a repeated case that if we are estimating the mean for one period using data over a number of past periods (denoted by T) then they are unaware of any work that suggests the superiority of geometric returns or combinations of geometric or arithmetic returns in situations when the data are iid or correlated. We see no compelling reason why the situation described above is the only one that the AER should consider.

977 For example, see AER, *Final decision: SPI Networks (Gas) access arrangemen*t, March 2013, Part 3, B.5.1.

978 Australian Competition Tribunal, *Application by Envestra Ltd (No 2) [2012] ACompT4*, 11 January 2012, paragraph 157. Also see, Australian Competition Tribunal*, Application by Public interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016.

979 Wright and Smithers, *The cost of equity capital for regulated companies: A review of Ofgem*, 2014, p. 9.

980 McKenzie and Partington, *Report to the AER: Supplementary report on the equity MRP*, 22 February 2012, p. 5; Partington and Satchell, *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015, pp. 16–17; Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 44–45.

981 See, for example: NERA, *Prevailing conditions and the market risk premium: A report for APA Group, Envestra, MultiNet and SP AusNet*, March 2012, pp. 3–16; NERA, *The market, size and value premiums: A report for the Energy Networks Association*, June 2013, pp. 25–30 (NERA, *The market, size and value premiums*, June 2013); NERA, *Historical estimates of the market risk premium*, February 2015, pp. 12–24.

982 NERA, *Further assessment of the historical MRP: Response to the AER's final decisions for the NSW and ACT electricity distributors*, June 2015, pp. 14–28.

983 HoustonKemp, *The Cost of Equity: Response to the AER's Draft Decisions for the Victorian Electricity Distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, pp. 33-38.

984 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 44.

There remains uncertainty over whether an arithmetic or geometric average (or some combination of the two) of historical excess returns provides a better estimate of expected excess returns. The answer to NERA's concern whether geometric or arithmetic averages are better is unclear and not settled amongst academics. Both methods have limitations. This is well summarised by Partington and Satchell:[985]

> So which of these estimates is a better measure of expected returns? Jacquier, Kane and Marcus (2003) claim that academics tend to use the arithmetic return and that practitioners tend to use the geometric return. A more rigorous answer is that the choice depends upon what is assumed to be the distribution of returns through time. Assuming returns over time follow independent identical distributions with a finite variance, then it is widely accepted that the arithmetic average is the appropriate estimator of expected returns. Otherwise, the geometric average has a role to play. It has long been well understood that returns do not conform to the assumption of independent identical distributions, see for example Akgiray (1989). The literature has therefore suggested a weighted sum of the arithmetic and geometric averages be used in estimating the expected return. Unfortunately, there is no generally accepted optimal weighting scheme. In our opinion the use of arithmetic averages alone is likely to result in an upward biased estimate of expected returns and the use of geometric averages alone is likely to result in a downward biased estimate.

In their 2012 report, McKenzie and Partington provided numerous references to academic studies that support this view.[986] They considered that unbiasedness is only one desirable property of an estimator. Another consideration is efficiency, and 'the question then becomes one of trading off bias and efficiency'.[987] We agree with this view.

Moreover, in their October 2015 report, Partington and Satchell demonstrate that, even in the restricted case that NERA presents, the geometric average can be a superior estimator.[988]

HoustonKemp submitted that Partington and Satchell, in their October 2015 report, made an incorrect claim that if the gross return to an asset is lognormally and independently and identically distributed through time, then the arithmetic mean of a sample of gross returns to the asset will provide an upwardly biased estimator of the expected gross return to the asset over a single period while the geometric mean will, for a large gross return, provide an unbiased estimator.[989]

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985 Partington and Satchell, *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015, p. 17.

986 See McKenzie and Partington, *Report to the AER: Supplementary report on the equity MRP*, 22 February 2012, pp. 5–9.

987 See McKenzie and Partington, *Report to the AER: Supplementary report on the equity MRP*, 22 February 2012, p. 8.

988 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 44–45.

989 HoustonKemp, *The Cost of Equity: Response to the AER's Draft Decisions for the Victorian Electricity Distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, pp. 35.

We consider that HouseKemp's 2016 report has incorrectly considered Partington and Satchell's results on geometric and arithmetic mean returns. This is well summarised by Partington and Satchell:[990]

> "We are interested in the term $\exp(\mu) - 1$; which we call the implied arithmetic rate of return. If we knew that the true geometric rate of return is μ then the true arithmetic rate of return is $\exp(\mu) - 1$. This is a property of the parameters of our model and, as yet, involves no notion of expectations of estimators, contrary to any assertions by HoustonKemp. We then consider the extent to which estimators, based on the arithmetic mean and the geometric mean over or under estimate $\exp(\mu) - 1$. We showed that the expected value of the arithmetic mean is $\exp(\mu + \frac{1}{2}\sigma^2) - 1$; independent of the sample size so it is always biased upwards relative to $\exp(\mu) - 1$. We also show that the expected value of the geometric mean= $\exp(\mu + \frac{1}{2T}\sigma^2) - 1$, where T is the size of the sample. This is biased upwards relative to $\exp(\mu) - 1$; but the bias disappears as T gets large. HoustonKemp arrive at the same formula, see equation (23), page 36, but then wrongly assume that the parameter function of interest is $\exp(\mu + \frac{1}{2}\sigma^2)$. The report then asserts that the bias, relative to the wrongly assumed parameter $\exp(\mu + \frac{1}{2}\sigma^2)$, is increasing in T. The HoustonKemp analysis is simply irrelevant."

NERA has questioned the relevance of the Akgiray (1989) and the Jacquier, Kane and Marcus (2003) articles referenced by Partington and Satchell.[991] It considered these articles do not match how we use historical excess returns data. We consider it is the key messages of the articles that are relevant to our analysis and these are more broadly applicable than NERA suggests. If the key messages of an academic article were only relevant to those undertaking precisely the same task, their usefulness would be exceedingly limited. For example, Akgiray's use of daily stock returns does not necessarily limit the relevance of his key message about the temporal behaviour of stock returns.

Frontier Economics have also submitted that no weight should be given to geometric average historical excess returns.[992] Frontier stated that geometric averages do not provide an appropriate estimate of the expected return for the purpose of estimating the market risk premium, notably when forming a range for historical return estimates based on arithmetic averages.[993] This reiterates views from previous reports and submissions from Frontier, SFG and some service providers in past determination

990 Partington and Satchell, *Report to the AER: Cost of equity issues–Final decisions for the VIC DNSPs*, April 2016, pp. 51–52.

991 NERA, *Further assessment of the historical MRP: Response to the AER's final decisions for the NSW and ACT electricity distributors*, June 2015, pp. 19–20.

992 Frontier Economics, *The Market Risk Premium*, September 2016, p.74; AusNet, AusNet transmission Revised Revenue Proposal, 21 September 2016, p 147

993 Frontier Economics, *The Market Risk Premium*, September 2016, P27-28,74

processes.[994] The new report does not provide new evidence except to cite the AER's own concerns with relying solely on the geometric averages as a forward looking estimate of the market risk premium.[995]

Ultimately, we consider there are strengths and weaknesses associated with using arithmetic or geometric averages of historical excess returns to estimate the 10 year forward looking (or expected) market risk premium. We are not satisfied that NERA, HoustonKemp, SFG or Frontier have provided sufficient evidence to support the conclusion that using arithmetic averages of historical excess returns provides a 'materially better estimate' of the market risk premium than an estimate based (solely or in part) on geometric averages, especially considering the weight of evidence we have provided in previous decisions.[996] We agree with Partington and Satchell's conclusion (a reiteration of McKenzie and Partington's 2012 conclusion) that:[997]

> The widespread current practice is to use unadjusted geometric and arithmetic averages. Given the current state of knowledge, we see no strong case to depart from this common practice and recommend the use of both of these metrics, tempered by an understanding of their inherent biases.

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994 See, for example: AER, *Access arrangement draft decision: Multinet Gas (DB No. 1) Pty Ltd Multinet Gas (DB No. 2) Pty Ltd 2013–17—Part 3 appendices*, September 2012, appendix B section B.2.1; AER, *Access arrangement final decision: Multinet Gas (DB No. 1) Pty Ltd Multinet Gas (DB No. 2) Pty Ltd 2013–17—Part 3 appendices*, September 2012, appendix B section B.5.1; AER, A*ccess arrangement draft decision: Roma to Brisbane Pipeline 2012–13 to 2016–17*, April 2012, appendix C section C.1.1; AER, *Access arrangement final decision: Roma to Brisbane Pipeline 2012–13 to 2016–17*, August 2012, appendix B section B.2.1; AER, *Jemena Gas Networks final decision 2015-20: Attachment 3—Rate of return*, June 2015, pp. 333–338.; See SFG, *The required return on equity for the benchmark efficient entity*, February 2015, p. 23; Frontier, *Key issues in estimating the return on equity for the benchmark efficient entity: Report prepared for ActewAGL Distribution, AGN, AusNet Services, CitiPower, Ergon, Energex, Jemena Electricity Networks, Powercor, SA Power Networks, and United Energy*, June 2015, p. 62;

995 Frontier Economics, *The Market Risk Premium*, September 2016, P27-28,

996 NERA, *Historical estimates of the market risk premium*, February 2015, p. 12. Also see NERA, *Further assessment of the historical MRP: Response to the AER's final decisions for the NSW and ACT electricity distributors*, June 2015, p. 14.

997 Partington and Satchell, *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015, p. 17.

D AER's dividend growth model

Dividend growth models use forecast dividends of businesses to derive the return on equity by assuming that the present value of these dividends is equal to the business' market value of equity.[998] Consistent with the rate of return guideline (Guideline), we use dividend growth models to inform our estimate of the market risk premium.[999] However, we consider that limited reliance should be placed on estimates from dividend growth models.

In this appendix we set out:

- Prevailing estimates of the market risk premium using our preferred construction of the dividend growth model.
- Sensitivity analysis surrounding our prevailing estimates.
- Our preferred construction of the dividend growth model.
- Limitations with the use of dividend growth models due to potential upward bias.

D.1 Prevailing estimates

Results in Table 3-24 show that, for the two month period up to end–April 2017, the dividend growth models produce a range of market risk premium estimates between 6.53 to 7.80 per cent.

Table 3-24 Market risk premium estimates under dividend growth models (per cent)

Growth rate	Two stage model	Three stage model
3.8	6.56	6.53
4.6	7.33	7.17
5.1	7.80	7.57

Source: Bloomberg, AER analysis.

Notes: Growth rate is nominal, for more detail on derivation of these long term dividend growth rate estimates see section B.2.1 of Attachment 3 to our preliminary decision for AusNet Services' 2016-20 distribution determination. Market risk premium estimates are based on an assumed theta of 0.6, and a 2 month average (March - April 2017) of analysts' dividend forecasts.

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[998] For clarity, we use the term 'return on equity' in regards to market value. This is consistent with the rest of our decision, and the use of terminology in the rules. In its report on the DGM, SFG uses 'return on equity' in regards to book value and uses the term, 'cost of equity' with regards to market value.

[999] AER, *Explanatory statement rate of return guideline (appendices)*, December 2013, p. 84.

D.2 Sensitivity analysis

We consider that market risk premium estimates from dividend growth models are very sensitive to input assumptions such as the:

- Long term dividend growth rate.
- Period estimates are averaged over.
- Use of analyst forecasts, which are likely to be biased.

For further discussion of these issues see section D.4. In the remainder of this section, we show how sensitive our dividend growth model is to these factors. This is summarised in Table 3-25.

Table 3-25 Sensitivities in the dividend growth model (per cent)

Sensitivity	Two stage model	Three stage model
Baseline 4.6% long-term growth rate 2 month average to end March 2017 unadjusted analysts' forecasts	7.33	7.17
5.1% long-term growth rate	7.80	7.57
3.78% long-term growth rate	6.56	6.53
6 months to end April 2017	7.42	7.40
12 months to end April 2017	7.83	7.89
Analysts' forecast + 10%	7.89	7.57
Analysts' forecast - 10%	6.78	6.63
Combined - low	6.00	5.97
Combined - high	8.88	8.86

Source: Bloomberg, AER analysis.

Notes: All market risk premium estimates are based on an assumed theta of 0.6.

Combined - low is based on 3.78% growth, 2 month averaging, analysts' forecasts - 10%.

Combined - high is based on 5.1% growth, 12 month averaging, analysts' forecasts + 10%.

Long-term dividend growth rate

We use our point estimate growth rate (4.6 per cent) as a baseline. This is based on the mid-point of Dr Martin Lally's (Lally's) estimates.[1000] While the top of Lally's range is 5.1 per cent, McKenzie and Partington have advised that a long term dividend growth

[1000] Lally, *Review of the AER's proposed dividend growth model*, 16 December 2013, p. 14.

rate of 4.6 per cent is on the high side.[1001] McKenzie and Partington considered that the long term dividend growth rate should be 3.73 per cent—or 3.78 per cent, excluding the most extreme values.[1002]

We have not changed our approach set out in the Guideline. We do not adopt a lower long term dividend growth rate.

Averaging period

We based our dividend growth model estimate on data over the February and March 2017 period. Our approach is consistent with the Guideline method. We do not average over several years because this would reduce the tracking ability of our dividend growth model.

As seen in Table 3-25, we use a two month averaging period as a baseline. We also consider a six month averaging period, which is consistent with SFG's dividend growth model.[1003] Having regard to McKenzie and Partington's advice, we also consider a 12 month averaging period.[1004]

Biases in analyst forecasts

McKenzie and Partington advised that dividend growth models are often biased upwards because analysts tend to overestimate dividends in their forecasts.[1005] Partington and Satchell continue to note this limitation in their latest advice.[1006]

To demonstrate the potential impact, we adjusted forecast dividends per share by 10 per cent downwards and upwards.

D.3 Preferred construction of the dividend growth model

Our preferred construction of the dividend growth model is consistent with that set out in the Guideline.[1007] The following equation depicts this dividend growth, which we apply to estimate *k*, the expected return on equity for the market portfolio:

1001 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, p. 34; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 53; McKenzie and Partington, *The DGM*, December 2013, p. 24.

1002 The extreme values include the Lally/Barra growth estimate of 0.31% and the CEG estimate of 6.5%. See: McKenzie and Partington, *The DGM*, December 2013, p. 15. Note McKenzie and Partington call the market value return on equity, the 'cost of equity'.

1003 As applied in its 2014 report. SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, 15 May 2014.

1004 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014.

1005 McKenzie and Partington, *Report to the AER: The DGM*, 14 December 2013, pp. 8–9; McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, p. 26, Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 46.

1006 Partington and Satchell, pp. 23–25.

$$P_c = \frac{m \times E(D_c)}{(1+k)^{m/2}} + \sum_{t=1}^{N} \frac{E(D_t)}{(1+k)^{m+t-0.5}} + \frac{\frac{E(D_N)(1+g)}{k-g}}{(1+k)^{m+N-0.5}}$$

Where: Pc is the current price of equity, for which we use the S&P/ASX 200 index as the proxy

E(Dc) is expected dividends per share for the current financial year[1008]

E(Dt) is expected dividends per share for the financial year t years after the current financial year

m is the fraction of the current financial year remaining, expressed as a decimal point

N is the time period after which dividend growth reverts to its long-term rate (for the two stage model, N = 2, for the three stage model N = 9)

g is the expected long term growth rate in nominal dividends per share. For this parameter, we use a range of 4.0 to 5.1 per cent, with a point estimate of 4.6 per cent.

We adopt two versions of a simple standard dividend growth model:

- A two stage model, which assumes that dividends grow at the long term growth rate following the dividend forecast period.
- A three stage model, which assumes that dividend growth transitions linearly over eight years from the short term growth rate implied in the dividend forecast period to the long term growth rate.

Our dividend growth models also display the following characteristics:

- They use daily data of analysts' consensus dividend forecasts for the ASX 200 index from the Bloomberg Professional Services (Bloomberg). Analyst' dividend forecasts are for the current and following two financial years. We take monthly averages of the daily data.
- They use market prices for the ASX 200[1009].
- They estimate a long term growth rate in dividends per share. We determine this by adjusting the long term growth rate in real gross domestic product (GDP) for the net creation of shares and expected inflation.[1010]

We consider our preferred construction of the dividend growth model to be reasonable. We developed our preferred construction of the model in close consultation with stakeholders when developing the Guideline.[1011] We have analysed a variety of

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[1007] See: AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, pp. 114–125 for more information on our preferred DGM construction. Note that since publishing our Guideline we have been informed by Bloomberg that its convention for reporting dividend forecasts on an index is to use calendar year forecasts as the relevant financial year forecasts.

[1008] We sourced dividend forecasts from Bloomberg. We have been informed by Bloomberg that its convention for reporting dividend forecasts on an index is to use calendar year forecasts as the relevant financial year forecasts.

[1009] Rather than target prices.

[1010] Assumed to be 2.5 per cent, which is the mid-point of the RBA's target inflation band.

[1011] For example, see AER, *Explanatory statement to the draft rate of return guideline*, August 2013, pp. 219–225; AER, *Consultation paper: Rate of return guidelines*, May 2013, pp. 101–102.

submissions on our construction of the model,[1012] which have not persuaded us to depart.[1013] Further, experts have critically reviewed[1014] our construction of the dividend growth model and consider that, overall, this advice suggests our model construction is reasonable.[1015] We also have sound reasons for adopting the technical specifications of our preferred construction of the model. A detailed discussion of the reasons for our preferred construction of the dividend growth model can be found in Appendix B to Attachment 3 of our preliminary decision on AusNet Services' 2016-20 distribution determination.

We note that AusNet Services used the AER's construction of the dividend growth model[1016] in its multi-model approach to estimating its proposed market risk premium.[1017] We observe a similar approach in AusNet Services' revised revenue proposal for its transmission services where it uses the AER's construction of the 3-stage model modified to set the theta to 0.35 and no downward adjustment to the long-run GDP growth.[1018]

Service providers have in the past proposed the use of SFG's dividend growth model.

D.4 Sources of potential upward bias

Evidence we have reviewed indicates that the market risk premium estimates from dividend growth models are very sensitive to input assumptions and likely to show an upward bias in current market conditions.[1019] While we still propose to use our construction of the dividend growth model to inform our market risk premium estimate, we consider it important to have regard to the existence of this potential bias. We discuss below the factors that we have considered.

Slow-changing dividends

[1012] Specifically, see SFG, *Dividend discount model estimates of the cost of equity*, 19 June 2013; SFG, *Reconciliation of dividend discount model estimate with those compiled by the AER*, 10 October 2013; SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, 15 May 2014; SFG, *Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network*, 13 February 2015.

[1013] Note that since publishing our Guideline we have been informed by Bloomberg that its convention for reporting dividend forecasts on an index is to use calendar year forecasts as the relevant financial year forecasts.

[1014] McKenzie and Partington, *Report to the AER: The Dividend Growth Model (DGM)*, December 2013; Lally, *Review of the AER's Proposed Dividend Growth Model*, December 2013.

[1015] For example, McKenzie and Partington found our 'implementation of a two stage model is a reasonable, transparent and easily reproducible' and recommended consider a transition to long term growth (which we subsequently adopted). See McKenzie and Partington, *The DGM*, December 2013, p. 24.

[1016] Although it used a different value for the assumed utilisation rate of imputation credits.

[1017] AusNet Services adopts the market risk premium estimates of Frontier Economics, see: Frontier Economics, *an updated estimate of the required return on equity, Report prepared for AusNet Services*, August 2015, p. 6.

[1018] Frontier Economics, The market risk premium, September 2016, p. 76.

[1019] Lally, *The DGM*, 4 March 2013; McKenzie and Partington, *The DGM*, December 2013, pp. 4–5; McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 26–30; Partington, Report to the AER: Return on equity (Updated), April 2015, pp. 46–50.

Dividends are a smoothed version of both free cash flow to equity and profits.[1020] Slow-changing (or 'sticky') dividends are a well-understood phenomenon in financial theory and empirically supported by survey evidence, which suggests that companies are reluctant to cut dividends and increase dividends only when maintainable high earnings per share are expected.[1021] McKenzie and Partington consider that there is likely to be an asymmetry in the effects because of a greater reluctance to cut dividends than increase dividends.[1022]

If investors revise downwards their earnings expectations for a firm, the share price may drop significantly with the 'sticky' dividend unchanging. Together, this will cause a higher dividend yield, giving an upwardly-biased estimate of the return on equity. The reverse occurs if expectations are for profits and free cash flow to equity to rise.

Frontier submitted that this theoretical possibility is not material in current circumstances. Frontier submitted that:[1023]

> An examination of the top 20 firms (which collectively account for approximately half of the total ASX market capitalisation) indicates that analysts are anticipating increasing dividends and earnings. The market capitalisation weighted average increase in forecasted earnings per share from 2015 to 2017 is 19%.

We note that Frontier's forecast is only to 2017, and we are not satisfied that such short-term forecasts invalidate our concerns as market prices likely reflect expectations over a longer period. We note that the RBA forecasts growth in earnings per share to fall in the 2015–16 and 2016–17 financial years, and we do not consider it is certain that investors expect positive growth in dividends per share post-2017.[1024]Frontier responded to our concerns about the dividend growth model's use in estimating the market risk premium by noting that it is 'highly unlikely for analysts to forecast dividend growth based on strong earnings over the short term if they considered those dividends to be unsustainable in the longer term'.[1025]

We note that dividends may be forecasted to increase for a number of reasons, including absence of satisfactory projects for reinvestment of earnings, and not necessarily related to strong earnings. It is not apparent that there is or will be strong earnings growth. In the RBA chart, while forecast earnings per share in 2016–17 is

[1020] Which is the share of the operating cash flow available for owners. See: McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, p. 27; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 47. Also see Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 43.

[1021] See, A. Brav, *Payout policy in the 21st century*, May 2005.

[1022] McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 29–30; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 49–50.

[1023] Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016, p. 39.

[1024] RBA, *The Australian Economy and Financial Markets Chart Pack,* February 2016, p. 24.

[1025] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 61–62 above that of 2015–16 as Frontier points out, both slow over time which has been the pattern since 2011–12.[1026] We do not consider that this is indicative or supportive of strong earnings growth.

Frontier added that there is no evidence to indicate 'future dividends were likely to fall so materially as to make the current dividend unsustainable'.[1027] We note that dividends can be stylised as a function of earning and given information suggests material declines in earnings per share.[1028] We also note that the chartpack relates to one-year forecasts which would not provide conclusive evidence consistent with our 10-year time frame.

Biases in analyst forecasts

Analyst forecasts are well understood to be upwardly biased.[1029] McKenzie and Partington also consider that analysts' forecasts are slow to adjust to changing information.[1030] This creates problems with time matching analyst dividend forecasts with prices. It also implies that dividend growth models may not track changes in the return on equity accurately.

We note that Frontier has not provided any evidence that bias has not increased. In response, Frontier estimated that actual earnings for ASX-20 firms is slightly above (2.37 per cent) the forecast and stated that this is inconsistent with the proposition that forecast earnings are becoming more optimistic over time.[1031]

We have not changed the weight we apply to the dividend growth model. Our approach requires the application of judgment and our market risk premium estimate does not mechanically update with changes to dividend growth model estimates.

Further, we do not hold a view either way about whether bias has increased or not. However, Frontier refers to a report by JP Morgan that notes that current price-to-earnings ratios[1032] could be evidence that the prevailing market is now more sceptical of analysts' forecasts than they have been in the past.[1033] That is, bias (or at least the market's perception of bias) may have increased. We also have reservations about a survey from only 20 firms. Partington and Satchell advised that they would "place little

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1026 RBA, *The Australian Economy and Financial Markets Chart Pack,* January 2017, p. 24

1027 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 61–62

1028 Damodaran, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/lectures/pe.html,

1029 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 26, 31; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 46, 51; McKenzie and Partington, *The DGM*, December 2013, pp. 8–9. Also see Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 43.

1030 McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 31–32; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 51.

1031 Frontier, The market risk premium, September 2016, p. 63.

1032 While the JP Morgan report concerns the United States market, Frontier referred to the report as providing insights transferrable to an Australian context (Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016, p. 23).

1033 JP Morgan, *Musing on low cost of debt and high risk premia*, April 2012, pp. 2–3.

weight on a non-random sample of twenty firms and one year's observations" when assessing the reliability of analyst's forecasts.[1034]

Frontier submitted that the AER should focus on estimating the implied return that equates the dividend forecast to the actual stock price, and not on the dividend forecast that the AER thinks the market should have used.[1035]

We remain of the view that if analysts' dividend and price forecasts are biased, it is also plausible that the analysts' implied return on equity is biased. Partington and Satchell agree with us and noted that 'if we assume the market is unbiased, then the AER are correct in observing that any upward bias in analysts' forecasts will result in a higher implied return on the market for a given method of inferring that implied return'.[1036]

McKenzie and Partington also consider that analysts' forecasts are slow to adjust to changing information.[1037] This creates problems with time matching analyst dividend forecasts with prices. It also implies that dividend growth models may not track changes in the return on equity accurately.

Dividends as a proxy for free cash flow to equity

In a particular period, differences between the free cash flow to equity and the dividend may arise as a consequence of financing transactions (that is, borrowing or issuing new shares). Where there is significant financing of dividends and/or where substantial investment demand for funds is anticipated, there is a risk that dividend growth will slow or even turn negative for a period. This is likely to result in the dividend growth model producing upwardly biased estimates of the return of equity.[1038]

Partington and Satchell has advised the need for a downward adjustment to the growth rate is because all of the capital required for growth will not come from the company internally which means that additional equity will be raised–diluting existing equity and reduce its share of the growth.[1039] We agree and consider that the downward adjustment remains appropriate.

Low risk free rate and term structure for equity

The risk free rate is currently relatively low. Lally observed that if dividend growth models do not incorporate a term structure, these will produce upwardly biased estimates when the risk free rate is low relative to its long term average, and expected

[1034] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity, March* 12 April 2017, p. 32.

[1035] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 62-63

[1036] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017, pp. 17–18, 32.

[1037] McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 31–32; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 51.

[1038] McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 27–29; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 47–49.

[1039] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017, p. 29.

to increase in a future period.[1040] We consider it useful to be aware of this potential bias. This is consistent with McKenzie and Partington's advice:[1041]

> we do recommend that it be borne in mind that the existence of a term structure could materially change cost of equity estimates from the DGM.

[1040] Lally, *Review of the AER's proposed dividend growth model*, 16 December 2013, pp. 11–12.

[1041] McKenzie and Partington call the market value return on equity, the 'cost of equity'. McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, p. 37; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 56.

E Return on equity conditioning variables

Conditioning variables are market data that can be used to inform (or 'condition') an initial estimate. We do not consider conditioning variables provide reliable estimates on their own.[1042] However, we consider that this information is relevant and may be useful for indicating changes in prevailing market conditions.

In the Guideline we stated that we would consider three types of conditioning variables to inform our estimate of the market risk premium: dividend yields, yield spreads and implied volatility. Some service providers have also proposed the use of price-to-earnings ratios, and we considered these in the 'Price-to-earnings ratios' section above. In the Guideline we also stated that we would use yield spreads to inform our overall return on equity estimate.

Conditioning variables should be considered symmetrically through time to avoid bias. Since the weighted average cost of capital (WACC) review in 2009, various service providers have presented this information asymmetrically. For example, in periods where the implied volatility suggested the market risk premium may be significantly above the long term average, some service providers relied upon this evidence.[1043] However, when implied volatility estimates fell in 2013, other service providers did not propose we consider this evidence.[1044]

APTPPL, in their most recent submission, put forward that no reliance should be placed on the conditioning variables in the absence of formal econometric mapping to a point estimate. However they feel that if they are to be used, they point to a higher market risk premium than the AER estimated given indications of a stable return on equity indicated.[1045]

For the reasons set out below, we consider that, overall, the conditioning variables appear to have experienced moderate short term movement. Consideration of the dividend yields and corporate bond spreads show slight increases.[1046] The state government bond spreads and the comparison between equity and debt premiums provide no clear indication that there have been any changes to conditioning variables.[1047] The implied volatility index has seen a steady decline over the past

[1042] See: AER, Explanatory statement—Rate of return guideline, December 2013, pp. 94 and 97.

[1043] See, for example, AER, *Final decision: Envestra Ltd access arrangement proposal for the SA gas network 2011–2016*, June 2011, pp. 195–197; VAA, *MRP for Envestra*, March 2011, p. 4.

[1044] We note that, during the Guideline development process in 2013, the ENA recently submitted there is a high degree of uncertainty over the relevance of implied volatility. See ENA, *Response to the draft guideline*, October 2013, p. 47.

[1045] APTPPL, *2017-2022 RBP Access Arrangement revision submission*, September 2016, pp.138-146

[1046] See, Figure 3-7: Dividends yields; Figure 3-8 Australian bond spreads over government yields.

[1047] See, Figure 3-9: State government bond spreads over government yields; Figure 3-10: Comparison of equity and debt premiums.

twelve months.[1048] Taken together, we see no significant trend to support any further changes to our approach.

Moreover, it appears that conditioning variables are close to or below their long term averages. This is particularly apparent when compared with the sharp increases in these variables seen between 2008–13, which were likely associated with the height of the Global Financial Crisis and European debt crisis. We acknowledge that implied volatility and dividend yields increased above their long term averages towards the end of 2015 but have since declined below the long term average. We consider there is insufficient evidence of a sustained trend away from their long term averages.

It is important to note that we are estimating a 10-year forward-looking market risk premium with regard to prevailing conditions in the market for equity funds. In this context, prevailing conditions can be considered 'prevailing expectations' over the relevant forward looking timeframe, which is 10 years. Therefore, we consider short term fluctuations in conditioning variables should be treated with caution.

E.1 Implied volatility

The implied volatility approach assumes that the market risk premium is the price of risk multiplied by the volume of risk (volatility).[1049] Figure 3-7 shows volume of risk in the market portfolio estimated using the implied volatility index.

Implied volatility was high during the global financial crisis and the height of the European debt crisis. However, recent implied volatility levels have generally been below the long run average of 18.1 per cent (measured from the start of the data series in 1997). We note that after a spike in volatility levels in mid to late 2015 levels have fallen again to below the long term average. This downward trend has continued for around the past twelve months, indicating it is a sustained movement away from the long run average.

Figure 3-7 shows the value of this measure of implied volatility relative to its long run average level since the start of the data series in 1997 to 28 April 2017. We observe that the volatility index appears to show a downward trend:

- The index was 14.3 per cent if averaging over the year ending 28 April 2017.
- The index was 12.5 per cent over the placeholder risk free rate averaging period (29 March 2017 to 28 April 2017).
- The index was 11.4 per cent on 28 April 2017.

Overall, despite this downward trend over the past year, it is not clear there is a sustained movement away from the long term average.

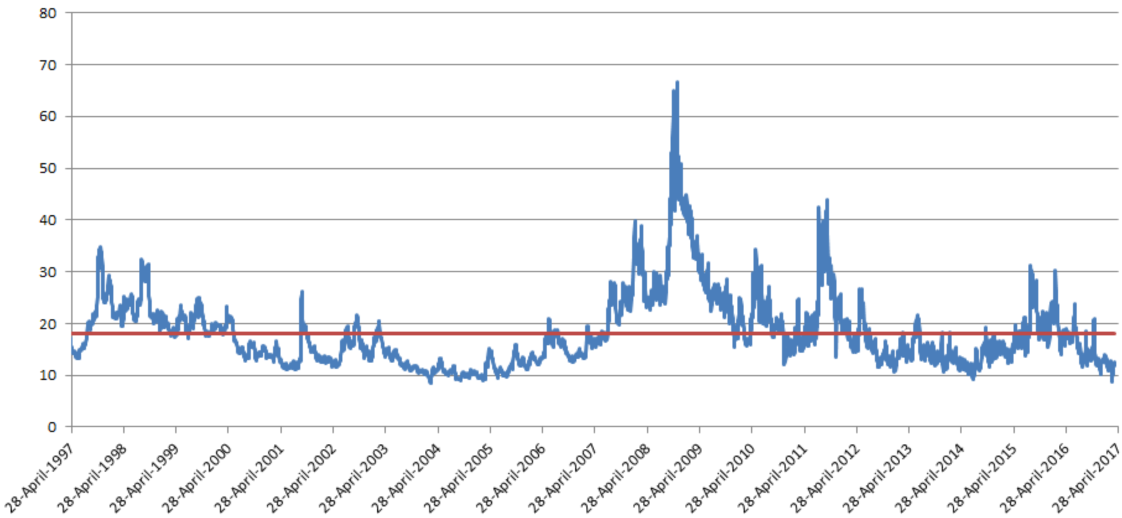
[1048] See, Figure 3-6: Implied volatility (VIX) over time

[1049] This was based on Merton, R.C., 'On Estimating the Expected Return on the Market: An Exploratory Investigation', *Journal of Financial Economics*, 1980, Vol. 8, pp. 323–361.

- Partington and Satchell also feel that this decline in the Implied Volatility could have downward pressure on the Market Risk Premium. In their most recent report to the AER they stated:

"Currently the ASX VIX index, a measure of market volatility, has been trading at an implied standard deviation of returns on the market of around 12% per annum. This is a particularly low level of volatility as a value of about 20% per annum, would be considered a normal level of volatility… It seems an unlikely outcome to have a relatively high market risk premium when market volatility is particularly low."[1050]

Figure 3-7 Implied volatility (VIX) over time



Source: AER analysis; ASX200 VIX volatility index, sourced via Bloomberg code AS51VIX from 2/1/2008 and code CITJAVIX prior to 2/1/2008.

E.2 Dividend yields

We use dividend yields as a directional indicator of the market risk premium.[1051] We consider this information by comparing current dividend yields with the average dividend yield through time.[1052] Figure 3-8 shows dividend yields against their historical average up to 28 April 2017.

Figure 3-8 shows dividend yields are currently slightly below their long term average of 4.25 (meaured from 3rd April 2017). This decrease occurred during 2016 and appears to offset the increase from 2015. It is unclear whether this downward trend will continue

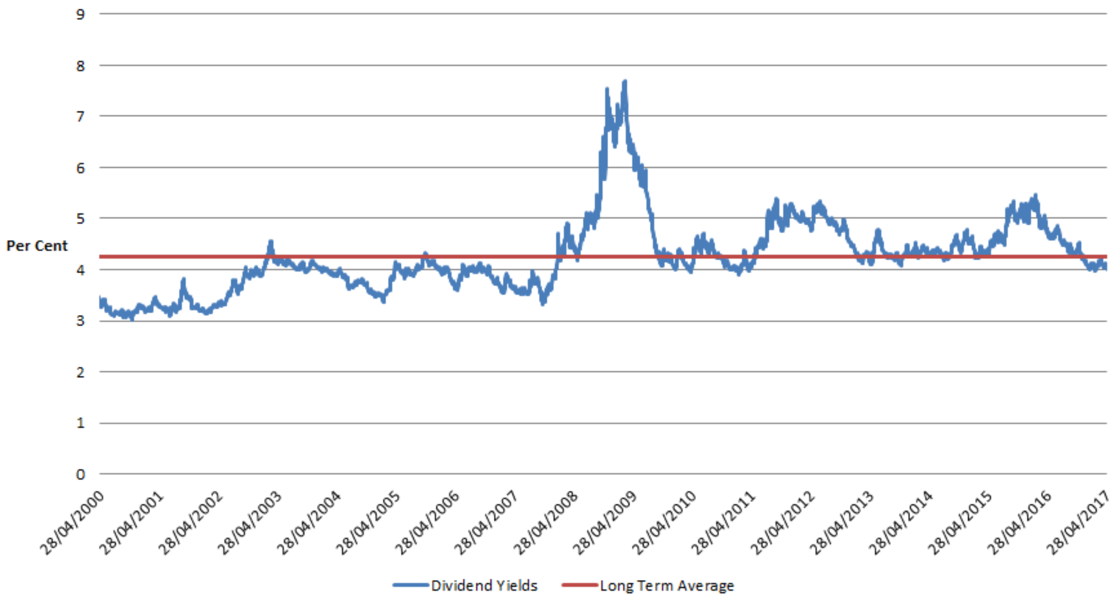
[1050] Partington and Stachell, *Report to the AER: Discussion of submissions on the cost of equity*, 29 May 2017, p. 47

[1051] AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, p. 94.

[1052] For a similar approach, see SFG, *Market risk premium: Report for APT Petroleum Pipelines Ltd*, October 2011, p. 13.

however there is no strong evidence to suggest a sustained movement away from the long term average.

Figure 3-8 Dividend yields



Source: Bloomberg AS51 Index, AER analysis.

E.3 Yield spreads

Yield spreads are the difference between the yields on different assets, typically debt instruments. We examine two categories of yield spreads:

- Credit spreads, used to inform our market risk premium estimate.
- The spread between our equity risk premium and debt risk premium, used to inform our overall return on equity estimate.

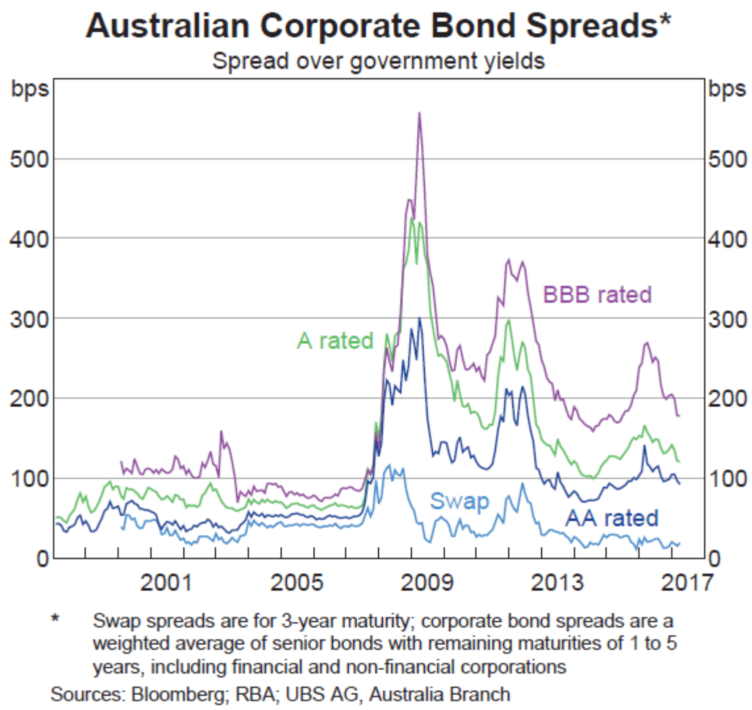
Credit spreads are the spreads between the risk free rate (the yield on Australian government securities) and the return on debt for different debt instruments. We use credit spreads as a directional indicator of the market risk premium.[1053] We consider this information can be used to indicate changes in market conditions. That is, to indicate whether spreads are widening, stabilising or narrowing.

Figure 3-9 shows credit spreads for A-rated, AA-rated, and BBB-rated corporate debt instruments over yields on Australian government securities. These credit spreads were showing a clear downward trend from approximately 2012 before widening slightly in recent times.

1053 AER, *Explanatory statement rate of return guideline (appendices)*, 17 December 2013, p. 96.

Most credit spreads are also above their pre-2007 levels, while the swap rate spread is at or below its pre-2007 levels. In essence, lower quality debt is further from pre-2007 levels than higher quality debt. However, the credit spreads are all substantially lower than they were between 2008 and 2013.

Figure 3-9 Australian bond spreads over government yields

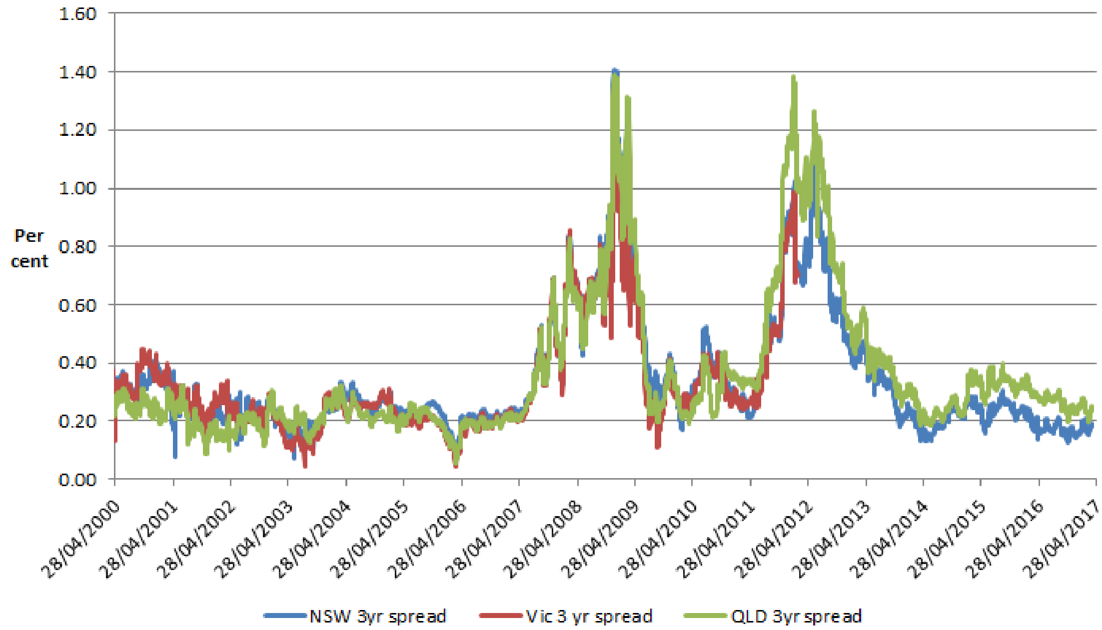


Source: RBA, Chart Pack, May 2017.

Note: Swap spreads are for a 3 year maturity. Corporate bonds are a weighted average of senior bonds with remaining maturities of 1 to 5 years and include financial and non-financial corporates.

Figure 3-10 shows the spread between state government debt and Australian government debt up to 28 April 2017. This uses maturities of three years as more data are available. Figure 3-10 shows that credit spreads were falling since late 2012, and are now around their pre-2007 levels with no discernible trend.

Figure 3-10 State government bond spreads over government yields



Source: AER analysis, RBA F.2 interest rate statistics.

On the comparison between the return on equity and return on debt, we consider that prevailing debt market conditions provide support for the view that:

- our estimated return on equity is not below efficient financing costs[1054]
- APTPPL's proposed return on equity is likely to exceed efficient financing costs.

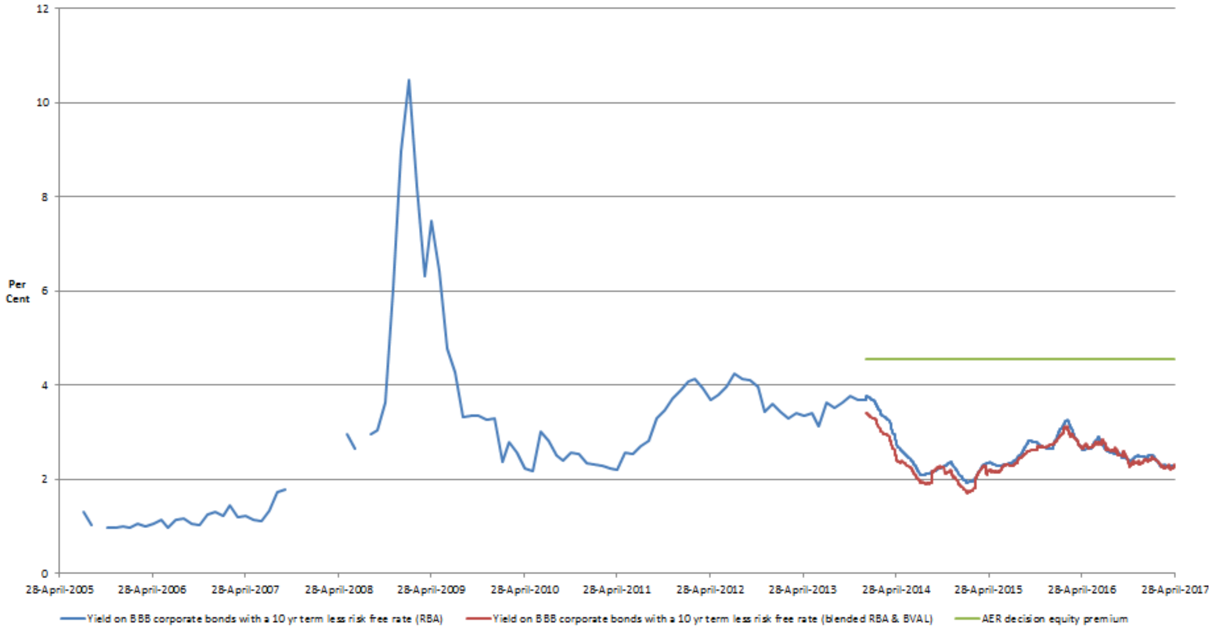
The current debt market is indicating a premium over the risk free rate of about 2.21 per cent.[1055] This compares to our foundation model equity premium over the risk free rate of 4.55 per cent (given a market risk premium of 6.5 per cent and a beta of 0.7). Figure 3-11 shows the current and historical debt risk premium and our foundation model equity risk premium. APTPPL proposed an equity risk premium of 6.45 per cent.[1056]

1054 Efficient financing costs for a benchmark efficient entity with a similar degree of risk as that which applies to the distribution (or transmission) network service provider in respect of the provision of standard control services (prescribed transmission services or reference services). See: NER, cl. 6.5.2(c); NER, cl. 6A.6.2(c); NGR, r.87(3).

1055 Based on the spread to CGS from our estimation of the cost of debt (based on an average of the RBA's data (on yield to maturity on BBB-rated corporate bonds with a ten year term and the Bloomberg BBB–rated AUD BVAL curve).

1056 Based on a proposed MRP of 8.06 per cent and a beta of 0.8.

Figure 3-11 Comparison of equity risk premium and indicative debt risk premiums



Source: AER analysis, RBA interest rates statistics, Bloomberg data.

We do not consider that the current 221 basis points difference between the equity risk premium allowed in this decision and debt risk premiums[1057] to be too low, on the basis of:

- the low risk nature of a benchmark efficient entity as outlined above
- the gap between the equity risk premium and debt risk premium is likely to be wider than stated above, since it compares a promised, pre-tax return on debt to an expected, post-tax return on equity.[1058]

In relation to our review of debt risk premiums relative to equity premiums in our April 2015 decisions, ActewAGL submitted:[1059]

> In relation to more stable market conditions, ActewAGL Distribution does not consider that the AER provides any supporting evidence that 260 basis points is a sufficient margin. Noting that the debt risk premium for a long time has

[1057] The debt risk premiums to CGS are calculated as the extrapolated effective annual yield to maturity on BBB rated debt with 10 years to maturity less the effective annual yield to maturity on CGS with 10 years to maturity). BBB bond yields have been used instead of BBB+ because the RBA quotes BBB yields to maturity.

[1058] We consider that promised returns will always exceed expected returns and pre-tax returns will always exceed corresponding post-tax returns. For further explanation, see McKenzie and Partington, *Report to the AER: The relationship between the cost of debt and the cost of equity*, March 2013, pp. 7, 21; AER, *Final decision: Access arrangement final decision—Multinet Gas (DB No. 1) Pty Ltd, Multinet Gas (DB No. 2) Pty Ltd 2013-17*, March 2013, Part 3, p. 48.

[1059] ActewAGL Gas Distribution, *Appendix 8.02: Return on Equity - detailed proposal*, June 2015, p. 48.

> been between 2 and 4 per cent indicates that the ERP of 4.55 per cent is low when compared with the last 8 years. ActewAGL Distribution also considers that the 'flight to safety' in relation to the decreasing CGS values are very likely to have influenced the return on debt

We agree that it is difficult to derive definitive conclusions about equity premiums from data on debt premiums, which is one of the reasons why we give this material a directional role.[1060] It is therefore unclear how ActewAGL reconciles this difficulty in extracting precision from this material with its statement that an equity risk premium of 4.55 per cent is too low. We consider that it is far from clear that a 'flight to safety' has impacted recent risk premiums. As noted by Partington, an alternative and equally plausible view is that low yields on Australian government securities may have driven investors to 'search for yield' with the result of decreasing risk premiums.[1061]

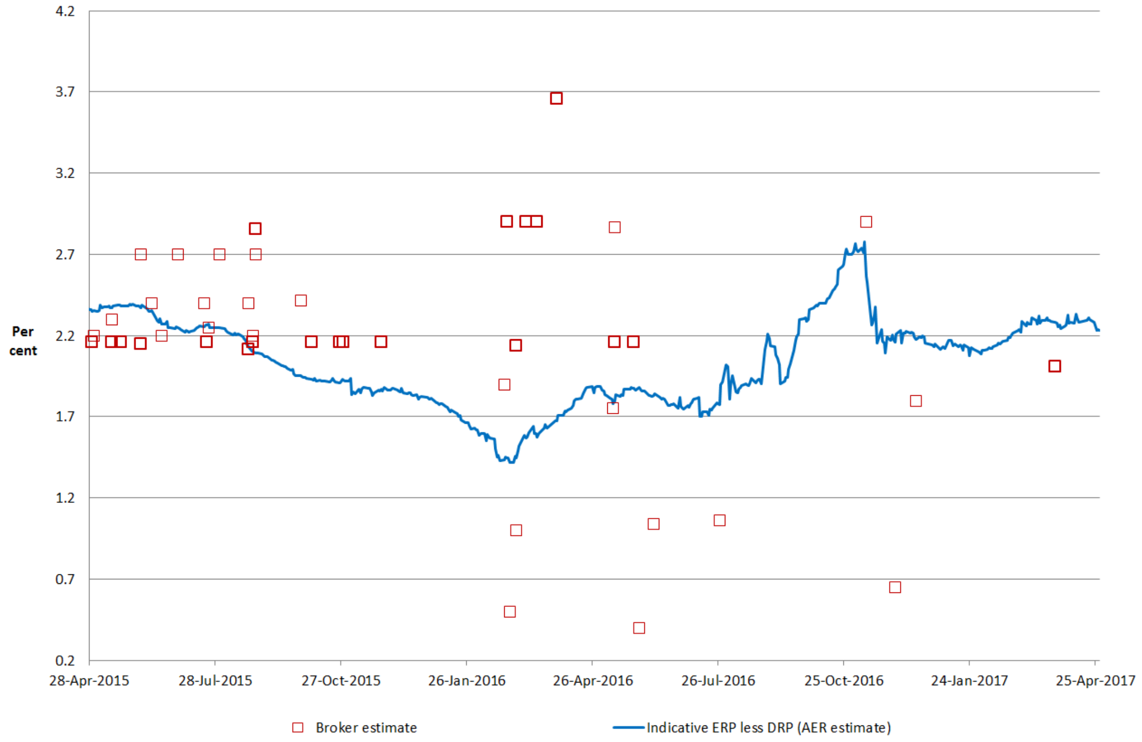
We note that the overall directional evidence shows that debt risk decreased during the middle of 2016 but then increased towards the end of the year, keeping them below the levels in December 2013 (when our Rate of Return Guideline was published), as shown in Figure 3-11.

We have also examined estimates from broker reports of the spread between debt and equity risk premiums for comparable businesses (see Figure 3-12). However, we note that the variance in the most recent broker estimates has increased. We consider that this data does not provide a clear indication of brokers' views on recent movements in risk premiums.

Figure 3-12 Difference between equity and debt premiums in broker reports

[1060] AER, *Better Regulation: Explanatory Statement: Rate of return guideline (appendices)*, December 2013, pp. 46–48; AER, *Preliminary decision: CitiPower determination 2016 to 2020, Attachment 3–Rate of return*, October 2015, pp. 96–99; AER, *Powercor Preliminary Decision - Attachment 3: Rate of Return*, October 2015, pp. 96–100; AER, *Draft decision ActewAGL distribution determination 2016 to 2021: Attachment 3 – Rate of return*, November 2015, pp. 97–98; AER, *Preliminary decision United Energy determination 2016 to 2020: Attachment 3 – Rate of return*, October 2015, pp. 94–99; AER, *Draft decision Australian Gas Networks Access Arrangement 2016 to 2021: Attachment 3 – Rate of return*, November 2015, pp. 96–100; AER, *Preliminary decision Jemena distribution determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 94–98; AER, *Preliminary decision AusNet Services determination 2016 to 2020: Attachment 3–Rate of return*, October 2015, pp. 94–98; AER, *Draft decision Amadeus Gas Pipeline access arrangement 2016 to 2021: Attachment 3–Rate of return*, November 2015, pp. 97–100.

[1061] Partington, *Report to the AER: Return on Equity (updated),* April 2015, p. 72.



Source: AER analysis of various relevant broker reports, RBA and Bloomberg data.

Notes: The broker estimate of the difference between equity and debt risk premium is calculated by deducting brokers' debt risk premium from their equity risk premium.

The indicative estimate is calculated by deducting an estimate of the indicative debt risk premium from the equity risk premium for this decision. The indicative debt risk premium is estimated as the yield on BBB-rated corporate bonds (a simple average of the RBA corporate bond data and Bloomberg BVAL curve) less the yield on 10-year CGS.

F Other practitioner's return on equity estimates

Other market practitioners may, in the course of their operations, produce return on equity estimates for entities with a similar degree of risk as APTPPL. Other practitioners may also produce estimates of input parameters required in the Sharpe-Lintner CAPM (our foundation model). These estimates may be relevant material that can inform our return on equity estimation.

Relevant estimates of other market practitioners are typically sourced from surveys, broker reports, valuation reports, and other regulators' decisions. Such estimates are discussed further in the subsections below.

We have focused on return on equity estimates for companies with a similar degree of non-diversifiable risks as APTPPL in providing reference services. This means that greater reliance is placed on electricity and gas network service providers over other types of businesses. Greater reliance is also placed on businesses with revenues that are substantially regulated over businesses with less regulated revenue. We take this approach as it better reflects the degree of risk of APTPPL in relation to the provision of reference services.

We have also focused on the equity risk premium rather than the overall return on equity to isolate the business-specific risk premium from movements in the risk free rate.[1062]

Some service providers have stated that past decisions of other regulators should not be used as direct evidence of the required return on equity, as they are, 'at best, secondary evidence of the prevailing return on equity at previous points in time' and 'use of such decisions will be circular and self-perpetuating'.[1063] We note that some estimates from other market practitioners—including from survey respondents, brokers

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1062 Note that the valuation reports show there is a general consensus among valuers on the estimation methods for the risk free rate. Valuers typically estimate the risk free rate as the current yield to maturity on long term (10 year) Australian government securities. We acknowledge that there is some evidence suggesting that there is a tendency for valuers to adopt risk free rates exceeding the yields on Australian government securities when these yields are low, but we consider this practice to be neither widespread nor persistent (see section F.5 for more detail). Therefore, we do not consider that removing the risk free rate and examining the equity risk premium will bias the results.

1063 CitiPower, *Revised regulatory proposal 2016–2020*, pp. 321; Powercor, *Revised regulatory proposal 2016–2020*, pp. 315; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, p. 80; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 74–75, United Energy, *Response to AER Preliminary Determination Re: Rate of return and gamma*, January 2016, p. 75; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, p. 101; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 78–79; Frontier Economics, *The market risk premium*, September 2016, p32.

and valuers—may be affected to some extent by 'herding' behaviour.[1064] We continue to consider that it is relevant for us to have some regard to these estimates, as long as we remain aware of their limitations.

F.1 Prevailing estimates: surveys

Survey estimates explore investor expectations about the market risk premium. They achieve this by directly asking investors and market practitioners what their expectations are and/or what they apply in practice. We place some reliance on survey estimates in estimating the market risk premium.

Table 3-26 shows that market risk premium estimates, from surveys published since 2013, cluster around 6.0 per cent. The 2015 survey estimates are generally equal to or lower than their 2013 and 2014 counterparts. This provides some evidence to suggest that investor expectations of the market risk premium have not increased, and may have eased.

Table 3-26 Key findings on market risk premium from recent surveys

Survey	Numbers of responses	Mean (%)	Median (%)	Mode (%)
Fernandez et al (2013)	73	5.9	6.0	N/A
KPMG (2013)[a]	19	N/A	6.0	6.0
Fernandez et al (2013)	17	6.8	5.8	N/A
Asher and Hickling (2013)	46	4.8	5.0	6.0
Fernandez et al (2014)[b]	93	5.9	6.0	N/A
Asher and Hickling (2014)[c]	27	4.4	4.6	6.0
Fernandez et al (2015)	40	6.0	5.1	N/A
KPMG (2015)[d]	~27	N/A	6.0	6.0
Asher and Carruther (2015)	29	4.9	N/A	N/A
Fernandez et al (2016)	87	6.0	6.0	N/A
Carruther (2016)	24	5.3	N/A	N/A

Sources: Several survey reports.[1065]

[1064] McKenzie and Partington, *Report to the AER: Part A: Return on Equity*, October 2014, p. 46.

[1065] Fernandez, Ortiz, Acín, M*arket risk premium used in 71 countries in 2016: a survey*, May 2016; KPMG, *Australian valuation practices survey 2015*, May 2015; Fernandez, Ortiz, Acín, *Discount rate (risk-free rate and market risk premium) used for 41 countries in 2015: a survey*, April 2015; Asher and Hickling, *Equity Risk Premium Survey 2014*, Actuaries Institute, April 2015; Fernandez, Linares, Acín, *Market Risk Premium used in 88 countries in 2014*, IESE Business School, June 2014; Asher and Hickling, *Equity Risk Premium Survey*, Actuary Australia, December 2013; Fernandez, Arguirreamalloa and Linares, *Market Risk Premium and Risk Free Rate used for 51 countries in 2013*, IESE Business School, June 2013; KPMG, *Valuation Practices Survey 2013*, February 2013; Fernandez, Notes: a) While this survey had 23 market participants, 19 specified what market risk premium they used.

b) The 2014 survey did not report the response rate. AER staff obtained this information from Professor Fernandez via email correspondence on 22 July 2014.

c) The response rate for this survey is lower than the response rate in previous Asher and Hickling surveys because the survey took place from 5 December 2014 to 14 December 2014, which was very close to Christmas. AER staff obtained the mode from Associate Professor Anthony Asher via email correspondence on 17 September 2015.

d) The KPMG (2015) survey had 29 market participants, but figure 24 indicates that not all the market participants gave a response for the market risk premium. However, visual inspection indicates that the response rate was approximately 27.

Several factors should be considered when examining survey evidence:[1066]

- Timing of the survey—we consider the timing of each survey is clear in all but two surveys we consider. The earliest survey we consider was published in January 2013 but its questionnaires were sent out in May and June 2012.[1067]
- Sample of respondents—financial managers and analysts, expert valuers, actuaries, finance academics, investment banks, professional services firms and infrastructure funds were among the target respondents of surveys. These professionals apply the market risk premium, so we consider the surveys' target populations can make informed judgments about the market risk premium. Each survey also sets out the selection of the sample surveyed (or respondents).[1068]
- Wording of survey questionnaires—we consider the adequacy of survey wording can be subjective to judge and often relies on the quality of the authors. However, we also consider confidence in this area can be enhanced when the work is published in a refereed academic journal, or when the survey is repeated. In our sample, only the KPMG survey has not been repeated at least three times.
- Survey response rate and non-response bias—McKenzie and Partington suggested a sample size of more than 30 is sufficiently large statistically so a representative sample of 30 respondents is expected to be adequate.[1069]

Arguirreamalloa and Corres, *Market Risk Premium used in 82 Countries in 2012*, IESE Business School, January 2013; Asher and Carruther , *Equity Risk Premium Survey 2015, Actuaries Digital*, May 26 2016; David Carruthers, Equity Risk Premium Survey 2016, 8 March 2017

1066 As noted in: Australian Competition Tribunal, *Application by Envestra Limited (No 2) [2012] ACompT 3*, 11 January 2012, paragraphs 165–166.

1067 The KPMG valuation practices surveys do not clearly state the time period over which the survey was made. Fernandez, Ortiz, Acín, *Discount rate (risk-free rate and market risk premium) used for 41 countries in 2015: a survey*, April 2015, p. 2; Asher and Hickling, *Equity Risk Premium Survey 2014*, Actuaries Institute, April 2015, p. 1; Fernandez, Linares, Acín, *Market Risk Premium used in 88 countries in 2014*, IESE Business School, June 2014, p. 2.

1068 KPMG, *Australian valuation practices survey 2015*, May 2015, p. 2; Fernandez, Ortiz, Acín, *Discount rate (risk-free rate and market risk premium) used for 41 countries in 2015: a survey*, April 2015, p. 3; Asher and Hickling, *Equity Risk Premium Survey 2014*, Actuaries Institute, April 2015, p. 1; Fernandez, Linares, Acín, *Market Risk Premium used in 88 countries in 2014*, IESE Business School, June 2014, p. 2.

1069 McKenzie and Partington, *Supplementary report on the MRP*, February 2012, pp. 17–18.

After having regard to the above factors, we consider that the survey estimates in Table 3-26 are useful for informing our market risk premium estimate. We note that triangulation across surveys can reduce the limitations associated with particular survey evidence.[1070]

AusNet Services has resubmitted that survey evidence should not be considered given methodological shortcomings (such as the content and relevance of the questions and potential bias in the survey groups).[1071] We do not agree. We consider that the survey questions and responses indicate that the estimates reflect investors' expectations of the market risk premium. What evidence investors use to form their expectations is their choice and, in our view, does not deem these estimates irrelevant.

Several service providers previously submitted that the surveys we use do not appear to comply with the Federal Court guidelines for conducting surveys.[1072] Market participants prepare survey material for practical purposes and it would be unreasonable to expect that all material we consider would be prepared in compliance with the Federal Court guidelines. We carefully consider the merits of all of the material available to us.

F.2 Prevailing estimates: broker reports

Table 3-27 shows the estimates of return on equity and premium above the risk free rate contained in broker reports which we have examined since our draft decision.[1073]

Table 3-27 Recent broker reports

		Return on equity	Equity risk premium
Broker estimate—no imputation adjustment	Minimum	6.8	3.5

[1070] McKenzie and Partington considered triangulation increases their confidence in the results from survey evidence. McKenzie and Partington, *Supplementary report on the MRP*, February 2012, pp. 17, 19–20.

[1071] AusNet, AusNet Transmission Revised revenue proposal 2017-2022, 21 September 2016; , *The required return on equity for regulated gas and electricity network businesses*, 27 May 2014, pp. 66–71; SFG, *Estimating the required return on equity: Report for Energex*, 28 August 2014, pp. 42–47; SFG, *The required return on equity for the benchmark efficient entity*, February 2015, p. 26. Also, in a subsequent 2015 report for JGN, SFG submitted that survey evidence reflects historical information because the surveys we consider 'almost invariably' report an MRP of 6.0 per cent (see: SFG, *Cost of equity: Update for Jemena Gas Networks' averaging period —19 January to 16 February 2015*, 27 March 2015, p. 7).

[1072] See, for example, AusNet Services, *Transmission Revenue Review 2017–2022 regulatory proposal*, 30 October 2015, p. 235; AusNet Services, *Regulatory proposal*, 30 April 2015, p. 324; United Energy, *Regulatory proposal: Attachment—Return on equity*, April 2015, section 2.7.7.3; Jemena Electricity Networks, *Regulatory proposal: Attachment 9-2—Rate of return proposal,* April 2015, p. 75; Federal Court of Australia (PA Keane Chief Justice), *Practice note CM 13: Survey evidence*, 1 August 2011.

[1073] The ranges given in Table 3-27 capture the most recent report from each broker on each of the stated companies in this time period.

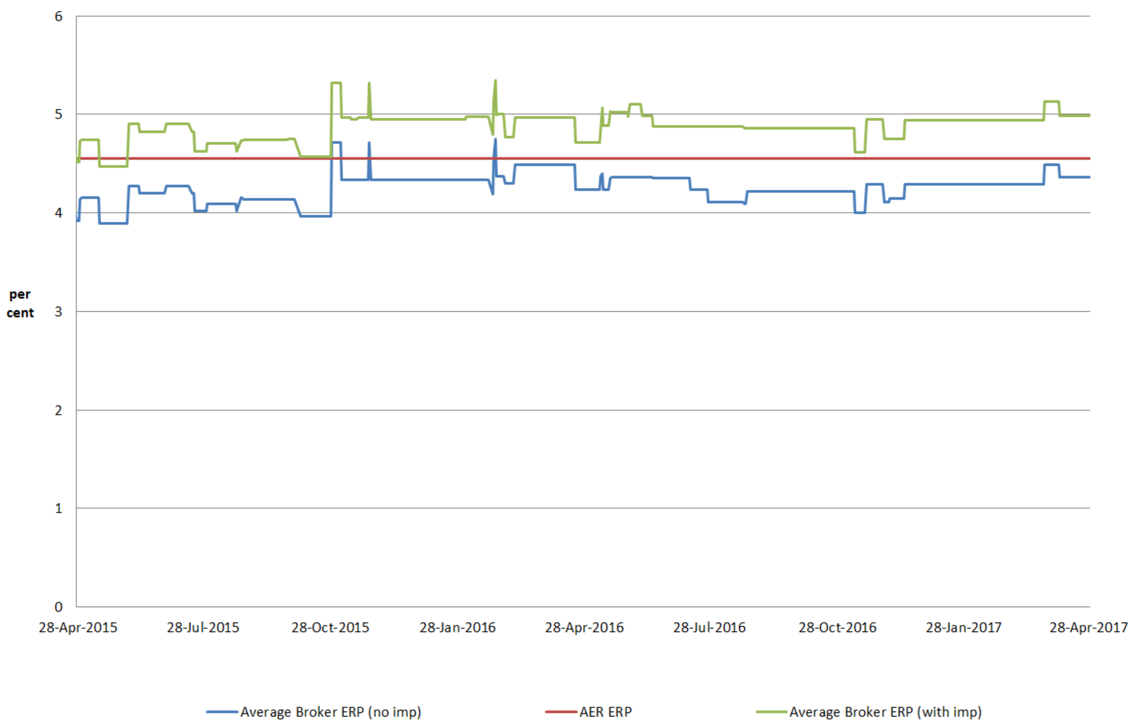
Broker estimate—no imputation adjustment	Maximum	9.4	5.3
Broker estimate—adjusted for imputation	Minimum	7.4	4.1
Broker estimate—adjusted for imputation	Maximum	10	6.1

Source: AER analysis of broker reports, dated 1 October 2016 to 28 April 2017 by Credit Suisse, JP Morgan, Morgan Stanley, and Macquarie Bank that include a valuation for AusNet Services, Spark Infrastructure, APA Group, and/or DUET Group.

The equity risk premium from the AER's foundation model of 4.55 per cent is within the range of premiums recently estimated by brokers, even when these estimates are adjusted for imputation. APTPPL's proposed equity risk premium of 6.45 per cent is above the upper bound of the range of premiums recently estimated by brokers.

Directionally, as shown in Figure 3-13, the ERP has remained within similar parameters for the duration of 2016 which was a movement upwards from 2015 levels. Our equity risk premium estimate remains, in general, below the imputation-adjusted broker estimates and above the unadjusted broker estimates. We do not consider that the directional evidence currently supports a move away from the return on equity resulting from our Guideline approach.

Figure 3-13 Equity risk premium estimates from broker reports



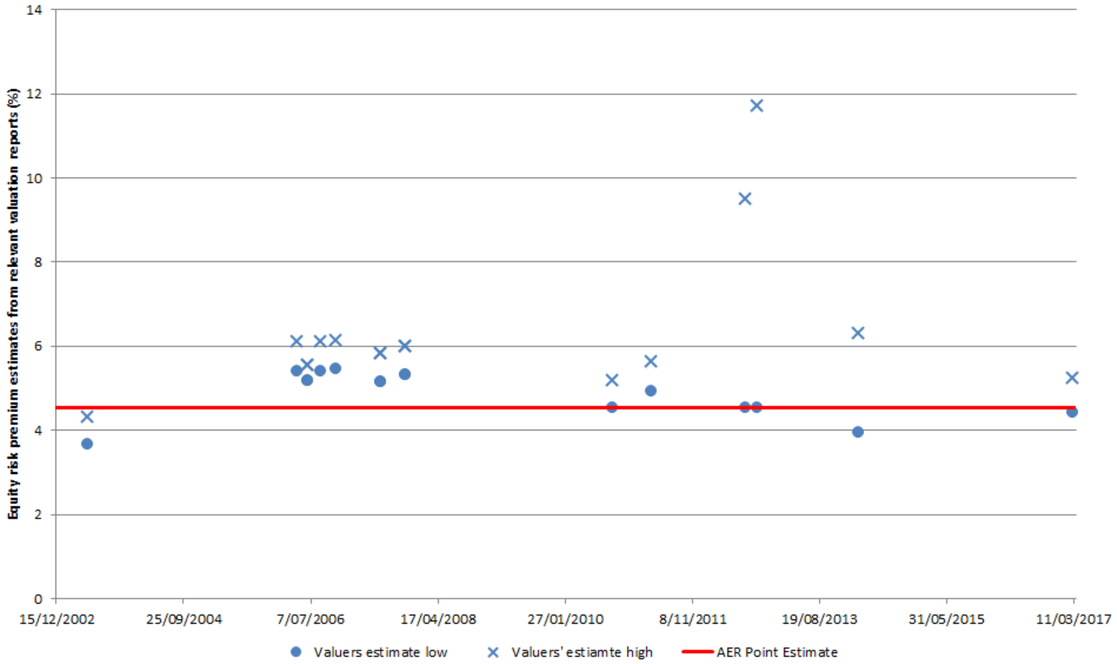
Source: AER analysis of broker reports by Credit Suisse, JP Morgan, Morgan Stanley, and Macquarie Bank that include a valuation for AusNet Services, Spark Infrastructure, APA Group, and/or DUET Group.

Notes: Average broker ERP is the mean of estimates from all brokers and for all businesses available at the time.

F.3 Prevailing estimates: valuation reports

Figure 3-14 outlines the range of return on equity and equity risk premium estimates from relevant independent valuation reports. We consider that the number of reports is too low and the concentration of reports among only a few valuers is too high to be able to place significant reliance on the evidence from valuation reports.[1074]

Figure 3-14 Equity risk premium from relevant valuation reports over time



Source: AER analysis of reports from the Thomson Reuters Connect4 database

Notes: We have shown the equity risk premium based on a nominal vanilla WACC, expert reports using a different WACC form have been adjusted accordingly. This equity risk premium ('Valuers estimate-high') also reflects the impact of any discretionary uplifts applied by the independent valuer.

There have been only 19 relevant independent valuation reports spanning a period going back to 1991.[1075] Only 13 reports included a discounted cash flow analysis with information on a return on equity estimate. These 13 reports were provided by only four independent valuation firms, with 9 of the 13 reports being provided by Grant Samuel & Associates.

[1074] We note that the correction of a small number of errors in Incenta Economic Consulting's analysis of valuation reports resulted in material changes to its results. See: Incenta Economic Consulting, *Addendum to report titled 'Update on evidence on the required return on equity from independent expert reports'*, 20 August 2014, p. 1.

[1075] The Thomson Reuters' Connect 4 database contains reports going back to 1991, but contains no reports between 1991 and 1998 for comparable electricity or gas network businesses. A list of the reports assessed in this report can be found in Table 3-20 of AER, *Draft Decision: TransGrid transmission determination*, 2015–16 to 2017–18, Attachment 3–Rate of return, November 2014.

We note that the ranges for return on equity and equity risk premium estimates contained in Figure 3-14 include the final values used in the independent valuation reports and reflect any uplifts applied. However, as noted in Table 3-6 we have concerns about the applicability of these uplifts to the allowed rate of return objective.[1076] We also have concerns that the adjustment for dividend imputation may not be appropriate (see). The risk premium appropriately reflecting dividend imputation is likely somewhere between the adjusted and unadjusted premiums, but we are unable to distil a precise estimate due to a lack of transparency in valuation reports.

The most recent report for a regulated energy business is KPMG's report for DUET released on 7 March 2017. This report indicates an equity risk premium of 4.44 to 4.62 per cent (without adjustment for dividend imputation).

We find this to be consistent with our foundation model estimate of 4.55 per cent. Prior to the DUET report, the most recent report for a regulated energy network business was Grant Samuel's report for Envestra on 4 March 2014. We find that this evidence does not support a move away from our foundation model estimate of 4.55 per cent. We note that:

- Grant Samuel's initial Sharpe-Lintner CAPM-based return on equity estimate provides an equity risk premium range of 3.6 to 4.2 per cent (without adjustment for dividend imputation, 4.1 to 4.8 per cent including our estimated adjustment for dividend imputation).
- Grant Samuel outlined four separate uplift scenarios that supported its discretionary uplift to its rate of return above the initial Sharpe-Lintner CAPM-based estimate.[1077] Although we have concerns with the applicability of these uplifts to the allowed rate of return objective, our foundation model premium is above or within the equity risk premium range in three of the four scenarios if no adjustments are made for dividend imputation.[1078]

In response to our previous decisions, some service providers submitted that it is not clear how we arrived at our imputation-adjusted equity risk premium range.[1079] This

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1076 See Appendix E.6. 'Return on equity estimates from other practitioners' in the October and November 2015 decisions for more detail.

1077 These being (1) increased risk free rate, (2) increased market risk premium, (3) broker estimates of return on equity, and (4) DGM estimates of return on equity.

1078 Grant Samuel's submission in response to our November 2014 decisions provided some clarification about its use of uplifts and dividend imputation in its Envestra valuation report. However, we considered that this clarification did not affect the fundamental premise of our concerns and hence did not support a change to our approach (for more detail, see sections E.3 and E.6 of Attachment 3 to CitiPower's draft decision). In its revised proposal, CitiPower submitted that our consideration of both imputation-adjusted estimates and unadjusted estimates is illogical given Grant Samuel's submission [CitiPower, *Revised regulatory proposal 2016–2020*, pp. 320]. CitiPower provided no additional information about Grant Samuel's Envestra valuation report and hence our consideration of it is unchanged.

1079 CitiPower, *Revised regulatory proposal 2016–2020*, pp. 317–318; Powercor, *Revised regulatory proposal 2016–2020*, pp. 311–312; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 96–98; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 71–72;

range was calculated using the premiums implied by the low (high) equity beta estimate given by the independent valuer for the bottom (top) of the range for each independent valuation report.

F.4 Prevailing estimates: other regulators

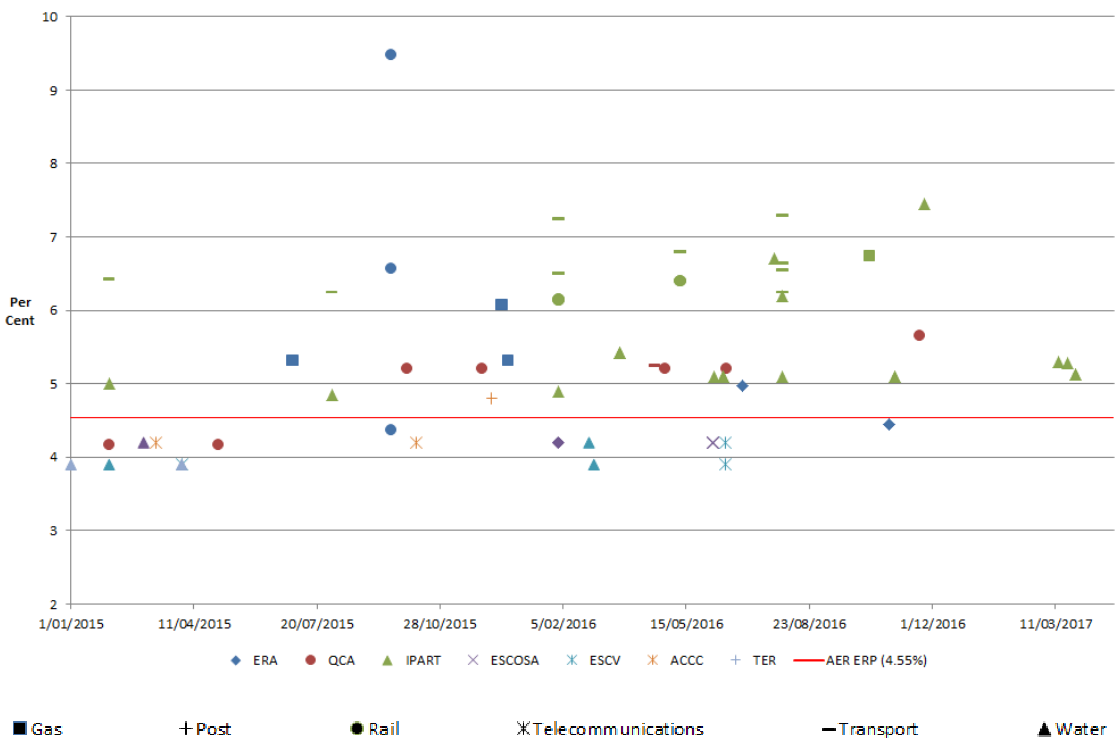
The estimates of return on equity from other regulators' decisions (dated between August 2016 and April 2017) range from 6.66 to 10.5 per cent. The premium above the risk free rate from these return on equity estimates decisions ranges from 3.9 to 7.3 per cent.[1080]

The equity risk premium from our foundation model of 4.55 per cent is within the range of premiums recently estimated by other regulators. Directionally, the range of equity

AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 75–76; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 70–72

1080 Australian Competition and Consumer Commission, *NBN Co Special Access Undertaking: Long Term Revenue Constraint Methodology 2014–15 - Draft Determination*, March 2016; Essential Services Commission of Victoria, *Melbourne Water Price Review 2016: Draft Decision*, March 2016; Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation from 1 July 2016 to 30 June 2020 - Draft report*, March 2016; Independent Pricing and Regulatory Tribunal, *Review of prices for Hunter Water Corporation from 1 July 2016 to 30 June 2020 - Draft report*, March 2016; Independent Pricing and Regulatory Tribunal, *Review of prices for WaterNSW from 1 July 2016 to 30 June 2020 - Draft report*, March 2016; Independent Pricing and Regulatory Tribunal, *Review of prices for WaterNSW from 1 July 2016 to 30 June 2020 - Draft report*, March 2016; Australian Competition and Consumer Commission, W*aterNSW: Annual review of regulated charges 2016-17 - Draft decision*, April 2016; Queensland Competition Authority, *Draft decision DBCT Management's 2015 draft access undertaking*, 19 April 2016; Queensland Competition Authority, *Final decision Aurizon Network 2014 Access Undertaking-Volume IV-Maximum allowable revenue*, 28 April 2016; IPART, *Weighted average cost of capital (WACC) Final report - information paper 10*, 10 May 2016; Australian Competition and Consumer Commission, *WaterNSW: Annual review of regulated charges 2016-17 -Final decision*, May 2016; QCA, *Regulated retail electricity prices for 2016-17, Final determination*, 31 May 2016; ESCOSA, *SA Water Regulatory Determination 2016 Final Decision*, June 2016; IPART, *Review of prices for the Water Administration Ministerial Corporation*, 7 June 2016; IPART, *Review of prices for Sydney Water Corporation, Final Report*, 14 June 2016; IPART, *Review of prices for Hunter Water Corporation, Final Report*, 14 June 2016; IPART, *Review of prices for WaterNSW, Final Report*, 14 June 2016; ESCV, *Goulbourn-Murray Water Price Review 2016*, 16 June 2016; ESCV, *Melbourne Water Price Review 2016 final decision*, 16 June 2016; QCA, *Queensland Rail's Draft Access Undertaking, Decision*, 17 June 2016; ACCC, *Australian Rail Track Corporation's application to vary the 2011 Hunter Valley Access Undertaking - extension of term*, 22 June 2016; ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020*, Appendix 4 Rate of Return, 30 June 2016; ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, 30 June 2016; IPART, *Maximum fees and charges for cruise ships in Sydney Harbour Draft decision*, 26 July 2016; IPART, *WACC biannual update*, August 2016; IPART, *Review of maximum fares for private ferry services in 2017*, 11 October 2016; ERA, *Public Transport Authority- Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks and for Pilbara Railways*, 27 October 2016; *Prices for wholesale water and sewerage charges- Sydney Water Corporations and Hunter Water Corporations - draft report*, November 2016; QCA, *DBCT 2015 Draft Access Undertaking Final decision*, 21 November 2016; IPART, *Maximum fees and charges for cruise ships in Sydney Harbour Final decision*, 25 November 2016; IPART, *Review of Prices for Sydney desalination plant ltd*, 1 March 2017; IPART, *Review of Prices for rural bulk water services from 1 July 2017 to 30 June 2021*, 1 March 2017 risk premium estimates appears broadly consistent with those examined in our previous decisions[1081] as shown in Figure 3-15.[1082]

Figure 3-15 Equity risk premium estimates from other regulators' decisions



Source: AER analysis of other Australian regulators since 01/01/2015

The estimates of the market risk premium from other regulators' decisions (dated between August 2016 and April 2017) range from 6 to 7.55 per cent.[1083] Figure 3-16

1081 Our April and June 2015 decisions examined decisions by other regulators from November 2014 to March 2015. Our October and November 2015 decisions examined decisions by other regulators from March to June 2015.

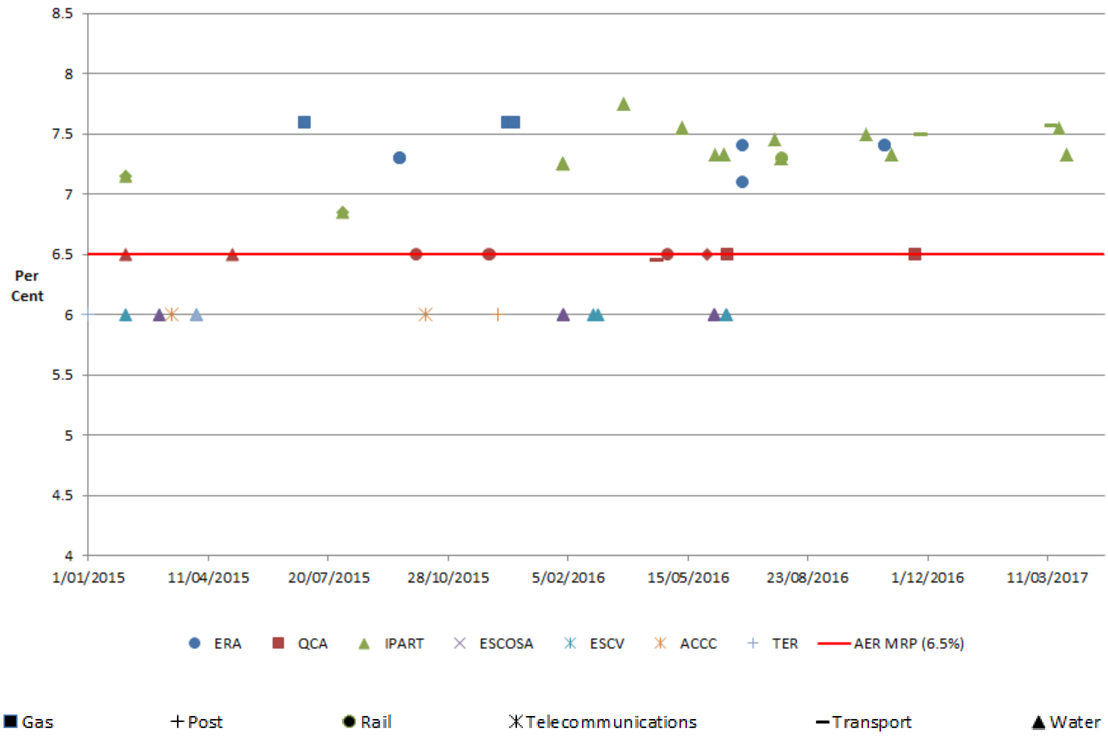
1082 Note that the risk characteristics of rail businesses such as The Pilbara Infrastructure Pty Ltd (an operator of a rail network that transports iron ore freight) may be significantly different to those of the benchmark efficient entity (for example, due to demand risk). Similar concerns may be expressed about Brookfield Rail and IPART Transport decisions. We also note that the ERA's use of the Wright approach to estimating market risk premium is influenced by its annuity pricing framework. The ERA states: "A key consideration in the context of the rail WACC relates to the purpose. The estimate is required to contribute to the annuity that will deliver the value of the rail infrastructure assets, over their economic life. Given the length of the rail asset economic lives, the estimate is long term." [ERA, *Review of the method for estimating the Weighted Average Cost of Capital for the Regulated Railway Networks – Revised Draft Decision*, November 2014, p. 89.] Nevertheless, we have included these decisions for comparative purposes.

1083 Australian Competition and Consumer Commission, *NBN Co Special Access Undertaking: Long Term Revenue Constraint Methodology 2014–15 - Draft Determination*, March 2016; Essential Services Commission of Victoria, *Melbourne Water Price Review 2016: Draft Decision*, March 2016; Independent Pricing and Regulatory Tribunal, *Review of prices for Sydney Water Corporation from 1 July 2016 to 30 June 2020 - Draft report*, March 2016.

shows that our estimate (6.5 per cent) of the market risk premium is consistent with the range of estimates from other regulators over time.

Independent Pricing and Regulatory Tribunal, *Review of prices for Hunter Water Corporation from 1 July 2016 to 30 June 2020 - Draft report*, March 2016, Independent Pricing and Regulatory Tribunal, *Review of prices for WaterNSW from 1 July 2016 to 30 June 2020 - Draft report*, March 2016, Australian Competition and Consumer Commission, *WaterNSW: Annual review of regulated charges 2016-17 - Draft decision*, April 2016, Queensland Competition Authority, *Draft decision DBCT Management's 2015 draft access undertaking*, 19 April 2016; Queensland Competition Authority, *Final decision Aurizon Network 2014 Access Undertaking-Volume IV-Maximum allowable revenue*, 28 April 2016; IPART, *Weighted average cost of capital (WACC) Final report - information paper 10*, 10 May 2016; Australian Competition and Consumer Commission, *WaterNSW: Annual review of regulated charges 2016-17 -Final decision*, May 2016; QCA, *Regulated retail electricity prices for 2016-17, Final determination*, 31 May 2016; ESCOSA, *SA Water Regulatory Determination 2016 Final Decision*, June 2016; IPART, *Review of prices for the Water Administration Ministerial Corporation*, 7 June 2016; IPART, *Review of prices for Sydney Water Corporation, Final Report*, 14 June 2016; IPART, *Review of prices for Hunter Water Corporation, Final Report*, 14 June 2016; IPART, *Review of prices for WaterNSW, Final Report*, 14 June 2016; ESCV, *Goulbourn-Murray Water Price Review 2016*, 16 June 2016; ESCV, *Melbourne Water Price Review 2016 final decision*, 16 June 2016; QCA, *Queensland Rail's Draft Access Undertaking, Decision*, 17 June 2016; ACCC, *Australian Rail Track Corporation's application to vary the 2011 Hunter Valley Access Undertaking - extension of term*, 22 June 2016; ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020*, Appendix 4 Rate of Return, 30 June 2016; ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, 30 June 2016; IPART, *Maximum fees and charges for cruise ships in Sydney Harbour Draft decision*, 26 July 2016; IPART, *WACC biannual update*, August 2016; IPART, *Review of maximum fares for private ferry services in 2017*, 11 October 2016; ERA, *Public Transport Authority- Determination on the 2016 Weighted Average Cost of Capital for the Freight and Urban Railway Networks and for Pilbara Railways*, 27 October 2016; *Prices for wholesale water and sewerage charges- Sydney Water Corporations and Hunter Water Corporations - draft report*, November 2016; QCA, *DBCT 2015 Draft Access Undertaking Final decision*, 21 November 2016; IPART, *Maximum fees and charges for cruise ships in Sydney Harbour Final decision*, 25 November 2016; IPART, *Review of Prices for Sydney desalination plant ltd*, 1 March 2017; IPART, *Review of Prices for rural bulk water services from 1 July 2017 to 30 June 2021*, 1 March 2017

Figure 3-16 Market risk premium estimates from other regulators' decisions



Source: AER analysis of other Australian regulators since 01/01/2015

F.5 Relationship between risk free rate and market risk premium in valuation reports

Some service providers have previously submitted that independent valuation reports provide evidence of an inverse relationship between the risk free rate and the market risk premium.[1084] In addition to reports by Incenta and NERA considered in our October and November 2015 decisions, the HoustonKemp report considered in the April and May 2016 decisions submits that there is a statistically significant inverse relationship

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[1084] CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 307, 316; Powercor, *Revised regulatory proposal 2016–2020*, January 2016, pp. 301, 310; ActewAGL, *Revised 2016–21 access arrangement proposal Response to the AER's draft decision, Appendix 5.01 Detailed response to rate of return, gamma and inflation*, January 2016, pp. 73–74, 83–84; United Energy, *Response to AER preliminary determination–Re: rate of return and gamma*, 6 January 2016, pp. 53–54,61–62; AGN, *2016–17 to 2020/21 Access Arrangement information response to draft decision: Attachment 10.26 Response to draft decision: rate of return*, January 2016, pp. 67 ; JEN (Vic), *2016–20 Electricity distribution price review regulatory proposal revocation and substitution submission: Attachment 6–1 Rate of return, gamma, forecast inflation, and debt and equity raising costs,* 6 January 2016, pp. 58–59, 67–68; AusNet Services, *Electricity distribution price review 2016–20 Revised regulatory proposal: Chapter 7 Rate of return & gamma*, 6 January 2016, pp. 53, 70–73.

between the government bond yield and the market risk premium that is applied by independent expert valuation professionals.[1085]

As stated in previous decisions we consider that there is not sufficient evidence to establish the existence of such a relationship in valuers' estimates, because:

- Incenta's sample is too small to support a reliable inference.
- NERA's regression results are driven by its unsupported assumption that any difference between a valuer's stated risk free rate and the prevailing yield on Commonwealth government securities is to be taken as part of their adopted market risk premium.

As HoustonKemp's analysis uses the same methods to that of NERA, our assessment of NERA's analysis in our October and November 2015 decisions are equally applicable to it. These reasons were supported by Partington and Satchell.[1086]

[1085] HoustonKemp, *The cost of equity: Response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016, pp. xiii–xiv.

[1086] Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 28; Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 36.

G Empirical estimates of equity beta

The equity beta is a key input parameter in the Sharpe–Lintner capital asset pricing model (CAPM). Equity beta measures the sensitivity of an asset or business's returns to movements in the overall market returns (systematic or market risk).[1087]

This appendix focusses on empirical estimates of equity beta. Empirical estimates of equity beta are based on regressions that relate the returns on a set of comparator firms to the return on the market.

As discussed in section 3.4.1, empirical estimates using a comparator set of listed Australian energy network firms from Henry's 2014 report are the main determinants of our equity beta estimate for a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services. Henry's 2014 report is one of a number of Australian empirical studies showing a consistent pattern of equity beta estimates that is robust to the use of different econometric techniques and time periods. We have regard to these other Australian empirical studies. We consider this information supports an equity beta range of 0.4 to 0.7.

We note (and accept) AGN's, AusNet's and Multinet's proposal to adopt our Guideline equity beta of 0.7.[1088]

However all three service providers submitted a CEG report that suggested a higher value based on updating and extending Henry's empirical Australian estimates.[1089] We responded to this material in section 3.4.1 and discuss them in more detail in this appendix. We also have regard to empirical estimates of equity beta for international energy firms. However, we place only limited reliance on this evidence as we do not consider the international firms are sufficiently comparable to a benchmark efficient entity with a similar degree of risk as AusNet Services in providing regulated services. We consider this information provides some support for an equity beta point estimate towards the upper end of the range.

We note (and reject) APA and APTPPL's proposal for an equity beta of 0.8. APTPPL submitted a Frontier report (dated December 2016) with more recent estimates of the equity.[1090] We responded to the two service providers' material in 3.4.1.

[1087] McKenzie and Partington, *Risk, asset pricing models and WACC*, June 2013, p. 21; Brealey, Myers, Partington, Robinson, *Principles of Corporate Finance*, McGraw-Hill Australia: First Australian Edition, 2000, p. 187.

[1088] Multinet Gas, *Rate of Return Overview*, 16 December 2016, p. 6; AusNet Services, *Gas Access Arrangement Review 2018–2022: Access Arrangement Information*, 16 December 2016, p. 202; AGN, *Final Plan Access arrangement information for our Victorian and Albury natural gas distribution networks: 2018 to 2022–Attachment 10.1: Financing Costs*, December 2016, pp. 5, 17..

[1089] AusNet submitted a September 2016 version of the report: CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016. Multinet submitted a November 2016 version of the report: CEG, *Replication and extension of Henry's beta analysis*, November 2016

[1090] Frontier, *An equity beta estimate for Australian energy network businesses*, December 2016.

This appendix sets out:

- the Australian and international empirical estimates we consider in this decision
- the comparator set we use for our empirical analysis and our reasons for using this comparator set.

G.1 Australian empirical estimates from Henry's 2014 report

For our Australian empirical analysis we commissioned an expert report from Professor Olan Henry (Henry), which provided an update on his 2009 econometric analysis of equity beta.[1091] We consider the evidence presented in Henry's 2014 report in detail because it uses the most recent data and this is relevant in selecting an equity beta (and return on equity) that is reflective of prevailing market conditions.[1092]

Henry's 2014 report presented empirical estimates of equity beta for our comparator set of nine Australian energy network firms (see section G.4.1), using available data from 29 May 1992 to 28 June 2013.[1093] Based on our detailed discussion of methodological choices in recent decisions,[1094] we consider the most useful empirical estimates:

- use the Ordinary Least Squares (OLS) estimator (with the Least Absolute Deviation (LAD) estimator used as a robustness check for outliers in the underlying data)
- are measured over multiple estimation periods
- use weekly return intervals (with monthly returns used as a robustness check)
- use the Brealey–Myers formula to de- and re-lever raw[1095] estimates to a benchmark gearing of 60 per cent, although we consider both raw and re-levered estimates
- are based on averages of individual firm estimates and fixed weight portfolios (equal weighting and value weighting)
- do not apply a Blume or Vasicek adjustment.[1096]

We consider the equity beta estimates presented in Henry's empirical analysis support a range of 0.4 to 0.7. Table 3-28 and table 3-29 set out Henry's re-levered OLS equity beta estimates for the individual comparator firms (averaged across firms) and fixed weight portfolios respectively. The results show that:

[1091] Henry, *Estimating β*, April 2009; Henry, *Estimating β: An update*, April 2014.

[1092] NER, cll. 6A.6.2(g) and 6.5.2(g); NGR, rule 87(7). It is the most recent AER report.

[1093] Henry, *Estimating β: An update*, April 2014, p. 9.

[1094] See, for example, AER, *Preliminary decision: AusNet Services determination 2016 to 2020—Attachment 3: Rate of return*, October 2015, section D.2.2.

[1095] Raw equity beta estimates are those that are observed from the initial regression

[1096] Henry does not apply a Blume or Vasicek adjustment of any of his estimates, as specified in our terms of reference.

- The re-levered individual firm estimates (averaged across firms) range from 0.46 to 0.56. The corresponding raw (that is, observed market gearing level) estimates range from 0.48 to 0.50.[1097]
- The re-levered fixed weight portfolio estimates range from 0.39 to 0.70. The corresponding raw estimates range from 0.42 to 0.58.[1098]

Table 3-28 Average of re-levered equity beta estimates (individual firm) from Henry's 2014 analysis (OLS, weekly)

Issue	Longest available period	2002 to 2013 (excluding GFC)	Last five years [(a)]
Re-levered OLS estimates	0.52	0.56	0.46

Source: AER analysis; Henry, *Estimating β: An update*, April 2014.

(a) AAN, AGL and GAS were not used for this estimation period because Henry only uses data up to 2006 or 2007 for these firms. See: Henry, *Estimating β: An update*, April 2014, p. 17.

Table 3-29 Re-levered fixed weight portfolio equity beta estimates from Henry's 2014 analysis (OLS, weekly)

	P1	P2	P3	P4	P5
Firms	APA, ENV	AAN, AGL, APA, ENV, GAS	APA, DUE, ENV, HDF, SPN	APA, DUE, ENV, HDF, SKI, SPN	APA, DUE, ENV, SKI, SPN
Equal weighted					
Longest available period[(a)]	0.46	0.52	0.50	0.48	0.39
Longest period available (excl. tech boom & GFC)	0.49	0.52	0.5	0.53	0.45
Value weighted					
Longest available period[(a)]	0.50	0.70	0.44	0.42	0.39
Longest period available (excl. tech boom & GFC)	0.54	0.70	0.52	0.50	0.48

Source: AER analysis; Henry, *Estimating β: An update*, April 2014.

Note: Henry's 2014 report also presented time varying portfolio estimates of equity beta (which range from 0.39 to 0.53, see Henry, *Estimating β: An update*, April 2014, p. 56). We do not place any material reliance on these estimates for reasons discussed in section D.2.2 of Attachment 3 to AusNet Services' preliminary decision.

(a) The longest available period is June 2000–June 2013 for P1; December 2001–October 2006 for P2; December 2005–November 2012 for P3; March 2007–November 2012 for P4; March 2007–June 2013 for P5.

1097 The raw equity beta estimates are those that are observed from the initial regression. They have not been de-levered and re-levered to a benchmark gearing of 60 per cent. These estimates are not presented but can be found at: Henry, *Estimating β: An update*, April 2014, pp. 87–89.

1098 These estimates are not presented but can be found at: Henry, *Estimating β: An update*, April 2014, pp. 90–93.

Additionally, Henry's 2014 report presented LAD (weekly) estimates as a robustness check for outliers in the underlying data. He also presented OLS estimates using monthly return intervals as a robustness check of the estimates using weekly return intervals. Henry stated the difference between the re-levered OLS and LAD equity beta estimates are 'almost universally statistically insignificant'.[1099] The results are as follows:[1100]

- the re-levered LAD estimates range from 0.38 to 0.58 and the raw LAD estimates range from 0.31 to 0.60.[1101]
- the OLS estimates using monthly return intervals range from 0.37 to 0.58.[1102]

Henry also performed various robustness and sensitivity tests on the equity beta estimates. These included the Dimson adjustment for thin trading, as well as recursive estimates and the Hansen test for parameter stability and sensitivity. Henry concluded that there is little to no evidence of thin trading across all regression permutations and 'no overwhelming issue with instability'.[1103] Therefore, we are satisfied the estimates presented in Henry's 2014 report are reasonably stable and not significantly affected by thin trading. We also note Associate Professor Graham Partington stated that:[1104]

> A final comment may be made with reference to a number of the reports that allege instability in the estimates of β. Henry (2008, 2009, 2014) provides a range of evidence demonstrating the stability of the estimates.

We consider the equity beta estimates presented in Henry's 2014 report are consistent across a range of different regression permutations, as outlined above. Henry used credible econometric techniques and incorporated robustness checks for data outliers, thin trading and parameter instability in his analysis. Therefore, we have confidence that the equity beta estimate for a benchmark efficient entity falls within the range of

1099 Henry, *Estimating β: An update*, April 2014, p. 62.

1100 These equity beta estimates are not presented but can be found at: Henry, *Estimating β: An update*, April 2014, pp. 17–43. We consider fixed weight portfolio estimates (equal weighting and value weighting) and averages of individual firm estimates.

1101 The raw LAD estimates can be found at: Henry, *Estimating β: An update*, April 2014, pp. 87–89 (for averages of individual firm estimates) and Henry, *Estimating β: An update*, April 2014, pp. 90–93 (for fixed weight portfolio estimates). Henry also presented LAD equity beta estimates for time varying portfolios, and these estimates range from 0.39 to 0.53. See: *Henry, Estimating β: An update*, April 2014, p. 56.

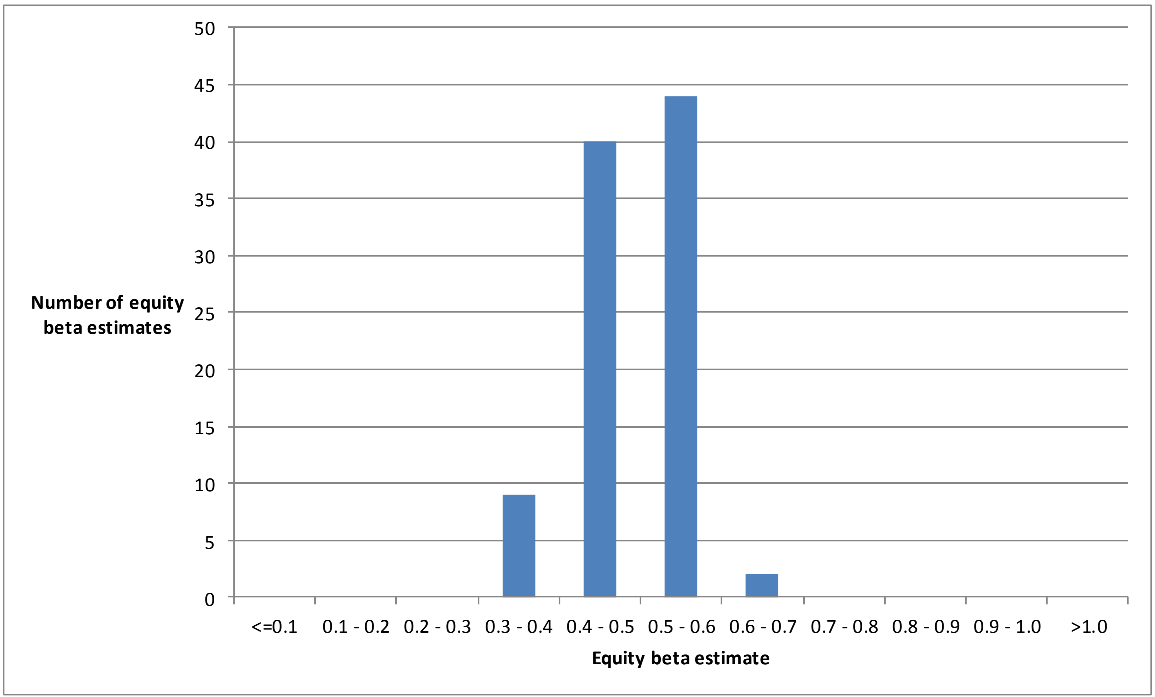
1102 Henry did not present raw estimates for monthly return intervals. Henry also did not present LAD estimates using monthly return intervals. Henry did present time varying portfolio OLS estimates using monthly return intervals, and these estimates range from 0.39 to 0.47. See: *Henry, Estimating β: An update*, April 2014, p. 58. Henry also suggested that the individual firm estimates based on monthly returns be treated with a degree of caution because some estimates are statistically insignificant. See: *Henry, Estimating β: An update*, April 2014, p. 27.

1103 Henry, *Estimating β: An update*, April 2014, p. 62. Henry explains that where the Hansen test does show evidence of instability, it is almost uniformly due to a change in the error variance in the regression model. He states that 'there is no evidence of parameter instability associated with the coefficients of the regression models themselves'. However, the Hansen test for equal and value weighted portfolio estimates for P2 (over the longest available period) shows some evidence of parameter instability for beta and should be treated with a degree of caution. See: Henry, *Estimating β: An update*, April 2014, pp. 50–51, 62.

1104 Partington, *Report to the AER: Return on equity (updated)*, April 2015, p. 22.

0.4 to 0.7. We also consider Henry's 2014 results indicate a best empirical estimate of approximately 0.5 for a benchmark efficient entity. This is because most of the estimates are clustered around 0.5, as shown in figure 3-17.

Figure 3-17 Equity beta estimates from Henry's 2014 report (average of individual firm estimates and fixed weight portfolio estimates)



Source: AER analysis; Henry, *Estimating β: An update*, April 2014.

Note: This figure contains all averages of individual firm estimates and fixed weight portfolio estimates presented in Henry's 2014 report (95 estimates in total). This includes OLS and LAD estimates, raw and re-levered estimates, weekly and monthly return intervals and all estimation periods.

G.2 Australian empirical estimates from other studies

We consider the equity beta estimates presented in Henry's 2014 report and our 2017 analysis are generally consistent with other empirical studies based on Australian energy network firms, as set out in table 3-30. These other empirical studies use different econometric techniques and/or comparator sets to our empirical analysis, some of which are not necessarily consistent with our methodological choices.[1105] Nonetheless, the empirical estimates presented give us confidence that there is an extensive pattern of support for an empirical equity beta within a range of 0.4 to 0.7.

[1105] As set out in section D.2.2 of Attachment 3 to AusNet Services' preliminary decision.

Table 3-30 Equity beta estimates for Australian energy network firms

Source	Time period	Individual firm averages	Fixed portfolios	Varying portfolios[a]	Summary of regression permutations
Frontier 2016a	2006–2016	0.48–0.63	0.49–0.75	n/a	weekly/monthly return intervals, multiple estimation period, OLS regression, fixed portfolios, average portfolios, raw/re-levered estimates, 4 comparators
CEG 2016a	1992–2016	0.6–0.69	0.55–0.71[b]	0.54–0.78	weekly return intervals, multiple estimation period, OLS regression, time varying portfolios, average/median varying portfolios, raw/re-levered estimates, 9 comparators
CEG 2016	1992 - 2016	0.6–0.68	0.62–0.78[b]	0.53-0.64	weekly return intervals, multiple estimation period, OLS regression, time varying portfolios, average/median varying portfolios, raw/re-levered estimates, 9 comparators
ERA 2016	2011-2016	0.54–0.6	0.64–0.78	n/a	weekly return intervals, 5 years (June 2011 to May 2016) for individual firms and portfolios, OLS/LAD/MM/T-S/ARIMAX/GARCH regressions, equal weight fixed/value weighted portfolios raw estimates, 4 comparators
Frontier 2016	1997–2015	0.49–0.63	n/a	n/a	Weekly/monthly return intervals, multiple estimation period, OLS regression, raw/re-levered estimates, 9 comparators
ERA 2015	2010–2015	0.55–0.59	0.65–0.79	n/a	weekly return intervals, 5 years for individual firms and portfolios, start November 2010 to October 2015, OLS/LAD/MM/T-S/ARIMAX/GARCH regressions, equal weight fixed/value weighted portfolios raw estimates, 4 comparators
SFG 2015	2002-2013	0.37-0.83	0.39-0.70	n/a	weekly return intervals, multiple estimation periods, OLS/LAD regressions, equal weight fixed portfolios raw/re-levered estimates, 9 comparators
Henry 2014	1992–2013	0.37–0.56	0.31–0.70[c]	0.39–0.53	weekly/monthly return intervals, multiple estimation periods, OLS/LAD regressions, value/equal weight fixed portfolios, average/median varying portfolios, raw/re-levered estimates, 9 comparators
Grant Samuel 2014	2009–2014[d]	0.42–0.64	n/a	n/a	weekly/monthly return intervals, multiple estimation periods, OLS regressions, Bloomberg adjusted betas, raw estimates, 5 comparators
ERA 2013	2002–2013	0.48–0.52	0.39–0.59	n/a	weekly return intervals, OLS/LAD/MM/TS regressions, value/equal weight fixed portfolios, multiple estimation periods, re-levered estimates, 6 comparators
SFG 2013	2002–2013	0.60	n/a	0.55	OLS regressions, four weekly repeat sampling, Vasicek adjustment, re-levered estimates, 9 comparators
ERA 2012	2002–2011	0.44–0.60	n/a	n/a	weekly/monthly return intervals, OLS/LAD regressions, re-levered estimates, 9 comparators

Henry 2009	2002–2008	0.45–0.71	0.35–0.94[(e)]	0.41–0.78	weekly/monthly return intervals, various estimation periods, OLS/LAD regressions, value/equal weight fixed portfolios, average/median varying portfolios, re-levered estimates, 9 comparators
ACG 2009[(f)]	1990–2008	0.50–0.58	n/a	0.69–0.91	monthly return intervals, OLS/LAD regressions, multiple estimation periods, raw/re-levered estimates, average/median varying portfolios, 9 comparators
Henry 2008	2002–2008	0.35–0.67	0.31–0.77[(g)]	n/a	daily/weekly/monthly return intervals, discrete/continuous returns, various estimation periods, OLS/LAD regressions, value/equal weight portfolios, raw/re-levered estimates, no adjustment/Vasicek/Blume, 10 comparators

Source: AER analysis.[1106]

(a) We place no material reliance on the estimates from time varying portfolios as they are not grounded in financial theory and are prone to measurement error. See: Henry, *Estimating β: An update*, April 2014, p. 52.

(x) 0.30 is an LAD estimate, which we place less reliance on. The minimum OLS estimate is 0.52.

(b) These estimates are based on five-year and one year data for the 4 remaining comparator firms (AST, DUE, SKI and APA).

(c) 0.31 is a raw LAD estimate, which we place less reliance on. The minimum re-levered LAD estimate is 0.38 and the minimum OLS estimate is 0.39.

(d) Grant Samuel uses equity beta estimates from the Australian Graduate School of Management (AGSM) and Bloomberg. This time period reflects AGSM's estimation, which uses a four year estimation period as at September 2013, and Bloomberg, which uses a four year estimation period as at February 2014.

(e) 0.94 is an LAD estimate based on a portfolio with only 18 monthly observations. If this portfolio is excluded the maximum estimate is 0.75, which is again an LAD estimate (which we place less reliance on). The maximum OLS estimate is 0.62.

(f) ACG did not make it clear what time period its data covered. However, it noted that equity beta estimates were only used where there were more than 20 observations.

(g) 0.31 is an LAD estimate, which we place less reliance on. The minimum OLS estimate is 0.42. 0.77 is a Blume–adjusted estimate, which we do not rely on. The maximum unadjusted estimate is 0.68, and the maximum OLS estimate is 0.66.

1106 Based on the following reports: ACG, *Empirical evidence on proxy beta values for regulated gas transmission activities: final report*, July 2002, pp. 35, 39–40; Henry, *Econometric advice and beta estimation*, November 2008; ACG, *Australian Energy Regulator's draft conclusions on the weighted average cost of capital parameters: commentary on the AER's analysis of the equity beta*, January 2009, pp. 22, 25; Henry, *Estimating β*, April 2009; ERA, D*raft decision on proposed revisions to the access arrangement for the Western Power network*, March 2012, pp. 202, 204; SFG, *Regression-based estimates of risk parameters for the benchmark firm*, June 2013, pp. 12–15; ERA, *Explanatory statement for the rate of return guidelines*, December 2013, pp. 171, 173; Grant Samuel and Associates, *Envestra financial services guide and independent expert's report (appendix 3)*, March 2014, p. 6; Henry, *Estimating β: an update*, April 2014; SFG, *Beta and the Black capital asset pricing model*, 13 February, 2015; ERA, *Draft decision on proposed revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016–2020: Appendix 4 Rate of Return*, 22 December 2015, p.192; ERA, *Final decision on proposed revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016–2020: Appendix 4 Rate of Return*, 30 June 2016, p. 193; CEG, *Replication and extension of Henry's beta analysis*, September 2016, pp. 7, 9, 15, 20-1;

We note AusNet, AGN and Multinet submitted more recent Australian empirical estimates of equity beta since our previous regulatory decision. AusNet and AGN submitted a September 2016 CEG report that claim replication and extension of Henry's 2014 empirical Australian estimates of equity beta.[1107] Multinet submitted an updated version of this CEG report (dated November 2016).[1108]

After considering these materials, we are of the view that they do not provide satisfactory evidence to depart from our empirical range of 0.4–0.7 and point estimate of 0.7 which is selected towards the upper end of the range.

We discuss this material below.

G.2.1 September and November 2016 CEG report

We note AusNet, Multinet and AGN have adopted the Guideline equity beta of 0.7 but still submitted a CEG report in support of a higher beta. AusNet and AGN submitted the September 2016 version of the report.[1109] Multinet submitted the updated November 2016 version of the report.[1110] Apart from an additional four month of data, the November report conducted Quandt-Andrews tests to identify structural breaks.

We note CEG's main conclusions are:

- CEG's extension of Henry's estimates suggest that empirical estimates of equity have increased since Henry's 2014 report
- CEG's more recent estimates for still listed firms indicate a more prominent increase in the equity beta since Henry's estimates
- The increase in beta is consistent with the observation from a February 2016 CEG report which observed a structural break in average rolling beta at 2014/15.

We discuss each conclusion below.

Extension of Henry's results

CEG extended Henry's estimates in its report (to June 2016 in the September report and to October 2016 in the November report) and concluded that empirical estimates of equity beta have increased since Henry's 2014 report (see Table 3-31).

Table 3-31 Response to key results from CEG's report

Results	Our response
Empirical analysis	
Individual firm estimates show	The average re-levered firm-level estimates increased slightly (by 0.042) from 0.554 to

[1107] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016.
[1108] CEG, *Replication and extension of Henry's beta analysis*, November 2016.
[1109] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016.
[1110] CEG, *Replication and extension of Henry's beta analysis*, November 2016.

that the average re-levered equity beta has increased by around (0.04) since the end of Henry's sample period (or an increase of around 0.09 for firms with 3 years of additional data is available)[1111]	0.596. The average re-levered portfolio estimates increased by a similar magnitude. These estimates are consistent with our range of 0.4–0.7. Partington and Satchell advised that 'with one exception, all the betas resulting from [CEG's extension of individual firm beta estimates (longest time period) lay within the 95% confidence interval of Henry's estimates].[1112]
Weekly equal weighted portfolio beta show that average beta has increased by around 0.04 since the end of Henry's sample period (or an increase of around 0.07 for portfolios for which additional data is available)[1113]	For equally weighted portfolios, only one portfolio (P5) lay outside the 95% confidence intervals of Henry's estimates. This does not suggest a material change in empirical estimates of equity beta.
Weekly value weighted portfolio beta show that re-levered equity beta has increased by around 0.05 since the end of Henry's sample period (or an increase of around 0.1 for portfolios for which additional data is available)[1114]	The value-weighted portfolio-level estimates increased by a similar magnitude as the average of firm-level estimates.
November 2016 report	
Individual firm estimates show that the average re-levered equity beta has increased and for firms with additional data firm level estimates has increased by 0.05–0.14.[1115]	We have regard to average of firm-level estimates because no one comparator firm is perfectly reflective of a benchmark efficient entity with a similar degree of risk as that which applies to APTPPL, in providing regulated services, we rely on averages of individual firm estimates to determine an equity beta range.[1116] The average re-levered firm-level estimate (using weekly data and Henry's longest sampling period extended until October 2016) increased slightly (by 0.05) from 0.554 to 0.6.[1117] If this is restricted to firms with additional data, then the average re-levered firm-level estimate is 0.488 which is a decrease compared to CEG's and Henry's estimates for 2013.
Weekly equal weighted portfolio beta shows that average beta has increased by around 0.09 for portfolios for which additional data is available[1118]	CEG's portfolio-level estimates increased by a similar magnitude (0.48 to 0.53 for equally weighted portfolios and 0.5 to 0.56 for value-weighted portfolios) as the average of firm-level estimates over the longest sample period.
Weekly value weighted portfolio beta show that re-levered equity beta has increased by 0.12 for	

[1111] CEG, *Replication and extension of Henry's beta analysis* , 21 September 2016, p. 7.

[1112] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017. pp. 11–12.

[1113] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 10.

[1114] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 12.

[1115] CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 9.

[1116] AER, *Better Regualtion Explanatory Statement Rate of Return Guideline (Appendices),* December 2013, p. 49.

[1117] The average of Henry's re-levered equity beta for firm-level estimates was 0.52. CEG's replication (0.554) is different from Henry's result would be driven by the method we use for gearing to account for cross-holding. We compare CEG's extension with its replication of Henry's estimates to allow a like-for-like comparison.

[1118] CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 12.

portfolios for which additional data is available[1119]	

Having considered CEG's results, we do not consider that CEG's extension provides satisfactory evidence of an increase in equity beta for a number of reasons, including:

- Partington and Satchell noted that there is no statistical test of the significance of the increase in re-levered betas.[1120]Given the imprecision associated with empirical estimates, CEG's results in Table 3-31 do not indicate strong evidence of a material change in empirical estimates to depart from our empirical range and point estimate as CEG's extension indicate small changes.
- CEG's extension is consistent with (and within) our range of 0.4–0.7.
- We note CEG's replication are generally higher than Henry's original results. In particular, CEG's replication of SKI's re-levered beta is 57 per cent higher than Henry's estimate which would drive differences between CEG's replication (and extension) and Henry's original results.[1121] CEG also acknowledged the discrepancy between its replication and Henry's results.[1122] CEG's observed 'increases' in the equity beta would be overstated due to discrepancies with Henry's original results. Given the noted discrepancy with re-levered equity betas, a comparison of the asset betas (of Henry's original results and CEG's extension) shows little change. Partington and Satchell also agreed that 'all increases seem rather small and are very likely statistically insignificant' for the September report.[1123]
- CEG included a time varying element in the extension estimation of portfolios estimates. Henry 2014 had stated that great caution should be exercised when interpreting the beta estimates from the resulting time varying portfolios as they were not grounded in financial theory.

Our views are supported by Partington and Satchell who noted that they 'are not convinced that there has been material change in beta' after reviewing CEG's estimates[1124] and continue to see 'little evidence of change' in the November CEG report.[1125]

Recent estimates of equity beta

1119 CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 16.

1120 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017, p. 12.

1121 The discrepancy is because we adjust for related party transactions for SKI to Powercor, CitiPower and SAPN (formerly ETSA).

1122 CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 6; CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 8.

1123 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017, p. 13.

1124 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017, p. 8, 14.

1125 Partington and Satchell, *Report to the AER: Discussion of submissions on the cost of equity*, 8 June 2017. p. 8, 9.

CEG estimated more recent equity beta for the four still-listed firms (APA, SKI, DUE and AST) in Henry's comparator firms and concluded that this suggested a more prominent increase in the equity beta:

- Most recent 5 year average firm-level equity beta for still-listed firms have almost doubled on average compared to Henry's 5 year estimates[1126]
- Most recent one year estimate show average re-levered equity beta has increased by around 0.13 compared to Henry's 5-year estimates.[1127]
- Average firm-level re-levered equity beta has increased by 0.23 since Henry's results based on a comparison of five year estimates.[1128]
- Re-levered equity beta for some portfolio estimates (P1, P5 and P6) have increased by 0.19 to 0.31 since Henry's results.[1129]
- A comparison of P6's re-levered equity beta for different measurement periods (ranging from one year to five year estimates) indicate a rising trend for empirical estimates[1130]

We have previously outlined reservations about the imprecise nature of empirical estimates, particularly for shorter-term estimates and small samples.[1131] We continue to be of this view and consider that short term data is more prone to one-off events, fluctuations and volatilities in the market–which may obscure the 'true' equity beta for a benchmark efficient entity. Therefore, we have most regard to longer term estimates when determining the equity beta and do not consider, as proposed by CEG, that more recent estimates of equity sufficiently justify an increase to our range and/or point estimates.

We have estimated five-year estimates as Henry has done (at the firm-level and portfolio-level) using data to 28 April 2017.[1132] The results (portfolio estimates: 0.54–0.57, firm estimates: 0.31–0.72) support Henry's range of 0.3–0.8 (and as a result our range of 0.4–0.7) and do not suggest an increase in equity beta.

CEG submitted increases in the most recent 5 year data reflected increases in the raw equity betas, decreases in gearing ratios of the remaining listed stocks and an increase in the weighting of high-beta stocks (APA) in the value-weighted portfolios.[1133] We also note that some of the still-listed firms have undertaken a range of transactions that would increase their exposure to systematic risk from unregulated assets and/or assets

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[1126] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 13.
[1127] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 2.
[1128] CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 1.
[1129] CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 3.
[1130] CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 21.
[1131] AER, *Better regulation: Explanatory statement rate of return guideline,* December 2013, p. 122.
[1132] For still-listed firms.
[1133] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 1; CEG, *Replication and extension of Henry's beta analysis,* November 2016, p. 21; Partington and Satchell, *Report to the AER: Discussion of the Estimates of the Return to Equity*, 12 April 2017, pp. 11-13.

that are different from the risk of providing services with a similar degree of risk as the reference services.[1134] However, that should not affect their systematic risk of supplying reference services. Therefore it is not clear that CEG's result, even if reflective of a true increase in the underlying beta of the sample, is indicative of a material change in the equity beta of a benchmark efficient entity in providing reference services. Partington and Satchell has also advised that there is overall only 'weak evidence of increased beta at the individual firm level based on last five years data set'.[1135]

Structural breaks

CEG conducted the Quandt-Andrews structural break test to determine whether the change in asset beta indicates a statistically significant structural break for portfolios with still-listed firms (P1, P5 and P6).[1136]

The sixth portfolio (Portfolio 6 or P6) includes 4 firms only, and CEG focuses on this portfolio to test for a structural break.[1137] CEG submitted that the Quandt-Andrews test identified a break corresponding with the GFC and, when run on post GFC data, identifies another break in August 2014.[1138] On the basis of this "break", CEG is of the view that the estimate of beta is not stable across the whole sample.

Following this, CEG obtained estimates of the re-levered equity beta before and after the August 2014 break point. CEG concludes that, for the equal (value) weighted Portfolio 6, estimates of equity beta has increased by 0.38 (0.37) between the pre and post structural break sample periods. The best estimate of the re-levered equity beta is at least 0.88 after the 2014 August breakpoint and 0.7 over the last 5 years.[1139]

We have reservations about CEG's results and conclusions for structural breaks based on the following:

- Partington and Satchell have cautioned against results from CEG's Quandt-Andrews test because this test is a large sample test and 'whether a sample of five years of weekly data is a sufficient sample size is an open question'.[1140]
- The breakpoints identified from the Quandt-Andrews test will be more reliable if they are closer to the centre of the test sample. However, CEG's break points for P5 and P6 are all towards the end of the test samples.[1141]

[1134] https://www.apa.com.au/about-apa/our-history/; http://www.duet.net.au/getattachment/ASX-releases/2015/DUET-Completes-Acquisition-of-Energy-Developments/DUET-Completes-Acquistion-of-Energy-Developments-L/DUET-Completes-Acquistion-of-Energy-Developments-Limited.pdf.aspx

[1135] Partington and Satchell, Report to the AER: Discussion of the Estimates of the Return to Equity, 12 April 2017, p. 14.

[1136] CEG, *Replication and extension of Henry's beta analysis,* November 2016, pp. 23–26, 36–43.

[1137] It is noted that Portfolio 6 is the only portfolio for which all of the constituents have data to October 2016.

[1138] Competition Economists Group, 2016, *Replication and extension of Henry's beta analysis*, November 2016, page 4.

[1139] Competition Economists Group, 2016, *Replication and extension of Henry's beta analysis*, November 2016, page 5.

[1140] Partington and Satchell, *Report to the AER: Discussion of Submissions on the Cost of Equity*, May 2017, p. 13.

- The Quandt-Andrews test requires pre and post-test periods representing X% of the data which are excluded from the period examined for a structural break. Given the concern with sample size, we are uncertain about the robustness of CEG's results.

Therefore, we do not find satisfactory evidence of a structural break in empirical estimates (since Henry's estimation) to warrant departing from our range and point estimate. Partington and Satchell also do not consider that the case for an increase in beta to be nearly as compelling as CEG claims.[1142] They are particularly concerned about the re-levering process and that a more comprehensive picture could be obtained by also testing for structural breaks in the raw betas and re-levered betas, with tests conducted on both individual stocks and portfolios.

With particular reference to Portfolio 6 and compared with CEG's analysis, our analysis does not provide any evidence to support a break after August 2009.

We consider that it is important to recognise the structural break, if any, in the data because without recognising it, an estimated parameter of interest may provide irrelevant information. However, for meaningful results it is important that a robust approach should be followed. We consider that it is appropriate to follow a two-step approach to identify any structural break in the data.

1. First, a major event during a period is examined to consider a possible structural break in the data, to be named "the necessary condition"; and
2. Second, structural break tests such as a very popular Chow's test and the others are conducted to examine realised data to confirm if the structural break did occur during the period as anticipated, to be named "the sufficient condition".

Each of these two steps is discussed in turn below.

Step 1: An establishment of a major event

As the first step, it is necessary to identify any possible structural break recognizing a major event during the period under examination. For example, the Persian Gulf crisis of 1991 was examined to consider the international response of the equity prices (Malliaris and Urrutia, 1995).[1143] Nikkenin et al (2008)[1144] used the September 11 attack in the US to examine the impact of this event on the volatility stock markets in six different regions. The 1997 Asian financial crisis; the collapse of oil prices in 1998; and the adoption of the price band mechanism by OPEC in 2000 were examined to

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[1141] Partington and Satchell, *Report to the AER: Discussion of Submissions on the Cost of Equity*, May 2017, p. 15.

[1142] Partington and Satchell, *Report to the AER: Discussion of Submissions on the Cost of Equity*, May 2017, p. 16.

[1143] Malliaris & Urrutia (1995), The Impact of the Persian Gulf Crisis on National Equity Markets, *Advances in International Banking and Finance*, 1, 43-65.

[1144] Nikkinen, J., Omran, M., P., Sahlstrom, P. & Aijo, J. (2008) Stock Returns and Volatility Following the September 11 Attacks: Evidence from 53 Equity Markets, *International Review of Financial Analysis*, 17, 27-46.

consider sudden changes in volatility for five Gulf stock markets (Hammoudeh and Li, 2008).[1145]

As an illustration, CEG found a break in 2009 during the Global Financial Crisis. A similar finding is noted in our 2017 update. This structural break could be explained by the effects of the GFC. However, another structural break was found in August 2014 in the CEG (2016) study. We have conducted a comprehensive search to identify any major event which could be used to explain a structural break in beta in Australia.[1146] Significant events happening in 2014 include the Ukrainian Revolution (February 18);[1147] Malaysia Airlines Flight 370 (March 8); Russia formally annexes Crimea (March 21); Islamic State of Iraq forces seize control of government offices and other important buildings in the northern city of Mosul (June 11) and others. We are not convinced that one of these significant events in 2014 can be used to explain a structural break in Australian betas. As a consequence, the proposed structural break of August 2014 found in the CEG 2016 study, which is not found in our 2017 update, is viewed as a random or spurious finding. In addition, we note Partington and Satchell's view that the breakpoint test would be more reliable if the breakpoint detected was closer to the centre of the test sample. The fact that the break is near the end of the sample deems it to be less reliable. Importantly, CEG's proposed August 2014 structural break is identified from Portfolio 6 which includes only 4 firms in the data period from June 2000 (for the APA Group) to October 2016. As such, we are of the view that this structural break is less reliable.[1148]

Step 2: An empirical examination of a structural break around a major event using various tests

In their advice, Partington and Satchell considered that the Chow test is an appropriate test for a structural break. Partington and Satchell also considered that the Quandt Andrews test, as adopted in both CEG and our analysis, is also a suitable test for a structural break, although this test is less restrictive. We note that the Chow test is used to test for break points or structural changes in a model by partitioning the data into two separate parts. As such, the Chow test is a very restrictive test in that the point of the structural break should be pre-determined in advance of the test. Other tests including the Quandt Andrews test allow the point of the structural break to be determined from the data. We are open to the use of various tests for structural breaks because an exact break date may not be exactly pre-determined. From our perspective the structural break under investigation may be pre-determined or not, as long as the above two-step approach is considered. As such, we are of the view that a higher hurdle is required when identifying a structural break.

1145 Hammoudeh, S. and Li, H. (2008), Sudden Changes in Volatility in Emerging Markets: The Case of Gulf Arab Stock Markets, *International Review of Financial Analysis*, 17, 47-63.

1146 For details, please visit http://www.onthisday.com/date/2014, accessed on 25 May 2017.

1147 Ukrainian Revolution of 2014 begins as protesters, riot police and unknown shooters take part in violent events in the capital, Kiev, culminating after five days in the ouster of President Viktor Yanukovych.

1148 Partington, G. and Satchell, S. (2017), Report to the AER: Discussion of Submissions on the Cost of Equity, May 2017, page 15.

In conclusion, we consider that it is appropriate to adopt a two-step approach when testing for structural breaks in data. The first step will enable identification of major event(s) which may cause a discontinuity in the data used for estimating parameters of interest. Then in the second step various tests for structural breaks can be employed to confirm the presence of one or more breaks as anticipated in the first step. If one or more breaks do occur during the period under investigation then this evidence will inform estimation of the parameters.

G.3 International empirical estimates

The international empirical estimates we consider in this decision are set out in table 3-32 and range from 0.3 to 1.0.[1149] We consider this evidence provides some limited support for an equity beta point estimate towards the upper end of our empirical range. We do not include these firms in our comparator set (for our primary empirical analysis) because we do not consider they are sufficiently comparable to a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services (see section G.4.3).

Table 3-32 International empirical estimates of equity beta

Report	Details	Raw estimate	Re-levered estimate (to 60 per cent gearing)
SFG, *Regression-based estimates of risk parameters*, June 2013, pp. 15, 19 CEG, *Information on equity beta from US companies*, June 2013	The CEG report prepared as a part of the ENA submission to the Guideline process suggested a sample of 56 US–listed energy network companies to be included in our comparator set of Australian–listed energy network firms. Based on the comparator sample provided by CEG, SFG computed OLS equity beta estimates over an 11 year period from 2 January 2002 to 19 November 2012. SFG's results incorporate a Vasicek adjustment to its OLS equity beta estimates.	0.68—average of individual firm estimates (0.67 without a Vasicek adjustment)	0.88—average of individual firm estimates 0.91—average equity beta of an equal–weighted index of firm returns[1150]
Damodaran, *Updated data: The Data page, Levered and Unlevered Betas by Industry: Download detail*, Stern school of Business New York University, last	The Damodaran equity beta estimates for US industry groups have been updated for 2016 market data. However, Damodaran has changed his industry classifications since 2013. The only industry that reports energy network firms is 'Utility (general)'. It contains electricity and gas network businesses, as well as vertically integrated businesses. Damodaran uses OLS estimation, weekly return	0.84	1.09*

[1149] This range includes raw and re-levered equity beta estimates. The re-levered estimates presented have been calculated using the Brealey-Myers formula set out in our recent decisions (see, for example, AER, *Preliminary decision: AusNet Services determination 2016 to 2020—Attachment 3: Rate of return*, October 2015, section D.2.2). Also, the studies we consider in this section are largely the same as those considered in our recent decisions.

[1150] SFG defines its equal weighted index as an index of firm returns, which allows it to 'construct one time series in each market that is available over the entire 11 year period'. See: SFG, *Regression-based estimates of risk parameters*, June 2013, p. 2.

updated 5 January 2016, viewed 18 March 2016	intervals and a five year estimation period (up to 2015 year–end).		
FTI Consulting, *Cost of capital study for the RIIO-T1 and GD1 price controls*, July 2012, p. 42	This report for Ofgem provided equity beta estimates for three UK–listed energy network firms. FTI Consulting used OLS estimation, daily return intervals and calculated the average daily returns for the sector as the market–capitalisation weighted average of the returns for National Grid, Scottish and Southern Energy and Scottish Power.	0.45—over 10 May 2011 to 9 May 2012 0.48—over 10 May 2010 to 9 May 2012	We are not able to provide re-levered equity beta estimates because the report does not provide the appropriate gearing data.
Alberta Utilities Commission, *2013 Generic Cost of Capital*, 23 March 2015, pp. 1, 24–26	This 2013 Generic Cost of Capital report sets out the AUC's approved return on equity for several utilities for the years 2013, 2014, and 2015. The AUC considered advice from the following experts on the equity beta based on estimates of Canadian utilities: • Dr Sean Cleary of Queens University recommended an equity beta range of 0.3 to 0.6. He calculated an average beta of 0.29 using monthly returns over the 1988–2012 period. He also calculated an average beta of 0.25 using 60 months of returns up to 20 December 2013. • Dr Laurence Booth of the University of Toronto recommended an equity beta range of 0.45 to 0.55 for Canadian stand-alone utilities based on long run beta estimates. • Ms Kathleen McShane (president and senior consultant with Foster Associates Inc.) was critical of historical equity betas, but used beta estimates from Bloomberg and Value Line. These betas range from 0.65 to 0.7. These betas also incorporate an adjustment towards 1.0 (Blume or Vasicek).	0.3–0.7	This report did not specify whether the equity betas were raw or re-levered to a benchmark gearing.
PwC, *Appreciating Value New Zealand, Edition six*, March 2015, p. 20 (See also: http://www.pwc.co.nz/appreciating-value/pwc-wacc-formula)	An annual report on the cost of capital (and equity beta) for a number of New Zealand companies classified by industry. The equity beta estimates are based on an average of monthly returns over (up to) five years for two comparable firms (Horizon Energy Distribution Limited and Vector Limited). PwC's March 2015 report presents estimates as at 31 December 2014.	0.6—average of individual form estimates	0.88—average of individual firm estimates*
The Brattle Group, *The WACC for the Dutch TSOs, DSOs, water companies and the Dutch pilotage organisation*, March 2013, pp. 16–18	This report for the Netherlands Competition Authority estimated equity beta for a set of seven European and three US energy network firms. It used a three year estimation period and daily return intervals. In response to CEG's concerns, we have used the Dimson beta where the adjustment is significant.[1151]	0.58—average of European individual firm estimates 0.60—average of US individual firm estimates 0.58—average of European and	0.71—average of European individual firm estimates* 1.01—average of US individual firm estimates* 0.80—average of European and US

[1151] See: CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, p. 37.

	US individual firm estimates	individual firm estimates*

Notes: * We have de-levered and re-levered these raw equity beta estimates.

G.4 Choice of comparator set

Since 2014, we have received numerous submissions from service providers (and their consultants) expressing concern over the reliability of Henry's (2014) equity beta estimates.[1152] These concerns flow from their view that our comparator set of Australian energy network firms is too small to produce reliable equity beta estimates. These service providers and their consultants submitted that:

- equity beta estimates based on this comparator set are imprecise and unstable
- the estimates could be improved by including international energy firms in the comparator set
- the estimates could be improved by including Australian non-energy infrastructure firms in the comparator set—partly because they consider our comparator set should not be restricted to regulated energy network firms.[1153]

We responded to many of these submissions in detail in our recent decisions.[1154] However, we reproduce our key conclusions in sections G.4.2, G.4.3, and G.4.4, in response to new submissions and analysis.

Ultimately, we consider there is a trade-off between the increased statistical precision from a larger comparator set and the comparability of the firms in the comparator set to a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services.[1155] This necessarily requires a degree of regulatory judgement in determining a reasonable comparator set. We are satisfied, at this time that our comparator set is sufficiently reflective of a benchmark efficient entity, given this trade-off. We are also satisfied, at this time, that our comparator set produces reliable equity beta estimates.

1152 See, for example, SFG, *Equity beta*, May 2014, pp. 2–3; SFG, *The required return on equity for regulated gas and electricity network businesses*, May 2014, pp. 84–85; CEG, *WACC estimates*, May 2014, pp. 7–10; SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, pp. 4, 10–12; SFG, *The required return on equity for the benchmark efficient entity*, February 2015, pp. 19–20; CEG, *Estimating the cost of equity, equity beta and MRP, January 2015*, pp. 33–34; Frontier Economics, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, pp. 47–48, 50–51; Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 2–3; Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 39–40, 42–44.

1153 Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 20–25, 34.

1154 See, for example, sections D.2.1 and D.2.3 of Attachment 3 to our preliminary decision for AusNet Services. In these decisions we also responded to submissions from other stakeholders that suggested the equity beta estimates in Henry's 2014 report cluster around a range of 0.3 to 0.5.

1155 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 11.

G.4.1 Comparator set for Australian empirical analysis

We define a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services as a pure play, energy network business operating within Australia with a similar degree of risk as APTPPL in providing reference services.[1156] We would, ideally, use firms that share all or most of the key characteristics of this benchmark efficient entity when conducting our regression analysis to estimate the equity beta. In practice, few firms would fully reflect this benchmark. Therefore we use market data for domestic businesses that are considered to be reasonable comparators to the benchmark efficient entity to inform the equity beta estimate.

In the Guideline we identified nine firms that may be considered as reasonable comparators to a benchmark efficient entity (as we have defined it), and these remain relevant. They are ASX listed firms that provide regulated electricity and/or gas network services with a similar degree of risk as that which applies to APTPPL in providing reference services and are operating within Australia. Table 3-33 sets out the details of these nine firms.[1157]

It is important to note that three of these firms were no longer trading by June 2013. Another firm, AGL Energy Limited, has changed its operations such that it no longer closely represents a benchmark efficient entity.[1158] We account for this by only including data over an applicable time period for these four firms. Whereas, for the other five firms, we consider data up to 28 June 2013.[1159] We note that Envestra Ltd was delisted on 17 October 2014.[1160]

Table 3-33 Listed entities providing electricity and gas network services operating in Australia with a similar degree of risk as APTPPL in the provision of reference services

Firm (ASX ticker)	Time / trading period	Sectors
AGL Energy Limited (AGK)	January 1990 – October 2006	Electricity, Gas
Alinta (AAN)	October 2000 – August 2007	Gas
APA Group (APA)	June 2000 – present	Gas, Minority interest in other energy infrastructure
DUET Group (DUE)	August 2004 – present	Electricity, Gas

1156 AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 8, 33–36, 44–45.

1157 SFG used the same Australian energy network firms in its comparator set of Australian (and US energy) firms (see SFG, *Regression-based estimates of risk parameters for the benchmark firm*, June 2013, p. 9).

1158 In October 2006, AGL sold its infrastructure and asset management business to Alinta and acquired a portion of Alinta's retail and co-generation businesses.

1159 Henry, ***Estimating β: An update***, April 2014, p. 12.

1160 See: http://www.asx.com.au/asx/statistics/announcements.do?by=asxCode&asxCode=ENV&timeframe=Y&year=2014.

Envestra Ltd. (ENV)	August 1997 – October 2014	Gas
GasNet (GAS)	December 2001 – November 2006	Gas
Hastings Diversified Utilities Fund (HDF)	December 2004– November 2012	Gas
Spark Infrastructure Group (SKI)	March 2007[1161] – present	Electricity, Gas
AusNet Services (AST), formerly SP AusNet (SPN)	December 2005 – present	Electricity, Gas

Source: AER analysis; Bloomberg; AER, *Review of the WACC parameters: Final decision*, May 2009, p. 255.

While we consider the firms in table 3-33 are reasonably comparable to a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services, they differ to some degree as they provide some electricity and/or gas services that are different from the reference services and this may affect their risk profile. Examples of this include:

- Approximately 10 per cent of APA Group's revenue in the 2016 financial year (excluding pass–through revenue) was subject to prices determined under full regulation. APA generates a large part of the remaining 90 per cent of its revenue from contracts which have set terms, including negotiated pricing for the life of the contract.[1162]
- DUET Group's assets receive limited unregulated revenue—Dampier Bunbury Pipeline (4 per cent unregulated), United Energy (8 per cent unregulated), Multinet Gas (5 per cent unregulated) in the 2015 financial year.[1163] DUET Group disclosed that 10 per cent of Multinet Gas' revenue was unregulated in the 2016 financial year.[1164] DUET Group did not publicly disclose the share of regulated of revenue for Dampier Bunbury Pipeline and Dampier Bunbury Pipelines.[1165] However, we consider these two assets would have still generated limited unregulated revenue since both are regulated.
- Approximately 88 per cent of AusNet Services' revenues are regulated, as at 30 June 2016.[1166]
- Hastings Diversified Utilities Fund (HDF) had investments in three gas pipelines and South East Water, a UK water utility (although it divested its interest in this utility in December 2010). The Pilbara Pipeline System is unregulated. Regulatory

1161 The SKI data is available from December 2005, but the data prior to March 2007 reflects stapled securities traded as instalment receipts—these instalments requires further leverage adjustment and makes beta estimation difficult.
1162 APA Group, *Annual report 2016: energy.connected.*, pp. 16, 29.
1163 DUET Group, *Annual report 2015*, p. 3.
1164 DUET Group, *Annual report 2016*, p. 20;
1165 DUET Group, *Annual report 2016*, pp. 10, 16.
1166 AusNet Services, *Annual report 2016*, p. 73.

coverage of the Moomba to Adelaide pipeline was revoked in September 2007 and ceased to apply for the South West Queensland pipeline in 2008.[1167]

- While GasNet earned the majority of its revenue from tariffs charged on its regulated assets, a contribution to its earnings for the 2005 financial year was also provided by specialised engineering and project management services.[1168]

Generally, with the exception of APA Group and HDF, these non–regulated activities only constitute a small portion of the revenue earned by the firms in this comparator set. Therefore, when we consider the impact of these unregulated activities, we expect the net impact would be sufficiently minor such that our equity beta estimates for the comparators are reasonable and reflect an entity that has a similar degree of risk in the provision of reference services as APTPPL.[1169] If unregulated activities were to have a non–minor impact on the comparator firms' equity beta estimates, we consider it would more likely overstate than understate the 'true' equity beta because unregulated activities are likely to result in greater systematic risk for the firm.[1170]

G.4.2 Precision and stability of Australian empirical estimates

We do not consider our empirical equity beta estimates of listed Australian energy businesses are unreliable. Some service providers' consultants previously appear to have taken a narrow definition of what is reliable in this context. They measured reliability by considering precision and stability of equity beta estimates over time.[1171] They find that these statistical properties improve as the comparator set increases.[1172] However, a larger dataset is not an end in itself. Decreasing the dispersion of estimates by increasing the size of the comparator set may not be helpful if that comparator set is less representative of what we are trying to estimate. In such cases, the mean that the estimates are clustered around will be less representative of the 'true' equity beta (that is, biased). We do not consider this constitutes reliability. We

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1167 HDF, *Annual report 2011*, pp. 2, 10; AEMC, *WA: Pilbara Pipeline System*, viewed 7 November 2014, see link <http://www.aemc.gov.au/Energy-Rules/National-gas-rules/Gas-scheme-register/WA-Pilbara-Pipeline-System>; AER, *Moomba to Adelaide pipeline—Access arrangement 2006–10*, viewed 7 November 2014, see link http://www.aer.gov.au/node/5453; AER, *Epic Energy south west Queensland pipeline—Access arrangement 2006–08*, viewed 7 November 2014, see link http://www.aer.gov.au/node/5219.

1168 GasNet, *Infrastructure for generations: GasNet Australia Group annual report 2005*, p. 29.

1169 We understand that the organisational structure and commercial activities of these comparator firms are subject to change. Consequently, we will continuously review our comparator set in case we need to make adjustments. This may entail adjusting the comparator set by excluding or adding new comparators.

1170 Frontier Economics, *Assessing risk for regulated energy networks*, July 2013, pp. 3–4.

1171 See, for example, Frontier, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 13–19; SFG, *Beta and the Black capital asset pricing model*, February 2015, pp. 10–11; CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, pp. 33–34; CEG, *WACC estimates*, May 2014, pp. 7–10; SFG, *Equity beta*, May 2014, pp. 3–4, 13–15, 28–31. In its 2014 report, SFG considered the dispersion of equity beta estimates. It measures dispersion as the standard deviation of individual firm equity beta estimates, relative to the mean of the sample (of equity beta estimates) (see: Brooks, Diamond, Gray and Hall, *Assessing the reliability of regression-based estimates of risk*, June 2013, p. 5).

1172 See, for example, Frontier, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 34; CEG, *WACC estimates*, May 2014, pp. 7–10; SFG, *Equity beta*, May 2014, p. 13.

agree with Associate Professor Graham Partington and Professor Stephen Satchell's (Partington and Satchell's) statement that, 'The critical issue is how appropriate are the additional firms selected as comparators and how much improvement is obtained'.[1173]

It is also useful to note that Henry performed a separate time series regression for each comparator firm and various portfolios of comparator firms.[1174] The weekly returns for each firm are regressed against the weekly returns on the market over a period of time (the estimation period).[1175] This means that the number of observations, or sample size, relevant to the statistical analysis of the individual equity beta estimates is the number of weekly return intervals in the estimation period. In Henry's 2014 report this sample size ranges from 229 (last five years, HDF) to 826 (longest period available, ENV) observations.[1176] In addition, we place most reliance on averages of individual firm estimates and fixed weight portfolio estimates, which cluster around 0.5 (see figure 3-17). This focus on average and portfolio equity beta estimates further reduces any residual uncertainty associated with individual firm estimates.

Frontier Economics previously submitted graphs of 10 year rolling beta estimates with confidence interval bands to provide support for its view that empirical equity beta estimates based only on Australian energy network firms are imprecise and unstable.[1177] We have assessed this material and consider it is, in substance, the same evidence that has been previously submitted to us on this issue.[1178] Nevertheless, Partington and Satchell have analysed the graphs of 10 year rolling beta estimates.[1179] They concluded that:[1180]

> … for the portfolio estimates of beta, any improvements in the precision of the estimates appear to be modest as are any improvements in stability. Since portfolio estimates would be our preferred way to estimate an industry beta, we conclude that the improved statistical properties are modest and come at the cost of potentially biased estimates from comparators that may be inappropriate.
>
> .... and in the time series of rolling portfolio beta estimates the US betas appear to be less stable than the Australian betas.

1173 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 11.

1174 Henry, *Estimating β: An update*, April 2014.

1175 We also measure returns over monthly intervals. The sample size for monthly return intervals ranges from 51 to 190 observations. See: Henry, *Estimating β: An update*, April 2014, pp. 23–26.

1176 Henry, *Estimating β: An update*, April 2014, pp. 17, 21.

1177 Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 13–19.

1178 For example, the precision and stability of equity beta estimates based on Australian energy network firms has been discussed in SFG, *Equity beta*, May 2014, pp. 3–4, 13–15, 28–31; Brooks, Diamond, Gray and Hall, *Assessing the reliability of regression-based estimates of risk*, June 2013, pp. 2, 9–15; and SFG, *Beta and the Black capital asset pricing model*, February 2015, pp. 10–11.

1179 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, pp. 11–12, 15.

1180 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 15.

Frontier Economics also considered it is unsurprising that our estimates tend to cluster together because they are effectively a regurgitation of the same estimate, based on slight variations of the same dataset.[1181] We disagree with this view. Our estimates are based on data from a comparator set of Australian energy network firms because we consider these firms are most reflective of a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services. It is well known that estimates can vary based on changes in the estimation method or period, or variations to the dataset (such as the construction of different portfolios). This is why empirical analyses include sensitivity and/or robustness checks based on such variations.[1182] Even Frontier performs regressions based on a five year estimation period as a robustness check on its estimates from a 10 year estimation period.[1183] We do not consider the robustness of our equity beta estimates to different estimation choices is invalidated by the fact that the estimates are based on the same underlying comparator set of firms (or a subset of these firms).

Based on the available evidence and submissions, we do not consider our Australian empirical equity beta estimates are unreliable. We consider the data from our comparator set of Australian energy network firms is sufficient for us to form an equity beta estimate that will contribute to the achievement of the allowed rate of return objective.[1184] This comparator set is reflective of a benchmark efficient entity and generates a consistent pattern of empirical equity beta estimates that is robust across econometric techniques, time periods and different combinations of comparator firms. This is demonstrated in sections G.1 and 0.

G.4.3 Use of international energy firms

We have had regard to all available domestic comparators. Ideally, we would have further reasonable domestic comparators to include. However, we consider that the comparators we use are the most relevant and useful for our empirical analysis, given we are looking to ascertain the efficient financing costs of a benchmark efficient entity with a similar degree of risk as APTPPL in relation to the provision of its reference services. We do not include international energy network firms in our comparator set for empirical analysis. We consider international energy firms are not suitable comparators in this case, for the following reasons:

- They deviate from our definition of a benchmark efficient entity definition because they do not operate within Australia. Differences in regulation of businesses, the domestic economy, geography, business cycles, weather and a number of different factors are likely to result in differences between equity beta estimates for similar

1181 Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 17–18.

1182 For example, SFG states that, 'Because there are so many methodological choices to be made, it is common practice to consider the sensitivity of beta estimates to the different choices that might be made.' (see SFG, *Equity beta*, May 2014, p. 9).

1183 Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 7.

1184 NER, cll. 6.5.2(f) and 6A.6.2(f); NGR, rule 87(6).

businesses between countries.[1185] It is difficult to assign quantitative impacts to these qualitative factors.

- We discuss equity beta estimates in the context of our foundation model, which is the domestic Sharpe-Lintner CAPM.[1186] This provides a strong rationale for estimating the equity beta using Australian data. If we included international energy firms in our comparator set, it may be more appropriate to use an international or global CAPM.[1187]
- Equity beta estimates from international comparators are measured with respect to the market portfolio of their home market.[1188] This means the equity beta estimates from international comparators are not a measurement of the firm's systematic risk relative to the Australian domestic market portfolio.[1189] As Associate Professor John Handley (Handley) stated:[1190]

  > In general, domestic betas and international betas measure different things and are not comparable due to potential differences in the covariance structure and level of systematic risk in the respective markets. This is purely a definitional difference.

- They may not have the same structure as Australian energy network firms. For example, a number of US comparator businesses identified by the Competition Economists Group (CEG) are vertically integrated.[1191] They engage in energy generation, wholesale and retail of energy, as well as other activities distinct from energy distribution and transmission. Some of the firms even engage in telecommunications, real estate development and manufacturing activities.[1192] These activities are very different from our definition of a benchmark efficient entity, which is a pure play energy network business (operating within Australia) with a

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1185 This is supported by Partington and Satchell. See Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 11. They stated, 'Considerable caution in reaching conclusions about beta needs to be exercised when the comparators are drawn from overseas countries. This is because of differences in industry structure, technology, the nature of competition, the economic environment and regulatory and tax systems'.

1186 We implement the Sharpe-Lintner CAPM under the assumption of a domestic market, but with a presence of foreign investors. This allows us to recognise that foreign investors cannot utilise imputation credits. However, the benchmark efficient entity operates in the Australian market by definition, and we estimate the MRP in the context of the Australian market portfolio.

1187 See Handley, *Advice on the return on equity*, October 2014, p. 24; Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 16.

1188 This is the case unless the equity betas are estimated using an international CAPM framework.

1189 This is supported by Handley and Partington and Satchell. See Handley, *Advice on the return on equity*, October 2014, pp. 23–24; Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 16. In his May 2015 report, Handley concluded that he does not consider it necessary to change any of the findings in his earlier (2014) report. See: Handley, *Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks*, 20 May 2015, p. 28.

1190 Handley, *Advice on the return on equity*, October 2014, p. 23.

1191 CEG describes vertically integrated US energy utility firms as 'common among [its] sample'. See: CEG, *Information on equity beta from US companies*, June 2013, p. 20.

1192 CEG, *Information on equity beta from US companies*, June 2013, pp. 47–68.

similar degree of risk as that which applies to APTPPL in providing reference services. As noted in the Guideline, we consider vertically integrated firms tend to have higher equity beta estimates than pure play energy network firms.[1193]

- We consider the available Australian data is sufficient for us to form a reasonable equity beta range that is reflective of the equity beta for a benchmark efficient entity.

These factors are discussed in more detail in the Guideline and 2009 WACC review.[1194] Based on the above reasoning, we consider it is a suboptimal outcome to use a foreign proxy (or proxies) to estimate the equity beta for a domestic benchmark. It should only be used where there is evidence that this will produce more reliable estimates of the domestic equity beta than the Australian estimates themselves. We do not consider the material submitted by the relevant service providers present us with such evidence.

The submitted consultant reports appear to have recognised international energy network firms are less comparable to a benchmark efficient entity than Australian energy network firms. However, some also considered our comparator set of Australian energy network firms is too small and produces unreliable equity beta estimates.[1195] In analysing these competing considerations, these consultants concluded that the 56 US energy firms identified by CEG during the Guideline process are sufficiently comparable to a benchmark efficient entity. Therefore, they should be included in our comparator set for empirical analysis, albeit with less weight than the domestic comparators.[1196]

We do not consider these submissions provided satisfactory evidence that the suggested sample of 56 US energy firms are sufficiently comparable to a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services.[1197] Handley supports this view.[1198] We provided detailed reasoning for this

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1193 In the rate of return guideline, we found the average equity beta of 56 US energy utilities (identified by CEG) was greater than the average equity beta of 18 US utilities identified by ACG as 'almost exclusively electricity and/or gas distribution and transmission businesses'. See: AER, *Explanatory statement to the rate of return guideline (appendices)*, December 2013, pp. 62–63. Also see: ACG, *Beta for regulated electricity transmission and distribution: Report to Energy Network Association, Grid Australia and APIA*, September 2008, p. 18; CEG, *Information on equity beta from US companies*, June 2013; SFG, *Regression-based estimates of risk parameters*, June 2013, p. 19.

1194 AER, *Explanatory statement to the rate of return guideline (appendices)*, December 2013, pp. 59–64. AER, AER, *Review of WACC parameters: Final decision*, May 2009, pp. 261.

1195 SFG, *Equity beta*, May 2014, p. 28–31; CEG, *WACC estimates*, May 2014, pp. 7–10; SFG, *Beta and the Black capital asset pricing model*, February 2015, pp. 10–12; CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, pp. 33–34; Frontier, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 13–19.

1196 SFG, *Equity beta*, May 2014, pp. 31–34, 40; CEG, *WACC estimates*, May 2014, pp. 8–10; CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, pp. 33–34; Frontier, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 29–31; Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, p. 44.

1197 Nor do we consider our Australian empirical equity beta estimates are unreliable (see section G.4.2).

view in our recent decisions, which we do not reproduce in this decision but which remains applicable.[1199] However, Partington and Satchell have assessed Frontier Economics' most recent (2016) report on the issue, and conclude that:[1200]

> … the case that the samples are homogeneous has not been made…Indeed on the basis of Frontier's analysis of the means for weekly betas the US comparators are inappropriate
>
> …Furthermore, the use of 24% by weight of Australian data and 76% by weight of US data to compute an Australian beta seems intuitively inappropriate.
>
> …The notion that Beta is a measure independent of the index used, and hence can be aggregated across different countries troubles us. The usual way this would be addressed is to build a global CAPM and compute betas with respect to a world portfolio, or regard the USA and Australia as a single region and define a new market portfolio based on the capitalisation weighted aggregate of the two markets.

We also received submissions in 2015 from other stakeholders that do not support the inclusion of international energy firms in our domestic comparator set. For example, Origin supported our decision to use a comparator set of Australian energy network firms.[1201] It considered international comparators should not be used as primary determinants of risk to the extent that the risks faced by these firms are not directly comparable to Australian conditions. The Consumer Challenge Panel also disagreed with the inclusion of 56 US energy firms in our Australian comparator set.[1202]

This does not imply that the empirical evidence based on international energy network firms should be discarded completely. Rather, we consider that such evidence may have some use in informing the equity beta point estimate from within the range derived using Australian empirical estimates. Further, we consider it useful to examine evidence on many available international energy network firms, rather than only those based in the US.

G.4.4 Use of non-energy infrastructure firms

Frontier Economics (previously SFG) previously submitted that we should include Australian non-energy infrastructure firms in our comparator set in addition to

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1198 Handley, *Advice on the return on equity*, October 2014, pp. 23–24.

1199 See, for example, AER, *Preliminary decision: AusNet Services determination 2016 to 2020—Attachment 3: Rate of return*, October 2015, section D.2.1 (under the heading 'International comparators').

1200 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, pp. 15–16.

1201 See, for example, Origin Energy*, Submission to Victorian electricity distributors regulatory proposals*, 3 July 2015, pp. 10–11. Also see QCOSS, *Submission to the Queensland distribution network service providers' regulatory proposal for 2015–20*, 30 January 2015, p. 78.

1202 CCP3, *Response to proposals from Victorian electricity distribution network service providers for a revenue reset for the 2016–2020 regulatory period*, August 2015, pp. 70–71.

Australian energy firms.[1203] Frontier Economics examined equity beta estimates for nine Australian energy network firms, seven Australian non-energy infrastructure firms[1204] and 56 US energy firms. It concluded that the expanded comparator set has better statistical properties (precision and stability) than our comparator set based on Australian energy network firms.[1205]

We have had regard to all available domestic comparators. Ideally, we would have further reasonable domestic comparators to include. However, we consider that the comparators we use are the most relevant and useful for our empirical analysis, given we are looking to ascertain the efficient financing costs of a benchmark efficient entity with a similar degree of risk as APTPPL in relation to the provision of its reference services. We do not include non-energy infrastructure firms in our comparator set for empirical analysis. We consider these firms are not suitable comparators in this case, for the following reasons:

- The allowed rate of return objective requires us to consider the efficient financing costs of a benchmark efficient entity with a similar degree of risk as APTPPL in the provision of reference services. These firms do not provide gas network, or more generally energy network, services.
- Differences in regulation (including minimal or no regulation and the associated difference in the degree of risk of supplying services similar to the reference service), industry structure and consumer demand for non-energy infrastructure firms are likely to result in different risk profiles relative to energy network firms regulated under the rules and law.[1206] For example, a number of Australian non-energy infrastructure firms are unregulated or are partly resgulated under different regulatory regimes.[1207] We explain why we consider unregulated businesses are likely to have a very different risk profile to firms providing reference services in section 3.3.3. Also, a number of Australian non-energy infrastructure firms provide

1203 Frontier Economics also proposed international energy firms be included. See: Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 2–3.

1204 Although it excluded two of these from its analysis because they have been engaged in merger activity (see Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 21).

1205 Specifically, Frontier considered the average and portfolio estimates (10 year rolling beta estimates) are more stable over time and have tighter confidence intervals (see Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 24–25, 31–33). We respond to this in section G.4.2.

1206 That is, the National Electricity Law and Rules, and the National Gas Law and Rules.

1207 For example, Sydney Airport and Transurban are listed infrastructure firms that are not subject to direct price/revenue regulation. Sydney Airport is subject only to price and quality monitoring by the ACCC (see Department of Infrastructure and Regional Development, *Economic regulation*, last updated 12 June 2014, viewed 23 February 2016, https://infrastructure.gov.au/aviation/airport/airport_economic_regulation/economic_regulation.aspx). 79% of Transurban's assets are concession assets, 'representing the provision by Government entities for the right to toll customers for the use of the assets' (see Transurban, *2015 Transurban annual report* (for the year ended 30 June 2015), p. 11). Both of these types of regulation are very different to direct price/revenue cap regulation.

a range of different services in addition to management of and access to the monopoly infrastructure,[1208] which are likely to influence their overall risk profile.

- We consider the available data for Australian energy network firms are sufficient for us to form a reasonable equity beta range that is reflective of the equity beta for a benchmark efficient entity.

As discussed at the start of section G.4.2, our view is that while increased statistical precision and/or stability is desirable, it is not preferable if the resulting estimates are substantially less reflective of the 'true' equity beta for a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services.

Frontier Economics also performed two statistical tests (the Kolmogorov-Smirnov test and a t-test)[1209] to infer that the three comparator sets are drawn from the same population.[1210] However, we do not consider these tests show that the comparator sets are drawn from the same underlying population. Partington and Satchell consider both tests have been incorrectly applied. They advise:[1211]

> Frontier(2016a) use the Kolmogorov-Smirnov (KS) test which compares two distribution functions, but Frontier’s analysis is based on estimated parameters being used as the parameters of the distribution functions. It is known that the critical values of the KS test assume no unknown parameters; that is, they are based on the two empirical distribution functions, and will, consequently, be wrong for the problem being considered by Frontier. Generally, Monte Carlo analysis is necessary.

Partington and Satchell also consider there are test specification issues with Frontier Economics' application of the t-test (that is, it may lead to upward bias) and that small sample sizes were used for the tests. They consider:[1212]

> Inappropriate application, or low power, of the tests, is likely to explain why despite the appearance of quite different distributions of beta for the AER sample and other listed Australian Infrastructure firms (see Frontier 2016a, Figure 4 reproduced below) the statistical tests fail to reject the null hypothesis of no difference between the beta estimates for the two groups.

Finally, Partington and Satchell show Frontier Economics misinterpret the results of their own analysis comparing the weekly equity beta estimates for the US and

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[1208] For example, Telstra provides a range of services, categorised into segments such as Telstra Retail, Global Enterprise and Services, Telstra Wholesale and Telstra Operations. See Telstra, *Our brilliant connected future: Telstra annual report 2015*, pp. 21–22.

[1209] The Kolmogorov-Smirnov test tests whether two samples have the same distribution function; and the t-test tests whether two samples come from populations that have the same mean. See Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 7.

[1210] Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 22–24, 29–31.

[1211] Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 13.

[1212] Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, pp. 13–14.

Australian comparator sets.[1213] Frontier Economics conclude the result is borderline when, based on tis reported statistics, the null hypothesis is rejected.[1214]

Moreover, CEG and SFG provided analysis on the comparability of 56 US energy firms to a (domestic) benchmark efficient entity. We have analysed this material and explained in detail why we consider international energy firms are not reasonably comparable to a benchmark efficient entity with a similar degree of risk as APTPPL in providing reference services (see section G.4.3). However, we have received little analysis (outside of the above statistical tests) on the comparability of the seven Australian non-energy infrastructure firms used in Frontier Economics' report to a benchmark efficient entity with a similar degree of risk as the service providers we regulate in providing reference services. Frontier Economics simply chose the listed firms that were identified as 'infrastructure firms' in the Osiris database, with a sufficient history of available stock returns data and with a majority of operations within Australia.[1215]

We disagree with the suggestion by several service providers that a benchmark efficient entity should be defined as an unregulated entity operating in a workably competitive market (see table 3–6). However, we note in any case that we do not consider there is persuasive evidence that these entities are reasonable comparators for a benchmark efficient entity with similar degree of risk to APTPPL in the provision of its reference services.

We note that Frontier Economics, despite recommending the use of non-energy infrastructure comparators, proposed its original equity beta estimate of 0.82, which does not include non-energy infrastructure comparators.[1216] The average equity beta estimates from Frontier Economics' analysis of non-energy infrastructure firms range from 0.58 to 0.91,[1217] which is consistent with our final equity beta estimate of 0.7.

[1213] Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 15.

[1214] Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 31 (Table 11).

[1215] Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 20.

[1216] Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 34.

[1217] See Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 21. This range is based on the raw and re-levered estimates presented in this report and excludes Asciano and Qube (as Frontier does).

H Response to previous submissions on the equity beta

Service providers have made a number of submissions on the equity beta in previous regulatory processes. APA, APTPPL and Multinet have all proposed to depart from the guideline estimate of equity beta.[1218] In doing so, they have made submissions in line with those we have assessed in previous decisions.

H.1 Empirical analysis

Service providers and their consultants have submitted that our comparator set of Australian energy network firms is too small and results in unreliable equity beta estimates in previous regulatory determinations.[1219]

We do not consider our Australian empirical equity beta estimates are unreliable. SFG appears to have taken a narrow definition of what is reliable in this context. Decreasing the dispersion of estimates by increasing the size of the comparator set may not be helpful if that comparator set is less representative of what we are trying to estimate.

We consider the data from our comparator set of Australian energy network firms is sufficient for us to form an equity beta estimate that will contribute to the achievement of the ARORO. The comparator set contains firms with a similar degree of risk as that which applies to APTPPL's provision of reference services. This comparator set generates a consistent pattern of empirical equity beta estimates that is robust across econometric techniques, time periods and different combinations of comparator firms. We consider this issue in more detail in section G.4.2 of this attachment.

Service providers have submitted that an equity beta estimate implied from SFG's construction of the dividend growth model should be used as a cross check on our foundation model equity beta estimate.[1220]

[1218] While Multinet has proposed an equity beta of 0.7 for use in the CAPM, it has argued against the AER's empirical beta range as determined in the guideline. APAVTS, *Access arrangement information submission*, January 2017, pp. 136–144; Multinet Gas Network, *Rate of return overview*, December 2016, pp. 8–26; APTPPL, Access arrangement revision submission, pp. 135–140.

[1219] SFG, *Beta and the Black capital asset pricing model*, February 2015, pp. 10–11; Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 13–19. CitiPower, Powercor, United Energy, JEN, AusNet, AGN and ActewAGL submitted these reports with their initial and revised proposals respectively. Also see for example: CitiPower, *Revised proposal*, January 2016, p. 311–312; AER Final decision, *SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 451-62, 473-79, 496; AER Final decision*, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER Final decision, *AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 264-75.

[1220] Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 41–42, 64–65; AER Final decision, *SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 351-8, 501-5; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

We note SFG's dividend growth model-based estimates of equity beta are derived by estimating the relative risk ratio of Australian energy network firms to the market, which it uses as an implied beta estimate. We consider there are several technical issues with SFG's approach. These include: the method used to derive its implied beta estimate is not aligned with the definition of equity beta; its implied beta estimate is based on a relatively small dataset; and it used inappropriate weightings in the estimation process. For more detail see sections B.3 and D.5.3 of Attachment 3 to SAPN's final decision.

Service providers previously noted that our approach is inconsistent with the approach we used to estimate equity beta in the 2009 WACC review because we have selected a different point estimate from the same range.[1221] We disagree. During the Guideline process we stated, 'During both the 2009 WACC review and now we considered the empirical estimates support a range of 0.4 to 0.7. In the 2009 WACC review, we adopted a point estimate of 0.8 (slightly above the range of empirical estimates). In this issues paper, we propose to lower our point estimate from 0.8 to 0.7 because we now have greater confidence in the reliability of the empirical estimates—In 2009, there were fewer empirical estimates available. The data spanned a shorter time period and we were facing uncertainty due to the global financial crisis. Four years on, we now have more studies, spanning a longer time period and a diversity of market conditions. The results from these studies demonstrate a consistent pattern over time.'[1222]

Service providers have submitted that our multi-stage approach to estimating the equity beta pre-emptively dilutes or eliminates the impact of other relevant evidence.[1223] We disagree. As noted in the Guideline, our use of relevant material is based on their relative merits and suitability for our regulatory task.[1224]

Frontier has previously submitted that our comparator set should include international energy firms (specifically, 56 US firms) and Australian non-energy infrastructure firms.[1225]

1221 SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, pp. 24–25; AER *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 497-500; AER *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return,* May 2016, pp. 44-90.

1222 AER, *Equity beta issues paper*, October 2013, p. 7. We provided similar reasoning in the final Guideline. See: AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 84–85.

1223 Frontier, *Key issues in estimating the return on equity for the benchmark efficient entity*, June 2015, pp. 20–25, 47–54. CitiPower, Powercor, United Energy, JEN, AGN and ActewAGL submitted this report during the decision process.
See for example: CitiPower, *Revised proposal*, January 2016, pp. 311–313;
Also see Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, p. 39; ; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 501-5; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

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1225 Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 26–34. Also see for example: CitiPower, *Revised proposal*, January 2016, p. 312–314; AER, *Final decision, SA Power*

We consider international energy firms are unlikely to have a similar degree of risk as APTPPL (in the provision of reference services), for several reasons set out in section G.4.3 of this attachment. We also considered this issue in detail in section D.2.1 of Attachment 3 to SAPN's final decision.

We also consider other (Australian) infrastructure firms are not suitable comparators to the benchmark efficient entity in this case, for several reasons set out in section G.4.4 of this attachment.

Frontier previously submitted that our estimate of equity beta does not sufficiently account for possible biases in the Sharpe-Lintner CAPM—our equity beta estimate should be specifically adjusted for 'low beta bias' and/or 'book-to-market bias' using empirical evidence from the Black CAPM and Fama French model.[1226]

We do not consider our use of the Sharpe-Lintner CAPM in our foundation model approach will result in a downward biased estimate of the return on equity. We provide extensive reasoning for these views in the 'service providers' proposed multi-model approach' subsection in section 3.4.1 of this attachment.

Service providers, in previous regulatory processes, submitted that our comparator set should not be restricted to regulated entities as the benchmark efficient entity should be defined as an unregulated entity operating in a workably competitive market[1227]

We do not agree. We consider the regulatory framework for the provision of prescribed transmission services mitigates the risk exposure that service providers face in significant respects and therefore must be properly accounted for in equity beta estimates. Incentive regulation typically allows businesses to earn more stable cash flows with periodic resetting of revenues to better reflect actual expenditure. Most unregulated businesses do not have these same protections or restrictions, and so are likely to have a very different risk profile. We carefully considered these factors when developing the Guideline. Overall, we consider that a substantial proportion of the regulatory framework has the effect of mitigating various systematic and non-systematic risks.

We have previously received submissions that our comparator set should exclude delisted firms whose data are outdated.[1228] In relation to the exclusion of delisted firms, we acknowledge that some of our comparator firms have been delisted for some time.

Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return, October 2015, pp. 451-62; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87

1226 Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 41–42, 65–66. For example, also see CitiPower, *Revised proposal*, January 2016, pp. 324–326; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 451-62, 473-79, 496; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87;

1227 For example, see CitiPower, *Revised proposal*, January 2016, p. 310.

1228 For example, see CitiPower, *Revised proposal*, January 2016, pp. 310–311.

However, we consider three estimation periods in our empirical analysis, one of which is the last five years. This captures the more recent data and excludes Alinta, AGL Energy Limited and GasNet (who only have relevant data to 2006 or 2007). The average estimate from this estimation period is not substantially different from the longer estimation periods (in fact, it is slightly lower, see Table 3-28). The two most recent portfolios we consider (P4 and P5) also provide estimates that are, overall, not substantially different from the portfolios that include older data (see Table 3-29). We consider these results suggest that including older data in our empirical analysis (which increases the size of our dataset) does not bias the results.

SFG (now part of Frontier) has previously submitted that the Least Absolute Deviations (LAD) estimation method produces systematically downward biased equity beta estimates and should not be used[1229]

We are not satisfied that SFG has produced compelling evidence to infer the LAD estimator produces systematically downward biased estimates of equity beta. For example, we consider that discovering LAD estimates are lower than Ordinary Least Squares (OLS) estimates ex post, on a particular subset of the market, does not necessarily indicate systematic bias. In any case, we rely more on OLS estimates and consider that removing LAD estimates from our empirical analysis would not substantially change our empirical results. We considered this issue in section D.2.2 of Attachment 3 to SAPN's final decision and sections 3.4.1 and G.1 of Attachment 3 to AusNet Services' final decision for its distribution services. Those reasoning remain relevant.

CEG has previously submitted that the mining boom should be excluded from the estimation periods[1230] We consider that, at any given time, there are sectors of the economy that are experiencing relative booms and busts. As such, we do not consider the mining boom period represents an exceptional circumstance that should be removed from the estimation periods we use to estimate the equity beta.

SFG noted previously that we do not account for variation in equity beta estimates based on how the return interval is defined (in particular, what reference day is chosen to calculate weekly or monthly returns)[1231] We do not consider that SFG has provided

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[1229] Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 4; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 463-72; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90, 256-9.

[1230] CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, pp. 33–34, 46–58; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 463-72; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020*, Attachment 3 - Rate of return, May 2016, pp. 44-90.

[1231] SFG, *Beta and the Black capital asset pricing model*, February 2015, pp. 29–30; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return, October 2015,* pp. 463-72; AER, Final decision, *Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May any basis to expect that returns based on a particular day of the week will underestimate or overestimate equity beta for the benchmark efficient entity.

Only re-levered equity beta estimates should be relied on[1232] We consider it is useful to consider both raw and re-levered equity beta estimates where possible. On one hand, the resulting estimates will be more aligned with our benchmark. On the other hand, the relationship between equity beta, financial leverage and financial risk is complex and uncertain. Making a specific adjustment for leverage imposes a certain assumed relationship that may not necessarily be correct in all circumstances. For more detail see section 3.4.1. Partington and Satchell also advised that re-levering equity betas is problematic.[1233]

Frontier has previously submitted that averages of individual firm estimates are largely meaningless.[1234] We consider that, because no one comparator firm is perfectly reflective of a benchmark efficient entity with a similar degree of risk as that which applies to APTPPL, in providing reference services, we rely on averages of individual firm estimates to determine an equity beta range. SFG, Frontier Economics, CEG and NERA, in their previous reports, also rely on averages of individual firm estimates.[1235]

In previous regulatory processes, we received submissions that the basis of the portfolio formations in Henry's 2014 report is unclear[1236] We consider each firm in a particular portfolio should have returns data over the same period. For example, we consider you should not include a firm with data from 2000 to 2007 in a portfolio with another firm with data from 2005 to 2013. A portfolio can only be formed in this scenario if common data from 2005 to 2007 is used. The firms in our comparator set trade over different time periods (that is, they have returns data over different periods).

2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return,* May 2016, pp. 44-90.

1232 Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, p. 46.. Also see Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 5–6; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 463-72, 483-90; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return,* May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return,* May 2016, pp. 44-90.

1233 Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, p. 10.

1234 CitiPower, *Revised proposal*, January 2016, p. 314; Powercor, *Revised proposal*, January 2016, p. 308; United Energy, *Response to AER preliminary decision re rate of return, gamma*, January 2016, p. 68; JEN, *Revocation and substitution submission attachment 6-1*, January 2016, p. 73; AusNet, *Revised regulatory proposal*, January 2016, p. 7-67; AGN, *Revised SA access arrangement information*, January 2016, p. 72; ActewAGL, *Revised 2016-21 access arrangement proposal appendix 5.01*, January 2016, p. 91.

1235 SFG, *Regression-based estimates of risk parameters for the benchmark firm*, June 2013, pp. 2, 13; Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, p. 6; CEG, *Estimating the cost of equity, equity beta and MRP*, January 2015, p. 58; NERA, *Return on capital of a regulated electricity network*, May 2014, pp. 79–81; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 463-72; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

1236 For example, see: CitiPower, *Revised proposal*, January 2016, p. 314.

Therefore, in forming our portfolios, we balanced the desirability of having a long time period that includes recent data with the desirability of having more firms in the portfolio. We also sought to capture each firm in our comparator set in at least one portfolio.[1237]

Consultants have previously submitted that the Vasicek adjustment mitigates systematic estimation error.[1238] We do not apply a Vasicek adjustment. We note that SFG has applied the Vasicek adjustment in their beta estimates however report that this makes less difference due to the increasing size of the data set. We note that SFG's application of the Vasicek adjustment assumes a prior distribution of the market as a whole, not the firms that represent the benchmark efficient entity. We also note that applying the Vasicek adjustment in the manner recommended by SFG made little to no difference to the empirical equity beta estimates.

CEG has compared its estimates with the 'Raw beta' from Bloomberg's 'Historical Beta' field and found that its estimates are consistent with the figures from Bloomberg based on Henry's sample and benchmark index [1239] CEG was not able to completely replicated Henry's 2014 estimations. And it acknowledged that this is due to gearing estimates.[1240]

Once the differences between CEG replication and Henry 2014 estimations is accounted for the difference between CEG extension and Henry 2014 results is not significant. We do not take a mechanistic approach to the estimation of beta. There are other factors that require consideration in CEG's report for example, whether the difference is due to higher gearing or whether there may be other explanations for changes in systematic risk. We discuss in more detail in appendix G

H.2 Australian empirical estimates

We have also received a range of submissions on our Australian empirical estimates in previous regulatory processes.

[1237] See Henry, *Estimating β: An update*, April 2014, p. 35; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return,* October 2015, pp. 33-143; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return,* May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

[1238] SFG, *Beta and the Black capital asset pricing model*, February 2015, p. 31; Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016, pp. 4–5; AER*, Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 463-72; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

[1239] Henry, *Estimating β: An update*, April 2014, p. 35; CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, pp. 6, 9–12, 17.

[1240] CEG, *Replication and extension of Henry's beta analysis*, 21 September 2016, p. 6.

Frontier submitted that our range derived from Australian empirical estimates (0.4 to 0.7) is incorrect and inconsistent with Henry's 2014 report[1241] We recognise Henry reported a range of 0.3 to 0.8. However, while Henry appears to base his range on all his estimates (including individual firm estimates), we consider the most useful empirical estimates in our regulatory context are averages of individual firm estimates and fixed weight portfolio estimates. We note, in any case, that a point estimate of 0.7 is consistent with, and at the higher level of, the range identified by Henry. For more detail see section D.5.1 of Attachment 3 to SAPN's final decision and Appendix G of Attachment 3 in AusNet Services' final decision for its distribution services.

User groups have submitted that the equity beta estimates in Henry's 2014 report are clustered around a range of 0.3 to 0.5.[1242] This is based on individual firm estimates. We consider the most useful empirical estimates are averages of individual firm estimates and fixed weight portfolio estimates, and these estimates range from 0.4 to 0.7 under almost every regression permutation considered in Henry's 2014 report. For more detail, see section D.2.3 of Attachment 3 to SAPN's final decision and sections G.4.1 and G.4.2 of Attachment 3 in AusNet Services' final decision for its distribution services.

User groups also previously submitted that Australian empirical estimates support an equity beta within the range of 0.5 to 0.6.[1243] We are satisfied the Australian empirical estimates we consider support an equity beta range of 0.4 to 0.7. Our range is based on averages of individual firm estimates and fixed weight portfolio estimates from Henry's 2014 report. We also consider equity beta estimates from a number of other Australia empirical studies. This includes the ERA's 2013 study, which appears to contain the same estimates as the Vo, Mero and Gellard study discussed in the Consumer Challenge Panel's report.[1244] See sections G.1 and 0.

[1241] Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, p. 39. Also see CitiPower, *Revised proposal*, January 2016, pp. 314–315. Powercor, United Energy, JEN, AusNet, AGN and ActewAGL's revised proposals contain similar reasoning.
AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 496; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87

[1242] VECUA, *Submission on the AER: AER preliminary 2016–20 revenue determinations for the Victorian DNSPs*, January 2016, pp. 17–18; ; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 473-9; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 265-6, 267-8

[1243] CCP3, *Response to AER preliminary decisions and revised proposals for Victorian electricity distribution network service providers for a revenue reset for the 2016-2020 regulatory period*, 25 February 2016, pp. 89–94.

[1244] See Vo, Mero, Gellard, *Equity beta for the Australian utilities is well below 1.0*, March 2014. In this report, tables 1–12 and figures 1–8 appear to be the same as tables 19–29, 37, and figures 19–26 in the ERA's rate of return guideline (see ERA, *Explanatory statement for the rate of return guidelines*, December 2013, pp. 167–196); AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 495-505; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87

We also have regard to other information when selecting our equity beta point estimate from within this range. This includes international empirical estimates and the theoretical principles underpinning the Black CAPM. See section D.5 of Attachment 3 to SAPN's final decision and section G.1 of Attachment 3 in AusNet Services' final decision for its distribution services.

Grant Samuel has submitted that we have incorrectly analysed the equity beta estimates in Grant Samuel's 2014 independent expert report.[1245] We note that we do not average across the different sources for each energy network firm in Grant Samuel's peer group. We average over the four Australian energy network firms in the peer group for each source. For more detail see section D.2.4 of Attachment 3 to SAPN's final decision and section G.2 of Attachment 3 in AusNet Services' final decision for its distribution services.

CCP5 maintained its view that the AER's value for β of 0.7 is too high, citing the Olan Henry analysis commissioned by the AER in 2014 as rationale for a lower β. The CCP suggested a value of 0.5 would be in the better long term interests of consumers, while still meeting the requirements of the NER. [1246] We have considered the CCP's submission however this is based on only one source of relevant evidence. Our consideration of the relevant evidence for the equity beta is based on all the relevant information following an assessment of their relative merits and suitability for our regulatory task: conceptual analysis, Australian empirical estimates, international empirical estimates and theory of the Black CAPM.[1247]

We give most consideration to Australian empirical estimates and use Henry's report to inform a range of 0.4–0.7. This is supported by our conceptual analysis that the equity beta of a benchmark efficient entity would be less than one. We use empirical international estimates and the theory of the Black CAPM to inform our point estimate selection of an estimate towards the top of our range.[1248] We consider our approach and estimate contributes to the ARORO and this has been upheld by the Tribunal.[1249]

CEG considered that its replication of Henry's original results is sufficiently close so as to warrant using its methodology to extend results to 2016.[1250] We note that CEG was

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[1245] Grant Samuel and Associates, *Letter—Grant Samuel response to AER draft decision*, 12 January 2015, p. 8. CitiPower, Powercor, JEN and United Energy submitted this report with their initial proposals; ; AER*, Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 480-2; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 260-1.

[1246] CCP5, *Transmission for the Generations III–Response to: AER draft decision for AusNet Services' Transmission Revenue Review 2017–22*, October 2016, pp. 20–21.

[1247] AER*, Better Regulation Explanatory Statement: Rate of return Guideline*, December 2013, pp. 85–88.

[1248] AER, *Better Regulation Explanatory Statement: Rate of return Guideline*, December 2013, pp. 85–88.

[1249] Australian Competition Tribunal, *Application by Public interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016,

[1250] CEG, *Replication and extension of Henry's beta analysis*, *submission with AusNet Transmission Group Pty Ltd Transmission Revenue Review 2017-2022, Revised Revenue Proposal*, 21 September 2016, pp. 1, 6, 9, 13.

not able to completely replicate Henry's original results. In particular, there is a 57 per cent discrepancy in SKI's gearing estimate which would materially affect re-levered betas at the firm and portfolio level.

CEG's extension of Henry's estimates to June 2016 suggest that empirical estimates of equity beta have increased since Henry's 2014 report.[1251] Having analysed CEG's results, we do not consider that CEG's extension provides satisfactory evidence of a material change in equity beta estimates. We note CEG's extension are still consistent with Henry's original estimates such that our empirical range remains 0.4–0.7 and our point estimate 0.7. Our views are supported by Partington and Satchell who also noted that they 'are not convinced that there has been material change in beta' after reviewing CEG's estimates.[1252] We discuss this in more detail in Appendix G.

CEG submitted that more recent estimates (one year and five year estimates) of equity beta for still-listed firms indicate a more prominent increase in the equity beta.[1253] We do not consider, as proposed by CEG, that more recent estimates of equity sufficiently justify an increase to our range and/or point estimates because short term data is more prone to one-off events, fluctuations and volatility which may obscure the 'true' equity beta for a benchmark efficient entity. We discuss this in more detail in Appendix G.

CEG compared results of its extension against Henry's original results and note that beta has increased by around 0.1 or more since the end of Henry's sampling period.[1254] We note CEG compares results of its extension against Henry's original results in Table 13 and 14 of its report as support of a material increase in the equity beta.

However, this is misleading because CEG is not making the correct comparison. CEG should have compared its extension results against its own replication instead of Henry's original results. As observed in CEG's report, its re-levered betas (from the replication) are generally higher than Henry's results. And this difference would overstate the increase since Henry's original's results.

CEG stated increases in the most recent 5 year data reflected increases in the raw equity betas, decreases in gearing ratios of the remaining listed stocks (APA, DUE, SKI, AST) increase and an increase in the weighting of high-beta stocks (APA) in the value-weighted portfolios.[1255] Since the Guideline, some of the still-listed firms have

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1251 CEG, *Replication and extension of Henry's beta analysis, submission with AusNet Transmission Group Pty Ltd Transmission Revenue Review 2017-2022, Revised Revenue Proposal*, 21 September 2016, pp. 1, 6, 9, 13;

1252 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017, pp. 12–13.

1253 CEG, *Replication and extension of Henry's beta analysis, submission with AusNet Transmission Group Pty Ltd Transmission Revenue Review 2017-2022, Revised Revenue Proposal*, 21 September 2016, pp. 13, 22.

1254 CEG, *Replication and extension of Henry's beta analysis, submission with AusNet Transmission Group Pty Ltd Transmission Revenue Review 2017-2022, Revised Revenue Proposal*, 21 September 2016, pp. 15–16.

1255 CEG, *Replication and extension of Henry's beta analysis*, *submission with AusNet Transmission Group Pty Ltd Transmission Revenue Review 2017-2022, Revised Revenue Proposal*, 21 September 2016, p. 1; Partington and Satchell, *Report to the AER: Discussion of the Estimates of the Return to Equity*, 12 April 2017, pp. 11-13.

undertaken a range of transactions (some of these transactions would be expected to increase their exposure to systematic risk from unregulated assets and/or assets that are different from the regulated services) that should not affect their systematic risk of supplying regulated services.[1256] Therefore it is not clear that CEG's result, even if reflective of a true increase in the underlying beta of the sample, is indicative of a material change in the equity beta of a benchmark efficient entity in providing regulated services. Partington and Satchell has also advised that there is overall only 'weak evidence of increased beta at the individual firm level based on last five years data set'.[1257]

CCP5 has previously noted that the AER could set a lower return on equity by specifying an equity beta closer to 0.4 than 0.7, which would be within the AER's range but lower than that set by the AER to date.[1258] As noted above, we apply the Guideline approach to setting the equity beta. We outline our analysis and consideration of the relevant evidence in this chapter and do not only rely on one piece of material.

Our analysis of Australian empirical estimates indicates an empirical range of 0.4–0.7. Considerations of the theory of the Black CAPM and international empirical estimates lead us to set a point estimate towards the top of our range of 0.7.

CCP4 previously submitted that Henry's (2014) paper commissioned by the AER provide evidence that the AER should be applying an equity beta of 0.4 or lower. Of the nineteen calculations on which Henry (2014) based his recommended range on, most are at the lower end with fourteen calculations between 0.3 and 0.5.[1259] As noted above, we do not only use empirical Australian estimates to inform our equity beta decision. We consider all the relevant evidence and assign them roles following an assessment of their relative merits and suitability for our regulatory task.[1260]

We give most consideration to Australian empirical estimates and use Henry's report to inform a range of 0.4–0.7. This is supported by our conceptual analysis that the equity beta of a benchmark efficient entity would be less than one. We use empirical international estimates and the theory of the Black CAPM to inform our point estimate selection and they are consistent with an estimate towards the top of our range.[1261]

H.3 International empirical estimates

[1256] https://www.apa.com.au/about-apa/our-history/; http://www.duet.net.au/getattachment/ASX-releases/2015/DUET-Completes-Acquisition-of-Energy-Developments/DUET-Completes-Acquistion-of-Energy-Developments-L/DUET-Completes-Acquistion-of-Energy-Developments-Limited.pdf.aspx

[1257] Partington and Satchell, Report to the AER: Discussion of the Estimates of the Return to Equity, 12 April 2017, p. 14.

[1258] CCP5, *Transmission for the Generations III–Response to: Revised revenue proposal by AusNet Services for Transmission Revenue Review 2017–22*, October 2016, pp. 10–11.

[1259] CCP4(Hugh Grant and David Headberry), *Submission to the AER, Powerlink Queensland 2018-22 revenue proposal*, June 2016, pp.45-6; CCP4(Hugh Grant), *Submission to the AER: AER draft 2018–22 revenue decision Powerlink Queensland revised 2018-22 revenue proposal*, December 2016, pp.45-6

[1260] AER, *Better Regulation Explanatory Statement: Rate of return Guideline*, December 2013, pp. 85–88.

[1261] AER, *Better Regulation Explanatory Statement: Rate of return Guideline*, December 2013, pp. 85–88.

Previously, we received a number of submissions on international empirical estimates.

SFG and Frontier have previously submitted that our analysis of international empirical estimates is incorrect because we do not consider the relative reliability of different studies.[1262] The reports we review in G.3 are from reputable sources. Different reports use different estimation techniques because experts have different views on how best to estimate equity beta. It would be difficult to find reports that are fully consistent with our preferred estimation approach. For more detail see section D.3 SAPN's final decision and section G.2 and G.4.2 of Attachment 3 in AusNet Services' final decision for its distribution services.

Consultants for the service providers also previously noted that the international empirical estimates we consider (correctly analysed) are consistent with an equity beta estimate materially above 0.7.[1263] We do not agree with their interpretation of the international evidence we consider. We do not consider this evidence implies an equity beta estimate above 0.7 for the benchmark efficient entity. For more detail see section D.3 of Attachment 3 to SAPN's final decision and section G.3 of Attachment 3 in AusNet Services' final decision for its distribution services.

H.4 Theoretical principles underpinnning the Black CAPM

We have received a range of submissions on our use of the theoretical principles underpinning the Black CAPM .

Frontier has previously submitted that using the theory of the Black CAPM–to apply a specific uplift to equity beta to correct for 'low beta bias'—is insufficient to correct for this bias in the Sharpe-Lintner CAPM.[1264] We clarify that we do not use the theory underlying the Black CAPM to apply a specific uplift to the equity beta (and we did not do so in the Guideline). We do not consider that the theory of the Black CAPM can reliably support a specific uplift or that it implies that the Sharpe-Lintner CAPM

1262 SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, p. 18; Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 46–50; ; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 483-90; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 260-1, 267-8.

1263 SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, p. 18; Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 50–51; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 483-90; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 262-3.

1264 Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 40–41. Also see CitiPower, *Revised proposal*, January 2016, pp. 315–316; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 263-70, 491-4, 501-5; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87.

produces biased return on equity estimates. For more detail see sections D.4, D.5.3, and A.2 of Attachment 3 to SAPN's final decision and section B.2 of Attachment 3 in AusNet Services' final decision for its distribution services.

SFG previously submitted that our use of the theory of the Black CAPM to inform the equity beta point estimate is arbitrary and/or convoluted.[1265] It noted that the correct use of the Black CAPM (under our foundation model approach) is to use it empirically—this results in an equity beta estimate materially higher than 0.7.[1266] We consider it is open to us to consider the theory underlying the Black CAPM in informing our equity beta estimate. However, we consider the practical application of the Black CAPM produces unreliable empirical estimates. We set our reasons for not relying on empirical estimates of the Black CAPM, and for giving the theory of the Black CAPM an informative role in estimating equity beta, in section 3.4.1 (steps one and two) of AusNet Services' final decision for its distribution services and this decision.

User groups have previously submitted that neither the theory nor empirical evidence from the Black CAPM should be used to inform the equity beta point estimate.[1267] We consider there are merits to the theoretical principles underpinning the Black CAPM (for example, it relaxes an assumption underlying the Sharpe-Lintner CAPM),[1268] and we have assessed this information against the criteria set out in the Guideline. We consider this theory can be useful in informing our equity beta point estimate. For more detail see section D.4 of Attachment 3 to SAPN's final decision and section G.1 of Attachment 3 in AusNet Services' final decision for its distribution services. And section B.2.3 of this decision.

1265 SFG, *Beta and the Black capital asset pricing model*, 13 February 2015, p. 23–24, 35; Frontier Economics, *The required return on equity under a foundation model approach*, January 2016, pp. 40–41. Also see for example CitiPower, *Revised proposal*, January 2016, pp. 315–316.

1266 In its report 'Beta and the Black CAPM', SFG recommends using empirical results from the Black CAPM to adjust the Sharpe-Lintner CAPM equity beta estimate to 0.91 (see SFG, *Beta and the Black capital asset pricing model*, February 2015, pp. 32–35). In its report 'The required return on equity under a foundation model approach', Frontier Economics (previously SFG) recommends using empirical results from the Black CAPM to adjust the Sharpe-Lintner CAPM equity beta estimate for 'low beta bias', which results in an equity beta estimate of 0.88 (this excludes the subsequent adjustment for 'book-to-market bias using the Fama French model) (see Frontier, *The required return on equity under a foundation model approach*, January 2016, pp. 52–57); AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 33-143; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER*, Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

1267 See CCP2 (Bruce Mountain), *Submission on the AER's preliminary decisions for the Qld/SA distribution network service providers (2015-20)*, 29 July 2015, p. 10; CCP3, *Response to AER preliminary decisions and revised proposals for Victorian electricity distribution network service providers for a revenue reset for the 2016-2020 regulatory period*, 25 February 2016, pp. 89–90; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 491-4; AER*, Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 256-9.

1268 This assumption allows for unlimited borrowing and lending at the risk free rate. However, the Black CAPM replaces this with an assumption of unlimited ability to short sell stocks.

We also note that Partington and Handley have both provided support for our foundation model approach.[1269] Our foundation model approach includes our use of the theory of the Black CAPM to inform the equity beta point estimate.

H.5 Conceptual analysis

Consumer groups have previously submitted that the reduction in systematic risk (specifically, demand risk) from transitioning to a revenue cap from a price cap should be reflected in the equity beta.[1270] [1271] We consider differences in demand risk can be mitigated through either form of control. Under a revenue cap, where forecast quantity demanded differs from actual quantity demanded, price adjustments are made in subsequent years to enable the approved revenue to be recovered by the service provider. Under a price cap, service providers may mitigate the risk of forecast error by restructuring tariffs, such that higher fixed charges are set to offset demand volatility. This is one of the reasons why, in the Guideline, we considered the systematic risks between gas, electricity, transmission and distribution networks are sufficiently similar as to justify one benchmark.[1272]

Frontier has previously submitted that our assessment of financial risk and its impact on overall systematic risk is incorrect.[1273] We disagree. We consider financial risk relates to the additional systematic risk exposure that arises from the debt holdings of a firm and recognise the benchmark efficient entity is likely to have higher financial risk than the market average firm because it has relatively high financial leverage. However, the exact relationship between financial risk and financial leverage is not straightforward.

We consider our conceptual analysis suggests the intrinsic business risk of a firm is the main driver of its systematic risk. We expect a business with a similar degree of risk as

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1269 Partington, *Report to the AER: Return on equity (updated)*, April 2015, p. 33; Handley, *Advice on the return on equity*, October 2014, p. 5. Both consultants reiterated their support for our foundation model approach in their subsequent reports (see Partington and Satchell, *Return on equity and comment on submissions in relation to JGN*, May 2015, p. 6; Partington and Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 15; Handley, *Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks*, May 2015, p. 28).

1270 See VECUA, *Submission on the AER: AER preliminary 2016–20 revenue determinations for the Victorian DNSPs*, January 2016, p. 18; CCP3, *Response to AER preliminary decisions and revised proposals for Victorian electricity distribution network service providers for a revenue reset for the 2016-2020 regulatory period*, 25 February 2016, pp. 89, 94–95. CCP4 (Hugh Grant and David Headberry), *Submission to the AER, Powerlink Queensland 2018-22 revenue proposal*, June 2016, pp.45-6.

1271 CCP4 (Hugh Grant and David Headberry), *Submission to the AER, Powerlink Queensland 2018-22 revenue proposal*, June 2016, pp.45-6.

1272 AER, *Explanatory statement to the rate of return guideline*, December 2013, p. 33.

1273 Frontier Economics, *Review of the AER's conceptual analysis for equity beta*, June 2015, pp. 8–19. CitiPower, Powercor, United Energy, JEN, AGN and ActewAGL submitted this report during the decision process. AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 434-49; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

APTPPL in providing regulated services to have low intrinsic risk exposure (relative to the market average). We also consider the high financial leverage of a benchmark efficient entity (relative to the market average) does not necessarily correspond to an equivalently high exposure to financial risk. Therefore, we consider there are reasonable conceptual grounds to expect the overall systematic risk for a business with a similar degree of risk as APTPPL to be below that of the market average firm. Our views are supported by McKenzie and Partington. For more detail see section D.1 of Attachment 3 to SAPN's final decision and section 3.4.1 of Attachment 3 in AusNet Services' final decision for its distribution services.

Frontier also noted that we have misinterpreted the empirical evidence and expert reports we rely on (including Frontier Economics' 2013 report to the AER).[1274] We do not consider the empirical evidence referred to by McKenzie and Partington in their 2012 report has been misinterpreted. We also consider Frontier Economics have misunderstood our use of the information provided in its 2013 report. Regardless, Frontier's views (in its 2015 report) do not change our key conclusion on financial risk. For more detail see sections D.1.2 and D.1.3 of Attachment 3 to SAPN's final decision and sections G.2 and G.3 of Attachment 3 in AusNet Services' final decision for its distribution services.

Frontier previously stated that our conceptual analysis is unclear and likely to be counterproductive to good regulatory decisions.[1275] We disagree with this view. Frontier's analysis appears to be based on a misunderstanding of the role of our conceptual analysis. For more detail see section D.1.3 of Attachment 3 to SAPN's final decision and section 3.4.1 of Attachment 3 in AusNet Services' final decision for its distribution services.

Frontier has submitted that we have not adequately accounted for the recent risks arising from disruptive technologies.[1276] We do not consider the risk arising from disruptive technologies can be reasonably classified as systematic risk, and so should not be compensated for in the return on equity. For more detail see section D.1.4 of

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[1274] Frontier Economics, *Review of the AER's conceptual analysis for equity beta*, June 2015, pp. 8–19. AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 436-7, 438-46; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 260-1, 262-3.

[1275] Frontier Economics, *Review of the AER's conceptual analysis for equity beta*, June 2015, pp. 6–7; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 438-46; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER*, Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

[1276] Frontier Economics, *Review of the AER's conceptual analysis for equity beta*, June 2015, pp. 20–26; AER, *Final decision, SA Power Networks determination 2015 -16 to 2019 - 20, Attachment 3 - Rate of return*, October 2015, pp. 447-9; AER, *Final decision, Australian Gas Networks access arrangement 2016 to 2021, Attachment 3 - Rate of return*, May 2016, pp. 41-87; AER, *Final decision, AusNet Services distribution determination 2016 to 2020, Attachment 3 - Rate of return*, May 2016, pp. 44-90.

Attachment 3 to SAPN's final decision and section 3.4.1 of Attachment 3 in AusNet Services' final decision for its distribution services.

The equity beta used by TasNetworks in its cost of equity calculation should reflect the lower risk produced by being able to transfer risk to customers for pass through events.[1277] In determining the equity beta, we focus on risks that are compensated through the return on equity. We note cost pass throughs typically relate to unsystematic risks such as industry-specific tax changes or geographic-specific natural disasters that are not compensated through the rate of return.[1278]

H.6 Other issues

Some user groups previously submitted that the AER has been conservative with regard to setting the equity beta and it should set the equity beta towards the lower end of its range. [1279] We have considered this submission from stakeholders. However this seems to focus on only one source of the relevant evidence we consider: the empirical 2014 study by Henry. Our consideration of the relevant evidence for the equity beta is based on all the relevant information identified in the Guideline following an assessment of their relative merits and suitability for our regulatory task: conceptual analysis, Australian empirical estimates, international empirical estimates and theory of the Black CAPM.[1280]

We gives the most consideration to Australian empirical estimates and use Henry's report to inform a range of 0.4–0.7. This is supported by our conceptual analysis that the equity beta of a benchmark efficient entity would be less than one. We use empirical international estimates and the theory of the Black CAPM to inform our point estimate selection and they are consistent with an estimate towards the top of our range.[1281]

We consider our approach and estimate contributes to the ARORO and this has been upheld by the Tribunal.[1282]

The AER has not provided any substantive evidence that supports its decision to apply an equity beta significantly higher than Henry (2014) estimate of 0.4.[1283] As noted above, we apply the Guideline approach to setting the equity

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1277 CCP4(DH*), Submission to the AER, Response to the proposal from Tasmania's electricity distribution network service provider (TasNetworks – TND) for a revenue reset for the 2017-19 regulatory period*, 4 May 2016, p. 47.

1278 AER*, Draft decision, AusNet Services transmission determination 2017-18 to 2021-22, Attachment 3 - Rate of return*, July 2016, p. 24

1279 Tasmanian Small Business Council, *Submission to the AER, TasNetworks' electricity distribution regulatory proposal 1 July 2017 to 30 June 2019 and tariff structure proposal*, May 2016, p.8; CCP4(DH*), Submission to the AER, Response to the proposal from Tasmania's electricity distribution network service provider (TasNetworks – TND) for a revenue reset for the 2017-19 regulatory period*, 4 May 2016, pp. 5, 44; Tasmanian Small Business Council, *Submission to the AER, TasNetworks' electricity distribution regulatory proposal 1 July 2017 to 30 June 2019 and tariff structure proposal*, May 2016, p.36; CCP4(DH), *Submission to the AER, Response to the AER draft decision and revised proposal to Powerlink's electricity transmission*, 19 December 2016, p. 21.

1280 AER, *Better Regulation Explanatory Statement: Rate of return Guideline*, December 2013, pp. 85–88.

1281 AER, *Better Regulation Explanatory Statement: Rate of return Guideline*, December 2013, pp. 85–88.

1282 Australian Competition Tribunal.

beta. We outline our analysis and consideration of the relevant evidence in this chapter and do not only rely on one piece of material. Our analysis of Australian empirical estimates indicates an empirical range of 0.4–0.7. And considerations of the theory of the Black CAPM and international empirical estimates lead us to set a point estimate towards the top of our range of 0.7.

The AER needs to have greater regard to stakeholders' critiques of its equity beta estimation approach and to apply an equity beta at the lower end of the range (i.e. 0.4 or lower).[1284]. We consider carefully all submissions to our regulatory processes. We assess them based on their merits like all materials submitted to us.

[1283] CCP4(Hugh Grant and David Headberry), *Submission to the AER, Powerlink Queensland 2018-22 revenue proposal*, June 2016, p.47.

[1284] CCP4(Hugh Grant and David Headberry), *Submission to the AER, Powerlink Queensland 2018-22 revenue proposal*, June 2016, p.3.

I Previous MRP issues

In addition to those issues directly challenged in the market risk premium section of 3.4.1, the current service providers have also resubmitted on a number of issues raised in previous regulatory processes. Here we detail those and reasons for our decision.

I.1 Historical excess returns

Service providers argued in previous regulatory processes that the adjustment to the historical stock returns from NERA are more reliable than the ASX's adjustment.[1285] However the AER maintains its position that the NERA adjustment, which is based on less than ten data points out of 300, is not a material improvement in reliability.[1286] NERA has also not reconciled the data it uses for its adjustment to the data of the original series.

In estimating the market risk premium from historical excess returns, we take into account both arithmetic and geometric averages to provide a more complete picture. Service providers have again submitted that only the arithmetic averages should be used in the process.[1287]

We note that Partington and Satchell have consistently recommended the consideration of both arithmetic and geometric averages, tempered by an understanding of the potential biases.[1288]

In regards to the sample periods which we use to inform the Historical Excess Returns, the service providers have submitted that we should only use sample periods which begin pre 1980.[1289] Partington and Satchell considered that, although it reduces the precision of the estimates, there are reasons for using multiple sampling periods, such as possible structural breaks in the data and issues regarding data quality.[1290] We consider that concerns about data quality become increasingly important the further back into the past one looks. We have regard to five sampling periods because each has different strengths and weaknesses.

1285 AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revenue review 2017–22*, 30 October 2015;

1286 AER, *Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016, p. 62;

1287 AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016, p. 147; Multinet, Rate of Return Overview, 16 December 2016, p.26; AusNet Services, *Access Arrangement Information 2018-2022*, 21 December 2016, pp. 194-197;

1288 McKenzie and Partington, *Report to the AER: Supplementary report on the equity MRP*, 22 February 2012, p. 5; Partington and Satchell, *Report to the AER: Return on equity and comment on submissions in relation to JGN*, May 2015, pp. 16–17; Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 44–45; Partington and Satchell, *Report to the AER: Cost of equity issues–Final decisions for the VIC DNSPs*, April 2016, pp. 49–52.

1289 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 74–75; AusNet Services, *Access Arrangement Information 2018-2022*, 21 December 2016, pp. 196-197;

1290 Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, pp. 45–46;

Service providers have also stated the Guideline approach of using the mean excess returns over a long historical period is not suitable because past conditions are not likely to hold.[1291] As noted above, we use multiple periods to account for different market conditions and use other relevant evidence to inform our decision. Partington and Satchell have also advised that using multiple time periods, when assessing excess returns, minimises variation to the current time frame.[1292]

Further, it is important to note the current market situation is not uncommon for Australia.[1293] We note the magnitude of current interest rates is not so dissimilar to the past as to invalidate the historic market risk premium informing an estimate of the current market risk premium.[1294]

Frontier proposed that a reduction in theta from 0.6 to 0.35 would have commensurately small impact when estimating the market risk premium.[1295] We note that this conclusion is a product of Frontier's estimation of historical excess returns. Frontier used 3 averaging periods: 1883–2015, 1937–2015 and 1958–2015. Given theta only affects data from 1988 onwards, Frontier's choice of averaging periods 'dilutes' theta's impact on the estimates in the following manner:

- by excluding the averaging periods (1980–2015 and 1988-2015) where theta would have a more pronounced effect
- retaining averaging periods where the large number of years reduces the impact of theta on the end estimate

We note changing the theta from 0.6 to 0.35 has a marked reduction on the market risk premium estimate for the two excluded averaging periods (1980–2015 and 1988-2015):

- For the 1980-2015 period, the geometric average changes from 3.9 per cent to 3.5 per cent and the arithmetic average falls from 6.2 per cent to 5.8 per cent.
- For the 1988-2015 period the geometric average falls from 4 per cent to 3.6 per cent and the arithmetic average from 5.6 per cent from 5.2 per cent.

As noted above, we consider a range of estimation periods (both long term and short term) should be adopted for estimating historical excess returns. Frontier, in their 2016 report on the market risk premium, stated that their analysis historical excess returns supported a market risk premium of at least 7.5 per cent.[1296] They arrive at this estimate by averaging the estimates of two separate methods: the excess returns and the wright approach. Partington and Satchell has advised that 'the notion that

[1291] Frontier Economics, *The Market Risk Premium*, September 2016, p. 4;

[1292] Partington and Satchell…

[1293] Partington and Satchell, *Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016, pp. 23–26.

[1294] Partington and Satchell…

[1295] Frontier Economics, *The Market Risk Premium*, September 2016, p.78;

[1296] Frontier Economics, *The Market Risk Premium*, September 2016 averaging over different estimates of same parameters lead to better outcomes depends on the quality of the additional estimates used in the averaging'.[1297] We agree. Per our Guideline, we consider material should be used assessing the merits of the material and suitability for our regulatory task. Combining estimates from different sources without assessing the merits of the material and suitability for our regulatory task will not lead to an estimate that is unbiased and contribute to the achievement of the ARORO[1298]. We disagree with Frontier's historical excess returns and Wright estimates for the following reasons:

- Both estimates are based on a theta of 0.35. We consider the theta should be set at 0.6, consistent with a gamma of 0.4.[1299]
- The historical excess returns exclude the two most recent (1980–2015 and 1988–2015) averaging periods. They should be included because of clearly identifiable and material changes in the underlying data and to recognise each of these periods has different strengths and weaknesses. [1300]
- Changing the theta for the two most recent averaging periods shows a large change in both the arithmetic and geometric average obtained. See above for more details.
- Our assessment of the Wright CAPM in the Guideline and subsequent regulatory decisions shows that it should be used as a cross-check for the overall return on equity[1301]

I.2 Dividend growth model

Service providers have repeatedly called into question the weight assigned to the dividend growth model when informing the market risk premium estimate. In more recent proposals they have insisted that we have assigned less weight to the DGM as time has progressed.[1302] We disagree. Our approach is consistent with the 2013 Rate of Return Guideline when considering evidence from dividend growth models (from our preferred construction of the models). Due to limitations with dividend growth models, namely that the model is very sensitive to input assumptions and is likely to show an upward bias, we use them to inform if the point estimate should be set above or below the baseline estimate derived from historical excess returns. Service providers pointed to jumps in the DGM's estimations of the MRP in between decisions to highlight the

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1297 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 27

1298 AER, *Rate of Return Guideline*, December 2013, p. 6.

1299 AER, *Final Decision Ausgrid Distribution Determination Rate of Return attachment*, April 2015, pp.339-340.

1300 AER, *Final decision SA Power Networks distribution determination - Attachment 3 - Rate of Return*, October 2015, pp. 367–368.

1301 AER, *AER Explanatory Statement - appendices - rate of return guideline*, December 2013, pp. 25-28.

1302 AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016, pp. 147–149; Multinet, Rate of Return Overview, 16 December 2016, pp.26-28; AusNet Services, Access Arrangement Information 2018-2022, 21 December 2016, p. 196

lack of weight assigned by us during the decision process[1303], however this jump was a misleading use of previous results and updated risk free rates. As such this 'jump' in the MRP was misleading and erroneous.

Partington and Satchell have also advised that the dividend growth model is "unlikely" to produce a 'forward looking MRP commensurate with the prevailing conditions'.'[1304] We believe that it provides the evidence from the dividend growth model as much weight as is appropriate at the current time. We also note that, due to limitations listed below, using the 3 stage DGM to provide an estimate for the required return on equity is not an appropriate use of the model as it may lead to estimates that are persistent and stable over a period of time.[1305] As such, we consider the fact the return on equity estimate from the dividend growth models has remained stable since the 2013 Guideline to be a result of this and should be treated with caution.

In more specific criticisms of the AER's use of the dividend growth model , service providers maintain that the AER's concerns regarding sticky dividends creating bias in the model are unfounded, as dividends are forecast to grow in the coming years[1306]. However we believe there is no reason to believe that the bias is not material in the current market. We continue to consider that expectations in the long term may have greater effect on prices than expectations in the next year or two. Moreover, the RBA data suggests that forecast growth in earnings per share will likely slow over the 2016-17 financial year. [1307]

There are also continued concerns regarding our position on analysts' forecasts and biases in their values. [1308] However our position remains that analysts' forecasts are well understood to be upwardly biased.[1309] Although we show the effect of potential bias within our sensitivity analysis, the extent of any bias is unclear. There has been no proposal of a method to estimate the extent of any bias, and such methods may be complex, without widespread acceptance and open to gaming. As such, we find it appropriate not to apply an adjustment.

In addition to the above issues with analyst forecast bias, service providers have also argued that our concern is not relevant as the forecasts reflect analysts' implied

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1303 Frontier Economics, *The Market Risk Premium*, September 2016, P26; SAPN, *SA Power Networks - 2015-20 Revised Regulatory Proposal,* July 2015, p. 331.

1304 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 25

1305 AER, *AusNet transmission draft decision*, pp. 202–204.

1306 Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016, p. 39; Frontier Economics, *The Market Risk Premium*, September 2016, pp. 61–62;

1307 RBA, *The Australian Economy and Financial Markets Chart Pack,* January 2017, p. 24.

1308 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 62-63;

1309 McKenzie and Partington, *Report to the AER, Part A: Return on equity* October 2014, pp. 26, 31; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, pp. 46, 51; McKenzie and Partington, *The DGM*, December 2013, pp. 8–9. Also see Partington & Satchell, *Report to the AER: Analysis of criticism of 2015 determinations*, October 2015, p. 43; AER*, Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016, p. 62.

discount rates.[1310] We remain of the view that if analysts' dividend and price forecasts are biased it is also possible that the analysts' implied return on equity is biased. McKenzie and Partington also consider that analysts' forecasts are slow to adjust to changing information.[1311] This creates biases to the output of dividend growth models. It also implies that dividend growth models may not track changes in the return on equity accurately. Partington and Satchell also noted Frontier's survey of analysts' forecasts for the ASX 20 by stating they would "place little weight on a non-random sample of twenty firms and one year's observations" when assessing the reliability of analyst's forecasts.[1312]

Service providers have previously put forward that data from the RAB's chartpack is an indicator that our reservations with the DGM are not necessary in the current economic conditions.[1313] We disagree with this having previously noted that earnings per share as the best indicator going forward regarding dividend payments. We note the chart shows 2017 forecast of earnings per share are higher than 2016 forecasts as Frontier pointed out. [1314] However, it is not clear that conclusive findings about earnings or dividends can be drawn from the chartpack as it relates to one-year forecasts whereas we estimate a forward looking 10-year market risk premium.

Service providers have also previously relied on the DGM's estimate for the overall return on equity, stating that it has remained stable since the 2013 Guideline.[1315] We have previously considered the use of the 3-stage dividend growth model to provide an estimate for the required return on equity.[1316] However, limitations such as slow-change dividend forecasts and upward bias in analyst forecasts may lead to return on equity estimates that are persistent and stable over a period of time.[1317] None of the service providers using this approach provided any new evidence to support the use of the dividend growth model for estimating the overall return on equity, therefore we continue to be of the view that the dividend growth model estimates should be treated with caution and not used to directly estimate the market risk premium or the return on equity. Therefore we do not consider the stable estimate of the return on equity to be reasonable evidence to depart from the guideline.

Frontier also stated that DGM estimates support a market risk premium of at least 7.5 per cent.[1318] As discussed above, there are a range of issues with dividend growth models which makes their results unreliable and upwardly biased. We disagree with

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[1310] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 62-63.

[1311] McKenzie and Partington, *Report to the AER, Part A: Return on equity*, October 2014, pp. 31–32; Partington, *Report to the AER: Return on equity (Updated)*, April 2015, p. 51.

[1312] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017,p. 32.

[1313] Frontier Economics, *The Market Risk Premium*, September 2016, p. 62.

[1314] Frontier Economics, *The Market Risk Premium*, September 2016, p. 62.

[1315] Frontier Economics, *The Market Risk Premium*, September 2016, p.8, Figure 4; SAPN, *SA Power Networks - 2015-20 Revised Regulatory Proposal,* July 2015, p. 331; AusNet Services, Access Arrangement Information 2018-2022, 21 December 2016, p. 198; Multinet, Rate of Return Overview, 16 December 2016, p.29

[1316] AER, *AER Final Decision on SAPN distribution 2015-2020*, Attachment 3, Section A.3.4, p. 321.

[1317] AER, *AusNet transmission draft decision*, pp. 202–204.

[1318] Frontier, *The Market Risk Premium, September 2016*, p. 76.

Frontier using dividend growth model estimates to support a point estimate that is directly estimated from the dividend growth model. This 'double-counts' the material and ignores the fact that this model should not be used to directly estimate the market risk premium.

We also note Frontier's dividend growth model makes a number of methodological choices we disagree with:

- Frontier assumes a theta of 0.35. We consider the theta should be set at 0.6, consistent with a gamma of 0.4.[1319]
- Frontier does not include the downward adjustment to the long-run GDP growth. Partington and Satchell has advised the need for a downward adjustment is because all of the capital required for growth will not come from the company internally which means that additional equity will be raised–diluting existing equity and reduce its share of the growth.[1320] We agree and consider that the downward adjustment remains appropriate.

I.3 Wright CAPM

Various service providers have put forward that the AER should assign more weight to the results gained from the Wright approach of the CAPM. This has varied between service providers as to whether it should receive a heavier weighting when considering the overall return on equity or be directly involved in estimating the MRP. [1321] A key point of contention is that the overall return on equity estimate derived from the Wright Approach has remained stable since the 2013 Rate of Return guideline.

As stated in the guideline, our view of the Wright CAPM is that it should be used to inform the overall return on equity, however due to the historical form of the model we do not place much reliance on the information gained from the model. As the CAPM is a forward looking pricing model[1322] historical data, such as that from the Historical excess returns, may be a basis for estimates of the input parameters where they are good evidence of forward looking parameters. However we do not consider using historically based estimates where they are clearly not representative of the forward looking rate, as this is unlikely to result in an unbiased estimate of the return on equity. Consistent with the 2013 guideline, we use the Wright approach as a cross-check on our overall return on equity.

1319 AER, *Final Decision Ausgrid Distribution Determination Rate of Return attachment*, April 2015, pp. 339-340.

1320 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 27.

1321 AusNet Services, *AusNet Transmission Group Pty Ltd Transmission revised revenue review 2017–22*, 21 September 2016, pp. 147-153; APTPPL, *2017-2022 RBP Access Arrangement revision submission*, September 2016 ,pp. 141-155; AusNet Services, *Access Arrangement Information 2018-2022*, 21 December 2016, p. 198; Multinet, *Rate of Return Overview*, 16 December 2016, p.29; APA VTS, *VTS Revision Proposal submission*, 3 January 2017, pp. 146-162

1322 Bringham and Daves, *Intermediate financial management*, Ed. 10, Cengage Learning, 2010, p. 53.

Frontier, in their 2016 report on the market risk premium, stated that their analysis historical excess returns supported a market risk premium of at least 7.5 per cent.[1323] They arrive at this estimate by averaging the estimates of two separate methods: the excess returns and the wright approach. Partington and Satchell has advised that 'the notion that averaging over different estimates of same parameters lead to better outcomes depends on the quality of the additional estimates used in the averaging'.[1324] We agree. Per our Guideline, we consider material should be used assessing the merits of the material and suitability for our regulatory task. Combining estimates from different sources without assessing the merits of the material and suitability for our regulatory task will not lead to an estimate that is unbiased and contribute to the achievement of the ARORO[1325]. We disagree with Frontier’s historical excess returns and Wright estimates for the following reasons:

- Both estimates are based on a theta of 0.35. We consider the theta should be set at 0.6, consistent with a gamma of 0.4.[1326]
- The historical excess returns exclude the two most recent (1980–2015 and 1988–2015) averaging periods. They should be included because of clearly identifiable and material changes in the underlying data and to recognise each of these periods has different strengths and weaknesses. [1327]
- Changing the theta for the two most recent averaging periods shows a large change in both the arithmetic and geometric average obtained. See above for more details.
- Our assessment of the Wright CAPM in the Guideline and subsequent regulatory decisions shows that it should be used as a cross-check for the overall return on equity[1328]

I.4 Surveys

Service providers have continued to state that the AER place too much weight on the evidence from surveys[1329]. While survey estimates intend to provide an arm’s length assessment, we would not expect them to necessarily have complete impartiality. Survey estimates may strive for objective views but it seems unlikely that they will be entirely uninfluenced by commercial and other external interests. Respondents may also display some 'herding' behaviour. Therefore, we view that survey estimates supply relevant, but not definitive, information and considerable care needs to be taken in the

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[1323] Frontier Economics, *The Market Risk Premium*, September 2016

[1324] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 27

[1325] AER, *Rate of Return Guideline*, December 2013, p. 6.

[1326] AER, *Final Decision Ausgrid Distribution Determination Rate of Return attachment*, April 2015, pp.339-340.

[1327] AER, *Final decision SA Power Networks distribution determination - Attachment 3 - Rate of Return*, October 2015, pp. 367–368.

[1328] AER, *AER Explanatory Statement - appendices - rate of return guideline*, December 2013, pp. 25-28.

[1329] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 34-36; APA VTS, *VTS Revision Proposal submission*, 3 January 2017, pp. 176; Multinet, *Rate of Return Overview*, 16 December 2016, p.28; AusNet Services, *Access Arrangement Information 2018-2022*, 21 December 2016, p. 197;

analysis and interpretation of such estimates. Nonetheless, survey estimates explore investor expectations about the market risk premium by directly asking investors and market practitioners what their expectations are and/or what they apply in practice. We consider this remains useful for informing our market risk premium estimate.[1330]

It is also important to note that despite service provider insistence[1331] it is not clear whether survey estimates should be adjusted for imputation credits. As such we agree with the QCA's view that 'as participants can be considered sophisticated investors and/or market observers (including academics) it seems as likely they would have taken account of all factors, including the need to implicitly adjust for dividend imputation credits'.[1332]

I.5 Other regulators' decision

Service providers have compared our decisions to that of other regulators, and have stated that other regulators are currently adopting higher market risk premium estimates than ours.[1333] We note that other regulators arrive at different conclusions for a market risk premium as other regulators adopt different approaches, have different regulatory tasks and regulate different businesses. It is important to take these differences into account when comparing the results. We use information from other Australian regulators' decisions as a cross check to the market risk premium and return on equity point estimate because they are likely to be more comparable than foreign regulators. We note that Frontier's submission indicates that most Australian regulators are adopting a market risk premium of 6.5 per cent or below. It is also important to note that the ERA has acknowledged its estimate of 7.4 per cent is comparable with our 6.5 per cent market risk premium once differences in parameter estimates and judgement are accounted for.[1334]

We do not consider regulatory decisions by foreign regulators to be useful for informing the market risk premium for a benchmark efficient entity with a similar degree of risk as the service provider for supplying the regulated services.[1335] This is because, in addition to Partington and Satchell's advice that "overseas regulators decisions are not likely to be convincing unless one can show great similarities between the economies considered"[1336] and other caveats noted above, we note that the required return on the market may differ across countries.

[1330] AER, *Final Decision AusNet distribution determination - Attachment 3 - rate of return*, May 2016, p.61; AER, *Final decision on CitiPower distribution determination - attachment 3 - Rate of Return*, May 2016, p.60.

[1331] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 34-36.

[1332] QCA, *Draft decision: Aurizon Network 2014 Draft Access Undertaking - Maximum Allowable Revenue*, September 2014, p. 232.

[1333] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 32-34,51-54 AusNet Services, *Access Arrangement Information 2018-2022*, 21 December 2016, pp. 197-198

[1334] ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, June 2016, p. 240.

[1335] AER, *Final Decision SA Power Networks distribution determination - Attachment 3 - rate of return*, October 2015, pp. 487-489.

[1336] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 28

I.6 **Conditioning variables**

Service providers have submitted that conditioning variables should not be used in the absence of formal econometric mapping. [1337]We are aware of the limitations of conditioning variables, however our assessment indicates that the evidence still warrants “some consideration” as they can detect changing market conditions.[1338] Therefore we use conditioning variables in a directional role and not to directly estimate. We note that other regulators, such as the ERA, use conditioning variables when forming their estimate of the market risk premium in a similar manner.[1339]

Aside from the argument above, service providers submit that conditioning variables does not support the proposition that the required return on equity has decreased by 25 per cent since the Guideline.[1340] We are aware of the limitations of conditioning variables and do not use them to directly estimate the market risk premium. Our use of the conditioning variable is as outlined in the Guideline: to provide directional information/change in the market risk premium.[1341]

I.7 **Other market data**

In addition to other forms of evidence, service providers have proposed that data from valuation reports is useful when considering an estimate for the market risk premium.[1342] We disagree with using valuation reports to directly estimate the market risk premium. Based on a consideration of its relative strengths and suitability for our regulatory task, we have considered evidence from valuation reports as useful in a cross-check on the overall return on equity as well as return on equity our equity parameters. However valuation reports have a different objective to the ARORO which may make their estimates unsuitable for purpose.[1343] This effect is likely more prevalent for input parameters than the overall return on equity. A lack of transparency on the derivation of return on equity parameters on equity estimates prevents adjusting for these effects. Partington and Satchell have also noted that analysts’ beliefs ‘can seem somewhat unreliable’.[1344]

[1337] AusNet p150, Frontier Economics, *The Market Risk Premium*, September 2016, p.40; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, p.321-324; AusNet Services, *Access Arrangement Information 2018-2022*, 21 December 2016, p. 198; Multinet, *Rate of Return Overview*, 16 December 2016, p.29

[1338] AER, *Explanatory Statement - Rate of Return Guideline*, December 2013, p.140.

[1339] ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline*, June 2016, pp. 209-210.

[1340] Frontier Economics, *The Market Risk Premium*, September 2016, p. 76; CitiPower, *Revised regulatory proposal 2016–2020*, January 2016, pp. 321-324.

[1341] AER, *AER Explanatory Statement - appendices - rate of return guideline*, December 2013, p. 93.

[1342] Frontier Economics, *The Market Risk Premium*, September 2016, pp. 35-38;

[1343] AER, *Final decision on SA Power Networks distribution determination - attachment 3 - Rate of Return*, October 2015, pp.402-403.

[1344] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 28.

In further submissions service providers state that valuation reports indicate a market risk premium higher than 6.5 per cent. [1345] However, our assessment of valuation reports is that they should be used to cross-check our overall return on equity. Frontier's observations are based on uplifted parameters and/or return on equity estimates.[1346] We have greater regard to unadjusted parameters because uplifts applied by brokers and valuers may be inconsistent with ARORO. Further, Partington and Satchell have advised that 'there is evidence that valuation practitioners are using an MRP lower than the 6% favoured in Australia and there is no evidence that the MRP being used is going up.'[1347]

Frontier proposed that due to a decline in the P/E ratio, the AER should be increasing the required return on equity.[1348] We caution the use of P/E data. It can fluctuate significantly within a single year (2015/16 High:16, low 14.5[1349]) and the conclusions one can draw may be significantly impacted by the time period selected. Further, movements in P/E data can be driven by change in the growth rate, dividend payout ratio and the cost of equity.[1350] As Partington and Satchell observed, 'inferences about the cost of equity based on plots of earnings yield or P/E ratios are highly suspect'.[1351]

- Service providers have repeatedly submitted that expert valuation reports support a 7.5 per cent market risk premium.[1352] We disagree with this use of valuation reports as their limitations makes them unsuitable in a regulatory context:
- The ARORO states that data must be 'informed by sound empirical analysis and robust data'[1353] however many valuation reports do not state the source of their information or decisions.
- Our recent consultant report stated that upward adjustments found in valuation reports 'seem too ad-hoc to be a regulatory tool'.[1354]
- Using valuation reports as a guide means it is highly susceptible to sampling variation as Partington and Satchell notes, and whilst some practitioners are using an MRP above 6 per cent there 'is evidence that valuation practitioners are using an MRP lower than the 6% favoured in Australia'.[1355]

It is also important to note that out of the four reports Frontier listed:

1345 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 35–37

1346 Frontier Economics, *The Market Risk Premium*, September 2016, pp. 35–37

1347 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p.16.

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1349 RBA Table F7, Share Market. Available at: http://www.rba.gov.au/statistics/tables/

1350 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, pp. 20-21; AER, *Final decision CitiPower distribution determination - attachment 3 - rate of return*, May 2016, p. 88.

1351 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 21.

1352 Frontier Economics, *The Market Risk Premium*, September 2016 p. 76.

1353 AER, *AER Explanatory Statement - Rate of Return Guideline*, December 2013, p. 6.

1354 Partington and Satchell *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p.16.

1355 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p.16.

- Three of the reports specify a market risk premium of 6 per cent.[1356]
- The Grant Samuel report then goes on to apply uplift on this 6% based on "anecdotal evidence".[1357]
- Three of the reports apply uplift to the risk free rate as calculated by the AER.[1358] This does not change the market risk premium itself and so should not be compared as such. The AER does not apply any uplift to its risk free rate.
- One of the reports, and the only one which does not use a stated market risk premium of 6 per cent, does not provide any method as to how the market risk premium was calculated and as such is unsuitable for comparison.[1359]

I.8 Overall Market Risk Premium

Service providers have proposed that we set a constant market risk premium for each decision, regardless of evidence.[1360] Our market risk premium is informed by a range of relevant materials and our assessment of all these materials is informed by the roles assigned to them based on their relative merits and suitability for our regulatory task. The relevant evidence indicates that the forward looking 10-year market risk premium continues to be 6.5 per cent. Partington and Satchell noted 'to consider changes in the MRP requires some statistical evidence'.[1361] Service providers have not provided satisfactory evidence to indicate a different estimate.

A large amount of Frontier's submission on the subject seems to be mainly premised on estimates from dividend growth models and alternative specifications of the Sharpe-Linter CAPM. We have stated above our issues with over-reliance on the dividend growth model estimates of the market risk premium, hence our Guideline assigns less weight to this material. Submissions to date have not provided sufficient evidence for us to depart from this view.

We accept that the market risk premium may vary over time.[1362] However, our assessment of all the relevant material indicates (when applying the Guideline) that 6.5 per cent is the forward looking 10-year market risk premium that contributes to the ARORO and commensurate with the prevailing condition in the market for equity funds. Partington and Satchell have advised that the current conditions in Australia are not at

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[1356] Lonergan Edwards, *Valuation on Ethane Pipeline Income Fund,* 31 March 2016; Grant Samuel, *Valuation on Pacific Brands*, 20/05/2016; KPMG, *Valuation report on STW Comms*, 29 February 2016.

[1357] Grant Samuel, *Valuation on Pacific Brands*, 20 May 2016.

[1358] Lonergan Edwards, *Valuation on Ethane Pipeline Income Fund,* 31 March 2016, Grant Samuel, *Valuation on Pacific Brands*, 20 May 2016; KPMG, *Valuation report on STW Comms*, 29 February 2016.

[1359] Deloitte, *Valuation on Patties Foods,* 15 July 2016.

[1360] Frontier Economics, *The Market Risk Premium*, September 2016, p. 10, 22–25, 55;

[1361] Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity*, 12 April 2017 p. 33.

[1362] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, page 91.

all dissimilar to the historical interest rates in the periods which the AER calculates the historical excess returns from[1363] and 'common in Australia and elsewhere'.[1364]

1363 Partington and Satchell, *Report to the AER: Cost of equity issues–Final decisions for the VIC DNSPs*, April 2016, pp. 23-26.

1364 Partington and Satchell, *Report to the AER: Discussion of estimates of the return on equity,* 12 April 2017, p. 23.

J Return on debt approach

We transition all of the return on debt[1365] from an on-the-day approach in the first regulatory year to a trailing average by updating 10 per cent of the debt portfolio over 10 years (a full transition). This appendix explains why, if we move to a trailing average approach, doing so requires a full transition to achieve the allowed rate of return objective (ARORO). It also explains why we consider the on-the-day approach should apply if there is no transition between the current approach and the trailing average. In this appendix, a 'regulatory period' means a regulatory control period or an access arrangement period.

In setting out our reasons for this view, this appendix is structured as follows:

- Section J.1 establishes how we interpret the ARORO. This is with a particular focus on defining efficient financing costs (section J.1.1) and how the concept of a benchmark efficient entity interacts with the ARORO (section J.1.2).
- Section J.2 sets out what is required for us to form an allowed return on debt that contributes to the achievement of the ARORO. This includes:
    - section J.2.1—the need to provide ex-ante compensation for efficient financing costs (ex-ante efficient compensation) as opposed to providing compensation for historically incurred costs
    - section J.2.2—why we consider our approach is consistent with the National Electricity Law /National Gas Law (NEL/NGL)
    - section J.2.3—why we consider a revenue-neutral transition (in a present value sense) is required if there is a change in the methodology (or approach) for estimating the allowed return on debt (assuming that both methodologies can achieve the ARORO but produce different estimates at a given point in time).
- Section J.3 analyses the on-the-day and trailing average approaches to establish the extent these approaches can contribute to the achievement of the ARORO.
- Section J.4 establishes why a full transition can contribute to the achievement of the ARORO when moving from an on-the-day to a trailing average approach.
- Section J.5 explains why an immediate (or hybrid) transition will not achieve the ARORO given current interest rates relative to historical interest rates. This includes:
    - section J.5.1—a mathematical explanation.

[1365] For clarity, that is 100% of the base rate and DRP components of the allowed return on debt.

- section J.5.2—a further discussion responding to some issues raised in the service providers' revised proposals.[1366] Table 3-35 responds to arguments supporting an immediate transition to a trailing average. We also provide responses to the CEG’s most recent report on the AER’s current interpretation of the ARORO in this section. For Completeness we retain the explanation from our earlier decisions on why we disagree with an earlier CEG's report recommending that if we apply a hybrid transition, we should assume a benchmark efficient entity would have hedged one third of the base rate (noting this argument becomes redundant as we do not apply a hybrid transition).[1367]

This section also explains why, to achieve the ARORO, the on-the-day approach should continue if there is no revenue-neutral transition from the current on the day approach. We also included the material submitted by APA, APTPPL, AusNet and other service providers (in earlier decisions) who have proposed departures from our current approach to estimating the cost of debt. We consider it is necessary to include this material and the responses to the material given we have considered it in reaching our draft decision for APTPPL.

J.1 Interpretation of the ARORO

The ARORO provides that the rate of return for a service provider is to be 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 standard control, prescribed transmission or reference services.[1368] Given this, applying the ARORO requires an understanding of:

- efficient financing costs
- the degree of risk that applies to a benchmark efficient service provider in respect of the provision of reference services.

We elaborate on these components of the ARORO in the following sections.

J.1.1 Efficient financing costs

The ARORO provides for 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 service provider in respect of the provision of reference services. Given this, it is important to understand efficient financing costs.

Economists typically think of efficiency in three dimensions: productive, allocative and dynamic. Table 3-34 sets out how this applies in the context of debt financing.

[1366] The service providers referred to are Australian Gas Networks (AGN), ActewAGL gas distribution, APTNT, Jemena Electricity Networks (JEN), United Energy, AusNet Services, CitiPower and Powercor.

[1367] CEG, *Critique of the AER's approach to transition*, January 2016.

[1368] NER, cl. 6.5.2(c); NER, cl. 6A.6.2(c); NGR, r. 87(3).

Table 3-34 Application of economic efficiency to debt financing

Dimension of efficiency	Economic meaning[1369]	Application to debt financing[1370]
Productive efficiency	Achieved when output is produced at minimum cost. This occurs where no more output can be produced given the resources available, that is, the economy is on its production possibility frontier. Productive efficiency incorporates technical efficiency. This refers to the extent that it is technically feasible to reduce any input without decreasing the output or increasing any other input.	Refers to least cost financing (that is, the lowest required return on debt) subject to any constraints, such as risk. For our determinations to be productively efficient we need to incentivise service providers to seek the lowest cost financing (all else being equal).
Allocative efficiency	Achieved when the community gets the greatest return (or utility) from its scarce resources.	Allocative efficiency can be achieved by setting an allowed return consistent with the expected return in the competitive capital market (determined by demand and supply) for an investment of similar degree of risk as a service provider supplying reference services.
Dynamic efficiency	Refers to the allocation of resources over time, including allocations designed to improve economic efficiency and to generate more resources. This can mean finding better products and better ways of producing goods and services.	Refers to the existence of appropriate investment incentives. We can encourage dynamic efficiency by setting an allowance that does not distort investment decisions. Dynamic efficiency is advanced through incentive regulation rather than cost of service regulation that compensates a service provider for its actual costs no matter how inefficient.

Source: AER analysis; Productivity Commission, *On efficiency and effectiveness: Some definitions*, May 2013; AER, *Better regulation: Rate of return guidelines consultation paper*, May 2013.

Because the market for capital finance is competitive, a benchmark efficient entity is expected to face competitive prices in the market for funds. Therefore, we consider efficient debt financing costs are reflected in the prevailing cost of debt observed in capital markets for an investment with a similar degree of risk as that which applies to a service provider in respect of the provision of reference (or price regulated) services.[1371] As Alfred Kahn stated:[1372]

> The public utility company competes with all other companies in the economy for the various inputs of its production process—for labour, materials, and capital. To the extent that these are supplied in open markets (instead of, for example, under negotiated bids), in principle there ought to be readily available objective measures of the prices of these inputs that have to be incorporated in the cost of service. This is clearly true of the capital input: since the regulated

[1369] See Productivity Commission, *On efficiency and effectiveness: Some definitions*, May 2013, p. 3

[1370] We have previously discussed this in AER, *Better regulation: Rate of return guidelines consultation paper*, May 2013, pp. 75–76.

[1371] We note the cost of debt (from a firm's perspective) is also known as investors' required rate of return on debt (from an investors' perspective).

[1372] Kahn, A.E., 'The economics of regulation: Principles and institutions', The MIT Press, Massachusetts, 1988, p. 45.

> company must go to the open capital market and sell its securities in competition with every other would-be issuer, there is clearly a market price (a rate of interest on borrowed funds, an expected return on equity) that it must be permitted and enabled to pay for the capital it requires

Similarly, Associate Professor Graham Partington and Professor Stephen Satchell (Partington and Satchell) interpret efficient financing costs as the opportunity cost of capital, which is a market rate of return for assets with a given level of risk.[1373] They advise the opportunity cost of debt is generally measured using the (appropriately benchmarked) yield to maturity.[1374] They also consider our use of a benchmark BBB+ credit rating and ten year term is appropriate.[1375] In a new report to the AER, Partington and Satchell define the efficient financing cost of a BEE as the current cost of finance that leads to efficient investment.[1376] This is consistent with their previous interpretation.[1377]

We consider that productive, allocative and dynamic efficiency are advanced by employing a return on debt that reflects prevailing rates in the market for funds. This will also promote the long term interests of consumers in line with the National Electricity Objective / National Gas Objective (NEO/NGO).[1378]

J.1.2 Benchmark efficient entity

We previously considered a benchmark efficient entity would be 'a pure play, regulated energy network business operating within Australia'. This had been adopted in:

- The rate of return guidelines published in December 2013 (the Guideline).[1379] It is worth noting that while some service providers raised concerns with this during the Guideline development process, none objected to a notion that' a benchmark efficient entity' as referenced in the ARORO, would be an entity providing regulated services.[1380] To the contrary, stakeholders recognised that price and revenue caps

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1373 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 15.

1374 However, Partington and Satchell note the yield to maturity overstates the (expected) opportunity cost of risky debt because it is based on the promised return, which exceeds the expected return on risky debt (due to default risk). See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 28.

1375 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 31.

1376 Partington, G., Satchell, S., *Report to the AER: In relation to the cost of debt*, 9 April 2017, p. 23.

1377 Partington, G., Satchell, S., Report to the AER: Discussion of the allowed cost of debt, 5 May 2016, p. 15.

1378 The NEO is to 'promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to - (a) price, quality, safety, reliability and security of supply of electricity; and (b) the reliability, safety and security of the national electricity system'. Similarly the NGO is to 'promote efficient investment in, and efficient operation and use of natural gas services for the long term interest of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas'.

1379 AER, *Better regulation: Rate of return guideline*, December 2013, p. 7.

1380 AER, *Draft rate of return guideline*, August 2013, p. 9.

had particular roles in mitigating risk as well as other features of the regulatory framework such as maintenance of the regulatory asset base.[1381]

- Our previous 2009 weighted average cost of capital (WACC) review.[1382]
- Our rate of return decisions following the publication of the Guideline.[1383]

We have devoted considerable time to considering the characteristics of a benchmark efficient entity in the Guideline and this decision. We consider a 'benchmark' is a reference point or standard against which performance of achievements can be assessed.[1384] For a benchmark to be useful, it must 'fairly and accurately represent the key attributes of the market segment or financial instrument in question'.[1385] As the AEMC recognised (underline added for emphasis):[1386]

> In order to meet the NEO and the NGO, this [allowed rate of return] objective reflected the need for the rate of return to "correspond to" the efficient financing costs of a benchmark efficient entity, this entity being one <u>with similar circumstances and degree of risk to the service provider</u>.

It is important to note that a debate has now arisen, since the submissions of Victorian electricity DNSPs'[1387] proposals as to whether a benchmark efficient entity would be unregulated. In their revised proposals the Victorian DNSPs submitted that a benchmark efficient entity with a similar degree of risk in respect of the provision of regulated services must be an unregulated business.[1388] This is consistent with the submission of AusNet Services in its revised electricity transmission proposal and in

1381 APA Group, *Submissions responding to AER draft rate of return guideline*, 11 October 2013, pp. 12–16; APIA, *Meeting the ARORO? A submission to the AER's draft rate of return guideline*, 11 October 2013, p. 11; MEU, *Comments on the draft guideline*, October 2013, p. 12.

1382 AER, *Final decision–Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters*, May 2009, p. 82.

1383 These include decisions for Ausgrid, Endeavour Energy, Energex, Ergon Energy, Essential Energy, Jemena Gas Networks, SA Power Networks, TasNetworks, Transend and TransGrid. These also include preliminary or draft decisions for ActewAGL gas, Amadeus gas pipeline, Australian Gas Networks, AusNet Services distribution, CitiPower, Jemena Electricity Networks, Powercor and United Energy.

1384 The World Bank and OECD have used this definition in OECD, *Glossary of key terms in evaluation and results based management*, 2002, p. 18, World Bank, *How to build M&E systems to support better government*, p. 138.

1385 CFA Institute, *Benchmarks and indices: Issue Brief*, April 2013, p. 2.

1386 AEMC, *Rule determination: Economic regulation of network service providers and price and revenue regulation of gas services*, 29 November 2012. p. 43.

1387 That is CitiPower, Powercor, Jemena, United Energy and AusNet Serices

1388 ActewAGL, *Appendix 5.01 detailed response to rate of return, gamma and inflation*, January 2016, p. 18; AGN, *Attachment 10.26 response to draft decision: Rate of return*, January 2016, p. 25; APA Group, *Amadeus Gas Pipeline access arrangement information*, January 2016, p. 24; AusNet Electricity Services, *Revised regulatory proposal*, 6 January 2016, p. 163; CitiPower, *Revised Regulatory Proposal 2016—2020*, 6 January 2016, p. 332; JEN, *Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs*, 6 January 2016, p. 16; Powercor, *Revised regulatory proposal 2016–20*, 6 January 2016, p. 326; United Energy, *2016 to 2020 revised regulatory proposal*, 6 January 2016, p. 79.

APA VTS and APTPPL's initial proposal.[1389] The position of the Victorian DNSPs on this matter followed the Tribunal hearing in an application for review of revenue determinations by Networks NSW and several other service providers..[1390]

We did not consider this particular issue prior to the Ausgrid Tribunal's decision because it had not been raised substantively by any service provider.[1391] Consequently, the Tribunal did not have our fully formed view and reasoning before it when it considered this issue. We consider the Tribunal may have come to its position because it did not have our fully formed arguments before it. We sought review of the Tribunal's decision in the Full Federal Court. The decision was handed down in May 2017.[1392] The Full Federal Court arrived at the conclusion that the benchmark efficient entity should be taken as having "a similar degree of risk" as that which applies to the particular service provider in providing its regulated services,[1393] but it does not mean that the benchmark efficient entity must be characterised as a regulated entity.[1394] We consider the characteristics of a benchmark efficient entity we are adopting for this decision is consistent with the Full Federal Court's finding that the benchmark efficient entity must be efficient and it must face "a similar degree of risk" as that which applies to the regulated service provider in question in relation to the provision of its reference services. We adopt the Full Federal Court's decision that a benchmark efficient entity is not necessarily to be characterised as a regulated entity. Therefore in assessing the efficient rate of return we look to comparators that have similar risk characteristics. Otherwise our allowed rate of return would not achieve the ARORO or the NGO.

We also base our analysis in this decision on the brief material submitted by other service providers in earlier decision process (including AusNet Services in its revised transmission proposal) and the material submitted by APTPPL, AGN, Multinet, AusNet Gas and APA VTS in their initial proposals. This includes consideration of a new report by CEG that was submitted subsequent to our final decisions for the Victorian DNSPs.[1395]

[1389] AusNet, *Transmission Revenue Review 2017-2022 - Revised Revenue Proposal*, September 2016, p.155; RBP, *Access Arrangement submission 2017-22*, 16 September 2016, p.159; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

[1390] Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016

[1391] The AER submitted before the Tribunal that the contention raised before the Tribunal by Networks NSW and ActewAGL that the benchmark efficient entity was an unregulated firm was not raised and maintained before the AER, and was therefore precluded from being raised in submissions to the Tribunal by reason of s71O of the NEL. The Tribunal formed the view that the issue was raised by Networks NSW and by ActewAGL in submissions before the AER.

[1392] Federal Court of Australia, *Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79*, May 2017

[1393] We note reference services are the "regulated services" in the case of fully covered gas distribution and gas transmision networks regulated by the AER.

[1394] Federal Court of Australia, *Australian Energy Regulator v Australian Competition Tribunal (No 2) [2017] FCAFC 79*, May 2017. p. 164.

[1395] CEG, The AER's current interpretation of the ARORO, September 2016

After considering the material submitted by service providers subject to the earlier decisions, and by APTPPL, APA VTS, Multinet, AusNet Gas and AGN, we consider a benchmark entity would be an entity, whether it is conceived as regulated or not, that has a similar degree of systematic risk as that which applies to APTPPL in the provision of its reference services. In our guideline we undertook extensive analysis to identify a suitable set of comparator firms and we consider the comparators identified in that exercise remain valid. For our analysis, see 'elements of the ARORO' under section 3.3.3 of attachment three.

With respect to the current decision before us, we do not consider that the material submitted fully explores the implications of an unregulated benchmark efficient entity for all aspects of our decision on the allowed rate of return. This is consistent with the view we expressed in our final decisions released in May 2016 for ActewAGL and others, and also in our recent final decisions released in April 2017 for AusNet, TasNetworks and Powerlink.[1396]

Regulation has a fundamental impact on the risk characteristics of a service provider in the provision of reference services. Regulation provides a range of risk mitigation treatments that are unavailable to firms in competitive markets such as a revenue cap (or price cap), preservation of capital in a regulated asset base, pass through arrangements and shipwreck clauses.[1397]

Nevertheless, even if the benchmark efficient entity that has "a similar degree of risk" as that which applies to APTPPL was necessarily unregulated, we do not consider this would affect our conclusions. Our approach to the cost of debt would be applicable to an unregulated firm if it had a similar degree of risk to the service provider in providing reference services. Further, irrespective of whether a firm is regulated or not, efficient financing costs reflect the current (or prevailing) forward looking costs observed in capital markets.

J.2 Requirements under the ARORO

The ARORO provides that the rate of return for a service provider is to be 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.[1398] We consider this requires us to set an allowed rate of return that appropriately compensates investors on their capital investments (in an ex-ante sense) and aims to minimise the long run cost of capital (all else being

[1396] The AER, Final decision ActewAGL distribution access arrangement 2016 to 2021, attachment 3- Rate of return, May 2016
The AER, Final decision AusNet transmission determination 2017-2022, attachment 3- Rate of return, April 2017
The AER, Final decision Powerlink transmission determination 2017-2022, attachment 3- Rate of return, April 2017
The AER, Final decision TasNetworks distribution determination 2017-2019, attachment 3- Rate of return, April 2017

[1397] NGR, cl. 87(3). Similar wording is found in NER, cl. 6.5.2(c) and NER, cl. 6A.6.2(c).

[1398] NER, cl. 6.5.2(c); NER, cl. 6A.6.2(c); NGR, r. 87(3).

equal).[1399] By appropriate compensation we mean that the ex-ante return should be commensurate with the expected return in the capital market for an investment with a similar degree of risk as that of a benchmark efficient entity in the position of the service provider supplying reference services.[1400] We consider this is the efficient return expected in a competitive capital market, consistent with models underpinning financial theory on efficient markets.[1401] However, given the benefits of a trailing average approach as discussed in section 3.4.2, we consider that neither an on-the-day nor trailing average approach would be clearly superior to the other. With a full transition, a trailing average approach would provide a benchmark efficient entity with a reasonable opportunity to recover at least efficient costs.

We elaborate on this in the following sections by setting out why and how a rate of return that meets the ARORO must:

- provide for ex-ante efficient compensation
- be consistent with the NEL/NGL
- require a revenue-neutral transition if there is a change in the methodology used to estimate the allowed return on debt (assuming that both methodologies can meet the ARORO but produce different estimates across time).

J.2.1 Ex-ante efficient compensation

We consider a rate of return that meets the ARORO must provide ex-ante compensation for efficient financing costs (we refer to this as ex-ante efficient compensation).

We consider ex-ante efficient compensation should result in the ex-ante allowed return on capital cash flows having a present value equal to the present value of the ex-ante efficient cost of capital cash flows required to finance the regulatory asset base (RAB). This means we must set, ex-ante, an allowed rate of return for a benchmark efficient entity such that the return on its investment (in its RAB) equals its efficient cost.[1402]

[1399] We must also apply the rules in a manner consistent with the RPPs in the NEL. This requires providing regulated service providers a reasonable opportunity to recover at least efficient costs and allowing for a return commensurate with the regulatory and commercial risk involved in providing direct control services. We should also provide effective incentives to promote economic efficiency and have regard to the economic costs and risk of the potential for under and over investment by a regulated service provider.

[1400] We consider this is commensurate with definition of a 'fair return' to capital in Leland, H.E., 'Regulation of natural monopolies and the fair rate of return, *The Bell Journal of Economics and Management Science*, Vol. 5, No. 1, spring 1974, p. 7. Here, a fair return to capital is a pattern of profits across states of nature just sufficient to attract capital to its present use, which is equivalent to the stock market value of the firm equalling the value of a firm's assets.

[1401] For instance, this is consistent with zero expected returns in excess of equilibrium expected returns and 'fair game' models of expected returns. For a brief explanation of 'fair games' see Malkiel, B. G. and Fama, E. F. 'Efficient capital markets: A review of theory and empirical work, *The Journal of Finance,* 25: 383-417, 1970.

[1402] See SFG*, Preliminary analysis of rule change proposals: Report for AEMC*, February 2012, p. 41; Brennan, *Depreciation, investor compensation and, welfare under rate-of-return regulation*, Review of industrial organisation, This is a zero net present value (NPV) investment condition,[1403] which is a forward looking concept that shows a benchmark efficient entity is provided with a reasonable opportunity to recover at least efficient financing costs over the life of its investment (in its RAB). Partington and Satchell described it as follows:[1404]

> The zero NPV investment criterion has two important properties. First, a zero NPV investment means that the ex-ante expectation is that over the life of the investment the expected cash flow from the investment meets all the operating expenditure and corporate taxes, repays the capital invested and there is just enough cash flow left over to cover investors' required return on the capital invested. Second, by definition a zero NPV investment is expected to generate no economic rents. Thus, ex-ante no economic rents are expected to be extracted as a consequence of market power. The incentive for investment is just right, encouraging neither too much investment, nor too little.

As discussed in section 3.3.3 and J.1.1, we consider efficient financing costs, for debt and equity, should be based on (appropriately benchmarked) prevailing market rates. This reflects the current opportunity cost of capital for investments of similar risk to a benchmark efficient entity that has "a similar degree of risk" as that which applies to the particular service provider in providing its reference services.[1405] The opportunity cost of capital is the rate used to discount firms' expected future cash flows in NPV calculations.[1406]

Under the ex-ante regulatory regime, we reset the allowed rate of return (through the returns on debt and equity) at the commencement of each regulatory period (or annually for the allowed return on debt if we use a trailing average). If the allowed rate of return is reset to reflect the prevailing market cost of capital, it provides ex-ante efficient compensation over each reset period.[1407]

As shown in section J.3, the on-the-day approach resets the allowed return on debt to reflect the prevailing market cost of debt at the commencement of each regulatory period. Therefore, it provides ex-ante efficient compensation on debt capital over each regulatory period and over the life of the investment (that is, over the term of the RAB).This is supported by Partington and Satchell who expressed their strong favour in the on the day approach over trailing average approach.[1408]

1991, 6, p. 75. In his article, Brennan stated, 'With regard to investor compensation, the basic goal of regulation is to give investors an income stream just sufficient to cover the costs of their assets, and no more'.

1403 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 14.

1404 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 14.

1405 See, Peirson, Brown, Easton, Howard, Pinder, *Business Finance*, McGraw-Hill, Ed. 10, 2009, pp. 427, 434; Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 15.

1406 Partington and Satchell state that, 'the opportunity cost of capital is the discount rate that determines the market value of the benchmark efficient entity' (see Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 15, 29).

1407 See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 14–15; SFG*, Preliminary analysis of rule change proposals: Report for AEMC*, February 2012, p. 47.

1408 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*,9 April 2017, p.16.

The trailing average approach resets one tenth of the allowed return on debt to reflect the prevailing market cost of debt at the commencement of each regulatory year. As such, it provides ex-ante efficient compensation on debt capital only over the term of the RAB if a full transition is applied.[1409] This is because if a full transition is not applied the ex ante cash flows will have a present value that is above or below the value of the RAB where historical interest rates are below or above prevailing interest rates at the commencement of the trailing average.

The concept of ex-ante efficient compensation can be likened to the valuation of a coupon paying security with interest payments that are either fixed at issuance or reset periodically. Similarly, the regulatory regime allows the regulator to set (ex-ante) a series of fixed cash inflows (revenues) for a service provider that is reset periodically. The basic pricing formula for a debt security (for example, a bond) at time $t = 0$ is as follows:[1410]

$$P_0 = \sum_{t=1}^{T} \frac{C_t}{(1+r_0)^t} + \frac{P_T}{(1+r_0)^T}$$

where: P_0 is the price of the bond at time 0

C_t is the coupon (or interest) payment at time t—$C_t = c * P_T$

c is the coupon rate

r_0 is the required rate of return or cost of capital (based on market rates) at time 0

P_T is the face (or par) value of the bond (or principal repayment) at maturity.

The above formula shows that for a bond's price to equal its face (or par) value, at any time 0, the coupon rate (which is akin to the allowed rate of return) must be set (or reset) to equal the prevailing cost of capital.[1411] If the coupon rate is set (or reset) to a value above (below) the prevailing cost of capital, the price of the bond would trade above (below) its face value. This means the investor that paid the face value would be ex-ante over (under) compensated relative to other investments of similar risk.

Compensation for historically incurred costs

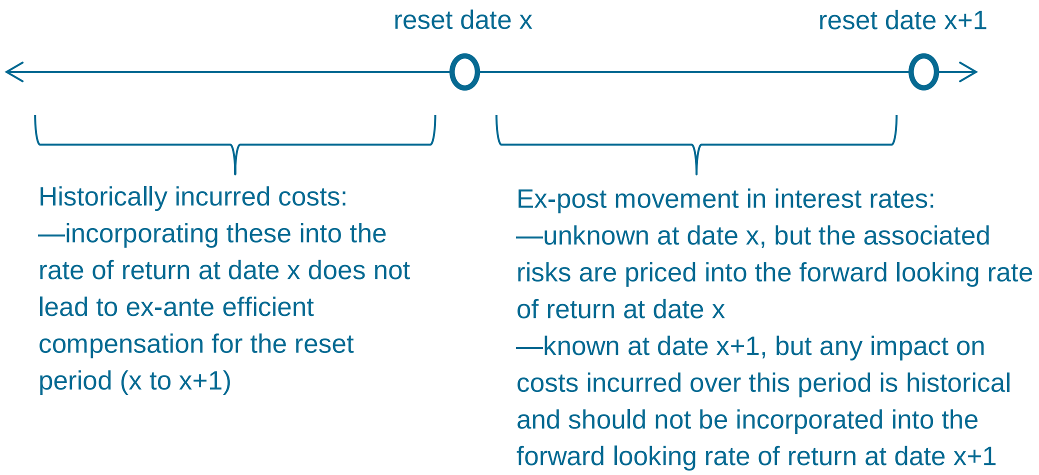
[1409] The expected future cash flows under a trailing average methodology can be likened to 10 long term floating rate securities where the coupon rates are reset every ten years. Each floating rate security covers a 10 per cent 'investment portion' in the RAB where they receive the net operating cash flows generated from these investment portions.

[1410] Peirson, Brown, Easton, Howard, Pinder, *Business Finance*, McGraw-Hill, Ed. 10, 2009, p. 85.

[1411] The required rate of return for a fixed term bond is the par yield in the market for fixed term bonds with similar characteristics (e.g. term and credit rating). However, we note that for a floating rate bond, the yield to equate the price to the face value may only equal the par yield on a fixed term bond with a maturity equal to the reset date of the variable rate note under certain assumptions. This may not include future default risk beyond the reset date. We discuss the valuation of a long term floating rate security as a conceptual analogy to our regulatory regime. This does not imply that the allowed return on debt should be equal to the required return on a floating rate bond. We use the par yield on fixed-term debt to calculate the allowed return on debt. Given we benchmark the cost of debt from the private sector service providers we regulate, we consider our use of the par yield on fixed term debt is appropriate.

We do not interpret the ARORO to require us to compensate a benchmark efficient entity for historically incurred financing costs where this will lead to compensation that would not be ex-ante efficient.

We consider setting an allowed rate of return that provides ex-ante efficient compensation gives a benchmark efficient entity a reasonable opportunity to recover at least efficient financing costs. This sets a forward looking return on investment based on investor expectations, and does not provide compensation for actual (historical) cost outcomes that can only be identified ex-post. As such, we consider ex-post movement in interest rates (after the allowed rate of return has been set for a regulatory period) do not affect the principle of ex-ante efficient compensation as long as the ex-ante rate of return appropriately reflects the risk of the investment in the RAB.[1412] Partington and Satchell agree with this view.[1413] The timeline below shows how we consider ex-post movements in interest rates (and historical costs) relate to ex-ante efficient compensation.



If, at reset date x+1, we set an allowed rate of return that provides compensation for a service provider's actual (historical) cost outcomes from the previous period, we would effectively remove realised gains or losses from risk it had previously borne. The regulatory regime is an ex-ante regime that is not intended to remove all risk from service providers and their capital investors. We set a forward looking allowed rate of return that compensates investors with a risk premium over the risk free rate for the compensable risk of their investment. The risk premiums we set (on both debt and equity) are based on appropriate benchmark returns from capital markets. If we

[1412] Specifically, under the rules, the rate of return must reflect the risk of a benchmark efficient entity with a similar degree of risk as a service provider supplying regulated services. This is consistent with Partington and Satchell's advice that 'the fundamental principle is that what drives the required return on the investment is the risk of the assets' (see Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 21–22).

[1413] See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 35–36.

removed all risks faced by capital investors then the appropriate return would theoretically be the risk free rate.

Critically, if an investor, at date x+1, looks back and sees it made a gain (or loss) in relation to an investment it made at date x, this does not mean the investor is incorrectly over (or under) compensated. The gain (or loss) is due to the realisation of risk that was associated with the investment when it was made at date x. Likewise, service providers (and their investors) are not incorrectly compensated because they (at date x+1, looking back) have made a loss (or gain) due to ex-post movements in interest rates impacting the value of their liabilities differently to their regulated revenue set at date x. Again, the gain (or loss) is due to an ex-post realisation of risk, risk for which investors received ex-ante compensation for bearing. This is accepted risk, which is a critical part of the choice to make a risky investment.

In an investment context there is no need to compensate investors for gains or losses resulting from a realisation of risk for which they have been ex ante efficiently compensated for bearing. In our regulatory context, investors have invested in the service providers we regulate under the knowledge they would bear the interest rate risk associated with the on-the-day methodology. In addition, the way we benchmark the allowed rate of return (in particular, the return on equity) provides compensation for bearing this risk (see below). On this basis, we consider no further compensation for the gains or losses associated with ex-post movements in interest rates is required or appropriate.[1414]

Desirability of minimising mismatch

In determining the allowed return on debt, we are required to have regard to the 'mismatch' between a benchmark efficient entity's actual debt cost outcomes (or cash outflows) and the return on debt allowance.[1415] However, we do not consider that this permits us to set a rate of return that will not meet the ARORO or will not achieve the NEO/NGO.

Rather, some mismatch between the actual (cash) debt costs and the regulated debt allowance is an intrinsic part of incentive regulation—whether the allowance is set using a trailing average approach or otherwise. This is because a mismatch can only be identified ex-post and we set an ex-ante fixed regulatory allowance based on forecast efficient costs. This allowance is not revised ex-post for a service provider's actual (historical) costs (see above).[1416] SFG recognised this in its report for the

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1414 Also see Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 32–37, 39, 43.
Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.26

1415 As required under NER, cl 6.5.3(k), which requires us to have regard to 'the desirability of minimising any difference between the return on debt and the return on debt of a benchmark efficient entity referred to in the allowed rate of return objective'.

1416 See, for example, AER, *Submission to the Productivity Commission: inquiry into electricity network regulation*, April 2012, p. 4. It is worth noting that while the rules establish an ex-ante regulatory regime, they also include some ex-

Australian Energy Market Commission (AEMC). Here, SFG considered a mismatch between a firm's debt service payments and the regulatory allowance could arise for a number of reasons, including:[1417]

- 'because the cost of capital is, in fact, variable over time' rather than because there is problem with the measurement
- because 'there may be a difference between the rate at which the business can borrow and the regulatory benchmark'.

We consider a service provider's ex-post mismatch does not (of itself) imply the regulator is setting a rate of return that will not appropriately compensate a benchmark efficient entity for its efficient cost of debt finance. A mismatch does not mean the present value of the ex-ante allowed return on debt (or return on capital) cash flows will not equal the present value of a benchmark efficient entity's ex-ante efficient debt financing costs (or overall capital financing costs). Rather, we consider it is the risk of a mismatch occurring that is relevant to ex-ante regulation. This risk is a form of interest rate risk.

In section J.3.3, we show (through present value relationships) that both an on-the-day and trailing average approach (with a full transition) should, in principle, provide the same ex-ante compensation for a benchmark efficient entity's efficient financing costs over the term of the RAB. We consider these present value relationships show both approaches can provide a benchmark efficient entity with ex-ante efficient compensation and meet the ARORO. There is no ex-ante over- or under-compensation overall (that is, over the term of the RAB), regardless of a benchmark efficient entity's actual (ex-post) cost outcomes.

We consider ex-ante systematic over- or under-compensation can only occur if the interest rate risk arising from an expected mismatch affects a benchmark efficient entity's cost of capital and the allowed rate of return does not reflect this. However, we benchmark the allowed rate of return (which requires consistently benchmarking the return on debt, return on equity and gearing)[1418] on observed data from service providers comparable to a benchmark efficient entity operating under an on-the-day approach (where the risk of mismatch is likely more material).[1419] Therefore, the allowed rate of return should be commensurate with the efficient financing costs of a

post elements. For example, see provisions on cost pass throughs under NER, cl. 6.6.1; NER, cl. 6A.7.3; NGR, r. 97(1)(c).

[1417] SFG, *Rule change proposals relating to the debt component of the regulatory rate of* return, August 2012, p. 35.

[1418] In particular, we consider any mismatch between the regulatory return on debt allowance and a benchmark efficient entity's actual debt costs will flow through to equity holders (as they are residual claimants). The equity beta is determined using historical data (when an on-the-day approach was in effect). We consider this should capture any interest rate risk associated with an on-the-day approach, to the extent that it is systematic.

[1419] For instance, we use the equity returns of service providers comparable to a benchmark efficient entity ('comparator firms') when estimating the equity beta. We also used comparator firms when estimating the credit rating and gearing of a benchmark efficient entity. This assists us in estimating an allowed rate of return that would compensate a benchmark efficient entity for the default risk and systematic risk more broadly that it would have faced under an on-the-day approach.

benchmark efficient entity with a similar degree of risk as a regulated service provider operating under this approach. To the extent a benchmark efficient entity's investors expect that moving to a trailing average approach would reduce the risk they require compensation for, our allowed return on debt will likely be generous to service providers.[1420] In particular, our estimate of systematic risk (beta) includes historical data, which will capture the systematic risk that a benchmark efficient entity would have been exposed to under the on-the-day approach.

We also note that Partington and Satchell considered mismatch between a service provider's actual incurred cost of debt and allowed return on debt is a consequence of its particular debt financing choices as an issue faces all firms. They do not consider this affects a benchmark efficient entity's opportunity to earn the efficient return on its RAB.[1421] Instead, the competitive equilibrium that results in zero NVP investments, which is characterised by product prices and the market value of assets and securities adjusting to a value where they offer the current cost of capital, is what regulators are generally attempting to replicate. It is this action of the regulator that determines the allowed rate of return. In this process the allowed rate for the cost of debt may well not match the historic cost of debt. Partington and Satchell referred to this mismatch as a direct consequence of interest rate risk (which is consistent with our interpretation above).[1422] Moreover, the desirability of minimising debt cash flow mismatch is not the only type of interest rate mismatch risk we consider relevant. The rules require us to have regard to the desirability of minimising this type of mismatch for a benchmark efficient entity. However, there can also be a mismatch between the allowed return on debt and the prevailing cost of debt for a benchmark efficient entity at the time at which the allowed rate of return is reset. We consider this can affect the ability of a return on debt approach to provide ex-ante efficient compensation, and can also result in investment distortions.[1423] To the extent that this type of mismatch results in compensation that is not ex-ante efficient, we consider this would not meet the ARORO.

While a trailing average approach is expected to reduce the former type of mismatch, the mismatch between the allowed rate for the cost of debt and the return on debt of a benchmark efficient entity, relative to an on-the-day approach, an on-the-day approach is expected to reduce the latter type of mismatch, the mismatch between the allowed return on debt and the prevailing cost of debt for a benchmark efficient entity at the time at which the allowed rate of return is reset, relative to a trailing average approach.

1420 Compensable risk could decrease if investors consider a benchmark efficient entity is less exposed to interest rate risk under the trailing average approach. This could occur if the trailing average approach allows a benchmark efficient entity to better match its debt cash outflows to its allowance than under the on-the-day approach. However, we note Partington and Satchell consider that, 'It is difficult to see how the use of the trailing average will materially reduce the financing costs of firms since such costs are primarily driven by the assets the firms invest in'. See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 38.

1421 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 18, 35–36;

1422 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017*,* p.26.

1423 See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 37–38; SFG, *Preliminary analysis of rule change proposals: Report for AEMC*, February 2012, p. 41.

J.2.2 Consistency with the NEL/NGL

We consider an allowed rate of return that meets the ARORO should lead to economically efficient investment, provision of and use of infrastructure, consistent with the NEL/NGL.[1424] This allowed rate of return should also provide service providers with a reasonable opportunity to recover their efficient costs. We consider our interpretation of the ARORO is consistent with the wording in the NEO/NGO in the NEL/NGL. Our view appears consistent with the views of the AEMC when it stated:[1425]

> If the rate of return estimate is set to the efficient required return, there will be no incentive for under- or over- investment. Such incentives for inefficient investment become more pronounced when the rate of return estimate differs from the efficient required return.

The concept that a reasonable return to investment is important to achieving efficient regulatory investment appears common sense. Setting an too high (or low) expected return relative to the expected return on alternate equivalent risk investments would be expected to lead to distorted over (or under) investment in regulated assets (all else being equal). The aim of setting an expected return to achieve efficient investment also appears broadly accepted in regulatory literature.[1426] This is also consistent with advice from the Consumer Challenge Panel Sub Panel 3 (CCP3) that stated:[1427]

> The AER must have regard to the impact of their RoR decision on capex incentives. Given that the DNSPs' revised proposal is significantly above current costs of capital for BBB/BBB+ rated companies, there will be perverse incentives to overinvest in the network.

Similarly, Partington and Satchell consider the rule requirements are consistent with the zero NPV investment condition, stating:[1428]

> The national electricity and gas objectives are to achieve efficient investment and efficient operation in the long term interest of consumers, while the

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1424 NEL, s. 7A(3); NGL, s. (24)(3).

1425 AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 November 2012, p. 14.

1426 Averch and Johnson show that if a regulatory rate of return exceeds the firm's true cost of capital, it has an incentive to choose too much capital relative to labour. Averch, H, Johnson, L.L., 'Behaviour of the Firm under Regulatory Constraint', *American Economic Review*, Vol. 52, No. 5, December 1962, pp. 1062–1069. Littlechild describes, 'Revenues need to be adequate to cover operating expenses and to ensure finance for necessary investment. They should not be so excessive as to encourage their dissipation on dubious schemes'. Littlechild, S., 'Economic regulation of privatised water authorities and some further reflections, *Oxford review of economic polic*y, Vol. 4, No. 2, summer 1988, p. 47. Cambini and Rondi find the cost of capital is positively correlated with investment under incentive regulation. Cambini, C., Rondi, L., 'Incentive regulation and investment: evidence from European energy utilities, *Journal of Regulatory Economics*, Vol. 38, 2010, p. 18. Greenwald notes that 'less than "fair" rates of return should simply elicit no investment' in Greenwald, B.C., 'Rate base selection and the structure of regulation', *The RAND Journal of Economics*, Vol. 15, No. 1, Spring 1984, p. 85.

1427 CCP3, *Submission to the AER: An overview—Response to the AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for a revenue reset for the 2016–2020 regulatory period*, 22 February 2016, p. 35.

1428 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 14.

revenue and pricing principles allow for the recovery, by the regulated businesses, of efficient costs including a return on capital and having regard for the costs and risks of overinvestment. There is very clear criterion that can be applied to meet these requirements. That criterion is that investment in regulated assets should be a zero NPV activity.

J.2.3 Requirement for a revenue-neutral transition if there is a regime change

We consider that both an on-the-day methodology to setting the cost of debt and a trailing average methodology can meet the ARORO. However, in moving between different approaches, a transition that is revenue-neutral in a present value sense will meet the ARORO. Section J.3 further discusses the position that either approach can result in a reasonable return on capital (and therefore could meet the ARORO). This position also appears consistent with SFG's view that the AEMC noted in its final rule determination where it stated:[1429]

> In its report, SFG highlighted that for a given definition of the return on debt for an efficient benchmark service provider (in particular, the assumed credit rating and term to maturity) the average cost of debt will be the same over the long run. This is regardless of whether the return on debt estimate is based on the prevailing debt cost spot rate or an average of that spot rate. Changing to an averaging approach will not, in itself, systematically reduce or increase the allowed return on debt in the long run. SFG observed that averaging approaches will by definition result in smoother estimates of the return on debt over time.

We note that when undertaking the rule change in 2012 the AEMC added in clause 6.5.3(k)(4) that states (emphasis added):

> (k) In estimating the return on debt under paragraph (h), regard must be had to the following factors…
>
> (4) any impacts (including in relation to the costs of servicing debt across regulatory control periods) on a benchmark efficient entity referred to in the allowed rate of return objective that could arise **<u>as a result of changing the methodology</u>** that is used to estimate the return on debt from one regulatory control period to the next.

This clause is explicit in requiring us to have regard to any impacts on a benchmark efficient entity that could arise as a result of a change of methodology. This would include having regard to any material changes in the present value of a benchmark efficient entity's allowed revenue purely due to changing the debt estimation methodology. If such changes increased a benchmark efficient entity's value, then this would benefit its equity holders at the expense of consumers. Conversely, if such

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1429 AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 November 2012, pp. 74–75.

changes decreased a benchmark efficient entity's value, then this would cost its equity holders but provide a short term financial benefit to consumers (which may not be a long-term benefit to the extent this results in underinvestment). As such, this methodological change may also have a material negative impact on the confidence in the predictability of the regulatory regime.[1430] This is also noted by Partington and Satchell. They proposed that under the trailing average approach consumers are effectively guaranteeing revenue to pay the historic cost of debt. A cost arising from that guarantee will arise immediately under a switch to the historic trailing average without transition as consumers will find themselves paying the premium of historic rates over current rates (knowing historic interest rates are much higher than the current interest rates). [1431] We consider the AEMC's guidance on the intent of this clause is consistent with our approach (emphasis added):[1432]

> The purpose of the fourth factor is for the regulator to have regard to <u>**impacts of changes in the methodology**</u> for estimating the return on debt from one regulatory control period to another. Consideration should be given to the potential for consumers and service providers to face a significant and unexpected change in costs or prices that may have negative effects on confidence in the predictability of the regulatory arrangements.

We have taken this factor into account and consider our transitional approach is consistent with the intent of this factor. Nevertheless, we consider that irrespective of this factor, our transition approach meets the requirements of the ARORO, NEO/NGO and RPPs. Partington and Satchell and the CCP3, in the context of our decisions released in May and July 2016, formed a similar view that the full transition to a trailing average in the Guideline would better satisfy the ARORO than the Victorian DNSP various revised proposals.[1433] Partington and Satchell remain of the view this is the case having considered CEG's new report.[1434] They proposed that a revenue neutral transition (full transition) in present value terms is appropriate as this involves no unplanned wealth transfers arising from regulatory risk. Without a revenue neutral transition the wealth transfer away from consumers will be a substantial unintended cost to consumers of the regulatory change to a trailing average.[1435] We also consider that an immediate (or hybrid) transition to a trailing average would result in a material and unexpected change in the present value of a benchmark efficient entity relative to a value consistent with investor expectations formed under the on-the-day regime. If this occurred it would likely increase expected regulatory uncertainty going forward.

1430 HoustonKemp, *Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 5.

1431 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.26.

1432 AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 November 2012, p. 85.

1433 CCP3, *Submission to the AER: An overview—Response to the AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for a revenue reset for the 2016–2020 regulatory period*, 22 February 2016, p. 36; CCP3, *Submission to the AER: Response to the AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for a revenue reset for the 2016–2020 regulatory period*, 25 February 2016, p. 88; Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 52.

1434 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.28.

1435 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.27.

We consider this may both undermine confidence in the predictability of the regulatory arrangements and not minimise efficient financing costs (all else being equal).[1436] For these reasons, we consider a lack of transition to limit uncertainty of regulatory changes affecting the value of the benchmark efficient entity is unlikely to be consistent with achieving the NEO/NGO and the RPPs.

Similarly, SFG advised the AEMC that a transition may be required to limit 'regulatory risk' and to avoid being inconsistent with the NEO and RPPs.[1437] SFG also considered that the transition we proposed (the QTC method) would be an appropriate means of transitioning from the current rules (that used an on-the-day methodology) to the use of a historical average cost of debt approach.[1438] The desirability for predictability was also commented on by an Expert Panel on Energy Access pricing for the Ministerial Council on Energy in 2006 who noted [emphasis added]:[1439]

> Regulatory (and hence investor and user) risk can greatly be reduced if decisions are made in a timely and predictable manner. Timeliness in access decisions (including any merits and judicial review process) is important for both reducing the costs of the regime and minimising uncertainty associated with the outcome of the review…
>
> **Equally important is the predictability of those decisions** – that is the development of an approach that gives energy users and investors in transmission and distribution infrastructure confidence that access and pricing outcomes will be guided by known principles that are applied in a consistent manner.

We consider our approach is consistent with the desire for predictability in regulatory decisions by using a transition to avoid material wealth impacts from the change in methodology. HoustonKemp also provided support for a transition when it advised the Essential Services Commission of SA (ESCOSA):[1440]

> Consistent with regulatory best practice, a regulatory authority should seek to avoid imposing windfall gains or losses as a result of regulatory changes. A regulatory change that imposes windfall gains or losses will be to the detriment of regulatory certainty and will likely increase the perceived level of regulatory risk, and so the cost of capital.

A transition is also likely to be important for maintaining the incentives on service providers to adopt efficient financing practices under the regulatory regime. We

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1436 HoustonKemp also held this view in *Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 5.

1437 SFG, *Rule change proposals relating to the debt component of the regulatory rate of* return, August 2012, p. 45. Similarly, Partington and Satchell consider an immediate transition to a trailing average approach can be regarded as a material regulatory risk (Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 42).

1438 SFG, *Rule change proposals relating to the debt component of the regulatory rate of* return, August 2012, p. 46.

1439 Expert Panel on Energy Access Pricing, *Report to the Ministerial Council on Energy*, April 2006, p. 59.

1440 HoustonKemp, *Appropriate objective to guide the setting the cost of debt allowance*, March 2015, p. 5.

consider this is consistent with the Revenue and Pricing Principles, which indicate regulated firms should be provided with a range of incentives including incentives that should promote the efficient provision of electricity network/pipeline services.[1441] These principles show our regime is intended to be an incentive base regime as opposed to a cost of service regime. To promote efficiency incentives, we consider regulated firms should be required to bear the consequences of their chosen financing approach from the prior regulatory period where returns were set under the on-the-day methodology and any financing decisions they made over this period were made in the expectation this methodology would continue. It could significantly undermine service providers' incentives to manage financial risk efficiently if we provide an allowed return on debt in this decision that results in regulated firms not bearing the consequences of their chosen financing practices. This is because service providers were required to bear and manage this risk.[1442]

Partington and Satchell argued that it is the on the day approach that promotes efficient investment.[1443] If a trailing average approach is to apply, the AER's transition is less distortionary in terms of investment incentives than a switch to a trailing average without transition. As an immediate switch to the trailing average immediately gives rise to a regulatory allowed return that exceeds the current required return, Partington and Satchell proposed that it will immediately give rise to economic rents and an incentive to overinvest.[1444]

J.3 On-the-day and trailing average approaches

In this section, we analyse the on-the-day and trailing average approaches to establish whether these approaches can contribute to the achievement of the ARORO. We also explain that, while we consider both approaches would be open to us; we would expect either approach to produce different estimates at given points in time.

From establishing this, we can demonstrate that in changing approaches from the on-the-day to the trailing average approach (or vice versa); a revenue neutral transition (in present value terms) is required to contribute to the achievement of the ARORO.

J.3.1 On-the-day approach

The on-the-day approach estimates the allowed return on debt for a service provider as the prevailing cost of debt as close as possible to the start of the regulatory period.[1445] The on-the-day approach is the longstanding return on debt approach

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1441 NEL, s. 7A(3)(b); NGL, s. 24(3)(b).

1442 See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 42. Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.17.

1443 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*, 9 April 2017, p. 29.

1444 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.29.

1445 The on-the-day benchmark requires estimating the return of debt of a service provider on the first day of the regulatory period because, in theory, an on-the-day rate is considered the best indication of the opportunity cost of capital at a given point in time. However, in practice, it entails estimating the return on debt over a short averaging adopted by us and generally by other regulators in Australia.[1446] While the NER and NGR no longer mandate that we adopt this approach, they still make it available to us.[1447] Prior to the rules changes in 2012, the on-the-day approach was used to not only set the return on debt but was used to set the overall allowed rate of return. Post the rule changes, the on-the-day approach will continue to be used to set the allowed return on equity as this remains mandated by the rules.[1448]

We consider the on-the-day approach can estimate an allowed rate of return commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as a service provider in the provision of reference services. This is because the on-the-day approach provides service providers with a reasonable opportunity to recover at least efficient costs over the term of the RAB and over each regulatory period (see section J.3.3). Ex-ante efficient compensation holds for each regulatory period under this approach because the entire allowed rate of return is reset to reflect the prevailing market cost of capital at the commencement of each regulatory period. In this way, the allowed revenue under the on-the-day approach can be likened to a form of long term floating rate security where the interest (or coupon) rate is reset to reflect prevailing market rates at the start of each regulatory period. Any compensable risk from the resetting process under the on-the-day approach is largely born by equity holders of the regulated firms. As SFG advised the AEMC, 'any mis-match between the cash inflows and cash outflows in relation to the return on debt will flow through to the equity holders'.[1449]

While we have chosen to move towards a trailing average approach (section J.3.2 explains why we consider a trailing average approach is open to us), this does not imply that the on-the-day approach provides an 'incorrect' outcome or an outcome inconsistent with the ARORO. Rather, we consider the on-the-day approach has advantages, including:

- It is consistent with the prevailing market cost of debt as close as possible to the commencement of the regulatory period. As such, it is commensurate with efficient financing costs at the commencement of the regulatory period and can promote efficient investment decisions. It is also internally consistent with how we estimate other components of the allowed rate of return and other building block components.

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period as close as practically possible to the start of the regulatory period. This is because using the on-the-day approach exposes the service provider to day-to-day volatility in the market rates.

1446 The on-the-day approach has been used to estimate the return on debt of service providers in Australia since at least 1998, by the ACCC/AER as well as other state regulators. See, for example, ACCC, *Final decision: APA GasNet transmission*, October 1998, p. xvi; ACCC, *Statement of principles for the regulation of electricity transmission revenues—background paper*, December 2004, pp. 96, 109. At this time, the risk free rate and DRP were estimated separately and added together to generate a return on debt estimate.

1447 See NER, cl. 6.5.2(j)(1); NER, cl. 6A.6.2(j)(1); NGR, r. 87(10)(a).

1448 NER, cl. 6.5.2(g); NER, cl. 6A.6.2(g); NGR, cl. 87(7).

1449 SFG, *Rule change proposals relating to the debt component of the regulated rate of return: Report for AEMC*, August 2012, p. 5.

- It leads to an estimate that is likely to more closely imitate the outcomes of a competitive market near the start of the regulatory period than a trailing average approach.

Consistent with prevailing market cost of debt

As discussed in section J.1.1 and J.2.1, we consider efficient financing costs, for debt and equity, should be based on (appropriately benchmarked) prevailing market rates. As shown mathematically in section J.3, the on-the-day approach resets the entire allowed rate of return (which includes the return on debt) to reflect, as closely as possible, the prevailing market cost of capital (which includes the cost of debt) at the commencement of each regulatory period.

We consider an allowed return on debt that reflects the prevailing market cost of debt promotes efficient investment decisions. When firms make investment decisions, they estimate the cost of capital based on prevailing market rates. This is important because the cost of capital is based on investors' expectations of future returns.[1450] Firms then use this estimate to set a discount rate at which they discount the expected future cash flows of the proposed investment in order to determine its viability (that is, whether the NPV of the expected cash flows is greater than or equal to zero).

As discussed in section J.2.1, we consider the ARORO requires us to set an allowed rate of return for a benchmark efficient entity such that the return on its investment in its RAB equals its efficient cost (that is, the zero NPV investment condition). The prevailing market cost of capital is the only discount rate that sets the present value of expected future cash flows equal to the RAB. In its 2012 report to the AEMC, SFG summarised this point by stating:[1451]

> The principle which underpins the regulatory framework in Australia is to estimate a price which equates the present value of expected cash flows to the regulated asset base. If the regulated rate of return is set at a rate other than the cost of capital this will no longer hold. Investment decisions will be distorted.

Similarly, Partington and Satchell (who recommend the on-the-day approach) stated:[1452]

> By definition, a stream of expected cash flows that allows the current required return on the book value of capital invested, recovers the capital invested and covers other costs, will have a discounted present value that ex-ante is equal to the book value of the investment. Allowing this cash flow for a regulated business, the book value of the RAB will be equal to the market value of the RAB. To put it another way this cash flow gives rise to a zero NPV investment.

1450 Peirson, Brown, Easton, Howard, Pinder, *Business Finance*, McGraw-Hill, Ed. 10, 2009, p. 434.

1451 SFG*, Preliminary analysis of rule change proposals: Report for AEMC*, February 2012, p. 4.

1452 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 17.

Therefore, we consider the on-the-day approach provides an appropriate signal for investment decisions made near the commencement of the regulatory period. We consider this would promote efficient investment decisions that increase dynamic efficiency. Partington and Satchell also argue in their reports to the AER, in terms of investment efficiency, it would be better to maintain the on the day approach rather than move to a trailing average, even with a transition.[1453] This aligns with the AEMC's view that:[1454]

> [the return on debt framework] should try to create an incentive for service providers to adopt efficient financing practices and minimise the risk of creating distortions in the service provider's investment decisions.

If we were to set the allowed return on debt in a different way, it would no longer be an estimate of the cost of debt (and thus the cost of capital) at the time of the determination or access arrangement. For example, under a trailing average approach, the overall allowed return on debt predominately compensates for historical interest rates, rather than for the risk of providing debt finance in the future.[1455] Only 10 per cent of the allowed return on debt will compensate for the risk of providing debt finance in the future because 10 per cent of the return on debt is updated annually to reflect prevailing interest rates. As discussed in section J.2.1, this results in a mismatch between the allowed return on debt and the prevailing cost of debt for a benchmark efficient entity at the time of the determination or access arrangement.

Moreover, estimating a forward looking return on debt at the time of the determination or access arrangement is consistent with how we determine the return on equity and other components of the building block model. For example, we determine an allowed return on equity that reflects, as closely as possible, the prevailing market cost of equity at the time of the determination or access arrangement. We also forecast the operating expenditure that will apply for each year of the upcoming regulatory period. Determining the allowed revenue for the regulatory period ex-ante, without within-period revisions, is consistent with the principles of incentive regulation.[1456]

Imitates the outcomes of a competitive market

We consider an allowed return on debt that reflects the prevailing market cost of debt at the time of the determination or access arrangement (that is, an on-the-day approach) is likely to promote economic efficiency because:

- Productive efficiency refers to least cost financing (that is, the lowest required return on debt). An allowed return on debt that reflects the (appropriately benchmarked) prevailing market cost of debt will likely promote productive

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[1453] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.29.

[1454] AEMC, *Final Rule Determination: Economic regulation of network service providers, and price and revenue regulation of gas services*, 29 November 2012, p. 73.

[1455] SFG*, Preliminary analysis of rule change proposals: Report for AEMC*, February 2012, p. 46.

[1456] See Office of the Regulator General, *Submission to the Productivity Commission review of the national access regime (part IIIA of the trade practices act) position paper*, 2001, p. 6.

efficiency. This is because a benchmark efficient entity faces competitive prices in the market for funds.

- Allocative efficiency refers to the allowed return on debt reflecting investors' opportunity cost of debt for investments of similar risk. The prevailing market cost of debt at any given time is likely to reflect investors' opportunity cost. This is because the market for capital finance is competitive with many buyers and sellers.
- Dynamic efficiency refers to the existence of appropriate investment incentives. As discussed above, a return on debt that reflects the prevailing market cost of debt provides an appropriate signal for new investment and promotes efficient investment decisions.

Moreover, a return on debt that better reflects the prevailing market cost of debt more closely imitates the outcomes of a competitive market. This is because the current market cost of debt reflects investors' opportunity cost of debt for investments of similar risk.

The current market cost of debt represents the costs that other service providers will face to enter the market. The on-the-day approach is more consistent than the trailing average approach with the theory that prices in a competitive market would be constrained by the entry, or threat of entry, of new providers. This is because in a competitive market, prices are theoretically constrained by entry or the threat of entry.[1457] As observed by HoustonKemp:[1458]

> when economic regulation was first introduced regulators sought to imitate the outcomes of a competitive market. That is, regulators sought to set prices consistent with the theory that in a competitive market prices would be constrained by the entry, or threat of entry, of new providers. This is colloquially known as the 'new entrant price'.

Similarly, Chairmont captured this concept when it advised:[1459]

> The solution should take current market rates and use those to project forward, rather than taking trailing averages as an indicator of future financing costs. The look forward approach is consistent with measuring the opportunity cost of capital and for the typical pressures, including from new entrants, faced by participants in an efficient competitive market.

We also note that Partington and Satchell considered the on-the-day approach is consistent with competitive market outcomes, stating:[1460]

[1457] HoustonKemp, *Memo: Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 1.

[1458] HoustonKemp, *Memo: Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 1. Also see Chairmont, *Cost of debt comparative analysis*, November 2013, p. 4.

[1459] Chairmont, *Cost of debt comparative analysis*, November 2013, p. 4.

[1460] Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 46.

> The equilibrium in a competitive market is that investments in assets are zero NPV. This implies that firms can expect to recover the current cost of capital, which in the form of the WACC includes the current cost of debt.

J.3.2 Trailing average approach

The trailing average approach estimates the allowed return on debt for a service provider as an average of the cost of debt over 10 years (which is annually updated). This approach is available to us under the NER/NGR.[1461]

We consider the trailing average approach can estimate an allowed rate of return commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as a service provider in the provision of reference services. Under the trailing average approach, ex-ante efficient compensation is unlikely to hold for each regulatory period. However, if there is an appropriate (full) transition, it should hold over the term of the RAB. Therefore, service providers would have a reasonable opportunity to recover at least efficient costs over the term of the RAB. We show this in section J.3.3.

Further, the trailing average approach may have particular benefits that an on-the-day approach cannot achieve. For instance, when it advised the AEMC, SFG stated that 'if it can be demonstrated that the benefits of a regulated rate of return which is less variable over time outweigh the costs associated with investment distortions, then a trailing average should be considered'.[1462] The potential benefits mainly relate to smoother prices and a potentially reduced mismatch between a benchmark efficient entity's actual debt cost outcomes (or cash outflows) and the allowed return on debt (see section J.2.1), which we discuss further below.

However, the trailing average also has disadvantages relative to an on-the-day approach (see sections 2.1 and 3.1). Given the trade-offs, we do not consider the trailing average is clearly preferable to the continued use of the on-the-day approach. For the reasons discussed in this appendix, we consider a change in methodology (to a trailing average approach) would not contribute to the achievement of the ARORO or meet the NEO/NGO unless it was revenue-neutral (in present value terms) as this would result in incorrect ex-ante compensation.

Reduced mismatch

In section J.2.1, we introduce and discuss the concept of an ex-post 'mismatch' between a benchmark efficient entity's actual debt cost outcomes (or cash outflows) and the regulatory return on debt allowance in determining the allowed return on debt. We consider an ex-post mismatch can occur for a number of reasons, including because a benchmark efficient entity does not (or cannot) engage in debt financing practices that result in debt cash outflows that match the regulatory return on debt

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[1461] See NER, cl. 6.5.2(j)(2); NER, cl. 6A.6.2(j)(2); NGR, r. 87(10)(b).

[1462] SFG, *Preliminary analysis of rule change proposals: Report for AEMC*, February 2012, p. 41.

allowance. We explain this below in the context of comparing the trailing average with the on-the-day approach to estimating the return on debt.

In any given regulatory period, a benchmark efficient entity will have existing debt that was previously issued and not yet matured. It will need to pay interest on this debt during the regulatory period, and these interest payments will be based on historical interest rates that prevailed in a previous period. If we adopt an on-the-day approach, then cash outflows from existing debt would be effectively revalued at current market rates.[1463] Unless a benchmark efficient entity can engage in debt financing practices that align its debt cash outflows with the regulatory allowance (all else being equal), it is expected that an ex-post mismatch may result. From our observations of past financing practices, it appears that individual service providers (and a benchmark efficient entity) are unlikely to engage in financing practices that fully align its debt cash outflows with the regulatory allowance under the on-the-day approach.

In contrast to the on-the-day approach, a trailing average approach is expected to better account for a benchmark efficient entity's actual (cash) debt costs within a regulatory period because it provides service providers with a return on debt allowance that they can more readily match each regulatory period.[1464] As such, this will likely reduce the mismatch between actual debt interest costs of regulated firms and the regulated return on debt allowance.[1465] Given that a trailing average approach reduces the risk of cash flow mismatch (a form of interest rate risk), it might better lead to productive efficiency. All else being equal, this reduced risk and the reduced need to enter hedging arrangements might lower the cost of financing. Partington and Satchell proposed that a motivation that has been advanced for the switch to the trailing average is that there will be less volatility in revenue and prices. In the case of the switch to a trailing average, while the physical assets may remain unchanged, the expected cash flows from revenue are changed. Ceteris Paribus, the risk of the assets will fall and hence the required return will fall.[1466]

Nevertheless, it is important to note that an ex-post mismatch does not result in a benchmark efficient entity being ex-ante over- or under-compensated for its efficient debt financing costs for a regulatory period or over the life of its assets (see sections J.2.1 and J.3.3).

J.3.3 Mathematical explanation

This section provides a mathematical explanation of the difference between the on-the-day and trailing average regimes in present value terms. While the mathematical explanation employs simplifying assumptions, this is for illustrative purposes and the principles hold true in more general situations. That is, mathematically, we demonstrate that in principle:

[1463] Lally, *The cost of debt*, 10 October 2014, p. 3.

[1464] See AER, *Final decision: TransGrid transmission determination, Attachment 3*, April 2015, p. 150.

[1465] HoustonKemp, *Memo: Appropriate objective to guide the setting of the cost of debt allowance*, 3 March 2015, p. 4.

[1466] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017, p.27.

- The on-the-day approach service providers with the reasonable opportunity to recover at least efficient costs over each regulatory period and over the term of the RAB.[1467]
- The trailing average approach provides service providers with the reasonable opportunity to recover at least efficient costs over the term of the RAB.

If switching between regimes, a full transition provides service providers with a reasonable opportunity to recover at least efficient costs over the term of the RAB. That is, the same ex-ante compensation should be achieved under: an on-the-day regime, a trailing average regime, or a switch from one regime to the other (but only if the switch is revenue neutral).

We use the following notation:

- CF_t denotes net operating cash flows for year t[1468]—that is, revenue less operating expenditure (opex).[1469] Under our depreciation assumptions, this can be expressed as $CF_t = r_t \times K_{t-1}$, where $r_t \times K_{t-1}$ is the return on capital cash flow.
- r_t is the allowed rate of return (which is reset periodically).[1470]
- K_t is the closing RAB at the end of year t (which equals the opening RAB at the beginning of year $t+1$).
- $r_{i,j}$ is the ex-ante cost of capital prevailing in the market for the investment at time i,[1471] with a term of j years—used to discount the expected cash flows.
- $E[.]$ denotes expected value.
- PV_t denotes present value, at year t (can also be referred to as market value).

For simplicity, we assume within-period investment equals depreciation in all periods prior to the end of the term of the RAB (year $t = T$),[1472] where all initial capital (K_0) is

[1467] This is consistent with NEL s.7A(2). Lally advised that this principle in the NEL is 'equivalent' to the NPV principle. See Lally, *The risk free rate and the present value principle*, 22 August, 2012. SFG also appears to support using the NPV principle to assess rate of return approaches. SFG, *Preliminary analysis on rule change proposals: Report for AEMC*, February 2012, p. 47.

[1468] We assume the expected net operating cash flows for year t are equal to those allowed through our regulatory determinations / access arrangements.

[1469] That is, CF_t entails subtracting operating expenditure (opex) from total revenue on the assumption that the regulatory allowance for opex covers actual opex costs incurred. For clarity, this assumption is for ease of exposition and does not affect whether the ARORO is satisfied.

[1470] r_t is the allowed rate of return applied to year t (that is, to determine the net operating cash flow for year t). However, it is calculated using data in year $t-1$.

[1471] The investment is an investment with similar degree of risk as a service provider with respect to the provision of regulated services.

[1472] The end of the term of the RAB occurs at time T when the final return on capital and return of capital revenue allowances are provided. After this year there is no more capital finance to return to investors.

returned (as K_T).[1473] Therefore, within-period investment cancels out and $K_0 = D_1 + D_2 + \cdots + D_T = K_T$, where D_t is depreciation (or return of capital) for year t.

We note the mathematical explanation in this section is a simplification of reality. We use it to demonstrate the principle that the allowed rate of return should be set (and periodically reset) such that the ex-ante allowed return on (and of) capital cash flows equals the ex-ante cost of a benchmark efficient entity's investment in its RAB (in present value terms). This gives service providers a reasonable opportunity to recover at least efficient financing costs over the term of the RAB. As Brennan (1991) stated:[1474]

> With regard to investor compensation, the basic goal of regulation is to give investors an income stream just sufficient to cover the costs of their assets, and no more

On-the-day approach

For simplicity, assume the term of the risk free rate matches the regulatory period (five years) under the on-the-day approach.[1475] If we provide service providers with a reasonable opportunity to recover at least efficient costs over a regulatory period commencing year t, then the present value of expected net operating cash flows over this period plus the closing RAB (at $t + 5$) should equal the opening RAB (at t). Under our depreciation assumptions, the opening RAB (at t) will equal its initial value (at $t = 0$).

This present value principle should hold under the on-the-day approach because we reset the allowed rate of return to reflect the (appropriately benchmarked) prevailing market cost of capital ($r_{t,5}$)[1476] at the commencement of each regulatory period. We show this below:

$$PV_t = E\left[\frac{CF_{t+1}}{(1+r_{t,5})^1} + \frac{CF_{t+2}}{(1+r_{t,5})^2} + \frac{CF_{t+3}}{(1+r_{t,5})^3} + \frac{CF_{t+4}}{(1+r_{t,5})^4} + \frac{CF_{t+5}}{(1+r_{t,5})^5} + \frac{K_{t+5}}{(1+r_{t,5})^5}\right]$$

1473 We note there are academic articles which support the view that the depreciation schedule does not affect the zero NPV investment condition (all else equal). See for example Schmalansee, *An expository note on depreciation and profitability under rate of return regulation*, Journal of Regulatory Economics, 1989, 1, pp. 293–298.

1474 Brennan, *Depreciation, investor compensation and, welfare under rate-of-return regulation*, Review of industrial organisation, 1991, 6, p. 75.

1475 In practice, we have used a 10 year term to estimate the allowed rate of return. Given interest rates on longer-term debt securities are often higher than those on shorter-term debt securities, this would lead to overcompensation all else being equal. However, we assume no material overcompensation given this excess allowance on the return on debt may compensate service providers for their hedging costs in relation to debt capital. And, in relation to the return on equity, we assume no material overcompensation given we use a MRP estimate which his partly reliant on historical MRP estimates, which are estimated using the yield to maturity on 10 year Commonwealth Government Securities (CGS).

1476 This is the weighted average cost of capital (WACC) for an investment with similar degree of risk as a service provider in the provision of regulated services, at time t. That is, $r_{t,5} = \frac{E}{V} * r(e)_{t,5} + \frac{D}{V} * r(d)_{t,5}$, where $\frac{E}{V}$ is the proportion of equity capital; $r(e)_{t,5}$ is the cost of equity; $\frac{D}{V}$ is the proportion of debt capital; and $r(d)_{t,5}$ is the cost of debt.

$$= K_{t-1}$$[1477]

where the allowed rate of return (in the cash flows) equals $\hat{r}_{t,5}$,[1478] and the present value (at time $t+5$) of expected future cash flows over the remaining term of the RAB equals the closing RAB at the end of year $t+5$ (that is, $PV_{t+5} = K_{t+5}$).

Under our assumptions, $K_{t-1} = K_0$, and:[1479]

$$CF_i = r_i * K_{i-1} = \hat{r}_{t,5} * K_0$$

$$= (\widehat{r(e)}_{t,5} * 0.4 * K_0) + (\widehat{r(d)}_{t,5} * 0.6 * K_0),\ \ for\ i = t+1, \ldots, t+5$$

$$K_{t+5} = K_0$$

We can show $PV_{t+5} = K_{t+5}$ $(= K_0)$ through the following sequences of equalities, which collapse down to PV_{t+5}:[1480]

$$PV_{t+5} = E\left[\sum_{i=t+6}^{t+10} \frac{CF_i}{(1+r_{t+5,5})^{i-5}} + \frac{K_{t+10}}{(1+r_{t+5,5})^5}\right]$$

$$PV_{t+10} = E\left[\sum_{i=t+11}^{t+15} \frac{CF_i}{(1+r_{t+10,5})^{i-10}} + \frac{K_{t+15}}{(1+r_{t+10,5})^5}\right]$$

$$\ldots$$

$$PV_{T-5} = E\left[\sum_{i=(T-4)}^{T} \frac{CF_i}{(1+r_{(T-5),5})^{i-(T-5)}} + \frac{K_T}{(1+r_{(T-5),5})^5}\right]$$

The above present value principle should hold under any regulatory period under the on-the-day approach, and therefore should hold over the term of the RAB, which would comprise of multiple regulatory periods.[1481] The allowed rate of return is reset to reflect the (appropriately benchmarked) prevailing market cost of capital at the commencement of each regulatory period. Therefore, the present (or market) value of the RAB is reset to its statutory value (or, under our assumptions, its initial value K_0) at

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1477 This is the closing RAB at the end of year t-1, which equals the opening RAB at the beginning of year t.

1478 $\widehat{r_{t,5}}$ is our best estimate of the prevailing market cost of capital $r_{t,5}$. It consists of, $\widehat{r(e)}_{t,5}$—our best estimate of the prevailing market cost of equity $r(e)_{t,5}$; $\widehat{r(d)}_{t,5}$—our best estimate of the prevailing market cost of debt $r(d)_{t,5}$; 0.4—our best estimate of $\frac{E}{V}$; and 0.6—our best estimate of $\frac{D}{V}$.

1479 These assumptions are: we ignore changes to the capital stock and assume all initial capital is returned at the end of the term of the RAB.

1480 These equalities hold under the expectation that the allowed rate of return is reset at the commencement of each regulatory period to reflect the prevailing market cost of capital at that time ($r_{t+5,5}$, $r_{t+10,5}$, etc.). However, these future rates are unknown at time t. Also, under our assumptions, $K_0 = D_1 + D_2 + \cdots + D_T = K_T$.

1481 The resetting of the allowed rate of return at the commencement of each regulatory period means the end-of-period closing RAB has a present value equal to its statutory value at that point in time. However, any cash flow with a present value equal to the statutory value of the end-of-period closing RAB K_{t+5} at that time (for example, a cash flow transitioning to a trailing average) should result in the equality holding.

the commencement of each regulatory period. This is supported by Partington and Satchell.[1482] To this extent, the regulatory regime under an on-the-day approach can be likened to a long term floating rate security where the allowed rate of return is the coupon rate, reset at the start of each regulatory period such that the present (or market) value of the bond equals its par (or face) value.[1483]

We consider this section shows the on-the-day approach provides service providers with a reasonable opportunity to recover at least efficient costs.[1484] That is, at the commencement of each regulatory period, the present value of expected future cash flows will equal the RAB. We note that given the ARORO is standalone, the ARORO will be achieved if the present value of expected return on (and of) capital cash flows equal the start-of-period opening RAB.

Trailing average approach

Under the trailing average approach, the service providers would not necessarily have a reasonable opportunity to recover at least efficient costs over a regulatory period. However, the service providers would still have a reasonable opportunity to recover at least efficient costs over the term of the RAB.

Assume we set the allowed rate of return based on a trailing average return on debt for a particular regulatory period (commencing year t). As set out above, for the present value principle to hold over the regulatory period commencing year t, the present value of expected net operating cash flows over this period plus the closing RAB (at $t+5$) should equate to the opening RAB (at t). Under our depreciation assumptions, this should result in the opening RAB (at t) being equal to its initial value (at $t=0$). That is, for the present value principle to hold over a regulatory period commencing year t, the following equality must hold:

$$PV_t = E\left[\frac{CF_{t+1}}{(1+r_{t,5})^1} + \frac{CF_{t+2}}{(1+r_{t,5})^2} + \frac{CF_{t+3}}{(1+r_{t,5})^3} + \frac{CF_{t+4}}{(1+r_{t,5})^4} + \frac{CF_{t+5}}{(1+r_{t,5})^5} + \frac{K_{t+5}}{(1+r_{t,5})^5}\right]$$

$$= K_{t-1} \ (= K_0)$$

where, under an immediate trailing average approach (under our assumptions):[1485]

[1482] See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 17. Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,* 9 April 2017, p.16.

[1483] For clarity, we make this analogy to demonstrate why the rate of return should be reset on each reset date. We do not consider our return on debt cash flows are equivalent to a floating rate bond or require the allowed rate of return to be determined as such. We consider our benchmarked return on debt and return on equity estimates reasonably reflects the prevailing cost of debt and cost of equity for an investment with a similar degree of risk as a service provider in providing regulated services.

[1484] Assuming the correct discount rate (or cost of capital) is used to benchmark the allowed rate of return (and therefore reset the RAB to its statutory value) at each reset date.

[1485] The allowed rate of return (r_i) is no longer an estimate of the prevailing market cost of capital $r_{t,5}$. The allowed rate of return consists of $\widehat{r(e)}_{t,5}$—our best estimate of the prevailing market cost of equity $r(e)_{t,5}$; 0.1*$\sum_{s=i-10}^{i-1}[r_{s,10}]$—a

$$CF_i = r_i * K_{i-1} = r_i * K_0$$

$$= (\widehat{r(e)}_{t,5} * 0.4 * K_0) + (0.1 * \sum_{s=i-10}^{i-1} [r_{s,10}] * 0.6 * K_0),\ \ for\ i = t+1, \ldots, t+5$$

The above equality is unlikely to hold for any given regulatory period. The only way this can hold is if the geometric average allowed rate of return used over the period equals $r_{t,5}$,[1486] and $PV_{t+5} = K_{t+5}$ (which equals K_0 under our assumptions).

Despite this, we can show the service providers would have a reasonable opportunity to recover at least efficient costs over the term of the RAB. We previously observed that the on-the-day approach can be likened to a long term floating rate security where the coupon rate is reset to reflect the prevailing market cost of capital at the start of each regulatory period. Similarly, we can interpret the trailing average approach as 10 long term floating rate securities each covering a 10 per cent 'investment portion' in the RAB where the coupon rate is reset to reflect the prevailing market cost of (debt) capital every 10 years.

There are three different components to the trailing average approach: the transition in, the full staggered portfolio, and the transition out at the end of the investment horizon (or end of the term of the RAB). We show these below.

The allowed return on equity continues to be reset to reflect the prevailing market cost of equity at the commencement of each regulatory period. Therefore, we can reasonably assume the present value of expected return on equity cash flows equals the equity financed component of the RAB each regulatory period, although Partington and Satchell note there are likely to be complications associated with leverage.[1487] Because of this, in the following sections we focus on the return on debt cash flows and assume, for simplicity, the RAB is 100 per cent debt financed.

Transition into the staggered portfolio

On the first year of a trailing average, a business would either:

- Raise an equal-weighted portfolio of 1, 2, 3 ... 9, 10 year debt. Each year 10 per cent of this would expire and the business would replace this with 10 year debt.
- Raise 10 year debt. Each year it would refinance 10 per cent of this and replace this with more 10 year debt.

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10 year historical average cost of debt that is updated annually; 0.4—our best estimate of $\frac{E}{V}$; and 0.6—our best estimate of $\frac{D}{V}$.

1486 We consider this is consistent with Partington and Satchell's view that, 'if all future cash flows are positive, then there is a unique solution for the rate of return that sets the NPV to zero' (over each regulatory period). Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 45. Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017, p.21.

1487 That is, they consider it is likely that the 'cost of equity will diverge from that assumed at a 60% leverage level'. See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 21.

We have calculated the return on debt allowance assuming the latter option. Since we expect this would be the higher cost option given interest rates on longer-term debt securities are often higher than those on shorter-term debt securities, our debt allowance should be conservative in the service providers' favour.

Valuing the return on debt allowance using the first of the two options would be expected to provide a benchmark efficient entity a reasonable opportunity to recover at least efficient costs for its initial investment at $t = 0$ as this would allow the following equality to hold:[1488]

$$PV_0 = E\left[\frac{1*CF_1+0.1*K_1}{(1+r_{0,1})^1} + \frac{0.9*CF_2+0.1*K_2}{(1+r_{0,2})^2} + \cdots + \frac{0.2*CF_9+0.1*K_9}{(1+r_{0,9})^9} + \frac{0.1*CF_{10}+0.1*K_{10}}{(1+r_{0,10})^{10}}\right] = K_{-1}$$ [1489]

where, under our assumptions:[1490]

$$CF_i = r_i * K_{i-1} = r_i * K_0$$

$$= \frac{1}{11-i}\sum_{j=i}^{10}[r_{0,j}] * K_0, \;\; for\ i = 1, 2, 3, \dots, 10$$

$$0.1 * \left(\sum_{i=1}^{10} K_i\right) = K_0.$$

As demonstrated under 'On-the-day approach', this equality holds because, for each one-tenth portion of the RAB:

- the expected net operating cash flows are, effectively, based on an allowed rate of return that reflects prevailing market rates at year $t = 0$, with the expectation that the allowed rate of return will be periodically reset to prevailing market rates
- the present (or market) value of the closing RAB (portion) at the end of each 'reset period' equals its statutory value.

For example, at $t = 0$, portion one of the initial RAB is financed through debt with a term of one year. The present value of expected net operating cash flows generated from portion one of the RAB plus portion one of the closing RAB at $t = 1$, should equal portion one of the opening RAB at $t = 0$. This is because it is expected that, at $t = 1$, we reset the allowed rate of return on portion one of the RAB to reflect the prevailing market cost of capital, and continue resetting every ten years (see equalities under 'The staggered portfolio' and 'End of the term of the RAB' below).

Similarly, at $t = 0$, portion two of the initial RAB is financed through debt with a term of two years, and the present value relationship holds for portion two over the two year period. The same logic applies to portions three to ten.

1488 We have used spot rates $r_{0,t}$ to discount the cash flows for years t=1 to t=10 because the debt portfolio consists of debt with different maturities. The cost of (debt) capital in this case is a complicated average of the spot rates.

1489 This equals the opening RAB at the beginning of year 0—because the opening RAB at the beginning of year t equals the closing RAB at the end of year t-1.

1490 The allowed rate of return (r_i) is an average of estimates of the spot rates (at time 0) for different terms. The allowed rate of return differs each year because the proportion of expected net operating cash flow allocated to this debt portfolio reduces as each tranche of debt matures and the staggered portfolio is formed (see next section).

What this shows, is that at the beginning of the transition into a trailing average approach, the present value of expected future cash flows should equal the RAB (all else equal).

The staggered portfolio

As noted previously, the trailing average regime can be likened to 10 long term floating rate securities covering a 10 per cent 'investment portion' in the RAB where they receive the net operating cash flows generated from these investment portions. We refer to these portions[1491] as $p1$ to $p10$. From $t = 1$ to $t = 10$, the present value relationships can be presented as:

$$PV[p1]_1 = E\left[\frac{0.1*CF_2}{(1+r_{1,10})^1} + \frac{0.1*CF_3}{(1+r_{1,10})^2} + \cdots + \frac{0.1*CF_{10}}{(1+r_{1,10})^9} + \frac{0.1*CF_{11}}{(1+r_{1,10})^{10}} + \frac{0.1*K_{11}}{(1+r_{1,10})^{10}}\right] = 0.1 * K_0$$ [1492]

$$PV[p2]_2 = E\left[\frac{0.1*CF_3}{(1+r_{2,10})^1} + \frac{0.1*CF_4}{(1+r_{2,10})^2} + \cdots + \frac{0.1*CF_{11}}{(1+r_{2,10})^9} + \frac{0.1*CF_{12}}{(1+r_{2,10})^{10}} + \frac{0.1*K_{12}}{(1+r_{2,10})^{10}}\right] = 0.1 * K_1$$

…

$$PV[p10]_{10} = E\left[\frac{0.1*CF_{11}}{(1+r_{10,10})^1} + \frac{0.1*CF_{12}}{(1+r_{10,10})^2} + \cdots + \frac{0.1*CF_{19}}{(1+r_{10,10})^9} + \frac{0.1*CF_{20}}{(1+r_{10,10})^{10}} + \frac{0.1*K_{20}}{(1+r_{10,10})^{10}}\right] = 0.1 * K_9$$

where the expected net operating cash flow generated each year from portions 1 to 10 of the RAB is based on the portion of the allowed rate of return that reflects the prevailing market cost of capital at time 1 to 10 respectively;[1493] that is:[1494]

$$0.1 * CF_i = \hat{r}_{t,10} * 0.1 * K_t,\ for\ t = 1, \ldots, 10\ and\ i = 2, \ldots, 20$$

and, under our assumptions, $K_t = K_0$.

As demonstrated under 'On-the-day approach', the above equalities hold because, for each portion of the RAB:

- the expected net operating cash flows are, effectively, based on an allowed rate of return that reflects prevailing market rates at year $t = 1 \ldots 10$ respectively, with the expectation that the allowed rate of return will be reset to prevailing market rates every ten years
- the present (or market) value of the closing RAB (portion) at the end of each 'reset period' equals its statutory value.

[1491] Or, the expected cash flows generated from these portions.

[1492] The opening RAB at the beginning of year t equals the closing RAB at the end of year t-1.

[1493] In likening this approach to ten long term floating rate securities, the proportion of expected net operating cash flow generated each year from portions 1 to 10 of the RAB can be seen as the fixed interest payments on the ten securities. One security is issued (at par value) each year 1 to 10 and the interest rate on each equals the prevailing market cost of capital at the time of issuance, until it is reset in ten years.

[1494] Where $\hat{r}_{t,10}$ is our best estimate of the prevailing market cost of (debt) capital at time t ($r_{t,10}$). We note this represents only one tenth of the trailing average rate of return (on debt).

In this way, the staggered portfolio can be seen as ten on-the-day approaches on ten portions of the RAB. Therefore, for each portion of the RAB, the present value of expected net operating cash flows over the ten year 'reset period' plus the closing RAB (portion) at $t + 10$ should equal the opening RAB (portion) at t.

We also note that while Partington and Satchell recommend the on-the-day approach, they acknowledge 'since the trailing average approach resets one tenth of the cost of debt to the market rate each year, the compensation is correctly set for one tenth of the debt each year'.[1495]

End of the term of the RAB

Nearing the end of the term of the RAB, the business must wind up its debt fund, which can be likened to 10 long term floating rate securities covering a 10 per cent 'investment portion' in the RAB. At $t = T - 10$, the business could either:[1496]

- Raise 9, 8 … 2, 1 year debt on a staggered basis. All its debt would thus expire in year T and it would repay the entire initial value of the RAB back to its investors.
- Allow its staggered portfolio to gradually expire, repaying 10 per cent of the initial value of the RAB to investors each year.

This means our return on debt allowance would have to allow for a transition out of the staggered portfolio. Valuing the return on debt allowance using the first of the two options would be expected to provide a benchmark efficient entity a reasonable opportunity to recover at least efficient costs as this would allow the following equalities to hold (from $t = T - 10$ to $t = T - 1$):

$$PV[p1]_{T-10} = E\left[\frac{0.1*CF_{(T-9)}}{(1+r_{(T-10),9})^1} + \frac{0.1*CF_{(T-8)}}{(1+r_{(T-10),9})^2} + \cdots + \frac{0.1*CF_{1(T-1)}}{(1+r_{(T-10),9})^8} + \frac{0.1*CF_T+0.1*K_T}{(1+r_{(T-10),9})^9}\right] = 0.1 * K_{T-11}$$ [1497]

$$PV[p2]_{T-9} = E\left[\frac{0.1*CF_{(T-8)}}{(1+r_{(T-9),8})^1} + \frac{0.1*CF_{(T-7)}}{(1+r_{(T-9),8})^2} + \cdots + \frac{0.1*CF_{1(T-1)}}{(1+r_{(T-9),8})^7} + \frac{0.1*CF_T+0.1*K_T}{(1+r_{(T-9),8})^8}\right] = 0.1 * K_{T-10}$$

…

$$PV[p10]_{T-1} = E\left[\frac{0.1*CF_T+0.1*K_T}{(1+r_{(T-1),1})^1}\right] = 0.1 * K_{T-2}$$

where the proportion of net operating cash flow generated from each portion of the RAB each year equals the interest payment on that tranche of debt; that is:[1498]

$$0.1 * CF_i = \hat{r}_{t,10} * 0.1 * K_t,\ for\ t = T - 10, \ldots, T - 1\ and\ i = T - 9, \ldots, T$$

1495 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 17.

1496 Note we ignore the treatment of changes to the capital stock before the end of the assets life (where we assume all capital is returned).

1497 The opening RAB at the beginning of year t equals the closing RAB at the end of year t-1.

1498 Where $\hat{r}_{t,10}$ is our best estimate of the prevailing market cost of (debt) capital at time t $r_{t,10}$.

and, under our assumptions, $K_t = K_0$.

As shown in the above sections, the above equalities hold because, for each portion of the RAB:

- the expected net operating cash flows are, effectively, based on an allowed rate of return that reflects prevailing market rates at year $t = T - 10 \ldots T - 1$ respectively
- the present (or market) value of the closing RAB (portion) at the end of each period equals its statutory value.

Given these equalities hold, the service providers would expect to have a reasonable opportunity to recover at least efficient costs for each of its investment portions. Since this applies to all stages of the trailing average approach, the service providers would expect to have a reasonable opportunity to recover at least efficient costs over the entire term of the RAB.

The sections above show that the key distinction between an on-the-day and a trailing average approach is:

- the on-the-day approach results in the entire allowed rate of return being reset to reflect prevailing market (or efficient) rates near the commencement of the regulatory period
- the trailing average approach results in one tenth of the allowed rate of return being reset to reflect prevailing market (or efficient) rates each year.

However, both approaches to setting the allowed rate of return, if appropriately implemented (in a forward looking manner) should result in the same ex-ante compensation for a benchmark efficient entity's ex-ante efficient financing costs over the term of the RAB.

J.4 A full transition satisfies the ARORO

If moving from the on-the-day to the trailing average approach, we consider a full transition is required to meet the ARORO and the objectives of the NEL/NGL. A full transition is revenue neutral in a present value sense.[1499] Assuming the on-the-day or trailing average approach would contribute to the achievement of the ARORO, a revenue neutral transition will also contribute to the achievement of the ARORO.

As shown in section J.3.3, ex-ante efficient compensation can hold under either the on-the-day approach or the trailing average approach (if a transition is applied). As such, both approaches are capable of being approximately equivalent over the term of the RAB (which will be multiple regulatory periods).

[1499] Wherever we say revenue neutral we mean revenue neutral in a present value sense. This is equivalent to avoiding wealth transfers from the change in methodology. This is also equivalent to saying there are no windfall gains or losses from the change in methodology (as HoustonKemp appear to use the term in their advice to ESCOSSA).

For this reason, setting the return on debt allowance under the assumption that the service provider does not instantly have a trailing average debt portfolio, but rather has to develop, it should neither have a positive or negative affect on the service provider. Rather, we expect this would be NPV neutral. This is supported by Partington and Satchell. They stated that the transition to the trailing average may approximate the zero NPV investment condition that would be achieved under the on day approach. However, using the full trailing average (i.e. with no transition), which by definition is entirely backwards looking, will not give rise to efficient investment outcomes meeting the zero NPV investment condition.[1500]

We show in section J.3.3 that under the trailing average approach, service providers expect to have a reasonable opportunity to recover at least efficient financing costs over the term of the RAB. However, for any given regulatory period, the present value of expected net operating cash flows over the regulatory period plus the closing RAB will not necessarily equal the opening RAB. That is, at the start of any given regulatory period, the present value of expected future cash flows will unlikely equal the RAB because the cash flows based on historical interest rates will either be higher or too low (relative to the prevailing cost of debt in the market). Given this, switching between regimes without a full transition would not satisfy the requirement to provide service providers with a reasonable opportunity to recover at least efficient costs over either the regulatory period or over the term of the RAB.

J.5 An immediate (or hybrid) transition will not satisfy the ARORO

We consider a full transition to a trailing average will result in an ex-ante reasonable return and would contribute to the achievement of the ARORO (see section J.4). Conversely, we do not consider that an immediate (or hybrid) transition to a trailing average will result in an ex-ante reasonable return and would contribute to the achievement of the ARORO. This is because these approaches are not revenue neutral (in a present value sense). Rather, because these approaches would not be revenue-neutral (supported by Partington and Satchell[1501]), these would result in ex-ante overcompensation if moving from a high to a low interest rate environment. Conversely, these would result in ex-ante undercompensation if moving from a low to a high interest rate environment. We show the difference between our full transition approach and the immediate transition to the trailing average approach that some service providers have favoured[1502]mathematically in section J.5.1.

It is also worth noting that while stakeholders generally supported moving to a trailing average approach when we developed the Guideline, the trailing average cannot be

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1500 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017, p.30.

1501 Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017, p.27.

1502 This was the preferred transition approach in recent revised proposals from ActewAGL distribution (gas), AGN, APTMT, AusNet Services (distribution), CitiPower, Jen, Powercor and United Energy.

considered in isolation of the transition set out in the Guideline.[1503] This was supported by the CCP3 in the context of the 2016 AER Vic DNSP decision in advising:[1504]

> consumer acceptance for the 10-year trailing average cost of debt (rather than continuation of the “on-the-day” or a 5-year trailing average aligned with the regulatory period) during the Better Regulation process was, arguably, contingent on the AER having an effective transition process that would prevent windfall gains or losses by either consumers or the businesses. The DNSPs’ revised proposals for transition violate this implicit understanding that has underpinned the consumers’ support of the 10-year rolling average approach.

For this reason, the CCP3 also advised that, 'the significant impact on consumers of the DNSPs’ proposed departure from the RoR Guideline risks a collapse in consumer confidence in the regulatory process'.[1505]

Moreover, Partington and Satchell advise that, given a move to the trailing average approach, our full transition is preferable to an immediate (or hybrid) transition.[1506] They also state that:[1507]

> …it is appropriate in the present case, of significant divergence between the trailing average and the current cost of debt, that a transition should be made to the trailing average rather than immediately moving to full implementation.

Consequently, we consider the on-the-day approach should continue in the absence of a full transition to the trailing average approach. This is because the on-the-day approach produces a return on debt estimate that, in conjunction with the return on equity, satisfies the ARORO. As shown in section J.3.3, the on-the-day approach provides ex-ante efficient compensation for a benchmark efficient entity's efficient cost of financing over each regulatory period and over the term of the RAB.

J.5.1 Mathematical explanation

This section demonstrates the difference (in present value terms) between our full transition and the immediate transition to the trailing average approach. We use the following notation:

- PV_t denotes present value, at year t

1503 The change in the return on debt approach and the associated transition were necessarily discussed, consulted on and determined upon together. See AER, *Explanatory statement to the rate of return guideline*, December 2013, pp. 98–125; AER, *Explanatory statement to the draft rate of return guideline*, August 2013, pp. 73–97; AER, *Consultation paper: Rate of return guidelines*, May 2013, pp. 49–55.

1504 CCP3, *Submission to the AER: Response to AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for revenue reset for the 2016–20 regulatory period*, 25 February 2016, p. 109.

1505 CCP3, *Submission to the AER: An overview —Response to AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for revenue reset for the 2016–20 regulatory period*, 22 February 2016, p. 35.

1506 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 52. Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017, p.28.

1507 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 45–46.

- $E[.]$ denotes expected value
- K_t is the closing RAB at the end of year t (which equals the opening RAB at the beginning of year $t+1$).
- 0.6 is the proportion of the RAB that is debt financed
- rd_t are the estimates of the return on debt used to calculate the return on capital cash flows
- $r_{t,j}$ is the (spot) discount rate at year t for a term of j years.

The present value of our proposed return on debt allowance over the next ten years (under a full transition) at time $t = 0$ is as follows:[1508]

$$PV[AER]_0 = \frac{rd_0 \times 0.6 \times K_0}{(1+r_{0,1})^1}$$

$$+ \frac{(rd_0 \times 0.9 + E[rd_1] \times 0.1) \times 0.6 \times E[K_1]}{(1+r_{0,2})^2}$$

$$+ \frac{(rd_0 \times 0.8 + E[rd_1] \times 0.1 + E[rd_2] \times 0.1) \times 0.6 \times E[K_2]}{(1+r_{0,3})^3}$$

$$+ \cdots$$

$$+ \frac{0.1 \times (rd_0 + E[\,rd_1 + rd_2 + rd_3 + rd_4 + rd_5 + rd_6 + rd_7 + rd_8 + rd_9]) \times 0.6 \times E[K_9]}{(1+r_{0,10})^{10}}$$

The present value of the service providers' proposed return on debt allowance over the next ten years (under an immediate transition) at time $t = 0$ is as follows:

$$PV[SP]_0 = \frac{0.1 \times (rd_0 + rd_{-1} + rd_{-2} + rd_{-3} + rd_{-4} + rd_{-5} + rd_{-6} + rd_{-7} + rd_{-8} + rd_{-9}) \times 0.6 \times K_0}{(1+r_{0,1})^1}$$

$$+ \frac{0.1 \times (E[rd_1] + rd_0 + rd_{-1} + rd_{-2} + rd_{-3} + rd_{-4} + rd_{-5} + rd_{-6} + rd_{-7} + rd_{-8}) \times 0.6 \times E[K_1\,]}{(1+r_{0,2})^2}$$

$$+ \frac{0.1 \times (E[\,rd_2] + E[rd_1] + rd_0 + rd_{-1} + rd_{-2} + rd_{-3} + rd_{-4} + rd_{-5} + rd_{-6} + rd_{-7}) \times 0.6 \times E[K_2]}{(1+r_{0,3})^3}$$

$$+ \cdots$$

$$+ \frac{0.1 \times (rd_0 + E[rd_1 + rd_2 + rd_3 + rd_4 + rd_5 + rd_6 + rd_7 + rd_8 + rd_9]) \times 0.6 \times E[K_9]}{(1+r_{0,10})^{10}}$$

Subtracting the present value of our return on debt allowance over the next ten years from the present value of the service providers' proposed return on debt allowance over the next ten years gives the following difference in present value terms:

$$PV[SP]_0 - PV[AER]_0$$

1508 This example does not consider expected allowed return on debt cash flows beyond year ten because beyond year ten the expected cash flows of the AER and the service providers are the same (in relation to the issue of transition only).

$$= \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3}+rd_{-4}+rd_{-5}+ rd_{-6}+rd_{-7}+rd_{-8}+rd_{-9})-0.9\times rd_0)\times 0.6\times K_0}{(1+r_{0,1})^1}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3}+rd_{-4}+rd_{-5}+ rd_{-6}+rd_{-7}+rd_{-8})-0.8\times rd_0)\times 0.6\times E[K_1]}{(1+r_{0,2})^2}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3}+rd_{-4}+rd_{-5}+ rd_{-6}+rd_{-7})-0.7\times rd_0)\times 0.6\times E[K_2]}{(1+r_{0,3})^3}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3}+rd_{-4}+rd_{-5}+ rd_{-6})-0.6\times rd_0)\times 0.6\times E[K_3]}{(1+r_{0,4})^4}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3}+rd_{-4}+rd_{-5})-0.5\times rd_0)\times 0.6\times E[K_4]}{(1+r_{0,5})^5}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3}+rd_{-4})-0.4\times rd_0)\times 0.6\times E[K_5]}{(1+r_{0,6})^6}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2}+rd_{-3})-0.3\times rd_0)\times 0.6\times E[K_6]}{(1+r_{0,7})^7}$$

$$+ \frac{(0.1\times(rd_{-1}+rd_{-2})-0.2\times rd_0)\times 0.6\times E[K_7]}{(1+r_{0,8})^8}$$

$$+ \frac{(0.1\times(rd_{-1})-0.1\times rd_0)\times 0.6\times E[K_8]}{(1+r_{0,9})^9}$$

$$+0$$

We can conclude several things from the above calculation in relation to the expected return on debt allowance:

- Assuming you use the same data series, term and credit rating, the difference between our proposed return on debt allowance and return on debt allowance under no transition is a fixed amount in each of the first nine years.[1509]
- Assuming you use the same data series, term and credit rating, there is no difference between our proposed return on debt allowance and return on debt allowance under no transition from year ten onwards.
- The present value of the difference in our proposed return on debt allowance and return on debt allowance under no transition for each of the next nine years can be calculated today.[1510] This total present value is a sum of the difference in values for each of the next nine years (as shown above).

1509 We note the exact amount in each year is impacted by the forecast capital investment and depreciation. However, these forecasts will impact both the AER's allowance and the NSPs proposed allowance as shown above, and the difference will still be a fixed amount which is a function of the known RAB at time 0 and the expected RAB at time 1 to 8.

1510 This assumes you have forecasts for the RAB at time 1 to 8. This may not be realistic for time 6 onwards (i.e. beyond the end of the current regulatory control period). However, even in the absence of RAB forecasts for yeas 6 to 10 a reasonable approximation of the present value difference can be made today.

- Given that current interest rates are well below average historical rates over the last nine years, return on debt allowance under no transition will have a materially higher present value than our proposed return on debt allowance (over both the upcoming regulatory period and the next nine years). For the reasons discussed earlier, this is inconsistent with the zero NPV investment condition and will not meet the ARORO or NEO/NGO. It is worth noting that current interest rates could have similarly moved above historical rates and this would have required a transition to avoid undercompensating a benchmark efficient entity.

The above propositions also hold when comparing our transitional approach with a hybrid transitional approach. That is, the difference between these allowances each year will be a fixed amount that can be quantified and valued. However, the magnitude of this difference will differ depending on the approach proposed.

In relation to the risk associated with the alternative return on debt allowances, the key interest rate risk associated with the allowed return on debt cash flow streams in each future year appears to come from rolling future interest rates into the trailing average. As all proposed allowances roll the same future interest rates in at a rate of 1/10 per year, the risk associated with the uncertainty from these rates should be the same across transition approaches. This implies that any mismatch risk associated with future interest rate uncertainty might be expected to be the same or similar under all transition approaches.[1511]

This above analysis implies the key difference between our proposed return on debt allowance and the other transitional approaches that service providers have recently proposed appears to be fixed changes in the present value of a benchmark efficient entity from the change in methodology. This change in value would represent a transfer between a benchmark efficient entity's shareholders and consumers, which would vary in quantum depending on the particular transition proposed. Partington and Satchell support this view, stating:[1512]

> It is also clear that the change to a trailing average if fully implemented immediately has substantial wealth effects. Substantial wealth transfers, whether to or from the regulated businesses, simply as a consequence of a relatively sudden regulatory change is undesirable.

In their new report to the AER, they further state:[1513]

> As far as possible regulatory action should not damage stakeholders' confidence in the regulatory process. When there are substantial and unintended wealth transfers that arise from regulatory change this may damage confidence in the regulator by those who suffer the wealth loss and increase the perception of regulatory risk.

[1511] Noting we do not consider if there was a lesser mismatch under one approach it would justify an approach that did not result in an efficient (forward looking) return on debt allowance.

[1512] Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 52.

[1513] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*,9 April 2017, p.27.

J.5.2 Initial proposal of APTPPL

APA VTS and APTPPL both proposed to depart from the AER's Guideline approach for debt transition and adopted an immediate trailing average.[1514] We note that some services providers in the past have proposed a hybrid transition under partial hedging.[1515] The hybrid transition combined a 10 year transition of the base rate into a trailing average approach with a backwards looking trailing average DRP. We do not agree with the reasons provided for adopting either no transition or a hybrid transition when changing methodology, which we respond to separately in the following sections. We note that APTPPL and APA have not submitted a hybrid transition as their second preference and have solely proposed immediate adoption of a backwards looking trailing average.

In response to the Victorian DNSPs' revised proposals lodged with the AER in early 2016 (that changed their transition approach in their initial proposals to an immediate backward looking trailing average), CCP3 submitted that following this new position, these service providers were proposing a higher effective DRP than what they would have incurred during the Global Financial Crisis.[1516] It subsequently advised:[1517]

> CCP3 does not consider that the DNSPs' revised RoD proposals for 2016-20 reflect a reasonable expectation of their current overall efficient debt portfolio costs; nor do the RoD proposals reflect expected future debt costs.

Proposals for immediately adopting a trailing average

APTPPL in relation to its access arrangement, APA VTS in relation to its transmission submission, AusNet Services in relation to its transmission determination (prior to changing its approach), and ActewAGL Gas and the Victorian DNSPs in relation to their distribution processes completed last year submitted a range of (often interrelated) reasons for immediately transitioning to a trailing average. We do not agree with the logic driving the no transition approach, which table 3-35 addresses. This table covers the reasons put forward by service providers in relation to decisions released in May and July 2016, as well as the reasons put forward by AusNet Transmission in its revised proposal and APTPPL and APA VTS in their initial

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1514 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p. 160; APA VTS, *Victorian Transmission System Access Arrangement Submission*, January 2017, p. 180.

1515 This was proposed by ActewAGL, AGN, Amadeus, CitiPower, JEN and United Energy

1516 CCP3 submitted that service providers are proposing an effective DRP of approximately 5.1%. In contrast, data suggests that the historical average DRP was in the order of 2.35% for BBB rated companies. Even during the GFC, the DRP was less than 4.5%. See CCP3, *Submission to the AER: An Overview — Response to AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for a revenue reset for the 2016-2020 regulatory period* , 22 February 2016, p. 34

1517 CCP3, *Submission to the AER: Response to AER Preliminary Decisions and revised proposals from Victorian electricity DNSPs for a revenue reset for the 2016-2020 regulatory period* , 25 February 2016, p. 104

proposals. We note that APTPPL and APA VTS both submitted the same reasoning for adopting an immediate trailing average approach in their regulatory proposal.

Table 3-35 AER view of reasons in proposals

Reason provided in proposals	AER view
An immediate (or hybrid) transition is consistent with a historically-based definition of efficient financing costs.	We do not consider 'efficient financing costs' in the ARORO refers to historical costs, requiring compensation for losses (or gains) from unhedged mismatch with the previous regulatory allowance. Rather, achieving the ARORO requires a benchmark efficient entity be ex-ante appropriately compensated in present value terms and for the allowance to lead to efficient compensation (see section J.2.1). If provided with ex-ante efficient compensation, then a benchmark efficient entity has a reasonable opportunity to recover its efficient debt financing costs. The on-the-day rate is an appropriate measure of 'efficient financing costs' and reflects the prevailing cost of debt in the capital market near the commencement of the regulatory period. This is consistent with the cost of capital being a forward-looking opportunity cost (see section J.1.1).[1518] The trailing average approach can also reflect prevailing market rates because one-tenth of the historical average is updated each year to reflect prevailing market rates (see section J.3.3). However, it is important to transition into this approach in a forward-looking manner using efficient prevailing market rates (as our full transition does). Without this, we would be providing an allowance based on historical costs, which unless by chance, will differ from prevailing (or current) market rates and is therefore not reflective of efficient costs.
Immediately implementing a trailing average (in whole or part) would reduce the ex-post 'mismatch' between the allowed return on debt cash flows and a benchmark efficient entity's actual (historical) debt costs (or cash outflows).[1519]	As discussed in section J.2.1, some mismatch between the allowed return on debt cash flows and a benchmark efficient entity's actual (historical) debt costs is expected under an ex-ante regime and this is consistent with the ARORO. However, we do not consider that removing the realisations of mismatch risk ex-post would meet the requirement to appropriately compensate a benchmark efficient entity (ex-ante) for its efficient financing costs. This is particularly because we ex-ante compensate a benchmark efficient entity for bearing this risk.[1520]

1518 It is useful to note that our trailing average reflects prevailing market rates (in part) because one-tenth of the average is updated each year to reflect prevailing market rates. In this way, a benchmark efficient entity's debt fund under a trailing average approach could be seen as 10 floating rate bonds that are raised on a staggered basis and reset to par every 10 years (see J.3.3 for a mathematical depiction).

1519 ActewAGL, *Appendix 5.01 detailed response to rate of return, gamma and inflation*, January 2016, p. 33; AGN, *Attachment 10.26 response to draft decision: Rate of return*, January 2016, p. 34; AusNet Electricity Services, *Revised regulatory proposal*, January 2016, p. 172; CitiPower, *Revised Regulatory Proposal 2016—2020*, January 2016, p. 341; JEN, *Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, p. 26; Powercor, *Revised regulatory proposal 2016–20*, January 2016, p. 335; United Energy, *Revised regulatory proposal: Response to AER preliminary decision—Re: rate of return and gamma*, January 2016, p. 32.; RBP, Access arrangement revision submission 2017-22, September 2016, p.161; AusNet Services, *Transmission Revenue Review 2017-2022 - Revised Revenue Proposal*, 21 September 2016, p. 138; APA VTS, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

1520 Investors in the service provides we regulate have for many years had allowed debt cash flows set using the on-the-day approach and would have reasonably expected future debt cash flows (and associated risks) consistent with the on-the-day approach. To the extent t these risks were systematic, these would be priced into investors'

	We consider that under ex-ante regulation, we are required to have regard to the desirability of reducing the risk of a mismatch (going forward).[1521] In contrast to what service providers suggest, we are not required to remove a mismatch that has eventuated (ex-post). Ex-post mismatch reflects the realisation of interest rate risk that has already occurred and cannot be hedged.[1522] The equity value of the service providers we regulate should already reflect the value of any losses (or gains) from interest rate movements.[1523] We consider the desirability of reducing mismatch risk is only applicable to new debt. All proposed approaches (immediate, hybrid and full transition) have 10 per cent of the allowed return on debt reset each year (see section J.5.1). Therefore, all proposed approaches should have the same exposure to future interest rate risk and result in the same level of genuine mismatch risk from changes in future interest rates.
An immediate transition to a trailing average is consistent with outcomes in a workably competitive market because unregulated infrastructure businesses tend to hold staggered debt portfolios. That is, because the intent of legislation is to replicate a workably competitive market, an immediate transition is necessary to replicate the (ex-post) cost outcomes that one would expect absent regulation.[1524]	Given the current market (and efficient) cost of debt is below the average market cost of debt over the past ten years, service providers' proposed transition paths would not achieve ex ante efficient compensation in present value terms, based on prevailing efficient market rates. We do not consider this is consistent with any outcome that might be expected in a workably competitive market in general. In workably competitive markets, the costs of new entrants often set prices irrespective of incumbent firms' sunk costs, and the equilibrium is that investments in assets are zero NPV (see section J.3.1). Also, we consider the outcome that the regulated firms are currently seeking is only possible due to their monopoly position in providing essential services (which would not exist in a workably competitive market). Firms have limited bargaining power in a workably competitive market. As such, we do not consider that consumers in a workably competitive market would freely enter into a bargain that would result in an immediate transition. In the current market, this would constitute a change of methodology that materially increases the firm's value at the expense of its consumers.

required cost of equity, and we would compensate service providers for this given by using historical returns to calculate beta. We consider mismatch risk arises from interest rate risk because any difference between a benchmark efficient entity's costs of servicing its debt and the allowed return on debt is a function of unforeseen interest rate movements.

1521 NER, cl. 6.5.2(k)(1); NER, cl. 6A.6.2(k)(1); NGR, cl. 87(11)(a).

1522 As noted by SFG, it is not possible to hedge historical interest rates as businesses cannot access historical rates at the time they issue new debt (see SFG, *Rule change proposals relating to the debt component of the regulatory rate of return*, August 2012, pp. 32, 45). Similarly, Partington and Satchell stated, 'Once the change in value has occurred the original event cannot be hedged. We cannot change the past. Hedges have to be put in place before the events to be hedged have occurred' (Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 34).

1523 Partington and Satchell state '…changes in the value of a regulated firm's debt portfolio value occur when the market interest rates change. These changes lead to increases or decreases in the market value debt, which in turn affect the market value of the equity of the regulated firm at the same time as the market value of the debt changes' (see Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, p. 34). We also note the firms we regulate generally account for gains or losses from interest rate movements in their financial accounts where they use fair value accounting. See for example APA Group, *Annual report 2015*, p. 64; DUET Group, *Financial report 2015*, p. 63, Spark Infrastructure, *Annual Report 2013*, p. 62.

1524 ActewAGL, *Appendix 5.01 detailed response to rate of return, gamma and inflation*, January 2016, pp. 4–5,18; AGN, *Attachment 10.26 response to draft decision: Rate of return*, January 2016, p. 6; APA Group, *Amadeus Gas Pipeline access arrangement information*, January 2016, p. 24; AusNet Electricity Services, *Revised regulatory proposal*, January 2016, p. 144–5; CitiPower, *Revised Regulatory Proposal 2016—2020*, January 2016, p. 264–5; JEN, *Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, p. ix–x; Powercor, *Revised regulatory proposal 2016–20*, January 2016, pp. 258–259; United Energy, *2016 to 2020 revised regulatory proposal*, January 2016, p. 76–8.

CEG advised that incentives created by the on-the-day regime may not have resulted in efficient financing practices and may not be commensurate with 'efficient financing costs' referenced in the ARORO.[1525]	We observe that CEG did not indicate what it considered 'efficient financing costs' meant in the context of the ARORO. As explained in section J.2, we consider efficient financing costs in the context of the ARORO mean we must provide a benchmark efficient entity with ex ante efficient compensation in present value terms, based on prevailing efficient market rates. We consider our transition approach achieves this. Further, we consider an interpretation of the ARORO that leads to materially higher (or lower) compensation (in present value terms) is inconsistent with achieving efficient investment and the objectives of the NEL/NGL.
The AER should define a benchmark efficient entity as unregulated rather than regulated.[1526] An unregulated benchmark efficient entity is consistent with the intent of the law to replicate workably competitive market outcomes.	We consider a benchmark efficient entity is to be taken as having "a similar degree of risk" as that which applies to the particular service provider in providing its reference services.Seeking to replicate the outcomes of a workably competitive market does not require defining a benchmark efficient entity as unregulated. Rather, it requires that we replicate the efficiency outcomes that we would expect under a workably competitive market (and the resulting prices and service levels).[1527] We consider our approach preferable for achieving efficiency outcomes expected in a workably competitive market. We consider our approach will promote productive efficiency because it is not expected to over- or under-compensate a benchmark efficient entity for its efficient cost of debt capital. This should also reduce regulatory uncertainty. We consider our approach will promote dynamic efficiency as we have designed our full transition so that methodological changes do not affect the value of the investment. This allows the investment to be appropriately valued to avoid directing excessive or insufficient resources towards network investment. Similarly, this promotes allocative efficiency by avoiding greater or fewer consumer resources being directed towards network investment than what consumers are willing to pay (thus maximises social welfare and allocative efficiency).
Efficient financing costs are properly identified by reference to financing	We do not consider a benchmark efficient entity's past financing practices determine its efficient financing costs (although we note we benchmark current

[1525] CEG, *Critique of the AER's approach to transition*, January 2016, p. 1.

[1526] ActewAGL, *Appendix 5.01 detailed response to rate of return, gamma and inflation*, January 2016, p. 19; AGN, *Attachment 10.26 response to draft decision: Rate of return*, January 2016, p. 25; APA Group, *Amadeus Gas Pipeline access arrangement information*, January 2016, pp. 79–81; AusNet Electricity Services, *Revised regulatory proposal*, January 2016, p. 7-21; CitiPower, *Revised Regulatory Proposal 2016—2020*, January 2016, p. 331; JEN, *Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, p. 16; Powercor, *Revised regulatory proposal 2016–20*, January 2016, p. 325; United Energy, *2016 to 2020 revised regulatory proposal*, January 2016, p. 22.; RBP, Access Arrangement revision submission, September 2016, p.159; AusNet Services, *Transmission Revenue Review 2017-2022 - Revised Revenue Proposal*, 21 September 2016, p. 155; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p. 180.

[1527] The basis for desiring a competitive market outcome in microeconomic theory stems from the theorems that a competitive equilibrium is Pareto-efficient and any Pareto-efficient allocation can be decentralised as a competitive equilibrium. This is where, in microeconomic theory, a 'competitive market equilibrium' is where firms' maximise their profits, consumers maximise their utilities and the market clears (there is no waste or undersupply). See Mas-Colell, A., Whinston, M.D., Green, J.R., *Microeconomic theory*, Oxford University Press, 2006, p. 314. It is worth noting that these theorems are derived from strong assumptions including an absence of externalities and market power, price taking behaviour and symmetric information. See for example Varian, H.R., *Intermediate micro economics: A modern approach*, ed. 7, W.W. Norton &Company, 1987, pp. 585; Hindriks, J., Myles, G.D., *Intermediate public economics*, The MIT Press, 2006, pp. 12–13.

practices that would be adopted in workably competitive markets.[1528]		gearing, credit rating and debt term at issuance in determining a benchmark efficient entity's ex ante efficient allowed return on debt). Rather, we consider achieving the ARORO requires a benchmark efficient entity be ex-ante appropriately compensated for its efficient financing costs in present value terms, where efficient financing costs are based on prevailing market rates (see section J.2.1). However, we consider what may be a reasonable benchmark efficient financing practice (under a given regulatory approach) in having regard to the likelihood of an ex-post mismatch between a benchmark efficient entity's actual debt costs and the regulatory debt allowance (as the rules require). We discuss this in more detail below under 'Proposals for a hybrid approach based on partial hedging'. We note that Partington and Satchell also advise against interpreting the efficient financing costs as relating to some assumed financing strategy. They state a number of reasons to support their view, including that what constitutes a benchmark efficient financing practice is ambiguous.[1529]

Source: AER analysis, service providers' proposals and supporting material.

Response to CEG's report

APTPPL and APA proposed to adopt an immediate transition to the trailing average approach in their initial proposals.[1530] APA VTS and APTPPL argue that they have not raised debt differently in response to the previous "on the day" approach to estimating the regulatory allowance for the return on debt. Rather, they submit they hold efficient trailing averages already and therefore their financing cost structure can be readily applied to the trailing average approach and no transition is required.[1531] As the service providers operate under an ex-ante regulatory regime, we consider the ARORO requires us to provide ex-ante efficient compensation rather than compensating for historically incurred costs. Investors have invested accepting the interest rate risk from the on-the-day approach and we have already compensated the services providers using the approach for bearing this risk. If we move to a trailing average approach without a transition, it would effectively remove realised losses or gain from interest rate risk that it had previously borne. Critically, it would also set an allowed rate of return above efficient financing costs and thereby not contribute to achieving the ARORO or the NEO.

1528 ActewAGL, *Appendix 5.01 detailed response to rate of return, gamma and inflation*, January 2016, pp. 34–35; AGN, *Attachment 10.26 response to draft decision: Rate of return*, January 2016, pp. 35–36; AusNet Electricity Services, *Revised regulatory proposal*, January 2016, pp. 7-32–7-33; CitiPower, *Revised Regulatory Proposal 2016—2020*, January 2016, p. 343; JEN, *Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, p. 28; Powercor, *Revised regulatory proposal 2016–20*, January 2016, p. 337; United Energy, *2016 to 2020 revised regulatory proposal*, January 2016, p. 33.

1529 See Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 15–27.

1530 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p. 160; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

1531 RBP, *Access arrangement submission 2017-22*, 16 September 2016, p. 160; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

We also repeat our response released in April 2017 to AusNet's revised transmission proposal and the report by CEG on the AER's current interpretation of the ARORO submitted by AusNet with its revised revenue proposal given that we have considered this material in reaching this draft decision. [1532]

In the new report for AusNet transmission, CEG critiqued the AER's approach and rational for a full transition to a trailing average cost of debt and stated that it does not believe that the AER's 2016 interpretation is consistent with a reasonable economic interpretation of the ARORO.[1533] CEG proposed that the correct approach to determine the allowed rate of return on debt is an approach that results in a match to the BEE's efficiently incurred financing costs.

We do not agree with CEG. We consider our interpretation of an allowed rate of return that compensates investors on their capital investments (in an ex-ante sense) and aims to minimise the long run cost of capital is consistent with the ARORO. We consider ex-ante efficient compensation should result in the ex-ante allowed return on capital cash flows having a present value equal to the present value of the ex-ante efficient cost of capital cash flows required to finance the regulatory asset base (RAB). In that sense, we must set allowances with a present value equal to the present value of future efficient costs.[1534] This is a zero net present value (NPV) investment condition. The theory of finance is that in computing the weighted average cost of capital for use in NPV calculations it is the current required returns on debt and equity (forward looking) that should be used for the WACC, instead of the historical values. We consider that the continuation of the on the day approach is revenue neutral in a present value sense and would contribute to the achievement of the ARORO. As discussed in section J.3, a revenue neutral transition will also contribute to the achievement of the ARORO. However, we do not consider a change in methodology that results in material wealth transfers will contribute to the achievement of the ARORO. For this reason, we consider a full transition is required if there is a change in methodology from on-the-day approach to trailing average approach.

Table 3-36 sets out the key issues raised by CEG in its September 2016 report. We sought advice from Partington and Satchell and provide a summary of our responses in the table below.[1535]

Table 3-36 Key issues raised by CEG

Issue	Summary of response
The AER's application of the NPV=0 condition in	With respect to the cost of debt, it is the current cost of debt (as

[1532] CEG, *The AER's current interpretation of the ARORO*, September 2016

[1533] CEG, *The AER's current interpretation of the ARORO*, September 2016, p.3.

[1534] See SFG, Preliminary analysis of rule change proposals: Report for AEMC, February 2012, p. 41; Brennan, Depreciation, investor compensation and, welfare under rate-of-return regulation, Review of industrial organisation, 1991, 6, p. 75. In his article, Brennan stated, 'With regard to investor compensation, the basic goal of regulation is to give investors an income stream just sufficient to cover the costs of their assets, and no more'.

[1535] More detailed responses with relevant supporting references are contained in text below the table.

the AusNet Services draft decision only holds if you assume a BEE has no debt at the commencement of the regulatory control period[1536]	currently required in the market) that should be used in the WACC to calculate the NPV, not the historic cost of debt. This is basic valuation theory in corporate finance text books. The AER's application of the NPV=0 condition holds regardless of the debt held by a BEE before the commencement of the regulatory control period or the access arrangement period. Appropriate regulatory compensation is about setting allowances with a present value equal to the present value of future efficient costs.
Mismatch risk is correctly defined as "regulatory risk' and not 'interest rate risk'. The implication is to reduce regulatory risk we must set allowed debt costs to match historically incurred debt costs.[1537]	CEG is incorrect in defining mismatch risk as regulatory risk. We consider mismatch risk under the on the day approach flows from unexpected changes in interest rates. This is agreed by our consultants.[1538] In competitive market, the equilibrium is achieved by setting product prices that result in zero NPV investments. In achieving the competitive equilibrium, the allowed rate of return should be set at the current cost of capital, which may not match the historical costs. This gives rise to interest rate risk, the risk associated with a mismatch between the allowed return on debt and a BEE's actual return on debt. [1539] However, we agree with our consultants that changes in the method for determining compensation for the cost of debt may give rise to regulatory risk; however the risk may apply either to the regulated entities, or to the consumers. In the case of a switch to a trailing average approach, there may be risk for some regulated entities in that their preferred financing strategy changes and there is a cost in switching. There is also regulatory risk and cost to consumers in that, under the trailing average approach, they are effectively guaranteeing revenue to pay the historic cost of debt. A cost arising from that guarantee will arise immediately under a switch to the historic trailing average (without a transition) as consumers will find themselves paying the premium of historic rates over current rates (historic rates are much higher than the current rates)[1540].
The use of a trailing average will provide better investment incentives than prevailing rates.[1541]	The trailing average reflects historic interest rates and only by chance this will reflect the current required return on debt. Our consultants consider that since the trailing average is unlikely to reflect current required return, then by definition it will not give the correct signal with respect to the desirability of investments. In other words, they consider it is inappropriate for the computation of an investment's NPV to be based on historic rates and consider that if the allowed rate of return is based on the historic cost of debt (calculated using a trailing average approach), it is likely to result in either understatement or overstatement of the current required rate of return. They consider this will lead to either an understatement or overstatement of allowable revenue, which will

[1536] CEG, *the AER's current interpretation of the ARORO*, September 2016, p. 36.

[1537] CEG, *the AER's current interpretation of the ARORO*, September 2016, p. 48.

[1538] Graham Partington and Stephen Satchell*, Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p.25.

[1539] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p.26.

[1540] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p.26.

[1541] CEG, *the AER's current interpretation of the ARORO*, September 2016, p. 32.

	in turn provide incentives for underinvestment and overinvestment respectively[1542]. Thus, they do not consider the use of a trailing average will provide better investment incentives than the use of the prevailing rate. They note that SFG (for the AEMC) and others have expressed the same view that the on the day rate is likely to provide better investment incentives. Having considered our consultants' views we remain of the view that the trailing average (implemented with full transition) will promote relatively efficient investment signals as cash flows with the correct present value are obtained over the life of the asset. To the extent the investment incentives are inferior to those obtained under the on the day approach, we consider the benefits of the trailing average (implemented with full transition) still warrant its use.
ARORO arguably requires compensation to match the BEE's efficiently incurred financing costs regardless of efficiency[1543]	CEG, APTPPL and APA VTS refers to historic financing costs as efficient financing costs, which we do not agree with. We consider efficient financing costs should be defined on an ex-ante or forward looking basis and should reflect the current cost of capital. The current cost of capital is the opportunity cost that investors currently demand in order to buy a firm's securities. We consider compensations based on historic financing costs are not reflective of efficient financing costs. If there was a change in methodology from using on the day approach to trailing average approach, we consider a full transition is required to meet the ARORO and the objectives of the NEL/NGL. A full transition is revenue neutral in a present value sense (shown in section H.7.3 in the AER draft decision)
The AER has changed its definition/approach to the NPV=0 condition[1544]	We consider the approach we are currently adopting to the NPV=0 condition, which is ex-ante efficient compensation should result in the ex-ante allowed return on capital cash flows having a present value equal to the present value of the ex-ante efficient cost of capital cash flows required to finance the regulatory asset base (RAB), is consistent with a reasonable interpretation of the ARORO. This is supported by our consultants.[1545]
The mathematical proof under the AER's assumption that allowed rates of return are based on a 5 year horizon is invalid given that the AER compensates debt based on a 10 year horizon[1546]	We consider this is not a valid criticism. As long as the allowed rate of return in the cash flows is equal to the discount rate used, the RAB at time t+5 should be the same as at time t. We consider our allowed return estimated based on debt with a 10 year maturity should approximately achieve this for the reasons set out in our decision. The algebra from our consultants is provided below.

In the report to the AER, Partington and Satchell expressed their view that a trailing average is inferior to the on the day approach in terms of an efficient investment incentive.[1547] They proposed that the trailing average is likely to be an incentive for

[1542] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p.16.

[1543] CEG, *the AER's current interpretation of the ARORO*, September 2016, pp. 27-28.

[1544] CEG, *the AER's current interpretation of the ARORO*, September 2016, p. 27; RBP, *Access arrangement submission 2017-22*, 16 September 2016, p. 160; APA, *Victorian Transmission System Access Arrangement Submission*, January 2017, p.181.

[1545] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt,*9 April 2017, p.11.

[1546] CEG, *the AER's current interpretation of the ARORO*, September 2016, p. 40.

[1547] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*,9 April 2017, p. 19.

inefficient investment and the generation of economic rents[1548], as we discussed in J.2.3 above. Moreover, Partington and Satchell also pointed out that the cost of equity should be adjusted downwards if a trailing average approach is adopted, otherwise the regulated entities would be likely to be overcompensated and there would be an incentive to overinvestment. They stated:[1549]

> "Setting the allowed return by using the historic cost of debt and weighting by the amount of financing undertaken substantially reduces the risk of leverage while retaining the benefits. A key effect of leverage for equity holders is to increase the volatility of returns. The equity holders gain from higher returns when the return on debt financed assets exceeds the cost of debt and lose when the return on debt financed assets is less than the cost of debt. The latter risk of loss is reduced if the allowed return is set using the historic cost of debt and more so if the weighting is by the amount of financing undertaken. The volatility of equity returns would be reduced and a consequence of this would be that equity betas would come down. Thus a reduction in the allowed cost of equity would be warranted. If this reduction were not made the regulated entities would be likely to be overcompensated and so there would be an incentive to overinvestment."

While we note Partington and Satchell's concerns, we remain of the view that a trailing average (implemented with full transition) will result in reasonably efficient investment incentives. We also note that the use of a trailing average will smooth price volatility for consumers moving forward.

While we acknowledge the introduction of a trailing average may reduce regulated firms default risk and equity beta, we consider material changes in risk should be reflected in benchmarked cost of capital parameters in the future. To the extent this occurs this benefit may flow through to consumers in the form of lower allowed rates of return in future revenue determinations.

Response to CEG's criticism on the AER's application of the NPV=0 condition

We agree with our consultants that the zero net present value (NPV) investment condition has two important properties. First, a zero NPV investment means that the ex-ante expectation is that over the life of the investment the expected cash flow from the investment meets all the operating expenditure and corporate taxes, repays the capital invested and there is just enough cash flow left over to cover investors' required return on the capital invested. Second, by definition a zero NPV investment is expected to generate no economic rents. Thus, ex-ante no economic rents are expected to be extracted as a consequence of market power. The incentive for investment is just right,

[1548] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*,9 April 2017, p. 19.

[1549] Partington, G., Satchell, S., *Report to the AER: Issues in relation to the cost of debt*,9 April 2017, p. 20.

encouraging neither too much investment, nor too little. [1550] This is basic theory of business finance.

Partington and Satchell consider that the allowed rate of return should be the rate of return consistent with regulated assets being a zero NPV investment. The theory of finance (and common practice) is that in computing the weighted average cost of capital (WACC) for use in NPV calculations it is the current required returns on debt and equity that should be used.[1551]

We agree with Partington and Satchell that efficient debt financing costs reflect prevailing market rates and investment in regulated firms should be a zero NPV activity. Given this, we consider the trailing average must be estimated based on prevailing rates (i.e. implemented in a forward looking manner) to ensure a zero NPV condition is maintained.

CEG claims the AER's view is the zero NPV investment condition is based on the present value of cash flows ‘before efficiently incurred debt financing costs are removed’.[1552] It then claims that ‘the AER’s new NPV condition assumes zero debt financing at the commencement of the regulatory control period’.[1553] We agree the NPV calculation should be performed on total cash flows to capital before debt financing costs are removed. This is supported by our consultants. However, we disagree with CEG that this assumes no debt financing at the commencement of the regulatory control period. As explained above, we consider it is the current required returns on debt rather than the historical cost of debt that is relevant in NPV calculation. We consider our zero NPV condition is consistent with well accepted finance theory and holds even if a benchmark efficient entity has outstanding debt. This is supported by our consultants. Partington and Satchell argue that if debt financing costs were to be removed from the cash flow before computing the present value of the cash flow, you would be left with the cash-flow to equity. The cash flow to equity would appropriately be discounted at the current cost of equity to give the market value of equity. While the debt financing cash flows would be discounted at the current cost of debt to give the market value of debt. These two values add together would be exactly the same as the value obtained by valuing the cash flows before “debt financing costs are removed” by discounting at the WACC based on the current costs of debt and equity. [1554]

We also agree with Partington and Satchell that any shifts in the value of assets and liabilities occurs at the time interest rate changes and would give rise to (immediate)

[1550] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 11.

[1551] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 12.

[1552] CEG*, the AER’s current interpretation of the ARORO*, September 2016, p. 14.

[1553] CEG*, the AER’s current interpretation of the ARORO*, September 2016, pp.15-16.

[1554] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 13.

gains or losses to the debtholders and shareholders. Consequently, at the start of the next regulatory period, the effect of interest rate shifts will already have been fully reflected in the equity market value of the entity undertaking the investment.[1555] Therefore, we consider our application of the NPV=0 condition holds for a BEE with debt financing at the commencement of the regulatory control period.

Partington and Satchell further emphasise the appropriate discount rate in computing the NPV as the opportunity cost of capital to support the points made above. [1556] The current required rates of return on a firm's asset should be equal to the rate of return that is currently offered in the capital market by securities of equivalent risk to the asset in equilibrium. If the return on the regulated asset is lower than the return on the equivalent risk securities, investors will prefer to invest in other securities rather than the regulated asset. Hence, the prevailing cost of capital from securities with the same risk as the regulated asset should be set as an allowed rate of return as it gives the opportunity cost of capital . Partington and Satchell also note that it is well understood that in a competitive industry the competition drives the prices of the goods produced to an equilibrium where investment is a zero NPV activity.[1557] Partington and Satchell also point out that in markets where producers have significant monopoly power this competitive equilibrium will not prevail unless there is a regulator who sets an allowed rate of return that result in zero NPV investments.[1558]

The validity of the AER's mathematical proof

CEG proposed that the mathematical proof under the AER's assumption that allowed rates of return are based on a 5 year horizon is invalid given that the AER compensates on a 10 year horizon for the cost of debt.[1559] To address this issue we sought advice from our consultants. They provided the mathematical proof and explanation below:[1560]

Let N be the regulatory period, t is the current time, let c be the allowed rate of return and r the discount rate, both known at time t. Let K_t be the RAB at time t.

Let PV_t be the present value of an investment at time t; let CF_t be the net operating cash flow for year t. The present value equation is that:

$$PV_t = E_t\left(\sum_{s=t+1}^{t+N} \frac{CF_s}{(1+r)^{s-t}} + \frac{K_{t+N}}{(1+r)^N}\right) \qquad (1)$$

[1555] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 16.

[1556] Graham Partington and Stephen Satchell, Report to the AER: Issues in Relation to the Cost of Debt, 9 April 2017, p. 13.

[1557] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 13.

[1558] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 13.

[1559] CEG, *the AER's current interpretation of the ARORO*, September 2016, p. 40.

[1560] Graham Partington and Stephen Satchell, *Report to the AER: Issues in Relation to the Cost of Debt*, 9 April 2017, p. 22.

Consistent with the AER's assumptions in H7.3, we make the following two assumptions:

Assumption 1: We shall assume that CF_s= cPV_t; s=t+1,...,t+N.

Assumption 2: We shall assume that K_{t+N} = PV_t

Theorem. If equation 1 holds as well as Assumptions 1 and 2, then c = r.

Proof.

Under the above assumptions, nothing is stochastic at time t; so we can drop the expected value operator. Equation 1 becomes, letting a = $\frac{1}{(1+r)}$

1 = c$\left(\frac{a-a^{N+1}}{1-a}\right) + a^N$; simplifying, we see that

$1 - a^N = c\left(\frac{a-a^{N+1}}{1-a}\right) = ca\left(\frac{1-a^N}{1-a}\right)$,

as long as r>0, a<1

We can cancel $1 - a^N$ and 1= $c\left(\frac{a}{1-a}\right)$,

c = $\frac{1-a}{a}$ = $\frac{1-\frac{1}{(1+r)}}{\frac{1}{(1+r)}}$. We multiply top and bottom by 1+r,

c=$\frac{1+r-1}{1}$=r

This proof demonstrates that if the discount rate is equal to the 5 year rate at the beginning of the regulatory period, then the RAB at time t+5 will be the same as at time t as long as the allowed rate of return in the cash flows is equal to the 5 year rate. The same property will be true if we use the 10 year rate to discount cash flows with as long as the allowed rate of return in the cash flows is equal to the discount rate used. Also the value of N is arbitrary, so the above would be true if the regulatory period is five years, or ten years, or some other period.

It would matter, however, if we used the 10 year rate for discounting and the 5 year rate for the allowed rate of return in the cash flows (or vice-versa) and, because the term structure had appreciable slope, these two numbers were notably different. However, our use of a 10 year return on debt does not imply an allowed return materially above the appropriate discount rate, particularly given we do not explicitly provide allowances for certain costs as we noted in footnote 1106 of our draft decision for AusNet Transmission.[1561] Our commentary on this point was also noted by our consultants.[1562]

Having fully considered CEG's arguments and sought and received advice on the matter, we remain of the view our mathematical proof is valid in demonstrating why a full transition is necessary to achieve the ARORO.

Proposals for a hybrid approach based on partial hedging

Several service providers previously submitted that if we do not accept their first preference to adopt an immediate transition, we should apply a hybrid transition based on the assumption that a benchmark efficient entity would only have hedged one third of the base rate in response to previous regulatory decisions.[1563] We are not satisfied that this ultimately has a material effect on what we consider to be a key factor that we must have regard to when setting the return on debt, namely, the need to promote efficient investment under the NGO having regard to each of the Revenue and Pricing Principles. This is encapsulated in the NPV=0 consideration and the need to set ex ante efficient allowances to achieve this outcome (explained in section J.2.1)

Nevertheless, we make these observations. First, observed practices of regulated energy network firms appear more consistent with a benchmark assumption of 100 per cent hedging than one third hedging (of the base rate). For example, in the 2009 WACC review, we observed that Treasurers' statements and Macquarie Research indicated that typically businesses hedged the base interest rate risk for nearly 100 per cent of their debt portfolios at the time of the regulatory reset.[1564] More recently, we collected return on debt data from a number of regulated energy network service providers. This data corroborated our findings from the 2009 WACC review.[1565] Recent annual reports also show similar findings.[1566]

[1561] AER, *Draft decision, AusNet Services Transmission Revenue Review 2017-2022, Attachment 3–Rate of return*, July 2016. p. 276.

[1562] Graham Partington and Stephen Satchell, Report to the AER: Issues in Relation to the Cost of Debt, 9 April 2017, p. 22.

[1563] ActewAGL, *Appendix 5.01 detailed response to rate of return, gamma and inflation*, January 2016, p. 19; AGN, *Attachment 10.26 response to draft decision: Rate of return*, January 2016, p. 25; AusNet Electricity Services, *Revised regulatory proposal*, January 2016, p. 7-21; CitiPower, *Revised Regulatory Proposal 2016—2020*, January 2016, p. 331; JEN, *Attachment 6-1 rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, p. 16; Powercor, *Revised regulatory proposal 2016–20*, January 2016, p. 325; United Energy, *2016 to 2020 revised regulatory proposal*, January 2016, p. 22.

[1564] AER, *Review of WACC parameters: Final decision*, May 2009, p. 153; AER, *Review of WACC parameters*: *Explanatory statement*, December 2008, pp. 103–104.

[1565] Chairmont, *Financing practices under regulation: Past and transitional (Confidential)*, October 2015, pp. 73–80.

[1566] See for example APA Group, *Annual report 2015*, p. 14; DUET Group, *Financial report for year ended 30 June 2015* , p. 61; Envestra Ltd, *2014 annual report*, p. 26; Envestra Ltd, *Directors' and financial report*, 30 June 2014, p. 27; AusNet Services, *Statutory annual report 2015: We move energy*, p. 36; SP AusNet, *Business review 2014: SP AusNet Distribution financial report*, Note 19, p. 11; Spark Infrastructure, *The Australian infrastructure network*

Second, we do not consider an on-the-day approach would require compensation for swap transaction costs. Several service providers have previously proposed to add an allowance for swap transaction costs to their return on debt each year if a hybrid transition (full or partial) is used.[1567] This is in line with CEG's advice (or references to Chairmont).[1568] We note that service providers in prior decisions requested this allowance if we apply a hybrid transition to a trailing average.[1569] We maintain our view from our recent decisions.[1570] That is:

- We are not satisfied that customers should pay for the service providers' reduction in interest rate risk that results from hedging undertaken in the past. CEG in its January 2016 report disputed our reference to a NERA report supporting this view because it considered the reference is only relevant under the old rules. CEG considered the current rules require a benchmark efficient entity to be compensated for the costs associated with its debt financing strategy.[1571] We disagree. We consider a rate of return that meets the ARORO must provide for ex-ante efficient compensation (see section J.2), and this view does not invalidate our reference to the NERA report.
- Similarly, Partington and Satchell do not consider the transaction costs of hedging to be part of the efficient financing costs of a benchmark efficient entity that should be compensated for through the return on debt allowance. They consider hedging is a choice and firms will rationally choose to hedge when the benefits outweigh the costs, stating that this 'suggests the costs are covered by the value enhancement that results'.[1572]
- We agree with Lally's advice that hedging would have been self-funding because the saving in converting 10 year debt into five year debt would have offset the cost of the hedge. Moreover, there is wide support for the view that interest rates on longer-term debt securities are often higher than those on shorter-term debt

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specialists: Annual report 2014, p. 7 (Spark does not currently engage in interest rate hedging, but over the previous two years have hedged almost 100% of their debt).

1567 JEN, *Revised regulatory proposal: Attachment 6-1 Rate of return, gamma, forecast inflation, and debt and equity raising costs*, January 2016, pp. 35, 41. See ActewAGL, *Revised access arrangement proposal: Appendix 5.01—Detailed response to rate of return, gamma and inflation*, January 2016, pp. 43, 45; AGN, *Revised access arrangement proposal: Attachment 10.26—Response to draft decision: Rate of return*, January 2016, pp. 9–10, 37–40, 87; CitiPower, *Revised regulatory proposal*, January 2016, p. 349–351; Powercor, *Revised regulatory proposal*, January 2016, pp. 343–345.

1568 Chairmont, *ERA Hedging costs in the cost of debt*, 13 May 2015; CEG, *Critique of the AER's approach to transition*, January 2016, pp. 63–64; CEG, *Memo– September 2015 cost of debt and inflation forecasts*, 5 January 2016.

1569 On this basis, some service providers do not propose swap transaction costs. APTNT, *Amadeus Gas Pipeline access arrangement revised proposal: Response to draft decision*, January 2016; and United Energy, *Regulatory proposal*, April 2015 do not mention swap transaction costs. AusNet Services, *Revised regulatory proposal*, January 2016, p. 7-37 specifically stated it does not propose swap transaction costs because it proposes an immediate transition to a trailing average.

1570 See, for example, AER, *Draft decision: Australian Gas Networks access arrangement 2016 to 2021*, November 2015, section G.1.6, p. 581.

1571 CEG, *Critique of the AER's approach to transition*, January 2016, p. 1.

1572 Partington, G., Satchell, S., *Report to the AER: Discussion of the allowed cost of debt*, 5 May 2016, pp. 27, 31.

securities.[1573] Therefore, even if we are incorrect in assuming hedging costs do not need compensation, we have effectively provided an allowance for these costs by using a ten year term on the base rate.

[1573] See, Peirson, Brown, Easton, Howard, Pinder, *Business Finance*, McGraw-Hill, Ed. 10, 2009, p. 95. Also see AER, *Rate of return guideline: Explanatory statement*, December 2013, pp. 138–139; NSW DNSP, *Submission on the rate of return draft guideline*, 11 October 2013, pp. 16–17; Ergon Energy, *Submission on the draft rate of return guidelines and explanatory statement*, 11 October 2013, p. 5; ENA, *Response to the draft rate of return guideline*, 11 October 2013, pp. 58–60.

K Return on debt implementation

This section sets out our detailed analysis of the key issues raised by stakeholders relating to the implementation of the return on debt approach. The analysis is set out in the following sections:

- criticisms of our current approach
    - CEG's curve criteria
    - issues with the RBA curve
    - the issue of sample size
    - the Asciano, Mirvac and Jemena bonds
    - conservativeness of the current approach
- the Thomson Reuters curve
- other issues
    - choice of extrapolation method
- credit rating

Importantly, we must be satisfied that the approach that we adopt will continue to contribute to estimates which achieve the allowed rate of return objective for each annual update over the five year regulatory period. For this reason, we consider it is most critical that the approach we adopt is reasonable and fit for purpose over an extended period. At any point in time, it is possible that one curve or the other will better reflect the costs of the benchmark entity. However, for the reasons set out in this and previous decisions, we are not satisfied that there is a robust means to quantitatively identify which of the curves is the best match. For this reason, our detailed analysis and expert advice focused on the underlying characteristics of the curve, their fitness for purpose, and their representativeness of the benchmark efficient entity. Having done so, we remain satisfied that a simple average of the BVAL and RBA curves will contribute to an estimate that achieves the allowed rate of return objective.

We note that APTPPL seeks to adopt an approach of using the RBA curve only, which is different from our current approach. We consider it is necessary to include the analysis and reasoning for why we adopted our current approach in the appendix. We also included the material submitted by AusNet and Multinet who have proposed departures from our current approach to estimating the cost of debt. We consider it is necessary to include this material and the responses to the material given we have considered it in reaching our final decision for APTPPL.

K.1 Criticisms of our current approach

The following section details our response to material presented by AusNet in its initial proposal.

K.1.1 Using appropriate criteria

We consider that decisions on the rate of return are more likely to achieve the allowed rate of return objective if they use estimation methods, financial models, market data and other evidence that are:[1574]

(1) where applicable, reflective of economic and finance principles and market information

(a) estimation methods and financial models are consistent with well accepted economic and finance principles and informed by sound empirical analysis and robust data

(2) fit for purpose

(a) the use of estimation methods, financial models, market data and other evidence should be consistent with the original purpose for which it was compiled and have regard to the limitations of that purpose

(b) promote simple over complex approaches where appropriate

(3) implemented in accordance with good practice

(a) supported by robust, transparent and replicable analysis that is derived from available credible datasets

(4) where models of the return on equity and debt are used these are

(a) based on quantitative modelling that is sufficiently robust as to not be unduly sensitive to errors in inputs estimation

(b) based on quantitative modelling which avoids arbitrary filtering or adjustment of data, which does not have a sound rationale

(5) where market data and other information is used, this information is

(a) credible and verifiable

(b) comparable and timely

(c) clearly sourced

(6) sufficiently flexible as to allow changing

These criteria are in the rate of return guideline and have been through a rigorous consultation process. When making our decisions we are required to have regard to

[1574] AER, *Better Regulation: Explanatory statement—Rate of return guideline*, December 2013, pp. 23–24.

the revenue and pricing principles. We have to give consideration to the need for network service prices and charges to provide returns commensurate with both regulatory and commercial risks involved in providing the services. We must also have regard to the economic risks of under or over investment. We seek to minimise regulatory uncertainty through consistency in the application of our regulatory approaches, after having undertaken rigorous consultation and testing of those approaches.

We are not persuaded by the methodology to assess curves adopted by CEG and included as part of AusNet's initial proposal.[1575] This particular weighting appears arbitrary and is based on qualitative criteria set out by CEG which do not appear to improve on or replace the set of principles that were set out in the Guideline and consulted on more widely.[1576] As noted recently by the Tribunal in relation to the choice of data sets adopted in our guideline:

> The AER had a choice to make as to what data services, or combination of data services, it should use. Its reasons for selecting the combination of data services are cogent, and reasonable. It is not shown to have misunderstood or overlooked material information. Although there are facts underlying the choice of the AER, the Tribunal is not persuaded of any particular material factual finding which is different from those made by the AER. For the purposes of the relevant Final Decisions, the AER does not positively find that the RBA curve was clearly superior to the BVAL curve, so that its averaging of the two curves was an acceptable measure of the DRP.[1577]

We remain satisfied that our criteria developed and applied in the Guideline and subsequent decisions remain fit for purpose. Further, we are satisfied that application of these criteria will contribute to estimates that will achieve the allowed rate of return objective.

K.1.2 Issues with the RBA curve

Overall, we remain unpersuaded that either the BVAL or RBA curve is clearly superior for the purposes of estimating the return on debt required to achieve the ARORO.

In making our decisions to adopt a simple average of the BVAL and RBA curves, we have consistently identified that both curves exhibit both strengths and weaknesses. The submissions made by AusNet Services have focussed primarily on alleged shortcomings in the BVAL curve. However, in our view these submissions have not fully engaged with the shortcomings of the RBA curve. Below, we discuss:

1575 CEG, *Criteria for assessing fair value curves, January 2016*, p. 55.

1576 AER, *Better Regulation: Explanatory statement—Rate of return guideline*, December 2013, pp. 23–24; AER, *Preliminary decision— Ausgrid —Attachment 3—Rate of return*, April 2015, p. 197pp. 320–322 ; CEG, *Criteria for assessing fair value curves*, January 2016, p. 17.

1577 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, February 2016, para. 983.

- Difficulties with relying on foreign bonds
    - Data quality of Australian bonds denominated in other currencies
    - Bloomberg and Thomson Reuters both exclude foreign denominated data
    - Failure of covered interest parity
- Monthly publication
- Inclusion of bonds with embedded options
- Inclusion of secured bonds.

Overall, our view remains that both the Bloomberg and RBA curves have strengths and weaknesses. However, we note that in many cases the Bloomberg and Thomson Reuters curves adopt similar bond selection criteria, and that both of these providers differ materially from the RBA bond selection criteria. While neither set of criteria is clearly superior, our confidence in the BVAL criteria and the view the RBA is not superior in this regard, is reinforced by the similarities between the approaches adopted by these independent commercial providers of yield curve estimates.

Difficulties with relying on foreign bonds

AusNet Services and CEG have submitted that the RBA curve is a clearly better fit to the benchmark efficient entity due to its relatively high composition of foreign bonds matching historical patterns of issuance.[1578] However, we are not persuaded by this analysis. While we agree there is evidence that the benchmark efficient entity may issue some or a large proportion of its debt in foreign markets, the RBA curve is affected by the issues raised below.

Data quality of Australian bonds denominated in other currencies

In making our initial decision to rely on the BVAL and RBA curves we considered expert evidence from both Lally and the ACCC Regulatory Economics unit (ACCC REU).[1579] In particular, Lally observed that that the Queensland Treasury Corporation, who raise debt finance, have identified that secondary market activity in these bonds is low and that most of the data is only "indicative non-binding bid and offer quotes".[1580] Where bonds are traded infrequently, the pricing data becomes 'stale' and is less likely to be reliable.

Bloomberg addresses these data-quality issues by the inclusion of a filter based on BVAL scores. The BVAL score is a proprietary measure of the amount and consistency

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[1578] AusNet Services Group, *Gas Access Arangement Review 2018-2022: Access Arrangement Information*, December 2016, pp. 213.

[1579] Lally, *Implementation Issues for the Cost of debt*, November 2014, Lally, *Review of Submissions on Implementation Issues for the Cost of Debt*, October 2015, and ACCC REU*, Return on debt estimation: a review of the alternative third party data series*, August 2014.

[1580] Lally, *Implementation Issues for the Cost of debt*, November 2014, p. 12.

of the market inputs used to calculate each price.[1581] The RBA curve sources its data from Bloomberg but does not apply a comparable filter,[1582] and relies on the size of the bond issuance as an indirect filter for data quality. In combination, our view is that a larger sample comprised mostly of foreign bond data is therefore not clearly an improvement in the overall data quality of the sample, and may at times worsen the overall data quality.

Bloomberg and Thomson Reuters both exclude foreign denominated data

As noted in previous decisions,[1583] the RBA curve is the only curve of the three currently available (including Thomson Reuters) to include non-AUD denominated bonds in its curve. In discussing methodological choices with Thomson Reuters, they identified that the Thomson Reuters curve excludes debt issued in other markets because they rely on strong assumptions to compare with AUD bonds on a like-for-like basis.[1584] In our view, where credible independent experts (Bloomberg and Thomson Reuters) both exclude non-AUD debt from their bond samples despite its impact on sample size, it is reasonable to exercise caution in relying heavily on non-AUD data.

Failure of covered interest parity

At any point in time, the composition of issued bonds' currency in the RBA curve will reflect past issuances by Australian owned (or Australian risk origin) entities in foreign markets. As noted by Lally on foreign and domestic debt:[1585]

> [A]t every point in time at which the costs of debt for these two types of debt are estimated (in the course of determining a trailing average), the weighting for these types of bonds in the index will reflect earlier issuance decisions (the average term from the issuance of ten-year bonds until a randomly selected secondary market trade on that bond would be about five years), the weights fluctuate over time (see Arsov et al, 2013, Graph 3) because the differential in the costs of debt from the two sources fluctuates over time…

That composition is appropriate if the cost of issuance (including yield and issuance fees) in different markets is almost identical due to the possibility of arbitrage or if the differences in cost do not change over time. Otherwise, a rational firm would issue into the cheapest market at that particular point in time—taking into account related benefits such as diversification of risk—and not necessarily according to the broad composition of the RBA curve.

The equivalence of interest rate and issuance costs in different markets is called Covered Interest Parity. Several papers (for example, Recent Trends in Cross-

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1581 https://www.bbhub.io/solutions/sites/8/2015/10/BVAL-Score-fact-sheet.pdf

1582 *Return on debt estimation: A review of the alternative third party data series: Report for the AER*, August 2014, p. 8.

1583 See for example, AusNet distribution final decision, p. 3-323

1584 See for example, AusNet distribution final decision, p. 3-323

1585 Lally, *Implementation Issues for the Cost of debt*, November 2014, p. 13

currency Basis from the Bank of Japan (2016)[1586] and Deviations from Covered Interest Rate Parity (2016)[1587]) have shown that since 2014 the Covered Interest Parity may be violated for risk-free assets in several of the main currencies used for issuing bonds. Even if parity did hold for risk-free assets, it may not hold for BBB rated bonds due difficulty creating arbitrage. As such, we would expect that a rational firm would re-evaluate its issuance strategy and possibly vary from its historical domestic-foreign issuance composition.[1588] As such, we have some concern in relying substantially on an assumption that historical issuance patterns (as reflected in the RBA curve) would remain constant over time. In combination with the other issues discussed in this section, we are therefore not persuaded that the inclusion of foreign bonds in the RBA sample will necessarily be a better fit to the costs faced by the benchmark efficient entity over the forthcoming regulatory period.

Monthly publication

While the RBA curve may include more bonds in each individual observation, the RBA only publishes estimates for one day in each month. As a consequence, we need to interpolate between month-end estimates in order to have a daily yield series. The impact of this is that, where we adopt the RBA estimate, we only have 12 data points for the spread to CGS that are used to produce a full year of estimates. In contrast, the BVAL and Thomson Reuters curves are published daily, which means that we have approximately 20 times as many data points for estimating the spread-to-swap over the course of a month compared to the RBA curve.[1589]

We are broadly satisfied that linear interpolation is reasonable and is unlikely to be biased. However, service providers can and have adopted averaging periods as short as 10 business days within a month. It is plausible that linear interpolation for these short averaging periods results in an underestimate or overestimate of the daily spreads to swap.

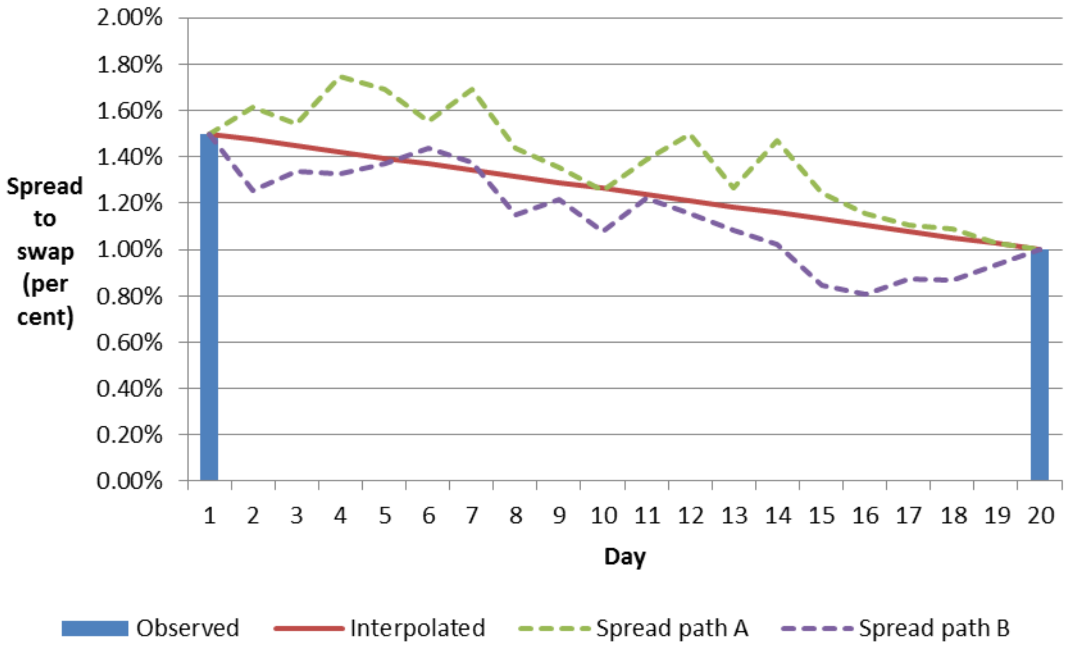
1586 Bank of Japan (2016), *Recent Trends in Cross-currency Basis*, Bank of Japan Review.

1587 Wenxin Du et. al., Deviations from Covered Interest Rate Parity, 2016.

1588 Issuing into the cheapest market appears to be in agreeance with CEG's view. CEG, *Criteria for assessing fair value curves*, January 2016, p. 20.

1589 To illustrate this, Bloomberg published data on 252 days in 2015, where the RBA published data on 12 days.

Figure 3-18 Illustration of monthly publication on sample size and error



Source: AER

In addition, the RBA's publication of data on one day a month masks any underlying daily volatility in its estimates.

Inclusion of bonds with embedded options

The RBA curve, unlike the BVAL and Thomson Reuters curves, includes bonds with embedded options. These embedded options, such as those in callable, convertible or puttable bonds, have an impact on the distribution of risk between issuer and lender and as a consequence have an impact on the bond's yield.[1590] As a result, these bonds need to be adjusted to account for the change in yield due to the optionality so that they can be compared on a like-for-like basis with debt without options. This is a complex process, as the conversion requires some strong assumptions. In the RBA's model, these calculations are outsourced to Bloomberg.[1591] The BVAL curve's sample avoids this risk, because it does not include bonds with optionality (other than make-whole options) due to the need for yield conversion.[1592] Again, we note that Bloomberg

[1590] *Return on debt estimation: A review of the alternative third party data series: Report for the AER*, August 2014, p. 8.

[1591] *RBA, New Measures of Australian Corporate Spreads, December 2013, footnote 13.*

[1592] The interest rate on make-whole options, according to Lally (2014), should not be affected by the presence of the option and therefore no adjustment should be required. Note that bonds with a make-whole call option are included in the BVAL curve – even when they also have other type of embedded options. For example, a bond that has a call option and a make-whole option would be included in the sample. As of 24th March 2017, one of the current constituents of the AUD Corporate BBB BVAL Curve has both call and make whole call option.

and Thomson Reuters adopt a largely consistent approach to excluding bonds with options.

K.1.3 CEG's analysis of sample size

In its reports, CEG has criticised the relatively smaller sample size arising from the BVAL selection criteria compared to the RBA selection criteria.[1593] We agree that a large sample size is clearly preferable to a smaller sample where it is clear that the additional data won't introduce bias or increase variance into the estimator. However:

- where this is not clear, it is a complex exercise to determine whether the benefits of a larger sample outweigh the disadvantages of lower quality data
- a smaller sample does not imply that a curve is not fit for purpose. A larger sample (all else being equal) is an advantageous feature of a curve, however it needs to be considered in the context of all of the curve's other features and criteria.

In its reports, CEG ignored the impact on the required sample size caused by the inclusion of the shaper curves by Bloomberg. The shaper curves have been created with the use of many bonds outside of the BBB sample and should lower the number of bonds needed in the sample to achieve a curve with a similar MSE (in reference to the BEE's cost of debt). The RBA method does not use shaper curves.

Importantly, the size of the bond sample underlying a particular curve is an outcome of the bond selection criteria. Both Lally and the ACCC Regulatory Economics unit assessed the bond selection criteria and advised that while the two sets of criteria were different, neither was clearly superior.[1594] While we agree that the RBA curve is based on a larger data sample, we are not persuaded that the relatively smaller BVAL sample will not contribute to an estimate which achieves the allowed rate of return objective.

K.1.4 Response of BVAL curve to Asciano, Mirvac and Jemena bonds

A key impetus in choosing an approach that relied on credible, independent third party curves rather than an AER-developed curve was to create stability and to avoid routine and ongoing debate about the suitability of individual bonds. For this reason, we undertook detailed analysis of the bond selection criteria of both the RBA and BVAL curves prior to settling on our approach. However, while AusNet Services and CEG appear to accept that both Bloomberg and the RBA are credible, independent experts, they have submitted the BVAL curve is not fit-for-purpose in part based on the inclusion of particular bonds which pass its bond selection criteria.

[1593] For example: CEG, *Criteria for assessing fair value curves*, January 2016, p. 31.

[1594] Lally, *Implementation issues for the cost of debt*, November 2014; ACCC Regulatory Economics Unit, *Return on debt estimation: A review of the alternative third party data series*, August 2014; Lally, *Review of submissions on implementation issues for cost of deb*t, October 2015.

Specifically, AusNet and CEG analyse the inclusion of the Asciano (EK907291), Mirvac (QZ330503) and Jemena (LW474837) bonds in 2016 and attempt to show weaknesses in the BVAL curve. As previously mentioned above, we agree that the BVAL curve has some weaknesses but on balance these are not larger than the RBA curve's. In this section we respond to some of the issues raised by CEG and AusNet in relation to the inclusion of these bonds.

Asciano bond

AusNet has argued that between May 2015 and 28 July 2016, the BVAL curve placed an inappropriately high weighting on the Asciano bond. In particular, AusNet cited a particularly high correlation between the BVAL 10 year spread and the Asciano bond.[1595] However, AusNet did not specify what correlation would be appropriate. If the BVAL curve was an exact estimate of the BEE's cost of debt, we would expect that the Asciano bond and the BVAL curve would both respond to systemic factors in the market. Therefore, we would expect high correlation between the Asciano bond and the BVAL curve.

AusNet also submitted that the Asciano bond did not behave like other long maturity bonds:[1596]

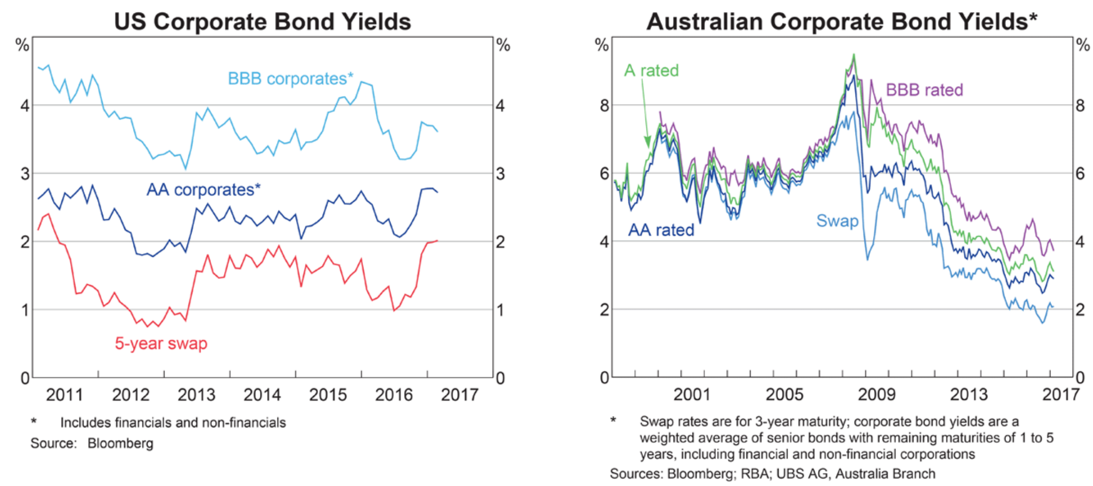
> This was particularly problematic because Asciano was the subject of takeover activity over this period. The influence of takeover activity on the Asciano bond's yields reflects firm-specific factors that would have no relevance to the benchmark efficient firm, and is therefore not relevant to setting the return on debt faced by debt investors in a BEE.
>
> As set out in AusNet Services' 24 March 2016 submission to the AER and supporting CEG memo (Appendix 6E – CEG, Review of AER Position on Curve Selection), over AusNet Services' distribution businesses' averaging period, all bonds included in the RBA's sample with tenors between 8 and 12 years (excluding the Asciano bond) exhibited very different movements in yields than the Asciano bond. At this time, there was a high degree of financial market volatility, which is consistent with the finding that there was a general rise in DRPs across the market. The Asciano bond was an outlier over this time period as its DRP did not increase by an amount commensurate with the general market. As the BVAL curve moved in (close to) lock step with the Asciano bond's yields, the BVAL curve did not reflect general market movements.

We are still not satisfied that there is persuasive evidence in support of these arguments. The analysis submitted by CEG and AusNet Services may support a conclusion that the movements in the Asciano bond are not representative of the movements of bonds issued in European and American bond markets. However, yields in different BBB corporate markets do not necessarily move in a one to one fashion. This can be seen in the figure below for the case where hedging does not occur and it also does not hold for when hedging takes place (we explore this further in the Failure

[1595] AusNet Services, *Access Arrangement Review 2018-22*, December 2016, p. 212.
[1596] AusNet Services, *Access Arrangement Review 2018-22*, December 2016, p. 212.

of Covered Interest Parity section). As set out in our previous decisions, the BVAL bond criteria include only AUD denominated bonds.[1597] The Reuters criteria similarly allow only AUD denominated bonds.[1598] In contrast, the RBA curve includes AUD denominated bonds, but the majority of bonds within the RBA curve are USD or EU denominated.[1599]

Figure 3-19 US and Australian BBB Corporate Bond yields



The takeover attempt did have an effect on Asciano's credit ratings but not in the way that CEG described.[1600] The Asciano bond's credit rating was downgraded in response to the takeover (which should be associated with a rise in yields). This rise was lower than those denominated in USD or EU according to AusNet. This suggests that it could be the different markets driving the result and not the takeover and would suggest that the BVAL curve responded as intended.

We do not agree with AusNet or CEG that their analysis demonstrates that the BVAL curve was 'too reliant' on the Asciano bond, or that this led to a BVAL estimate which did not contribute to achievement of the ARORO. In contrast, we are satisfied with Bloomberg's indication that the 10 year estimate is dependent on the Asciano bond, the other 20 bonds and the shaper curves.[1601]

Mirvac bond

We agree that, with the benefit of hindsight, Bloomberg's inclusion of the Mirvac bond was an error due to the inclusion of 'bad data'. The bad data, however, was quickly removed. While unfortunate that this occurred at all, the outcome was reassuring.

1597 AER, *Preliminary decision—AusNet Services—Attachment 3: Rate of return*, October 2015, pp. 226–227.

1598 See section I.1.

1599 AER, *Preliminary decision—AusNet Services—Attachment 3: Rate of return*, October 2015, pp. 226–227.

1600 https://www.moodys.com/research/Moodys-downgrades-Asciano-to-Baa3-following-acquisition-approvals-outlook-stable--PR_352423

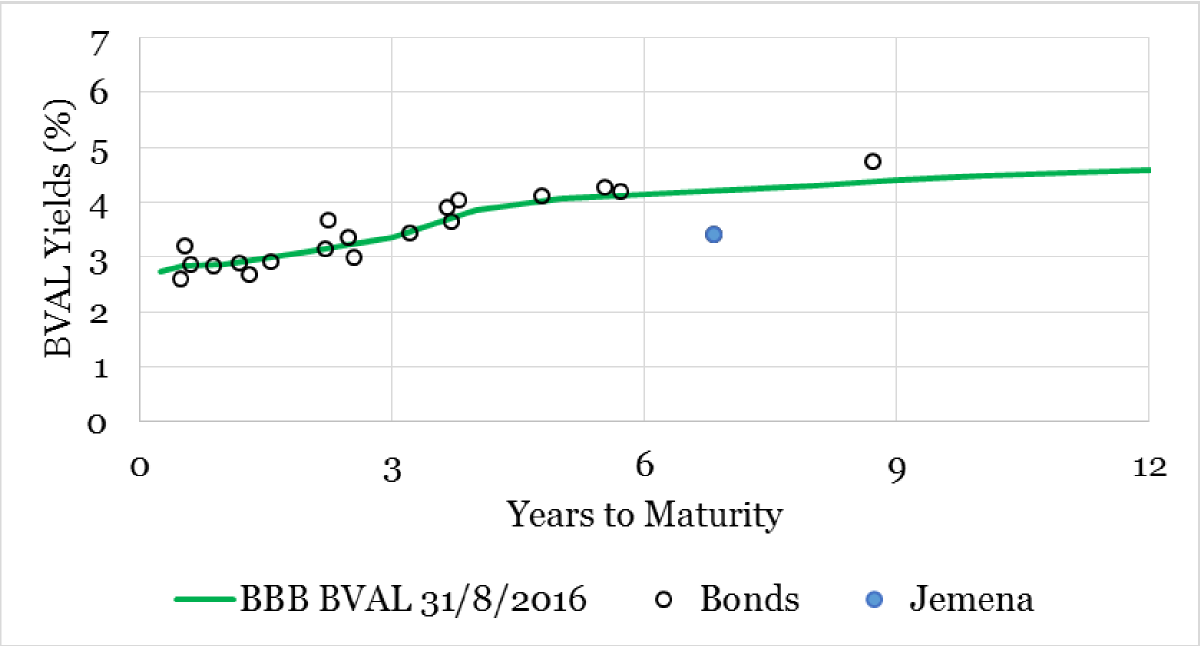
1601 Lally, *Review of Submissions on implementation issues for the cost of debt,* October 2015, pp. 14.

Producing such a yield curve is a complex exercise and we gain confidence from demonstration that the 3rd party providers are vigilant to the quality of our input curves. This is another reason why we choose to rely on credible independent experts for the curve estimate.

It is also not the first time our input curves have been revised to allow for improvements. As of October 2015 the RBA made retrospective changes to its yield curve.[1602] These changes resulted in retrospective changes to bond samples as well as changes to yield and spread estimates. AER staff corresponded with RBA staff about the causes and impact of these retrospective changes and remain satisfied that the combination of RBA and BVAL curves will contribute to an estimate which achieves the allowed rate of return objective.[1603] Nonetheless, we note that none of the service providers appear to have engaged in the proposals or subsequent submissions with the potential risks and implications of material retrospective changes made to the RBA curve.

CEG also used the inclusion of the Mirvac bond to test the robustness of the curve to outliers.[1604] The comparison used between the Reuters and Bloomberg curves, however, is not particularly informative because the Reuters curve does not include the Jemena bond which has a similar yield to the Mirvac bond. If a single bond is included (see below figure), the Bloomberg curve is also stable.

Figure 3-20 BVAL curve and bond constituents, 31 August 2016



Sources: Bloomberg; CEG analysis.

1602 Some information is available on the RBA website: http://www.rba.gov.au/statistics/tables/changes-to-tables.html

1603 Specifically, AER staff met with RBA staff on 8 April 2016.

1604 CEG, *Criteria for assessing fair value curves: an update*, September 2016, p. 9 & 19.

Jemena bond

CEG argues that because Bloomberg removed the Mirvac bond, which was closer to the resulting yield curve than the Jemena bond, that Bloomberg erred by not removing the Jemena bond as well. Bloomberg has stated that it does not rely only on yields as a test to omit outliers.[1605] For example, if the bonds had particularly stale pricing data then the bonds would be removed from Bloomberg and not the RBA curve.

The Jemena bond is issued by one of the regulated entities and should be more closely representative of the BEE than many of the other included bonds. Both Bloomberg and the RBA included the bond in the BBB band, because the S&P gave the bond a credit rating in the BBB band. Since September 2016, S&P has re-evaluated the bond and given it an A- credit rating and Bloomberg has moved the Jemena bond into its A credit rating yield curves. While it may have been possible for Bloomberg to predict S&P's credit rating movements we are not persuaded that it erred by not doing so in this instance. We also note that a bond can be rerated up or down and there is no prima facie reason to consider either a lag in rerating, or movement of the bond to a different curve following market rerating, is indicative of systematic bias.

If a bond being on the cusp of a credit rating changes the yield to a substantial degree, it implies that we are being markedly conservative by estimating the return on debt using curves which include BBB-, BBB and BBB+ rated firms when the BEE is a BBB+ rated firm.

K.1.5 BVAL and our overall approach still likely to be conservative

Estimates from the BVAL curve have a number of factors that should ensure the estimate is on the conservative side of the BEE's cost of debt. These include:

1. the increase of benchmark maturity from the average 8.7 to 10 years[1606]
2. the use of the total BBB band instead of the BEE's credit rating of BBB+
3. The likelihood of the networks having lower loss given default than the average of Australian issuers

K.2 The Thomson Reuters curve

We remain satisfied that a simple average of the BVAL and RBA curves will contribute to an estimate that will achieve the ARORO. However, we have not yet formed a definitive view on the suitability of the Reuters curve, and are open to further considering this curve in the future. AusNet Services submitted in their initial proposal that if we were not persuaded to accept their proposal to use only the RBA curve in making our estimate, then we should make use of the Thomson Reuters curve in

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[1605] CEG, *Criteria for assessing fair value curves: an update*, September 2016, p. 20.
[1606] AER, *Better Regulation: Explanatory statement—Rate of return guideline*, December 2013, p. 142.

addition to the Bloomberg and RBA curves. Multinet Gas proposed to use a simple average of the RBA, Bloomberg and Thomson Reuters curves.

We have decided not to adopt the Thomson Reuters curve for the following reasons:

- we are satisfied that our current approach is fit for purpose and is likely to contribute to achievement of the ARORO. In contrast, there is insufficient evidence before us that use of the Thomson Reuters curve would also do so.
- our analysis in the time available has indicated that there are a number of approach design issues (e.g. weighting, extrapolation, contingencies, domestic or blended, etc.) that should be consulted on and addressed before relying on the curve. Multinet and AusNet Services have not submitted evidence to support their preferences of weighting, extrapolation and contingencies in a manner that would satisfy us that it is clearly superior to the approach we have adopted, or which could be used, at least, as a starting point for further consultation with stakeholders.
- for the 18 months to the end of 2016, the differences between the simplest case of including the curve (equal weighted average) and the current return on debt appear immaterial when considered in the context that this alternative approach has not been through a rigorous industry wide consultation process.

We have discussed our satisfaction that the current approach will continue to achieve the ARORO in the 'Choice of third party data series' section. We discuss the other three points below.

K.2.1 Implementation concerns

As AusNet Services and Multinet Gas proposals do not address implementation issues in detail, we do not have evidence before us on the correct implementation of the curve (if it were to be included). Items that are required for optimal implementation include the extrapolation method, the use of the blended or domestic curve,[1607] the optimal weighting and the required new contingencies.

If we were to add the Thomson Reuters curve, we would have to resolve the above issues without a proposed solution from AusNet or Multinet s. We are therefore not satisfied that using the Thomson Reuters curve in any particular manner would be likely to contribute to achievement of the ARORO, nor do we consider it would be good regulatory practice to begin using the curve in these circumstances.

Extrapolation methodologies

[1607] Thomson Reuters publishes two versions of its AUD corporate yield curve; blended and domestic. The blended curve includes a larger sample as an outcome of including debt issued in AUD by issuers with a country of risk that is not Australia. That is a materially different selection criterion that either the BVAL or RBA curves in which all issuers have Australia as their country of risk.

Currently, we extrapolate both the RBA curve and, where it does not publish to 10 years, the BVAL curve. We do so as follows:

We extrapolate the RBA curve from its 'published' 10 year term (effective term is closer to 9 years) to an 'actual' 10 year term using linear extrapolation from the published 7 and 10 year estimates. This method is based on advice from Lally, who suggested that linear extrapolation was reasonable where the extrapolation term range was relatively small.

We extrapolate the BVAL curve, where necessary, using the corresponding margin from the RBA curve. For example, if BVAL only publishes to 7 years, we extrapolate it using the 7 to 10 year margin from the RBA curve.

If we add a third curve, the choices of extrapolation become substantially more complex. For the Thomson Reuters curve we expect the protocol for extrapolation to be material in effect as Thomson Reuters does not extrapolate beyond the longest term in its bond sample and the availability of its 10 year estimate may vary.

The choice of extrapolation methodologies potentially could differ depending on the number of curves available at 10 years. For example, if only BVAL or Thomson Reuters did not publish to 10 years, there is the option to rely solely on the RBA margin, which is more consistently available (albeit extrapolated). In the same circumstance, there is the possibility to rely on an average of the missing margins from the two remaining curves. For example, if Thomson Reuters only publishes to 7 years, an average of the RBA and BVAL curves' margins between 7 and 10 years could be used.

If both BVAL and Thomson Reuters did not publish to 10 years we have the option to extrapolate both using the margin on the RBA curve or, if (for example) Thomson Reuters published to 8 years and Bloomberg published to 7, we could use an average of the RBA and Thomson Reuters margin to extrapolate Bloomberg to 8 years, then RBA only beyond 8.

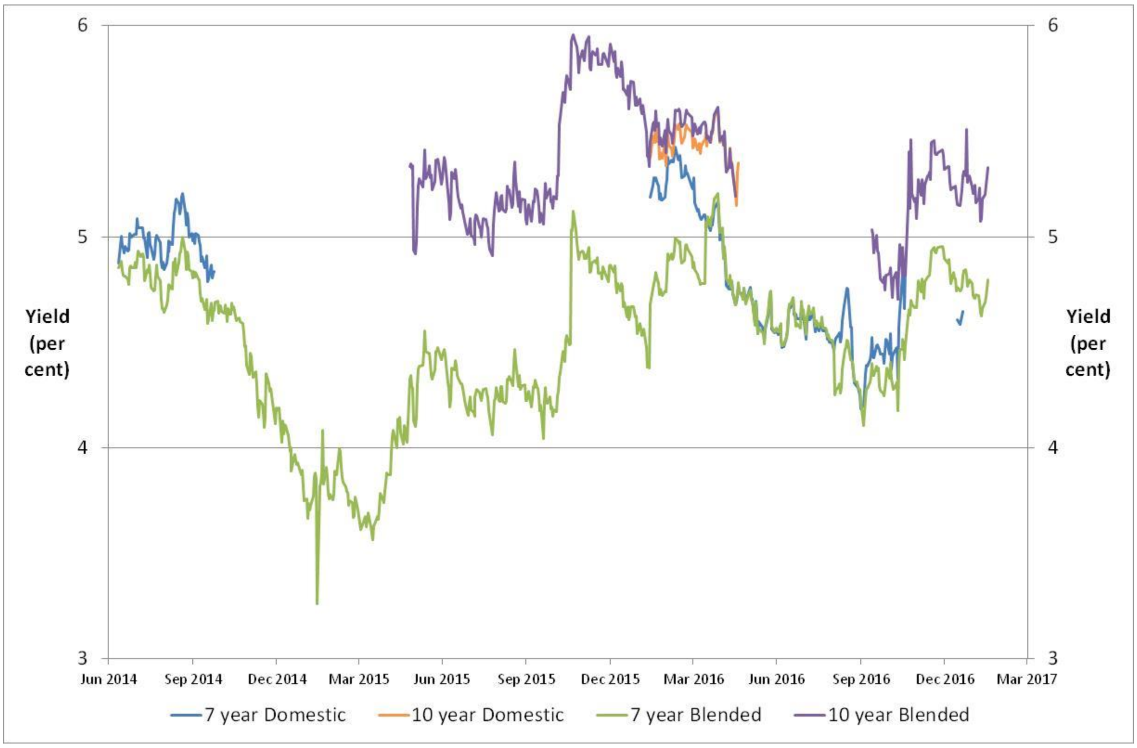
Overall, our view is that the inclusion of a new curve is a substantial change of approach. As the new curve has not been consulted on substantively with either consumers or the rest of the sector, we are not satisfied that this approach would contribute to achievement of the ARORO. In contrast, our current approach has been widely consulted on and tested by the Australian Competition Tribunal and other stakeholders. We remain satisfied that it will contribute to achievement of the ARORO.

Choice of Reuters curve

Thomson Reuters has two curves available for AUD broad-BBB rated bonds. These are the blended curve, which is a mixture of domestic firms and foreign firms issuing into the Australian market in AUD, and the domestic curve, which is limited to only domestic firms' issuance. As the BEE is an entity, whether it is conceived as regulated or not, that has a similar degree of systematic risk as that which applies to APTPPL in the provision of its regulated services it is likely that the domestic curve is more appropriate. However, of the two curves the domestic curve has both a smaller bond sample and is rarely published to 10 years (see figure below), thus requiring more frequent extrapolation.

In these circumstances, there appear to be advantages and disadvantages to relying on either curve, or some combination of the curves. Neither AusNet Services nor Multinet has submitted detailed analysis on this issue.

Figure 3-21 TR BBB blended and domestic credit curves



Source: Thomson Reuters

Other implementation concerns

Currently the RBA and BVAL curves are weighted equally. The weighting is based on findings from Lally. In particular, Lally derived formulae to demonstrate that, subject to some assumptions, the mean squared error of the two variable estimator would be reduced with equal weighting.[1608] While we could make simplifying assumptions to include the new curve at equal weight, it is unclear if these would be reasonable without further analysis.

Further, as we have accepted AusNet Services and Multinet Gas' proposal to update the return on debt annually, we are required to set out an approach that can be given effect by automatic application of a formula. For this reason, we would need also to alter the contingencies set out in our Final Decision to accommodate the Thomson

[1608] Lally, *Implementation issues for the cost of debt*, 20 November 2014, pp. 7–21.

Reuters curve. We note that the presence of a third curve would substantially increase the options and permutations to consider in determining the appropriate contingencies. And, as changes in data availability are relatively common, these contingencies could plausibly be highly material over a five year regulatory period. We are not satisfied that without these items being settled that adopting the Thomson Reuters curve would contribute to achievement of the ARORO.

These methodological design issues are not irresolvable. However, they are complex and would ideally involve consultation with stakeholders.

K.2.2 Immaterial in simplest case

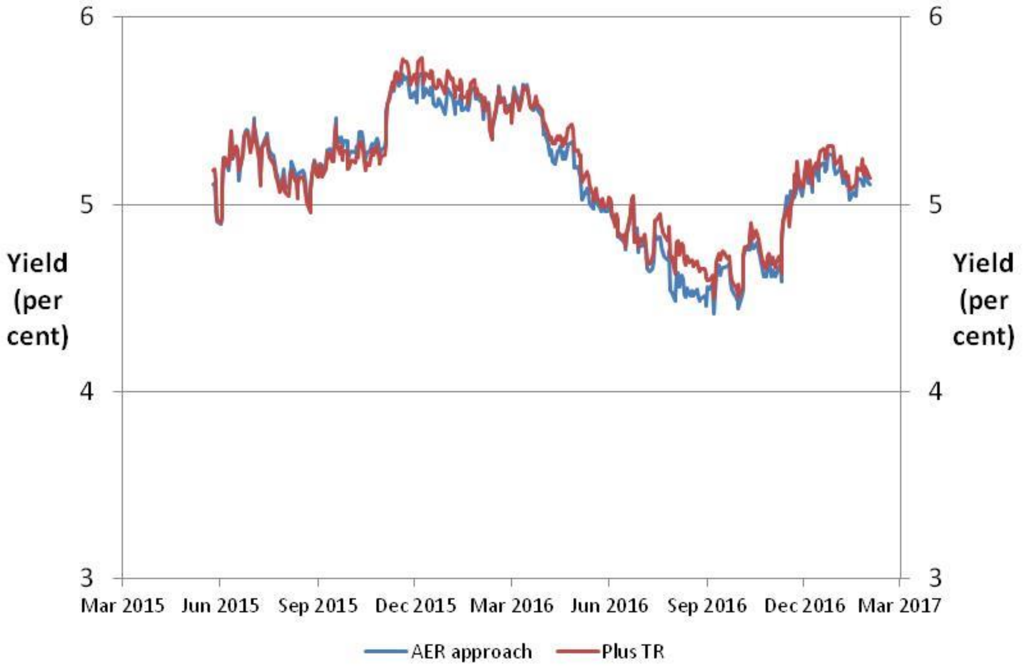
Aside from the design issues above, we are not persuaded there is sufficient evidence to suggest that the inclusion of a Thomson Reuters curve would materially change revenue outcomes. To test whether the curve would make a substantial difference to the achievement of the ARORO we considered the magnitude of the change to the return on debt with its addition. To do so, we used the simplest case of a simple average (1/3 weighting to each curve) and a similar extrapolation method to that done for the RBA curve.

We found that from mid-2015 (when the Reuters curve became available for a period at 10 years in blended form),[1609] to the end of 2016 the differences between the two approaches were largely immaterial. On average the difference was 3 basis points. As this has been created without the optimal weightings and extrapolation methods considered, the actual implementation could be different.

This does not imply these curves will continue to produce similar results. Further, we consider that analysis of the yield curve's underlying characteristics is the most informative means of evaluating the curves. To the extent that a comparison of outcomes is informative, we are not satisfied that there is sufficient evidence the addition of a third curve would, in expectation, have any more than incremental impact on the outcomes of our current approach.

[1609] We note that for 105 days of the 427 day sample period, we relied on extrapolation of the curve from 9 years.

Figure 3-22 Simple averages of RBA, BVAL and Reuters curves



Sources: AER; Bloomberg; RBA; Thomson Reuters

K.3 Other issues

This section sets out our analysis of other issues raised recently by CEG. Specifically, we address the extrapolation of the BVAL curve.

K.3.1 Extrapolation method

We remain satisfied that our methodology for extrapolating the return on debt series will contribute to achievement of the ARORO. In contrast, CEG recommended in a recent submission that the SAPN method should be used instead[1610]:

> To the extent that extrapolation of the BVAL curve is to be applied (to give an estimate of the cost of debt that is independent from those already available from RBA/Reuters) then the methodology should, in our opinion, be independent of the RBA/Reuters curves. The SAPN extrapolation method provides this independence and the results of applying this methodology are set out in Table 3-2 above.

We have addressed the SAPN approach in previous decisions, and remain unpersuaded that there is a compelling conceptual or practical basis to assume that yield curves should conform to a straight line along their entire length.[1611] In contrast,

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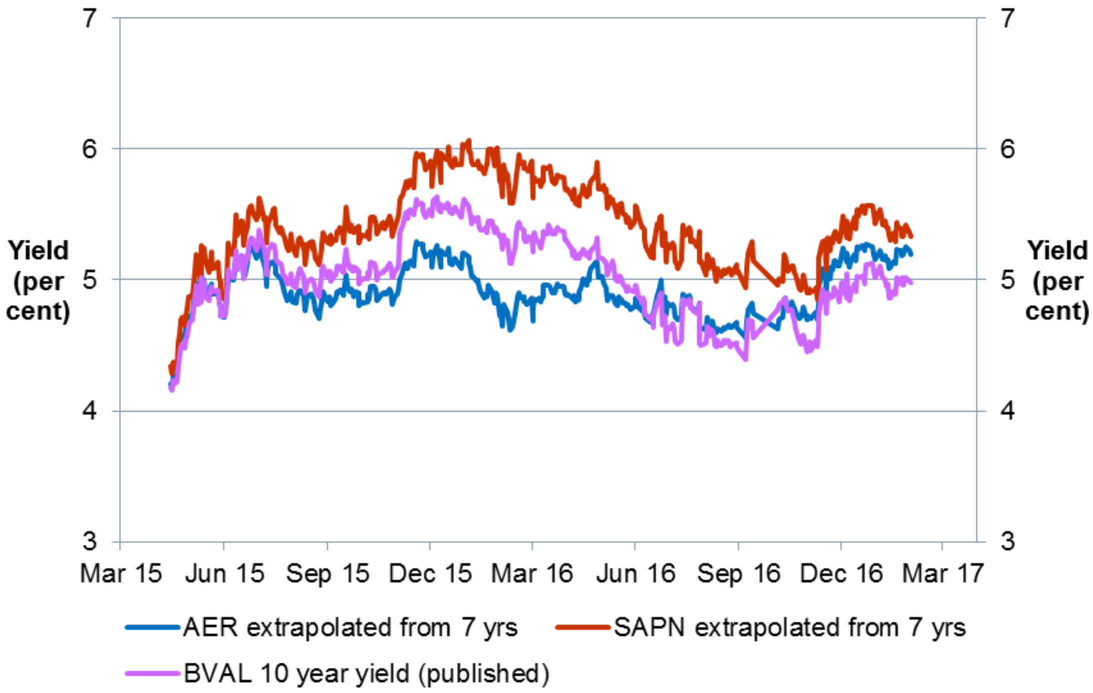
[1610] CEG, *Criteria for assessing fair value curves: an update*, September 2016, p. 25.

[1611] AER, *Preliminary Decision SA Power Networks distribution determination – Attachment 3*, April 2015, pp. 200-201.

our approach relies only on the shape of the yield curve from 7 to 10 years as published by the RBA. We are satisfied that this is likely to be more informative about the appropriate shape for the yield curve from 7 to 10 years compared to a presumption that the 7 to 10 year margin should reflect a line of best fit across the entire term range. Compared to the shape of either the RBA or Bloomberg curves over their published ranges, the SAPN curve appears counterintuitive.

Further, as a result of its straight line assumption the SAPN extrapolation method also appears to have been consistently biased upwards over the past one and a half years (for which we have published BVAL 10 year data to compare the approach). This can be seen in the figure below.

Figure 3-23 BVAL 10 Year Yield with AER and SAPN Extrapolation Approaches



Sources: AER; Bloomberg; RBA.

K.4 Credit rating

In section 3.4.2, we set out our position and key reasons on the benchmark credit rating. In this section, we set out further supporting details behind our calculation of the median credit rating of a sample of firms that are comparable to the benchmark efficient entity (the industry median). This entails:

- Setting out the comparator set we use to estimate the industry median
- Explaining why we consider market data supports an industry median credit rating of BBB+, rather than BBB.

In a previous decision AusNet Services proposed to exclude itself and SGSP Australia Assets Pty Ltd (SGSP) from the comparator set. We addressed this issue in the previous decision. This is not a current issue. We have included this argument in the current decision although it has not been expanded on in this decision.

K.4.1 Comparator Set

We draw our comparator set for estimating the benchmark credit rating from Standard and Poor's industry report cards, with the exclusion of a firm that is owned by an Australian state government.[1612] This is made up of the following businesses:

- APT Pipelines Ltd
- ATCO Gas Australian LP
- DBNGP Trust
- DUET Group
- ElectraNet Pty Ltd
- Energy Partnership (Gas) Pty Ltd
- Australian Gas Networks Ltd— previously Envestra Ltd
- ETSA Utilities
- Powercor Australia LLC
- AusNet Services — previously SP AusNet Group
- SGSP — previously SPI (Australia) Assets Pty Ltd
- The CitiPower Trust
- United Energy Distribution Pty Ltd
- Victoria Power Networks Pty Ltd[1613]

AusNet Services electricity transmission has previously submitted we should exclude it and SGSP from our comparator set. This was on the basis that the ownership by the Singaporean Government and later by the Chinese Government in these businesses affects how credit rating agencies consider their credit ratings.[1614]

[1612] That is Ergon Energy Corp Ltd.

[1613] Powercor Australia LLC and the CitiPower Trust now raise debt under a common funding vehicle, Victoria Power Networks (Finance) Pty Ltd. As such, from 2015, the CitiPower Trust and Powercor Australia LLC fall out of our sample and Victorian Power Networks Pty Ltd is added. See Spark Infrastructure, *Victoria Power Networks announces new joint funding vehicle for CitiPower and Powerco*r, 2 November 2015, see http://www.asx.com.au/asxpdf/20151102/pdf/432p758z1zn56z.pdf.

[1614] AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017–2022 regulatory proposal*, 30 October 2015, p. 270.

We have previously stated in our final decision for SA Power Networks that we do not consider partial government ownership is an important factor in the assigned rating by Standard and Poor's.[1615] We consider that Australian federal or state government owned service providers may have different incentives compared to foreign government owned and privately owned service providers. However, we have formed the view that foreign government owned firms, particularly those that hold minority investments, would be operated in a similar manner to privately owned firms with parent support, with regards to the likelihood of timely and sufficient government or parent company support in extraordinary circumstances.[1616]

Overall, we note that there are a range of possible reasons for excluding firms from the comparator set that could be put forward. These potential reasons include excluding firms within the same corporate group, excluding firms with parent ownership, excluding firms with gearing levels that differ from our benchmark 60 per cent level, and excluding firms with non-regulated activities. For example, in its submission on our preliminary decision for SA Power Networks, ECCSA expressed concerns that Australian Gas Networks Ltd contributed to our benchmark given Australian Gas Networks Ltd.'s gearing has exceeded 80 per cent.[1617] The merits of each of these can be debated, and we assess several of these reasons above. If each of these exclusion criteria were applied it would likely leave a sample that is too small to draw meaningful conclusions on. In such a case, we would likely find there were insufficient reasons to depart from the previous benchmark, which is BBB+.

Accordingly, our preferred approach is to include the full sample of privately owned (that is, non-Australian government owned) energy network service providers, while recognising the strengths and limitations of this approach. However, whether applying all or none of the potential exclusion criteria, we would likely maintain a BBB+ benchmark credit rating.

K.4.2 Current Industry Median

Consistent with the Guideline explanatory statement, we have had regard to empirical evidence in applying a benchmark credit rating of BBB+.[1618] We also have regard to variability in the median credit rating throughout time. This recognises that while shorter term data is more likely to reflect current expectations, longer term data may reduce the influence on the median from firm specific or idiosyncratic factors.

[1615] This was in response to CEG, *Attachment 7.01: WACC estimates, a report for the NSW DNSPs*, May 2014, p. 65. See AER, *Final decision: SA Power Networks determination 2015-16 to 2019-20, Attachment 3 – Rate of return*, October 2015.

[1616] This is supported by Standard and Poor's who have stated that it considers the importance of the entities role to government and whether it could be considered a core investment when undertaking credit ratings assessments

[1617] ECCSA, *AER review of SAPN application 2014: ECCSA response to AER's preliminary decision*, June 2015

[1618] AER, *Better regulation—Explanatory statement to the rate of return guideline*, December 2013, p. 156.

Table 3-37 sets out the median credit rating over historical periods of progressively longer length. While the table shows some support for a credit rating of BBB to BBB+, we consider it shows stronger support for a credit rating of BBB+.

We also note that this estimate entails taking the median from the yearly medians. We could also take the median of all credit rating observations over these time periods. This gives BBB+ for the four most recent periods and BBB/BBB+ for the remainder of the median credit rating periods. The Tribunal observed that the more recent years firmly point towards a BBB+ credit rating for the benchmark efficient entity[1619] and our latest data supports this view.

Table 3-37 Median credit rating—Comparator set of firms

Time period	Median credit rating	Time period	Median credit rating
2016 (to date)	BBB+	2010–2016	BBB/BBB+
2015 -2016	BBB+	2009–2016	BBB
2014–2016	BBB+	2008–2016	BBB/BBB+
2013–2016	BBB+	2007–2016	BBB/BBB+
2012–2016	BBB/BBB+	2006–2016	BBB/BBB+
2011–2016	BBB/BBB+		

Source: Bloomberg (S&P), AER analysis.

For further detail, **Error! Reference source not found.** sets out the median credit ratings across our comparator set since the 2006 calendar year end.

Table 3-38 Credit ratings of network service providers over time

Issuer	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
APT Pipelines Ltd	NR	NR	NR	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB
ATCO Gas Australian LP	NR	NR	NR	NR	NR	BBB	BBB	A-	A-	A-	A-
DBNGP Trust	BBB	BBB	BBB	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-
DUET Group	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	NR	NR	NR	NR
ElectraNet Pty Ltd	BBB+	BBB+	BBB+	BBB	BBB	BBB	BBB	BBB	BBB+	BBB+	BBB+

1619 Australian Competition Tribunal, *Applications by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1*, 26 February 2016, para 993.

Energy Partnership (Gas) Pty Ltd	BBB	BBB	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-
Australian Gas Networks Ltd	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB	BBB+	BBB+	BBB+
ETSA Utilities	A-	A-	A-	A-	A-	A-	A-	A-	A-	A-	A-
Powercor Australia LLC	A-	A-	A-	A-	A-	A-	A-	BBB+	BBB+	NR	NR
AusNet Services	A	A	A-	A-	A-	A-	A-	A-	A-	A-	A-
SGSP Australia Assets Pty Ltd	NR	NR	A-	A-	A-	A-	A-	BBB+	BBB+	BBB+	A-
The CitiPower Trust	A-	A-	A-	A-	A-	A-	A-	BBB+	BBB+	NR	NR
United Energy Distribution Pty Ltd	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB
Victoria Power Networks Pty Ltd	NR	NR	NR	NR	NR	NR	NR	NR	NR	BBB+	BBB+
Median (year)	BBB/ BBB+	BBB/ BBB+	BBB+	BBB	BBB	BBB	BBB	BBB/ BBB+	BBB+	BBB+	BBB+

Source: Bloomberg, Standard and Poor's, AER analysis.

K.4.3 Equity buffer and historical credit ratings

In its initial proposal, AusNet Services Electricity Transmission submitted that 'historical credit ratings do not reflect the extremely low equity buffer that would result if the AER's proposed approach to the cost of equity is adopted in current circumstances'.[1620] We are not persuaded by this submission, and maintain our reasons as set out in our draft decision.[1621]

[1620] AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017–2022* revised *regulatory proposal*, 21 September 2016, pp. 167-8.

[1621] AER, *Draft decision: AusNet Services transmission determination*, July 2016, pp. 313–314.

L Annually updating the return on debt

Our draft decision on the return on debt approach is to:

- estimate the return on debt using the on-the-day approach (that is, based on prevailing market conditions) in the first regulatory year (2017) of the 2017–22 regulatory control period, and
- gradually transitioning into a trailing average approach (that is, a moving historical average) over 10 years.[1622]

Because our return on debt approach involves annual updates to the return on debt, this means that the return on debt will be, or potentially will be, different for different regulatory years in the regulatory control period.[1623] The NGR require that the resulting change to APTPPL's annual building block revenue requirement is to be effected through a formula specified in the revenue determination.[1624] For the purposes of clause 87(12), our draft decision is that the resulting change to APTPPL's annual building block revenue requirement is to be effected through:

- the automatic application of the return on debt methodology specified in this appendix
- using the return on debt averaging periods specified in confidential appendix O and
- implemented using APTPPLT's draft determination post-tax revenue model (PTRM) in accordance with section 3 of the AER's PTRM handbook for transmission network service providers.[1625]

The return on debt methodology in this appendix specifies our draft decision:

- methodology on the return on debt approach, and
- methodology to implement the return on debt approach

L.1 Approach to estimating the return on debt

This section sets out our draft decision methodology on the return on debt approach. Below we specify the allowed return on debt formulae for each year of the 10 year transition path. In each formula:

[1622] This draft decision determines the return on debt methodology for the 2017–22 regulatory control period. This period covers the first five years of the 10 year transition period. This decision also sets out our intended return on debt methodology for the remaining five years. However, we do not have the power to determine in this decision the return on debt methodology for those years. Under the NGR, the return on debt methodology for that period must be determined in future decisions that relate to that period.

[1623] NER, cl. 6A.6.2(i); NGR r. 87(9).

[1624] NER, cl. 6A.6.2(l); NGR r. 87(12).

[1625] AER, *Final decision—Amendment—Electricity TNSPs PTRM handbook*, 29 January 2015.

$_{a}R_{a+10}$ corresponds to the estimated return on debt that was entered into in year a and matures in year a+10–which is to be calculated using the return on debt implementation methodology in section L.2 and APTPPL's return on debt averaging periods specified in confidential appendix O.

$_{b}kd_{b+1}$ refers to the allowed return on debt for regulatory year b+1.

In the first regulatory year of transitioning to the trailing average approach (2017), the allowed rate of return on debt will be based on the estimated prevailing rate of return on debt for that year (similar to the 'on the day' approach):

$$_{0}kd_{1} \;=\; _{0}R_{10}$$

In the second regulatory year, the allowed rate of return on debt will be the weighted average of the prevailing rates in the first and second regulatory years of the transitional period:

$$_{1}kd_{2} \;= 0.9 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11}$$

In the third regulatory year, the allowed rate of return on debt will be the weighted average of the prevailing rates in the first, second, and third regulatory years of the transitional period:

$$_{2}kd_{3} \;= 0.8 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12}$$

In the fourth regulatory year, the allowed rate of return on debt will be the weighted average of the prevailing rates in the first, second, third and fourth regulatory years of the transitional period:

$$_{3}kd_{4} \;= 0.7 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12} + 0.1 \cdot\; _{3}R_{13}$$

In the fifth regulatory year, the allowed rate of return on debt will be the weighted average of the prevailing rates in the first, second, third, fourth and fifth regulatory years of the transitional period:

$$_{4}kd_{5} \;= 0.6 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12} + 0.1 \cdot\; _{3}R_{13} + 0.1 \cdot\; _{4}R_{14}$$

The calculation for all subsequent regulatory years until the transitional period is completed is set out below:

$$_{5}kd_{6} \;= 0.5 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12} + 0.1 \cdot\; _{3}R_{13} + 0.1 \cdot\; _{4}R_{14} + 0.1 \cdot\; _{5}R_{15}$$

$$_{6}kd_{7} \;= 0.4 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12} + 0.1 \cdot\; _{3}R_{13} + 0.1 \cdot\; _{4}R_{14} + 0.1 \cdot\; _{5}R_{15} + 0.1 \cdot\; _{6}R_{16}$$

$$_{7}kd_{8} \;= 0.3 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12} + 0.1 \cdot\; _{3}R_{13} + 0.1 \cdot\; _{4}R_{14} + 0.1 \cdot\; _{5}R_{15} + 0.1 \cdot\; _{6}R_{16} + 0.1 \cdot\; _{7}R_{17}$$

$$_{8}kd_{9} \;= 0.2 \cdot\; _{0}R_{10} + 0.1 \cdot\; _{1}R_{11} + 0.1 \cdot\; _{2}R_{12} + 0.1 \cdot\; _{3}R_{13} + 0.1 \cdot\; _{4}R_{14} + 0.1 \cdot\; _{5}R_{15} + 0.1 \cdot\; _{6}R_{16} + 0.1 \cdot\; _{7}R_{17} + 0.1 \cdot\; _{8}R_{18}$$

$$ {}_{9}kd_{10} = 0.1 \cdot {}_{0}R_{10} + 0.1 \cdot {}_{1}R_{11} + 0.1 \cdot {}_{2}R_{12} + 0.1 \cdot {}_{3}R_{13} + 0.1 \cdot {}_{4}R_{14} + 0.1 \cdot {}_{5}R_{15} + 0.1 \cdot {}_{6}R_{16} + 0.1 \cdot {}_{7}R_{17} + 0.1 \cdot {}_{8}R_{18} + 0.1 \cdot {}_{9}R_{19} $$

L.2 Implementing the return on debt approach

This section sets out our draft decision methodology to implement the return on debt approach. This section specifies:

- our choice of data series
- extrapolation and interpolation issues with adjusting our choice of data series
- step-by-step calculation to calculating the final RBA and BVAL estimate
- contingencies associated with implementing our choice of data series, if the data series we have chosen to estimate the return on debt are unavailable or change in future regulatory years

L.2.1 Choice of data series

Our draft decision on the choice of data series is to adopt a simple average of the debt data series published by the RBA and Bloomberg that match, as close as available, our benchmarks of a BBB+ credit rating and a 10 year debt term. Specifically, we adopt a simple average of:

- The RBA broad-BBB rated 10 year curve, extrapolated to an effective term of 10 years (the RBA curve)
- The Bloomberg Valuation Service (BVAL) broad-BBB rated curve (the BVAL curve). Depending on the maximum term published at the time, this will be either the BVAL:
  - 10 year estimate[1626] where it is available
  - 7 year estimate extrapolated to a 10 year term using the 7–10 year margin from the RBA curve. This will be used where the 7 year estimate is available and the 10 year estimate is not available.
  - 5 year estimate extrapolated to a 10 year term using the 5–10 year margin from the RBA curve. This will be used where the 5 year estimate is available and neither the 10 year nor the 7 year estimates are available.

We do not estimate the allowed return on debt in this draft decision by reference to the 10 year yield curve published by Thomson Reuters (the Reuters curve). Nonetheless, we do not rule out including the Reuters curve in future determinations following a proper period of consultation. See appendix K for our reasoning and further details.

[1626] As of 14 April 2015, Bloomberg has revised its methodology for the BVAL curve (BVCSAB10). It has correspondingly recommenced publishing a 10 year yield estimate.

L.2.2 Choice of data series—Extrapolation and interpolation issues

Our draft decision on extrapolation and interpolation issues is:

- extrapolation—where we need to extend a curve beyond its observed or published range. For example, before April 2015, Bloomberg publishes its BVAL curve to a maximum term of 7 years, whereas we require an estimate for a 10 year term.
- Interpolation—where we need a value for which there is no published estimate but it lies between two published estimates. For example, the RBA only publishes its curve estimates for one day each month, but we require estimates for each business day.

Specifically, we will make the following adjustments as set out in table 3-39 and table 3-40.

Table 3-39 Adjustments to the RBA curve

Adjustment type	Amendment made?	Comments
Interpolation to construct daily estimates	Yes	The RBA curve only provides an estimate for one business day at the end of each month. In our experience, averaging periods commonly start and/or end on dates during the month. We will address this issue by linearly interpolating between month end values where possible. While we are satisfied that interpolation over business days is also reasonable, we will interpolate over all days because: • this is consistent with our widely accepted approach to interpolate estimates of the risk free rate using CGS • interpolating over all days is simpler to implement • it is impractical to interpolate over business days for estimating the risk free rate, as this would require calculations relative to specific trading days 10 years in advance • the difference to the estimates between interpolating over business days or interpolating over all days is immaterial.[1627] Where this is not practical due to timing, we will hold the last available RBA monthly estimate constant until the end of the averaging period. It would not be practical to linearly interpolate between two RBA monthly estimates where the allowed return on debt must be estimated and incorporated into the annual debt update process before the publication of the next RBA monthly estimate after the end of the averaging period. Our draft decision on the annual debt update process is set out in this appendix.
Extrapolation to target term	Yes	The 'effective term' of the RBA bond sample is commonly less than 10 years. For this reason, Lally recommended that the spread component of the yield should be extrapolated from its effective term at publication to the benchmark term (10 years).[1628]

[1627] For example, the difference between approaches between 2 June 2014 to 30-June 2014 was 22 basis points, which means it would have changed the return on debt by 0.0022 per cent.

[1628] Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

Adjustment type	Amendment made?	Comments
		We agree with Lally's recommendation to extrapolate the spread component of the RBA's published yield in order to match it with the benchmark term of debt. However, we do not agree it is necessary to extrapolate the base component. As identified by the RBA and Lally,[1629] the base component of the published 10 year yield already matches the benchmark term of debt. Therefore, extrapolating this component would result be erroneous and lead to overcompensation in most circumstances, where the yield curve is upward sloping.
Conversion to effective annual rate	Yes	The RBA's published methodology does not explicitly specify whether the published yields should be interpreted as effective annual rates. Effective annual rates are a consistent basis on which to compare bond rates and imply that the coupon payments compound during the year. We therefore consulted the RBA, who informed us that 'the spreads and yields in F3 can be best thought of as annual rates with semi-annual compounding'.[1630] Therefore, this would require conversion into an effective annual rate, using the same approach as is applied to the BVAL yield estimate.

Source: AER analysis.

Table 3-40 Adjustments to the BVAL curve

Adjustment type	Amendment made?	Comments
Interpolation to construct daily estimates	No	Bloomberg publishes daily estimates.
Extrapolation to target term	Depends on maximum term published by Bloomberg	For most of the time that the BVAL curve has been published, it has had a maximum term of 7 years. However, between September 2014 and November 2014, it was published to a maximum 5 year term.[1631] In April 2015, Bloomberg revised its methodology for the BVAL curve (BVCSAB10) and it now publishes a 10 year estimate.[1632] For the periods where 7 years is the maximum term, we extrapolate the spread component of the 7 year yield estimate to the 10 year target term. We have done so using the margin between the spread components of the extrapolated RBA 7 and 10 year yield estimates, converted to effective annual rates. We add to this extrapolation the difference between the base CGS estimates from 7 to 10 years. That is: BVAL yield 10 years = BVAL yield 7 years + difference in CGS from 7 to 10 years + difference in RBA extrapolated

[1629] See the 'notes' tab in RBA, *Aggregate measures of Australia corporate bond spreads and yields*, available at: http://www.rba.gov.au/statistics/tables/xls/f03hist.xls; Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

[1630] RBA, *Email in response to: AER follow up question on the basis of YTM quotations in RBA statistical table F3*, 16 October 2014.

[1631] Specifically, from 15 September 2014 to 3 November 2014.

[1632] Specifically, 14 April 2015.

Adjustment type	Amendment made?	Comments
		spread to CGS from 7 to 10 years As recommended by Lally,[1633] we are satisfied this approach is comparably reliable to the more complex approaches submitted by other stakeholders,[1634] but is simpler to implement and based on publicly available data. For the period where 5 years is the maximum term, we extrapolate the spread component of the 5 year yield estimate to the 10 year target term using an analogous methodology to that used to extrapolate from 7 to 10 years. For the period where 10 years is the maximum term, we do not extrapolate the estimate.
Conversion to effective annual rate	Yes	Bloomberg publishes its yield as annual rates with semi-annual compounding. This needs to be converted into an effective annual rate.

L.2.3 Choice of data series—Step-by-step guide to calculations

Below we describe the step-by-step processes of calculating:

- the adjusted RBA estimate
- the adjusted BVAL estimate
- the final estimate—where we combine our implementations of the RBA estimate and the BVAL estimate.

These formula steps relate to the approach specified in this draft decision. In the event that data availability changes during the regulatory control period, the formulas below will change to reflect the contingencies set out in section L.2.4.

For the purposes of calculating the return on debt, a 'business day' is a day that is not a Saturday or Sunday and not a national or NSW public holiday. This is because the independent data service providers (RBA and Bloomberg) do not publish data on national or NSW public holidays.

Calculation of the adjusted RBA estimate

1. Download RBA table F3—'Aggregate measures of Australian corporate bond yields' from the RBA website.
2. From this file, download the 7 and 10 year 'Non-financial corporate BBB-rated bonds—Yield' entries for dates:
    a. from the most recent published RBA date prior to the commencement of the nominated averaging period for debt

[1633] Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.
[1634] Incenta, *Methodology for extrapolating the debt risk premium*, June 2014, pp. 2–3.

b. to the first published RBA date following the conclusion of the nominated averaging period for debt

c. all published dates between a. and b.

3. Download, from RBA table F16—'Indicative Mid Rates of Australian Government Securities - 2013 to Current', daily yields on CGSs for dates within the service provider's averaging period.

4. Linearly interpolate between the two nearest bonds straddling 7 years remaining term to maturity,[1635] and the two nearest CGS bonds straddling 10 years remaining term to maturity. This should be done using the following formula: [1636]

   yield interpolated = yield lower straddle bond + (yield upper straddle bond - yield lower straddle bond) * (date 10 years from interpolation date - maturity date lower straddle bond) / (maturity date upper straddle bond - maturity date lower straddle bond).

5. Linearly extrapolate the published RBA 10 year yield (from step 2) from its published effective term to an effective term of 10 years using the formula below:[1637]

   $yield_{10} = yield_{10\ year\ published} + [(spread\ to\ swap_{10\ year\ published} - spread\ to\ swap_{7\ year\ published})/(effective\ term_{10\ year\ published} - effective\ term_{7\ year\ published})] * (10 - effective\ term_{10\ year\ published})$.

6. Linearly extrapolate the published RBA 7 year yield (from step 2) from its published effective term to an effective term of 7 years using the formula below:[1638]

   $yield_7$ = $yield_7$ year published + [(spread to $swap_{10}$ year published - spread to $swap_7$ year published)/(effective $term_{10}$ year published - effective $term_7$ year published)] * (7 - effective $term_7$ year published).

7. Subtract from the extrapolated 10 year RBA yield on each publication date the interpolated CGS yield on that date. For the 10 year term, use the RBA series as adjusted in step 5. These are the adjusted RBA 10 year spreads.[1639]

8. Obtain daily RBA spread estimates by linear interpolation of the adjusted RBA spreads (from steps 5 and 6) for both 7 and 10 year terms between the published

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[1635] That is, the bond with the nearest maturity date that is earlier than 10 years from the interpolation date, and the bond with the nearest maturity date than is later than 10 years from the interpolation date.

[1636] This formula relies on the operation in Microsoft Excel. Dates can be subtracted from one another to work out the number of days in between two dates.

[1637] As per Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

[1638] As per Lally, *Implementation issues for the cost of debt*, November 2014, pp. 38–44.

[1639] We have re-calculated the published 'spread to CGS' by subtracting our estimate of the interpolated CGS, as calculated in step 4, from the RBA's published yield to maturity. This allows us to combine daily data from the CGS with an estimate of the spread calculated correctly with reference to both the RBA's yield estimate and our estimate of CGS.

dates identified in step 2. Use the adjusted RBA spread estimates as calculated in step 6. This should be done using the following formula:

$$\text{spread}_{\text{interpolated}} = \text{spread}_{\text{first straddling publication date}} + (\text{date}_{\text{interpolation}} - \text{date}_{\text{first straddling publication date}}) * (\text{spread}_{\text{second straddling publication date}} - \text{spread}_{\text{first straddling publication date}}) / (\text{date}_{\text{second straddling publication date}} - \text{date}_{\text{first straddling publication date}})$$

Note: If the annual return on debt estimate must be finalised before a final published RBA month-end estimate is available, hold the last observed RBA spread constant to the end of the averaging period.

9. Add to these daily spreads (from step 8), daily interpolated estimates of the CGS (from step 4) for all business days in the service providers averaging period. Specifically:

   a. add the 7 year interpolated CGS estimates to the 7 year interpolated RBA spreads. These are the interpolated RBA daily 7-year yield estimates.

   b. add the 10 year interpolated CGS estimate to the 10 year interpolated RBA spread. These are the interpolated RBA daily 10-year yield estimates.

10. Convert the interpolated daily yield estimates (from step 9) to effective annual rates, using the formula:[1640]

$$\text{effective annual rate} = ((1 + \text{yield} / 200)^2 - 1)*100$$

11. Average the yield estimate for the 10 year RBA yield estimate over all business days in APTPPL's averaging period. This is our adjusted RBA estimate.

Calculation of the adjusted BVAL estimate

1. For dates after 14 April 2015, download the 10 year Corporate BBB rated Australian BVAL curve (BVCSAB10).[1641]

2. Convert the 10 year yields into effective annual rates, using the formula:

$$\text{effective annual rate} = ((1 + \text{yield} / 200)^2 - 1)*100$$

3. Average the extrapolated daily estimates of the BVAL 10 year yield over all business days in APTPPL's averaging period. This is our adjusted BVAL estimate.

[1640] In this formula, the term 'published yield / 200' is based on the yield being published as a number (e.g. 2.0) rather than a percentage (e.g. 2 %, or 0.02). The RBA yield data is published in this form at the time of this decision. For example, where the yield is published as '2.0', this is equivalent to 2 per cent or 0.02. However, it is necessary to convert from the published yield to either alternative to calculate the effective annual rate. If the spread was published as 2 per cent, this term would be 'published spread/2'.

[1641] In previous decisions, we have stated that for dates before 14 April 2015, calculating the adjusted BVAL estimate would require downloading the 7 year Corporate BBB rated Australian BVAL curve (BVCSAB07 index) and adding the difference between the 7 and 10 year daily RBA adjusted yields (as calculated in step 8 of the RBA process) to this yield. However, under the approach in this draft decision, all averaging period dates should be after 14 April 2015.

Final estimate

Take the simple average of the adjusted RBA estimate (from step 11 in the RBA data section) and the adjusted BVAL estimate (from step 4 in the BVAL data section). This is the annual estimate of the return on debt.

L.2.4 Choice of data series—Contingencies

Our decision is to largely maintain the set of contingencies as set out in our recent decisions.[1642] We have made our draft decision based on the information and third party data that is currently available.[1643] Nonetheless, in our experience it is common that the availability of third party data changes.

Specifically, our decision is to annually update the trailing average portfolio return on debt. Under the NGR, the change in revenue resulting from the annual update must occur by automatic application of a formula that is specified in the decision.[1644] This means our decision on how to apply these third party data sources must be fully specified upfront in the determination, and must be capable of application over the regulatory control period without the use of subsequent judgement or discretion.

For this reason, we have set out a series of contingencies in table 3-41, below. These describe how we propose to estimate the annual return on debt in the event of revisions in the RBA's or Bloomberg's methodologies or other changes to data availability.

Table 3-41 Contingency approaches to choice of data series

Event	Changes to approach
Either the RBA or Bloomberg ceases publication, temporarily or permanently, of Australian yield curves that reflect a broad BBB rating.	We will estimate the annual return on debt using the remaining curve.
A different third party commences publication of a 10 year yield estimate (or we are made aware of a different third party publishing a 10 year yield estimate)[1645].	We will not apply estimates from a third party data provider that we have not evaluated and included in our final decision approach. We will consider any new data sources in future determinations.
Either Bloomberg or RBA substitutes its current	We will adopt the revised or updated methodology. Then, at the next regulatory determination, we will review this updated methodology. As noted above, we would

[1642] For example, see AER, *Final decision—CitiPower determination, Attachment 3: Rate of return*, May 2016, pp. 359–61; Final decision- *AusNet,Attachment 3: Rate of Return*, April 2017, pp.361-363

[1643] As of 14 April 2015, Bloomberg has revised its methodology for the BVAL curve (BVCSAB10). It has correspondingly recommenced publishing a 10 year yield estimate.

[1644] NGR r. 87(12).

[1645] Or we determine it is open to us to use the Reuters curve, following a proper assessment and period of consultation on this information.

Event	Changes to approach
methodology for a revised or updated methodology.	also review any new data sources. However, if Bloomberg or the RBA backcasts or replaces data using a revised or updated methodology we will not use the backcasted data to re-estimate our estimates of the prevailing return on debt for previous years. This would be impractical and would create regulatory uncertainty over whether the allowed return on debt would at some point in the future be re-opened. Instead, we will continue to use the Bloomberg or RBA data that we downloaded at the time of estimating the prevailing return on debt for that point in time.[1646]
Bloomberg reduces the maximum published BVAL term from 10 years	If Bloomberg still publishes the BVAL curve to 5 or more years, we will extrapolate the BVAL curve from the longest published term to 10 years using the corresponding yield margin from the RBA curve. [1647] If Bloomberg no longer publishes the BVAL curve to 5 years, we will rely entirely on the RBA curve.
The RBA ceases publication of a 10 year yield estimate.	If the RBA ceases publication of a 10 year yield estimate, we will extrapolate the RBA estimate to 10 years using: • if available, the margin between spreads in the Bloomberg curve,[1648] from the RBA's longest published target term to 10 years • otherwise, the actual CGS margin from the RBA's longest published estimate to 10 years, plus the average DRP spread for the same term margin over the last month prior to the end of its publication.
The RBA commences publication of daily estimates.	We will cease interpolating the RBA monthly yields. Instead, we will estimate both the RBA yield and the RBA year extrapolation margin (used with the BVAL curve) using these daily estimates.
Either Bloomberg or the RBA publishes a BBB+ or utilities specific yield curve.	We will adopt the BBB+ or utilities curve in place of the provider's existing curve, on the basis that it is a closer fit to a benchmark efficient entity for the service provider.

Source: AER analysis.

1646 For example, for the current decisions we downloaded the RBA monthly data observation for August 2015 shortly after it was published (in September), and incorporated this data point into our prevailing return on debt estimates. After the RBA published its monthly observation for September (in October), we downloaded this data point too. This final data point is only relevant for estimation of APTPPL's placeholder averaging period. In doing so, we noticed that it appears the RBA has revised its methodology (though does not appear to have explained this change), and has backcast its monthly observations for the entire data series which starts in January 2005. However, we have not incorporated this backcasted RBA data into our return on debt estimates. Instead, we have continued to use the data we downloaded at the time of estimation. We note that if we had incorporated the backdated RBA data this would have decreased the allowed return on debt for the Queensland, SA and Victorian electricity distributors by between approximately 1–2 basis points. Accordingly, in this instance, our approach of not using the backdated data is in this group of service providers' interests. Our approach will be symmetrical and consistent over time, so we will not use backcast data that results from a change in the RBA or Bloomberg's methodology regardless of whether it is in or against the interests of particular groups of service providers or particular groups of consumers.

1647 For example, where Bloomberg only publishes a 6 year curve, we will extrapolate it to 10 years using the 6 to 10 year yield margin from the RBA curve. Or, where Bloomberg only publishes a 7 year estimate, we will extrapolate it to 10 years using the 7 to 10 year yield margin from the RBA curve.

1648 Specifically, the spread to CGS.

As in recent decisions, we have re-worded the contingency for the scenario where either the RBA or Bloomberg ceases publication of Australian yield curves that reflect a broad BBB rating. Specifically, we have clarified that this contingency will apply whether the cessation of publication is temporary (i.e. not published for a period of days) or permanent. This does not change the meaning of the required change in response to this event, and remains consistent with the approach we adopted in decisions prior to Bloomberg publishing a 10 year BVAL estimate. However, we consider this explanation of the 'changes to approach' is clearer.

In general, we have decided on these contingencies based on a series of guiding principles. These are that the contingency must:

- Be practically implementable—the rules require the automatic application of a formula to update the trailing average portfolio return on debt. As a result, we will be unable to analyse changes to the approaches or new approaches during the regulatory control or access arrangement period. Therefore, it is important that any contingency be practical and easily implementable.
- Use the curve in a form as close as possible to its published form—for example, in April 2015 Bloomberg commenced publication of a 10 year BVAL curve. Accordingly, for averaging periods where the 10 year estimate is available, we will adopt this estimate rather than the 7 year BVAL curve extrapolated with RBA data.
- Where necessary, rely on the independent expert judgement of the RBA and Bloomberg—In particular, where the RBA or Bloomberg makes changes to its methodology, we would prefer to evaluate these changes before concluding we are satisfied the curve still meets the criteria set out in the Guideline.[1649] However, this is not possible during the regulatory control or access arrangement period. In these circumstances, we therefore are faced with the two alternatives of ceasing to rely on the updated curve, or temporarily relying on the updated curve on the basis that we have assessed the data provider as credible. As we are satisfied that both the RBA and Bloomberg are credible and independent, but not that either curve is clearly superior, we consider it is preferable that we adopt the updated curve to limit stakeholders' exposure to the distinct characteristics of a single curve. This is consistent with our position of placing weight on both curves to minimise the mean squared error.

Averaging periods

Our draft decision is to accept APTPPL's proposed debt averaging periods for 2017 to 2022.[1650]

[1649] AER, *Explanatory statement–Rate of return guideline*, December 2013, pp. 23–24.

[1650] APTPPL, *Roma to Brisbane pipeline access arrangement submission. confidential attachment 7-1 – cost of debt averaging periods*, September; APTPPL, *Letter from Peter Bolding General Manager Strategy and Regulatory to Warwick Anderson General Manager AER - Roma to Brisbane Pipeline proposed revised Access Arrangement - rate of return averaging periods*, 10 February 2017;

We specify these averaging periods for the 2017 to 2022 regulatory years in confidential Appendix O. This is because our practice is to keep the dates of averaging periods confidential until they have expired.

In the Guideline, we proposed that service providers could nominate averaging periods of 10 or more consecutive business days up to a maximum of 12 months.[1651] We also proposed that an averaging period should satisfy certain conditions. We developed these conditions so that the application of the averaging period contributes to the achievement of the ARORO.[1652]

In general, when assessing service providers' proposed averaging periods, we applied the conditions we proposed in the Guideline, except for one condition that we do not consider is necessary to achieve the ARORO. This condition was that averaging periods should be as close as practical to the commencement of each regulatory year. We remain of the view that the remaining Guideline conditions are important and necessary to promote the ARORO. Those conditions include that at the time the period is nominated all dates in the averaging period must take place in the future, and that all averaging periods should be specified prior to the commencement of the regulatory control or access arrangement period. These conditions, respectively, help to ensure that the return on debt resulting from the averaging period is unbiased and the annual debt update can be practically and automatically applied (as required by the rules).

Table 3-42 sets out why we consider an averaging period that meets the remaining conditions in the Guideline contributes to the achievement of the ARORO. It also summarises our assessment of APTPPL's proposed debt averaging periods against these conditions.

Table 3-42 Assessment of proposed averaging periods against Guideline

Condition	Reasons for condition	Condition met?
Observed over a period of 10 or more consecutive business days up to a maximum of 12 months	Averaging daily estimates over a number of days smooths out short term volatility in the annually updated return on debt allowance.	Yes
It should be specified prior to the commencement of the regulatory control period.	This allows us to substantively assess the service provider's proposal. This avoids the practical difficulties with either (1) creating a new process for approving averaging period proposals or (2) assessing averaging period proposals during the annual pricing process, which is meant to be a compliance check that takes place over a short time frame.	Yes
At the time it is nominated, all dates in the averaging period must take place in the future.	If a regulated service provider can select an averaging period by looking at historical yields, it may introduce an upward bias.[1653]	Yes
An averaging period needs to be specified for each regulatory year	This allows for the annual debt update. The annual debt update reduces the potential for a mismatch between the	Yes

1651 AER, *Rate of return guideline*, December 2013, p. 21.

1652 NER, cll. 6.5.2(c) and 6A.6.2(c); NGR, r. 87(3).

1653 Lally, *Expert Report of Martin Thomas Lally*, 13 February 2011, pp. 9–10.

Condition	Reasons for condition	Condition met?
within a regulatory control period.	allowed and actual return on debt for a benchmark efficient entity for the service provider.	
The proposed averaging periods for different regulatory years are not required to be identical but should not overlap.	This avoids double counting averaging periods. This would detract from our specification of the trailing average, which weights periods equally. Not requiring periods to be identical helps preserve confidentiality and provide service providers with a degree of flexibility.	Yes
The nominal return on debt is to be updated annually using the agreed averaging period for the relevant regulatory year.	This prevents a service provider from introducing bias by only updating annually using the agreed averaging period when it is advantageous for it to do so.	Yes
Each agreed averaging period is to be confidential.	This facilitates service providers organising their financing arrangements without market participants being aware of the averaging periods. Accordingly, in practice we keep averaging periods confidential until they expire.	Yes

Source: AER, *Rate of return guideline*, December 2013, pp. 21-22;.

In assessing APTPPL's proposed debt averaging periods, we considered the timeframe within which each period should occur. In the Guideline, we proposed that service providers could nominate averaging periods of 10 or more consecutive business days up to a maximum of 12 months. However, the timing of the annual price/tariff variation process affects how late an averaging period can end and still be implemented in practice. Accordingly, under the 'Annual debt update process' section, we consider an averaging period for estimating APTPPL's allowed return on debt for regulatory year t should fall within the following timeframe:

- end no later than 25 business days before a service provider submits its annual pricing proposal or reference tariff variation proposal for year t to the AER[1654]
- commence no earlier than 12 months plus 25 business days before a service provider submits its annual pricing proposal or reference tariff variation proposal for year t to the AER.

We consider APTPPL's proposed averaging periods for 2017 to 2022 can be practically applied because they fall within this timeframe. We discuss this in more detail in the 'Annual debt update process' section.

Annual debt update process

The general process we propose to adopt for the annual debt update for APTPPL is set out in table 3-43.

[1654] However, we are open to individual service providers requiring a longer period (or requesting a shorter period) than 25 business days to accommodate their internal processes.

Table 3-43 Annual debt update process

Step	Timing	Description of step	Reasons for timing
1	25 business days before a service provider submits its reference tariff variation proposal to us.	Averaging period ends on or before this date.	We determine the maximum practical end date of the averaging period from the timing of steps 2 and 3.
2	10 business days before a service provider submits its reference tariff variation proposal to us.	So the service provider can factor this into its annual pricing proposal, we inform it of updates on the return on debt, annual building block revenue requirement and X factor that incorporates the updated return on debt.	15 business days between steps 1 and 2 provides sufficient time for us to calculate (and provide quality assurance checks on the updated return on debt, revenue and X factor.
	A service provider submits its pricing proposal to us on the date determined by the rules.	The service provider submits its pricing proposal to us for the relevant year.	10 business days between steps 2 and 3 is based on a service provider's advice regarding the minimum period it would require to factor the updated information into its prices. We are open to individual distributors requiring a longer period (or requesting a shorter period) to accommodate their internal processes.

Source: AER analysis.

On the basis of the process outlined in table 3-43, we consider an averaging period for estimating the return on debt for regulatory year t should fall within the following timeframe:

- end no later than 25 business days before a service provider submits its reference tariff variation proposal for year t to the AER
- commence no earlier than 12 months plus 25 business days before a service provider submits its reference tariff variation proposal for year t to the AER.[1655]

However, as set out in table 3-43, we are open to individual service providers requiring a longer period (or requesting a shorter period) between steps 2 and 3 to

[1655] A further possible constraint on the start date is, as set out in the previous section, one of our conditions is at the time it is nominated all dates in the averaging period must take place in the future.

accommodate their internal processes. We note that a longer (or shorter) time period would move back (or forward) the maximum practical end date of the averaging period by the same timeframe. For example, if a service provider requested 15 business days (instead of 10) for its internal processes, then its averaging period would need to end 30 business days (instead of 25) before the date the service provider must submit its reference tariff variation proposal to us.

The process outlined in table 3-16 does not apply to the first regulatory year in the regulatory control period. This is because the access arrangement decision will include the X factor for the first year, which will already incorporate the first year return on debt. Therefore, this process will generally apply to the subsequent years of a access arrangement period.

In table 3-43, we propose calculating the return on debt, annual building block revenue requirement, and X factor in accordance with the formula in the distribution determination. And we propose informing the service provider of our calculations before it submits its annual reference tariff variation proposal. We consider this preferable to the alternative approach, where we would assess updates the service provider calculated itself and submitted with its reference tariff variation proposal. This alternative approach could significantly complicate the annual tariff approval process if we identify calculation errors and require the service provider to revise all its proposed prices. On the other hand, our approach focusses the annual pricing approval process on how the distributor has incorporated the revised X factor into its prices, rather than also assessing the revised X factor itself.

M Expected inflation

We set out the reasons for our inflation decision in section 3.4.4. This section details our response to issues raised in regulatory proposals and submissions recently submitted to us.[1656]

It is important to note that we are currently conducting a broader review of methods for estimating expected inflation and the treatment of inflation in our revenue models. That review is yet to be finalised and so findings from the review cannot therefore be included in this decision.

The discussion set out here is necessarily limited to the information available to us at the time of making this determination. It is also necessarily limited having regard to both the time available (within the determination making process), and the fact that there has not been industry wide consideration of the issue. Our conclusions set out here therefore do not indicate the result of the review we are currently undertaking. In the context of that wider industry review, we expect we will have additional submissions and more complete analyses available to us.

That said, for the purposes of this determination, on the basis of the information currently available to us, we consider the RBA forecasts and target band approach:

- reflects our best estimate of expected inflation possible in the circumstances,
- is a recognised method that arrives at estimates of expected inflation on a reasonable basis,
- is commensurate with the efficient financing costs of a benchmark efficient service provider,[1657]
- contributes to the achievement of the National Gas Objective.

M.1 Issues with the RBA approach

Under the RBA forecasts and target band approach, 10 year inflation expectations are estimated as the geometric mean of 10 annual inflation rates, comprising:

- The RBA's short term inflation forecasts for years 1 and 2.
- The mid-point of the RBA's target band for each year from years 3 to 10.

M.1.1 The RBA's short-term forecasts used in years 1 and 2

[1656] Namely AusNet Services 2017-22 electricity transmission determination, AusNet Gas Distribution's, Multinet's, AGN's, and APAVTS's 2018-22 access arrangements and APTPPL's 2017-22 access arrangement.

[1657] With a similar degree of risk as that which applies to the service provider in the provision of regulated energy network services.

In our draft decision on AusNet Services' 2017–22 electricity transmission determination we noted that Tulip and Wallace (2012) find that the RBA's 1 year forecasts of inflation have substantial explanatory power and in the past RBA forecasts have been marginally more accurate than private sector forecasts.[1658]

CEG submitted that Tulip and Wallace (2012) report wide confidence intervals for the RBA's short-term forecasts. CEG noted that for the underlying inflation measure, actual inflation lies outside a 100 basis point range 30 per cent of the time. For the CPI inflation measure, the actual inflation will lie outside a 200 basis point range 30 per cent of the time.

However, CEG also noted that, on the relative accuracy of RBA forecasts relative to forecasts by the private sector, Tulip and Wallace (2012) states "the differences are small and not statistically significant".[1659]

Tulip & Wallace (2012) find that, regardless of the size of the confidence intervals, short term inflation forecasts by other entities do not materially outperform the RBA's forecasts. We note that in addition to Tulip and Wallace (2012), Tawadros (2013) found that the RBA forecasts produce much lower forecasting errors than the forecasts made by three other private sources (non-academic market economists, those made by union officials and the forecasts made by consumers or business people). The empirical results in Tawadros (2013) showed that the RBA had superior predictive information about inflation over the period of June 1993 to December 2010.[1660]

CEG also submitted that the relative accuracy of break-even inflation estimates versus the RBA's short-term forecasts is not addressed[1661] by Tulip and Wallace (2012). CEG submits that short-term inflation estimates from the break-even approach are superior to the RBA's short-term forecasts.[1662]

As stated in section 3.4.4, we consider that bond break-even estimates are likely to be distorted by biases and risk premia such that they may not be sufficiently reliable.

In any case, we note that our objective is to estimate inflation expectations over a ten year term, rather than short term forecasts. The RBA's short-term forecasts are merely an input into an approach for estimating long-term expectations. The role of the short-term (1 to 2 year) forecasts in the RBA forecasts and target band approach is to allow for short-term inflation expectations to have some influence on the overall 10-year estimate being above or below the RBA's inflation target. We consider that the currently available evidence suggests that RBA forecasts may be considered credible by the market such that short term inflation expectations may be informed by and

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[1658] Peter Tulip and Stephanie Wallace (2012), 'Estimates of Uncertainty around the RBA's Forecasts', RBA Research Discussion Paper – November 2012, RDP2012-07, p. 2.

[1659] CEG, *Best Estimate of Expected Inflation*, September 2016, paras 107–110, p. 40.

[1660] George Tawadros (2013), 'The information content of the Reserve Bank of Australia's inflation forecasts', Applied Economics, 45, pp. 623-628.

[1661] At the 10 year horizon or any other horizon.

[1662] CEG, *Best Estimate of Expected Inflation*, September 2016, paras 107–110, p. 40.

closely correspond to the RBA's forecast. In this case, we consider that the RBA's short-term forecasts are the best forecasts to use in the RBA forecasts and target band approach.

AusNet Services submitted that the RBA forecasts and target band approach only uses RBA short-term forecasts for the first two years of its 10 year term, ensuring that these forecasts do not have a significant influence on the overall estimate.[1663]

We reiterate that the available evidence supports the view that long-term inflation expectations are relatively stable over time and anchored to the RBA's target band. Further, if short term forecasts/expectations are volatile and deviate from long term inflation expectations – as found by Finlay and Wende (2011) for Australia[1664] – the weighting toward the midpoint of the target inflation band in the RBA forecasts and target band approach mitigates the distortionary effects of this volatility on long term estimates.

We consider that the influence of short-term forecasts on the overall 10-year inflation estimate from the RBA forecasts and target band approach appropriately reflects this evidence.

M.1.2 Probability weighted forecasts

AusNet Services and CEG submitted that the RBA's short term forecasts are "central forecasts" and, therefore, likely to underestimate "expected inflation" where the downside risks exceed the upside risk.[1665]

CEG submitted that bond break-even inflation estimates already reflect a probability-weighted average of all possible inflation outcomes as perceived by bond investors. CEG submitted that the bond break-even approach is the only plausible way in which the uncertainty about the multiple different paths inflation could take can be weighted in a manner consistent with the probabilities that bond investors attach to these outcomes, and that such probability-weighting is critical in the current low-inflation environment.[1666] AusNet Services submitted that in the current monetary policy environment, where policy rates are close to the zero lower bound, the greatest risks to inflation are to the downside. AusNet Services noted that Western developed countries

1663 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, p. 181.

1664 Richard Finlay and Sebastian Wende (2011), 'Estimating Inflation Expectations with a Limited Number of Inflation-indexed Bonds', Research Discussion Paper, Reserve Bank of Australia, RDP 2011-01, March, pp. 1-35

1665 AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, p. 232; AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 190–191; CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 12–14, 22–26.

1666 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 13–14, 22–26.

currently have monetary policy settings with policy rates close to zero and are currently undershooting inflation targets.[1667]

CEG also submitted that RBA's role in controlling inflation may affect the presentation of its forecasts and the RBA forecasts are a policy tool for anchoring inflation expectations as well as an expression of the RBA's view. In this case, the RBA may choose to publish only central forecasts and not lower-bound forecasts to avoid these lower bounds resulting in lower market expectations.[1668]

Short-term RBA forecasts are sourced from the RBA's quarterly statements on monetary policy. CEG assumes that the RBA's forecasts are central forecasts, but the RBA does not state whether these forecasts are central forecasts or probability-weighted forecasts.[1669] Further, CEG assumes an asymmetric distribution of market-anticipated inflation outcomes. We consider that this assumption is unsupported, noting that:

- The distribution of market-anticipated inflation outcomes is unobservable;
- The statements cited by CEG make no reference to the asymmetric distribution of anticipated-inflation outcomes for Australia;[1670]
- CEG has not relied on any studies on the distribution of market-anticipated inflation outcomes for Australia or provided any proxy-based estimates for this distribution.

CEG notes that the distribution of bond investors' inflation expectations may differ from the distribution of expectations of other parties, such as the RBA and participants in the inflation swaps market.[1671] We note that Fleckenstein et al (2014) has found that traders profit from such situations where breakeven inflation differs from other market measures such as inflation swaps.[1672] Therefore, it may be unclear which distribution of inflation expectations (that from bond investors, swaps participants, the RBA, or others) better reflects that of the market-expected inflation rate.

As noted in section M.1.4, we consider that the RBA's monetary policy remains effective and is perceived as such by investors.

M.1.3 The RBA's target band used in years 3 to 10

1667 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 190–191.

1668 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 26–27.

1669 For example, see: RBA, *Statement on Monetary Policy*, February 2017, pp. 56-62.

1670 CEG's cites RBA statements and statements made by mainstream media as evidence of an asymmetric distribution – neither which make reference to a skewed distribution of market-anticipated inflation outcomes [CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 23-26]. CEG cites the IMF which makes reference to the higher likelihood of weaker downside outcomes for world economic growth but in the passages cited no reference is made to anticipated inflation outcomes for Australia [CEG, *Best Estimate of Expected Inflation*, September 2016, p. 25].

1671 CEG, *Best Estimate of Expected Inflation*, September 2016, p. 12.

1672 Matthias Fleckenstein, Francis Longstaff and Hanno Lustig (2014), 'The TIPS-Treasury Bonds Puzzle', The Journal of Finance, 69(5), October, pp. 2168-2171.

AusNet Services submitted that the RBA forecasts and target band approach includes an assumption that investors expect inflation to average 2.5 per cent beyond two years.[1673] CEG submitted that an expectation that Australian inflation will jump to 2.5 per cent at the end of the second year (of the 10 year inflation forecast) is inconsistent with the fact that Australian (and global) inflation rates have been persistently below target for many years, with instances of deflation in Australia (March quarter CPI), US, Japan, the UK and the Eurozone.[1674]

To clarify, while we estimate inflation expectations over a 10-year term, we do not separately estimate or have to take a view on investors' inflation expectations for each year of the 10-year term. Neither do we need to have a view on the expected path of inflation over the 10-year term. Therefore, we do not assume that inflation expectations 'jump' to 2.5 per cent at the end of the second year. Annual inflation rates in the RBA forecasts and target band approach are merely inputs into deriving the best estimate of 10-year expected inflation.

CEG submitted that inflation estimates from the RBA forecasts and target band approach beyond year 2 is impervious to market developments, while the corresponding break-even inflation rate has declined dramatically.[1675]

As inputs into an overall 10-year estimate, we do not consider it relevant that individual annual inflation rates for years 8 through 10 do not vary with market developments. Rather, we consider it more relevant whether or not the overall 10-year estimate responds to market developments in a manner that is likely to reflect investors' inflation expectations. As stated above, the available evidence supports the view that long-term inflation expectations are relatively stable over time and anchored to the RBA's target band.

M.1.4 Anchoring of investor expectations to the RBA target band

In section 3.4.4, we noted that we consider that long-term inflation expectations are relatively stable over time and anchored to the RBA's target band. However, inflation expectations may de-anchor from the RBA's target if the RBA is perceived to be ineffective at using monetary policy to control inflation.

Multinet, AusNet Services and CEG submitted that the potential for the RBA's monetary policy to stimulate economic activity has diminished as policy interest rates

1673 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 190–191.

1674 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 13–17.

1675 CEG, *Best Estimate of Expected Inflation*, September 2016, p. 17.

have approached zero, thereby creating the potential for a low inflation trap: a situation in which monetary policy may be ineffective.[1676]

We acknowledge that the RBA's cash rate (policy rate) is currently at historically low levels.[1677] However, we do not agree that that the RBA's implementation of monetary policy is currently ineffective, or likely to be ineffective in the foreseeable future, as a result of the current level of the RBA's policy rate.

Central banks have several options if policy rates approach zero. One such example is the ability to lower interest rates below zero, which is due to a non-zero cost of holding cash (costs of safes, insurance, etc.). Interest rates below zero have been seen in several advanced economies such as the ECB, Bank of Japan and other smaller European authorities.[1678] Central banks also have the option to use ‘unconventional’ monetary policy, such as quantitative easing (bond buying) combined with macroprudential policy.[1679]

Further, if the public did not believe that the RBA had control of inflation due to the policy rate being close to zero, we would expect there would be evidence of an unanchoring of inflation expectations. There is no evidence of this in the survey measures (which are less likely to be affected by the bias exhibited in the breakeven approach). Long-term inflation expectations from Consensus Economics' survey measures and from 5-year to 10-year inflation swaps appear consistent with the RBA's medium-term inflation target.[1680]

CEG, in its recent report, claimed that all western developed countries are currently undershooting inflation targets. We consider that this mischaracterises the nature of central bank inflation targeting. Australia’s inflation target is to achieve an inflation rate of 2 to 3 per cent, on average, over the business cycle. The inflation target is defined as a medium-term average rather than as a rate (or band of rates) that must be held at all times. For instance, since June 1993,[1681] CPI inflation has been below 2 per cent for 24 per cent of the time, and coincidentally above 3 per cent for 23 per cent of the time.

[1676] CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 22–23; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, p.223; Multinet, Rate of Return Overview, 16 December 2016, p. 47.

[1677] See: http://www.rba.gov.au/statistics/cash-rate/

[1678] See: http://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html; Bloomberg Markets, *BOJ Maintains Policy Rate at -0.1 Percent*, 15 March 2017; https://www.snb.ch/en/iabout/stat/statpub/zidea/id/current_interest_exchange_rates; Wienberg, *Speculators Seen Driving Denmark to Test World’s Lowest Rate*, Bloomberg News 12 February 2015.

[1679] This was also noted by the CCP. The CCP also submitted that, with regards to quantitative easing, "that would make the use of bond yields to forecast inflation somewhat circular - bonds would be the measure as well as the tool wielded by Government to affect the measure" [CCP, Response to AusNet Services Revised Revenue Proposal for 2017-2022, October 2016, p.18].

[1680] RBA Bulletin, Measures of Inflation Expectations in Australia, December 2016.

[1681] Australia began inflation rate targeting in 1993. See: Bernie Fraser, *Two Perspectives on Monetary Policy*, Talk to a conference in honour of Don Sanders, Sydney, 17 August 1992; and Bernie Fraser, *Some Aspects of Monetary Policy*, Talk to Australian Business Economists, Sydney, 31 March 1993.

On average though, inflation was around 2.5 per cent.[1682] With such a mandate it cannot be said that Australia is currently undershooting the target.

There are other western developed countries facing short term inflation above their targets. Norway is currently overshooting its target, achieving inflation of 3.4 per cent, which is above its target of 2.5 per cent.[1683] The US CPI result for December 2016 was 2.1 per cent year on year, which is higher than the Federal Reserve's target of 2 per cent.[1684] The UK CPI result for February 2017 was 2.3 per cent year on year, which is higher than the Bank of England's 2 per cent inflation target.[1685] Finally, we note that western developed countries in general, and Australia in particular, continue to implement inflation targeting and have not rolled-back inflation targeting regimes in the presence of a 'low-inflation trap'.

M.1.5 Potential negative real risk free rate

CEG, AGN, Multinet, and AusNet Services submitted that by applying the RBA forecasts and target band approach to historical data, inflation estimates have at various times in the past resulted in negative estimates of the real risk free rate. CEG, AGN, Multinet, and AusNet Services submitted that this result is implausible, as it suggests that investors expect a negative real return on nominal CGS at the same time that they can achieve a positive guaranteed real risk free return simply by buying inflation indexed CGS.[1686] AusNet Services submitted that investors can achieve positive real risk free returns through investing in index-linked CGS, and that this test should be applied as a sense check as to whether regulatory decisions reflect market realities.[1687]

CEG submitted that a negative estimated real risk free rate is an anomaly and is a result of estimates of expected inflation from the RBA forecasts and target band approach being inappropriate for the current economic environment rather than a true anomaly in investor required returns.[1688] CEG submitted that indexed CGS are a more direct proxy for the real risk free rate than a measure that is based on nominal CGS

1682 RBA, *Inflation and Monetary Policy*, speech by Philip Lowe, 18 October 2016.

1683 See https://www.ft.com/content/2bd40fd7-6c27-3f79-9759-d109425cab6d; and https://www.bloomberg.com/news/articles/2016-08-10/norway-inflation-surge-casts-doubt-over-more-interest-rate-cuts as

1684 Bureau of Labor Statistics, *CPI Detailed Report - Data for February 2017*; US Federal Reserve, *Why does the Federal Reserve aim for 2 percent inflation over time?*, 26 January 2015.

1685 Office of National Statistics, *CPIH: % change over 12 months*, 21 March 2017; Phillip Hammond (Chancellor of the Exchequer), *Remit for the monetary policy committee*, 8 March 2017.

1686 CEG, *Best Estimate of Expected Inflation*, September 2016, paras 47–50, pp. 13–15; AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 179, 188–191; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp. 221, 223, 225; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp.223-224; AGN, Final Plan: Access Arrangement Information for our Victorian and Albury Natural Gas Distribution Networks: 2018 to 2022, December 2016, pp.109-110; Multinet, Rate of Return Overview, 16 December 2016, pp.48-50.

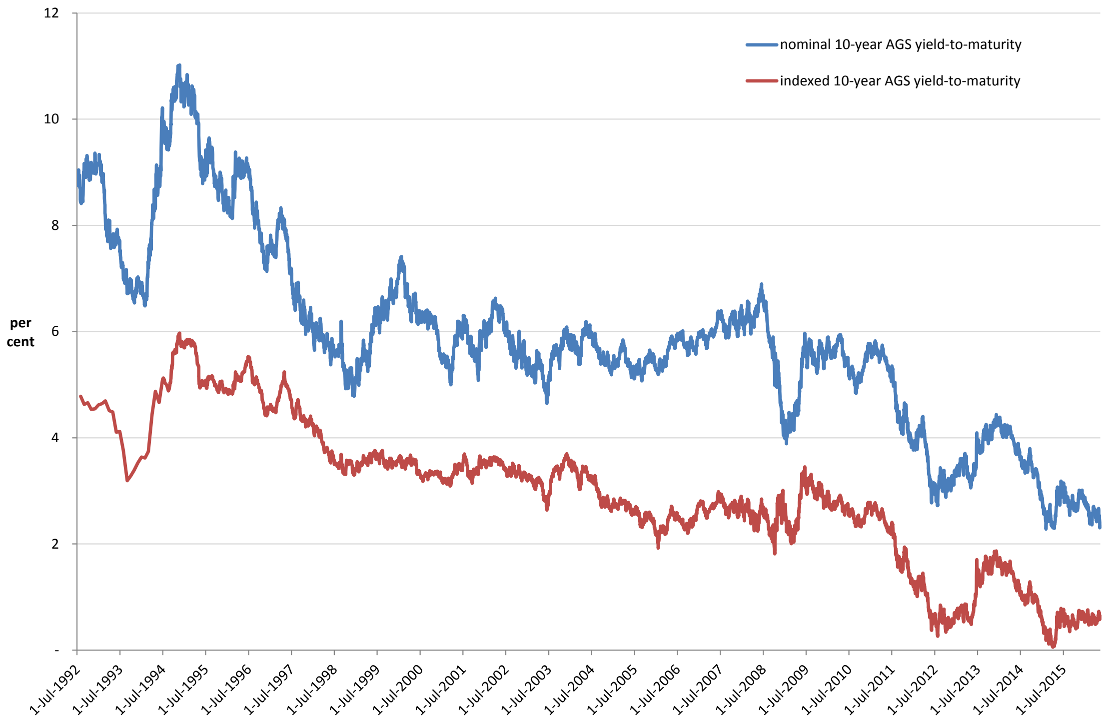
1687 AusNet Services, *Submission on Revised Proposal*, 19 October 2016, p. 4.

1688 CEG, *Best Estimate of Expected Inflation*, September 2016, paras 47–50, pp. 13–15.

and then adjusted for an estimate of expected inflation (even if that estimate of expected inflation is accurate). CEG submitted that adopting the yield on indexed CGS as the real risk free rate will substantially improve the accuracy of the PTRM in setting real returns.[1689]

We do not consider it implausible or anomalous for yields on indexed CGS to fall below zero. As shown in Figure 3-24 below, the yield to maturity on 10-year indexed CGS approached zero in mid-2012 and early 2015. Given the movement in observed yields on indexed CGS since 2010, we consider it plausible (though we have no views on likelihood) that yields could again approach or fall below zero.

Figure 3-24 Yields on 10-year nominal and indexed CGS (AGS)



Source: AER analysis, RBA interest rate statistics F16 Indicative Mid-Rates of Australian Government Securities

We also consider it plausible for yields on indexed CGS to be positive while the real risk free rate is negative. As outlined in section 3.4.4, there are a number of biases and risk premia that may affect yields on indexed CGS, specifically potential liquidity premia driven by the relative liquidity of nominal and indexed CGS. If investors in indexed CGS consider liquidity to be a significant risk, then yields on indexed CGS will be higher to compensate investors for this risk. In this case, the yields on indexed CGS do not represent a true real risk free rate, but the real risk free rate plus the liquidity premium. Academic researchers have found that liquidity premium on indexed CGS

[1689] CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 12-13.

could range from -30 to 300 basis points.[1690] Currently, a liquidity premium of 64 basis points[1691] or higher would result in a negative risk-adjusted return on indexed CGS.

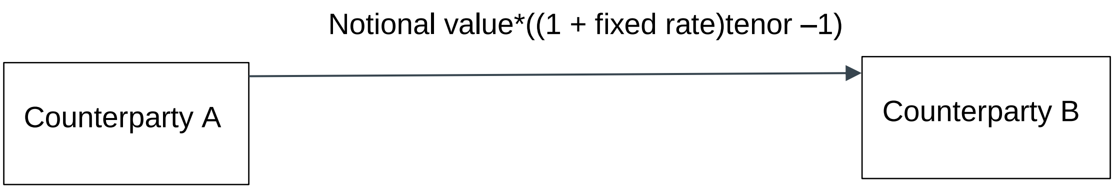
Further, we do not consider that negative interest rates are implausible in general. There may be a cost to storing and insuring cash reserves, such that investing in bonds and other assets can remain attractive even at negative interest rates.[1692] The CCP supported this view, stating:[1693]

> …very low rates are a fact, and negative rates are not outside the realms of possibility

In any case, our final decision implies a positive real risk free rate. In this light, the submissions from CEG, AGN, Multinet, and AusNet Services can be reduced to the contention that the RBA forecasts and target band method does not result in best estimates of expected inflation because it would result in an implied real risk free rate that is materially different from yields on indexed CGS (regardless of whether the risk free rate is negative or positive). This contention presumes that the yields on indexed CGS provide an accurate and unbiased estimate of the real risk free rate. We do not consider that this presumption is supported by the evidence currently available to us. Specifically, we consider that there are a number of biases and risk premia (see section 3.4.4) likely to affect the yield on indexed CGS such that it does not equal the real risk free rate.

We also consider the evidence from the Australian market for zero-coupon inflation swaps. CEG, AGN, Multinet, and AusNet Services submitted that an investor could invest in indexed CGS and earn a real risk free return. However, to earn a real risk free return, an investor could alternatively invest in nominal CGS and enter into an inflation swap to hedge inflation risk on its investment in nominal CGS. Figure 3-25 below outlines the structure of a zero-coupon inflation swap. In this case, the investor would be the fixed rate payer in the inflation swap agreement and would pay a fixed, market-determined rate to the counterparty in exchange for a floating rate payment (based on outturn CPI) from the counterparty.

Figure 3-25 Structure of a zero-coupon inflation swap



[1690] See Table 3 in Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017.. D'Amico, Kim, and Wei (2016) found liquidity premia in the US of up to 300 basis points during the GFC. Liu et al (2015) found liquidity premium in the UK between 2009 and 2013 averaged -30 basis points.

[1691] Based on a 20 day average of the yield on indexed CGS with a 10-year term to maturity, and using our return on equity risk free rate averaging period.

[1692] We acknowledge that, while investors have the option of investing in cash, large negative rates may not be likely without deflation.

[1693] CCP, *Response to AusNet Services Revised Revenue Proposal for 2017-2022*, October 2016, p.17.

$$\text{Notional value}*(\frac{CPI_{t+tenor}}{CPI_t} - 1)$$

Source: Michael Oman, 'Inflation swap structures: The benchmark – Zero coupon inflation swaps', Inflation Derivatives: A Users Guide, Barclays Capital, January 2005, p. 5.

The floating rate payments that the inflation-hedged nominal CGS investor receives from their inflation swap should equal the value of the nominal CGS yield that is eroded by inflation,[1694] preserving the nominal yield as the real return. The real return that the investor receives is then the yield on nominal CGS less the fixed swap rate, which is market-determined rate. Over our draft decision risk free rate averaging period, the market-determined zero-coupon swap rate was 2.34 per cent.[1695] Combined with our nominal risk free rate (estimated from yields on nominal CGS), this implies a real risk free rate of 0.25 per cent, about 40 basis points less than the yield on indexed CGS.

Although investors cannot (directly) invest in RBA forecasts or the RBA target band, this fact alone does not invalidate our real risk free rate estimate. Investors can invest in indexed CGS or in inflation swaps. Both swap and bond rates are market-determined, however swap-implied real risk free rates can differ materially from yields on indexed CGS. The difference between these two real risk free rate estimates is likely to be the presence of biases and premia in either the swap rates, the indexed CGS yields, or both.

We consider, based on the currently available evidence, that the swap rate is likely to be less influenced by biases and premia than the yields on indexed CGS. However, we also consider that the swap rate may be influenced by bias and premia, such that it too may not reflect the true real risk free rate.

Academic evidence that long term inflation expectations are relatively stable and anchored to the RBA target band, may suggest that the RBA forecasts and target band approach provides the best estimates of expected inflation. We also consider that the yields on nominal CGS provide the best estimate of the nominal risk free rate. Therefore, we are satisfied that the best estimates of the nominal risk free rate and expected inflation will result in the best estimate of the real risk free rate.

M.1.6 Calculating a nominal risk free rate from our inflation estimate and indexed CGS yields

[1694] Less a spread above the CPI rate that may be set by market markers in the swap market. The presence of this spread in the swap rate may result in swap-implied real risk free rate under-estimating the true real risk free rate. However, the yield on nominal CGS would likely include an inflation risk premium, and this premium would likely result in the swap-implied real risk free rate over-estimating the true real risk free rate (all else equal). Therefore, the net effect is unclear.

[1695] Based on Australian 10 year inflation swaps data from the Bloomberg Professional Service (AUSWIT10).

AusNet Services proposed that, if the break-even approach is not adopted for estimating expected inflation, then we should change the way we estimate the nominal risk free rate. In this case AusNet Services proposes that the nominal risk free rate should be estimated by starting with the yield on indexed CGS as an estimate of the real risk free rate, and then transform this real rate into a nominal rate using the Fisher equation and our estimate of expected inflation.[1696]

AusNet Services' proposal is premised on the yields on indexed CGS reflecting the real risk free rate. For the reasons set out in section M.1.5, we consider that the yield on indexed CGS is not the best estimate of the real risk free rate. For this reason, we consider that AusNet Services' alternative proposal for estimating the nominal risk free rate will not result in a reliable and unbiased estimate, and therefore would not contribute to the achievement of the allowed rate of return objective.

M.2 Break-even estimates as a direct market measure

AGN, AusNet Services and CEG submitted that bond break-even inflation estimates are a direct measure of inflation expectations in the same bond market that the AER uses to set the nominal rate of return on equity (i.e., the CGS market). CEG also submitted that indexed CGS are a more direct proxy for the real risk free rate than a measure equal to nominal CGS less an estimate of expected inflation (even if that estimate of expected inflation is accurate).[1697]

CEG contends that breakeven inflation, as calculated by the difference between nominal and indexed CGS bond yields, is a direct measure of market inflation expectations. This contention would only hold true if the following assumptions were true:

- breakeven inflation can be accurately and reliably calculated from nominal and indexed CGS; and
- yields for nominal and indexed CGS were not influenced by premia or biases held by bond investors (or if the various premia and biases influencing bond investors could be identified and decomposed within bond yields).

In regards to the first assumption, a lack of outstanding tenors in indexed CGS relative to nominal CGS can lead to problems in matching the maturities of nominal and

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1696 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 192-195.

1697 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 12-13; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp.223-224; AGN, Final Plan: Access Arrangement Information for our Victorian and Albury Natural Gas Distribution Networks: 2018 to 2022, December 2016, p. 108.

indexed CGS.[1698] The approximate matching of 10 year maturities of nominal and indexed CGS is necessary for the calculation of 10 year bond break-even estimates. Thus, if there are too few tenors of indexed CGS, or the tenors of indexed and nominal CGS don't match, the calculation of breakeven inflation may rely on estimates of yields to maturity rather than on observed yields to maturity.[1699] This leads to two implications:

- the break-even-implied forward inflation rates are unlikely to correspond to market expectations of future short term inflation rates; and
- the break-even estimate is unlikely to reflect mark-to-market expectations of inflation over any yearly horizon up to 10 years ahead.

Relying on interpolated yield curves may result in overly sensitive breakeven estimates. Deacon and Derry (1994) and Deacon et al. (2004) argue that the choice of term structure model can have a significant effect on the resulting bond break-even-implied inflation term structure. As a result break-even inflation estimates may vary considerably depending on the yield curve models employed. In this respect, break-even inflation may not produce robust estimates of expected inflation. Furthermore, this source of variability and lack of robustness of break-even inflation estimates may occur because there is no consensus on which yield curve models are the most appropriate.[1700] Another issue stems from differences in the sizes of coupon payments across maturities, which may alter break-even-implied forward inflation rates (see

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[1698] See, e.g., Angus Moore (2016), 'Measures of Inflation Expectations in Australia, *Reserve Bank of Australia Bulletin*, December Quarter, pp. 23–31; Will Devlin and Deepika Patwardhan (2012), 'Measuring market inflation expectations', Treasury Roundup Series, Issue 2, pp. 5–17.

[1699] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, paragraph 59.

[1700] As argued by Carlos Zarazaga (2010), 'The Difficult Art of Eliciting Long-Run Inflation Expectations from Government Bond Prices', Staff Papers, Federal Reserve Bank of Dallas, No. 9, March, pp. 1–53.

Table 3-18).[1701] These issues cast doubt on the accuracy of break-even inflation estimates derived from indexed and nominal CGS yield curves.

On the second assumption mentioned above, a number of significant premia and biases are evident in break-even inflation estimates, leading to these estimates not reflecting market expectations of inflation.[1702] Liquidity premia, inflation risk premia, convexity bias, inflation indexation lag, sensitivity to short term inflation trends, among others. All these act to influence break-even inflation estimates such that they do not directly reflect market-expected inflation.

Further, there is a lack of studies decomposing Australian break-even inflation estimates to quantify biases and premia.[1703] Moreover, the studies decomposing US and UK government bonds reveal varying levels of liquidity premia, suggesting that even if an attempt was made to decompose bond yields in Australia, estimates of inflation expectations may not be robust.

We consider that zero coupon inflation swaps may result in better estimates of expected inflation than the bond break-even approach, and note that inflation swaps are also (like bonds) market-traded instruments. We consider that inflation swaps may be subject to a number of biases and risk premia, however many of these are likely to be immaterial (see section 3.4.4). In addition, the published Australian zero coupon inflation swap rates are available for many more tenors than tenors for indexed CGS. On this basis, inflation swaps may provide a better decomposition of market-implied forward inflation rates than the breakeven method.

M.3 Biases and premia in the break-even and swaps estimates

AusNet Services and CEG submitted that the overwhelming conclusion of the academic literature is that the potential sources of bias in break-even inflation estimates are small and just as likely to result in an over-estimate of expected inflation as an under estimate.

CEG submitted that:[1704]

> An important confirmation of the existence of a positive bias is the very existence of CPI indexed bonds. If the bias was negative then this is just another way of saying that CPI indexed bonds are expected to be a more costly form of borrowing by the government in question … as soon as budgetary circumstances allowed, following the GFC, the Government recommenced issuance of indexed CGS. The fact that the Government did so is evidence that

[1701] Mark Deacon and Andrew Derry (1994), 'Deriving Estimates of Inflation Expectations from the Prices of UK Government Bonds', *Bank of England Working Paper*, No. 23, pp. 1–52.

[1702] See section 0.

[1703] As pointed out in Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, paragraph 212.

[1704] CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, pp. 8–9.

> it believed that the expected cost of issuing indexed CGS was, at a minimum, not higher than the cost of issuing nominal CGS. By definition, this can only be the case if break even inflation exceeds (or is not less than) actuarially expected inflation outcomes.

In support of this argument CEG refer to Campbell, Shiller, and Viceira (2009).[1705] However, Campbell, Shiller, and Viceira (2009) note that Governments are likely to issue indexed bonds for other reasons, stating: [1706]

> Several other considerations also suggest that inflation-indexed bonds are a valuable form of public debt. First, to the extent that particular forms of debt have different investment clienteles, all with downward-sloping demand curves for bonds, it is desirable to diversify across different forms so as to tap the largest possible market for government debt (Greenwood and Vayanos 2008; Vayanos and Vila 2007).
>
> Second, inflation-indexed bonds can be used to draw inferences about bond investors' inflation expectations, and such information is extremely valuable for monetary policymakers.

AusNet Services and CEG submitted that only the convexity and liquidity premium issues are likely to result in a potential downward bias of expected inflation forecasts and that if any bias exists, it is small and does not necessarily result in an under estimate of inflation.[1707]

CEG submits[1708] that the results of D'Amico, Kim and Wei (2010),[1709] Gurkaynak, Sack, and Wright (2010),[1710] Finlay and Wende (2011),[1711] and Grishchenko and Huang (2012)[1712] indicate that the breakeven method actually overstates expected inflation. Ang, Bekaert and Wei (2008)[1713] are also cited to support this contention. [1714]

1705 John Campbell, Robert Shiller and Luis Viceira (2009), 'Understanding Inflation-Indexed Bond Markets', Brookings Papers on Economic Activity, Spring 2009, pp. 79-138.

1706 John Campbell, Robert Shiller and Luis Viceira (2009), 'Understanding Inflation-Indexed Bond Markets', Brookings Papers on Economic Activity, Spring 2009, pp. 115-116.

1707 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 189-190; CEG, *Best Estimate of Expected Inflation*, September 2016, p. 35.

1708 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 41-44; CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, pp. 18–22.

1709 D'Amico, S., Kim, D.H.,Wei, M., *Tips from TIPS: The Informational Content of Treasury Inflation Protected Security Prices*, Federal Reserve Board, 2010-19, Draft Version 29 December 2009.

1710 Refet Gurkaynak, Brian Sack and Jonathan Wright (2010), 'The TIPS Yield Curve and Inflation Compensation', American Economic Journal: Macroeconomics, 2(1), pp. 70–92.

1711 Richard Finlay and Sebastian Wende (2011), *Estimating Inflation Expectations with a Limited Number of Inflation-indexed Bonds*, Research Discussion Paper, Reserve Bank of Australia, RDP 2011-01, March 2011, pp. 1-35.

1712 Olesya Grishchenko and Jing-zhi Huang (2012), *Inflation Risk Premium: Evidence from the TIPS market*, *Finance and Economics Discussion Series Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.* 2012-06

1713 Andrew Ang, Geert Bekaert and Min Wei (2008), 'The Term Structure of Real Rates and Expected Inflation', *The Journal of Finance*, 63(2).

1714 CEG, *Best estimate of expected inflation*, September 2016, pp. 46-47.

We note that Gurkaynak, Sack, and Wright (2010) and Finlay and Wende (2011) use survey estimates as proxies for inflation expectations against which to estimate biases and risk premia in break-even inflation rates.[1715] D'Amico, Kim & Wei (2016) use the spread between the inflation swap rates and the bond break-even inflation rates as a proxy for biases and risk premia in break-even rates.[1716] The use of inflation swaps or surveys as benchmarks suggest that these expected inflation rates are considered to be less distorted by biases and risk premia compared to bond break-even rates.

On liquidity premium in break-even inflation estimates, CEG submitted that academic studies have estimated this premium to be around zero, around 1 basis point or less, 10 basis points or less, or less than zero. In support, CEG referred to studies by D'Amico, Kim and Wei (2010), D'Amico, Kim and Wei (2016), Grishchenko and Huang (2012), Lehman Brothers (2006), Banco Central do Brasil (2014).[1717]

However, caution is required in the drawing of any inferences from any single study of Australian bond break-even inflation estimates. To gain a better indication of the potential biases, premia and distortions, all bond break-even inflation rate studies should be considered. Most studies find significant biases in the break-even inflation estimates, many of which are time-varying.

In addition, we consider that no single decomposition study cited may be considered as the most relevant or most appropriate because, as Zarazaga (2010) points out, our current understanding of bond prices is too limited to determine with any confidence the fraction attributed to bias and the fraction attributed to expected inflation.[1718]

Further, CEG's submission on 'net bias', referring to multiple studies which find various biases in break-even inflation estimates, presumes that:

4. these biases are constant and can be simply 'added' and 'subtracted' to obtain a 'net bias'; and
5. the 'net bias' is assumed to be the same 10 years ahead.[1719]

1715 Refet Gurkaynak, Brian Sack and Jonathan Wright (2010), 'The TIPS Yield Curve and Inflation Compensation', American Economic Journal: Macroeconomics, 2(1), p. 85; Richard Finlay and Sebastian Wende (2011), *Estimating Inflation Expectations with a Limited Number of Inflation-indexed Bonds*, Research Discussion Paper, Reserve Bank of Australia, RDP 2011-01, March 2011, pp. 3-4, 13-15, 22. Finlay and Wende's proxies for inflation expectations over 1, 5 and 10 year horizons are model-derived estimates of expected inflation using indexed bond price data and inflation forecasts from Consensus Economics.

1716 Stefania D'Amico, Don Kim and Min Wei (2016), 'Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices', Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, pp. 28-29 and p. 59.

1717 CEG, *Best estimate of expected inflation*, September 2016, Paras 100, 113, 118, 135, 136.

1718 Carlos Zarazaga (2010), 'The Difficult Art of Eliciting Long-Run Inflation Expectations from Government Bond Prices', Staff Papers, Federal Reserve Bank of Dallas, No. 9, March, p. 38.

1719 CEG also submitted that "it is not possible to reliably esitmate the magnitude of any bias over a short horizon (such as a cost of equity averaging period)" and that " It is, however, possible to, more reliably, arrive at estimates of the average bias over longer periods of time". [CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, pp. 7–8]. We note that the finding of ACCC Working Paper #11 that many potential

There is no a-priori reason to consider that at any point in time the biases, distortions and premia in break-even inflation estimates would wholly or largely offset one another. ACCC Working Paper #11 finds that the biases and risk premia affecting bond break-even inflation estimates are likely to be time-varying,[1720] and estimates from academic research sensitive to the methodological choices and sample periods adopted.[1721] The results of different studies cannot be easily 'added' to one another.

Nonetheless, for completeness, we respond in sections M.3.1to M.3.4 below to submissions made about specific studies.

CEG also submitted that:[1722]

> when using breakeven inflation to determine expected inflation prior to late 2008, the AER and its forerunner the ACCC, did not make any adjustments for inflation risk or any of the other potential sources of bias, for which it now argues adjustments must be made

ACCC Working Paper #11 was published on 18 April 2017 and includes a detailed survey of the academic literature. The Working Paper finds that there are a number of potential biases and risk premia that may affect inflation estimates from the bond break-even approach. This working paper, and most of the academic literature that it cites, was not available before 2008.

M.3.1Liquidity premium

AusNet Services and CEG submitted a number of arguments about the current liquidity of the CGS market, the materiality of liquidity measures, and the findings of individual studies of bond break-even estimates. Our consideration of these issues is in the subsections below.

Changes to the liquidity of the nominal and indexed CGS markets

Multinet, AGN, AusNet Services and CEG submitted that the smaller size (short supply) of the indexed CGS market was previously attributed by us as a reason for break-even inflation overstating expected inflation (not understating it). AusNet Services submitted that if these 'distortions' still exist then they imply that the actual expected inflation is even lower than the break-even rate.[1723]

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biases and risk premia are time-varying, such that an estimate of average bias over a longer period of time may not be a reliable estimate of the bias expected over the future period of interest.

[1720] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, para 208(d).

[1721] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, para 212.

[1722] CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, page 4.

[1723] AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 188-189; CEG, *Best Estimate of Expected Inflation*, September 2016, p. 39; CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, pp. 4–7; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16

In contrast, the CCP submitted:[1724]

> …at this point we are not persuaded by the information provided in it [the September 2016 CEG report titled 'Best estimates of expected inflation'] that the market is now liquid…
>
> Expert advice from those who administer the market and are most closely involved with it is the most useful input into whether it is a liquid and well-functioning market, so we suggest the AER should consult with the RBA and Australian Treasury, as it did in 2007

While the distortions in the bond break-even inflation rate observed in 2007 may still exist, we consider that given the significant number of distortions, premia and biases potentially present in break-even estimates, it would be:

- difficult to isolate these distortions, premia and biases and discuss these issues without consideration that at different times other biases, premia and distortions may dominate the distortions arising from the lack of supply;
- impractical to hold all other biases, premia and distortions constant; and
- difficult to consider how supply and its related distortions will influence the quantum of the net effects of all these biases, premia and distortions since the estimation method, model and sample period all influence the size of the estimated distortions.

This difficulty in decomposing bond break-even estimates into various potential biases and risk premia reduces the transparency and replicability of the estimates and impinges the ability of stakeholders to contribute to the regulatory process. These factors affect the ability of the bond break-even approach to provide best estimates of expected inflation, regardless of whether a particular bias may be considered to result in an over-estimate or under-estimate at a particular point in time.

Estimates of liquidity premium may be distorted by an immature indexed bond market

Multinet, AGN, AusNet Services, PwC, and CEG submitted that since 2012 there has been significant new issues of indexed bonds, and academic research prior to this time may not be reliable due to the US TIPS market being in its infancy.[1725]

December 2016, p.230; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp.223-224; AGN, Final Plan: Access Arrangement Information for our Victorian and Albury Natural Gas Distribution Networks: 2018 to 2022, December 2016, p.111; Multinet, Rate of Return Overview, 16 December 2016, p.53.

1724 CCP, Response to AusNet Services Revised Revenue Proposal for 2017-2022, October 2016, p.16.

1725 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, p. 189; CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 36-37; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, p. 230; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp.223-224; AGN, Final Plan: Access Arrangement Information for

We acknowledge that in an indexed bond market's infancy the yields may not behave in the same manner as when the bond market is more mature. However, it is not the case that the liquidity risk premium and inflation risk premium only existed in the bond market's infancy. Academic research has been completed using only mature market data. ACCC Working Paper #11 notes that:

> With the exception of the late 1990s and early 2000s, the cited US BBIR [bond break-even inflation rate] studies do not consider the supply of outstanding US TIPS to be a problem. In the cited studies of the UK indexed bond markets, issues relating to supply are not considered.

ACCC Working Paper #11[1726]outlines a number of studies that find potential liquidity premia in indexed government bond markets that are unlikely to be distorted by being in their infancy.

Investors' value of additional liquidity falls to zero once they cannot move the market against themselves

CEG submitted that investors' valuation of additional liquidity falls to zero as soon as they are confident that their own trading will not move the market against themselves. CEG submitted that the Australian nominal and indexed CGS markets are currently relatively large, such that there is no reason to believe that a material liquidity premium exists when moving from indexed to nominal CGS (under normal market circumstances).[1727] PwC submitted that relative liquidity should not affect the bond break-even inflation estimates due to the non-substitutability of nominal and indexed CGS given the diametrically opposed future inflation view of nominal and indexed CGS.[1728]

We consider that that the relative liquidity of the Australian nominal and indexed CGS markets, and the presence of a liquidity premium, is an empirical question. While PwC asserted the non-substitutability of nominal and indexed CGS as an a priori reason why relative liquidity bias may not be material, it did not cite any empricial or other supporting evidence to support this view. In contrast, ACCC Working Paper #11 noted[1729] that Fleckenstein et al. cite a number of studies which discuss how slow-moving capital or capital availability may explain the persistence of arbitrage

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our Victorian and Albury Natural Gas Distribution Networks: 2018 to 2022, December 2016, p.111; Multinet, Rate of Return Overview, 16 December 2016, pp.53-54; PwC, Report to Australian Gas Networks Limited, Estimating Expected Inflation using the Breakeven Method – Response to Liquidity Issues raised by the Australian Energy Regulator, December 2016, pp. 11-15, 17-20.

1726 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, Table 3.

1727 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 38-39.

1728 PwC, Report to Australian Gas Networks Limited, Estimating Expected Inflation using the Breakeven Method – Response to Liquidity Issues raised by the Australian Energy Regulator, December 2016, p. 16.

1729 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, pp. 30-31.

opportunities in mispricing of TIPS and Treasury bonds.[1730] We also note that the Australian government securities markets are typically less liquid than similar foreign markets (such as the US and UK), and that ACCC Working Paper #11's survey of the academic literature finds evidence of a potentially material and time-varying liquidity premium, including in the much more liquid US and UK markets.[1731] ACCC Working Paper #11 also finds it unlikely that relative liquidity in the Australian CGS market has improved since 2007-08, based on a consideration of relative turnover and bid-ask spreads as proxy measures of relative liquidity.[1732]

Further, we note that a recent RBA study of the Australian market finds that relative liquidity may be causing break-even inflation estimates to be increasingly downwardly biased: [1733]

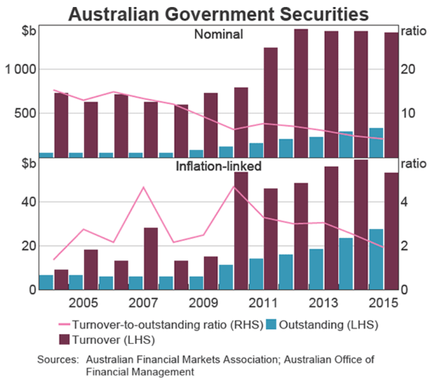
> The financial markets that are used to calculate some measures of inflation expectations are not particularly liquid in Australia, and the financial measures also include an inflation risk premium; these issues can affect the interpretation of movements in the series.
>
> …
>
> The first is that, in Australia, markets for these instruments are not particularly active or liquid. For inflation-linked bonds, liquidity is low relative to nominal AGS and so investors who wish to hold highly liquid assets will have a preference for nominal AGS. As a result, investors may demand a higher yield on inflation-linked AGS, known as a 'liquidity premium', to compensate for the risk of market prices moving against the investor in a substantial way if they try to sell their position. This liquidity premium may downwardly bias the bond-based measure of inflation expectations.
>
> …
>
> Various metrics suggest that liquidity is substantially lower for inflation-linked AGS than for nominal AGS (Graph 6). It is for this reason that the yields on inflation-linked AGS are believed to embed a liquidity premium over nominal AGS. If the liquidity premium were constant over time, it would affect only the level of the estimated bond break-even inflation rate. However, there is a steadily increasing wedge between the 10-year inflation swaps rate and 10-year bond break-even rates since about 2011 (Graph 7).
>
> Graph 6

[1730] Fleckenstein et al also state that "The relative mispricing of TIPS and Treasury bonds represents one of the largest examples of arbitrage ever documented and poses amajor puzzle to classical asset pricing theory". Matthias Fleckenstein, Francis Longstaff and Hanno Lustig (2014), 'The TIPS-Treasury Bonds Puzzle', The Journal of Finance, 69(5), October, pp. 2151, 2182-2183.

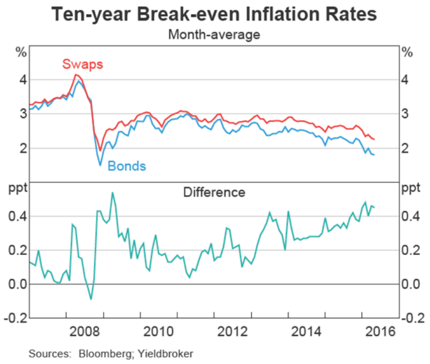
[1731] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, Table 3.

[1732] Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, section 5.3.3.

[1733] Moore, Measures of Inflation Expectations in Australia, RBA Bulletin, December Quarter 2016, pp. 23, 26-28.



Graph 7



The widening in the spread between the two rates might be the result of changes to either market. One possibility is that the liquidity premium in inflation-linked AGS has risen, exacerbating the downward bias in the bond-based measure of inflation expectations. This would be consistent with the widespread view that liquidity in global bond markets has declined noticeably since 2008 (e.g. Levine 2015; Debelle 2015; CGFS 2016). In Australia, the decline in fixed income market liquidity has been less pronounced than globally; nonetheless, there is some evidence that bond markets are less liquid than in the past, but that an increase in interest rate derivatives market liquidity has more than offset this (Cheshire 2016). This change reflects, at least in part, a correction in the pricing of liquidity, which had been 'underpriced in the years prior to the global financial crisis' (Debelle 2016). These developments may have raised the liquidity premium inherent in inflation-indexed AGS by more than in nominal AGS because of the lower initial liquidity in inflation-linked AGS. If this is the case, the bond-based measure of inflation expectations may have become more downwardly biased than in the past.

As mentioned in the excerpt above, the liquidity of indexed CGS is unlikely to be equivalent to nominal CGS. This implies that the liquidity premium for indexed CGS is not zero and is not insignificant.

Consideration of individual studies into bond break-even inflation

Ang, Bekaert, and Wei (2016)

CEG references the finding in Ang, Bekaert and Wei (2008) of a relatively large average inflation risk premium in the US market (approximately 114 basis points over the full sample, and 50 basis points since the 1980s) and suggests that it is unlikely that any other biases would offset such an inflation risk premium.[1734] ACCC Working Paper #11[1735] raises the following issue with the paper's methodology, which brings into question the conclusions CEG has drawn from its results:[1736]

> However, Ang et al.'s decomposition estimates are not estimates based on the observations of the yields of nominal and indexed bonds. Ang et al. do not observe real rates from TIPS for most of their sample (from the 2nd quarter 1952 to the 4th quarter 2004) since these securities were not introduced until 1997. Real rates and inflation risk premia are estimated by using a no-arbitrage term structure model of nominal yields that relied on historical data of short and long term nominal yields and inflation.

Coroneo (2016)

The findings of Coroneo (2016)[1737] are submitted by CEG as evidence of a liquidity factor that:[1738]

> …hovers around zero since 2005 (other than the period during the global financial crisis)

However the TIPS liquidity factor constructed by this paper is found to explain up to 23 per cent of the variance of TIPS yields[1739], and as Coroneo (2016) states:[1740]

> Our estimation results confirm that the liquidity premium is an important component of TIPS yields.

D'Amico, Kim, and Wei (2010) and D'Amico, Kim, and Wei (2016)

CEG submits[1741] that the results of D'Amico, Kim and Wei (2010)[1742] and D'Amico, Kim, and Wei (2016) [1743] indicate that the breakeven method actually overstates expected inflation.

1734 CEG, *Best estimate of expected inflation*, September 2016, pp. 46-47.

1735 Hayden Mathysen, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, ACCC Working Paper #11, 2017, paragraph 137.

1736 Andrew Ang, Geert Bekaert, and Min Wei, *The Term Structure of Real Rates and Expected Inflation*, The Journal of Finance, 63(2), April 2008, pp. 797-849.

1737 Coroneo, L, (2016) "TIPS Liquidity Premium and Quantitative Easing", Working paper (draft version April 2nd 2016).

1738 CEG, *Best estimate of expected inflation,* September 2016, p. 50.

1739 Coroneo, L, (2016) "TIPS Liquidity Premium and Quantitative Easing", Working paper (draft version April 2nd 2016), p. 11.

1740 Coroneo, L, (2016) "TIPS Liquidity Premium and Quantitative Easing", Working paper (draft version April 2nd 2016), p. 26.

1741 CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 41-44; CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, p. 3.

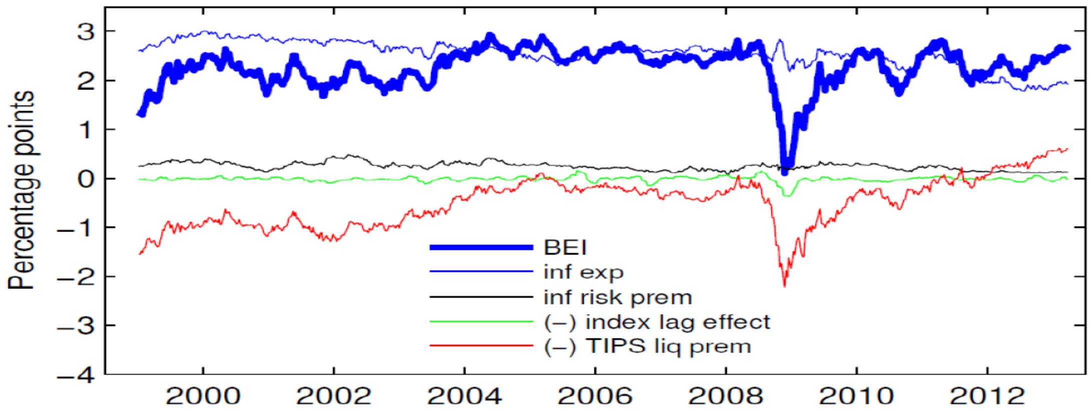
1742 D'Amico, S., Kim, D.H.,Wei, M., *Tips from TIPS: The Informational Content of Treasury Inflation Protected Security Prices*, Federal Reserve Board, 2010-19, Draft Version 29 December 2009.

However, D’Amico, Kim, and Wei (2016), which updates D'Amico, Kim and Wei (2010), states the following in regard to the breakeven method of estimating expected inflation:[1744]

> Treating the TIPS BEI [breakeven inflation] as a clean proxy for inflation expectation can be especially problematic, since a combination of economically significant TIPS liquidity premiums and inflation risk premiums could potentially drive a notable wedge between the TIPS BEI and true inflation expectations.

Figure 3-26 below, which is sourced from D’Amico, Kim, and Wei (2016) and referred to by CEG, shows large differences between break-even inflation estimates and the estimated true expected inflation rate estimated by D’Amico, Kim, and Wei (2016).[1745] This result holds even with the exclusion of the period during the global financial crisis. Most recently, the difference is around 75 basis points. Notably the expected inflation estimate is much more stable than the breakeven method would imply. ACCC Working Paper #11 highlights the stability of the RBA forecasts and target band approach and cites further literature which finds that inflation expectations are relatively stable.[1746] The finding in D’Amico, Kim and Wei (2016) of a negative liquidity risk premium in recent times highlights the potentially unstable nature of the biases associated with the breakeven method in contrast to the findings of ACCC Working Paper #11 that inflation expectations are relatively stable.

Figure 3-26 Inflation estimates from D'Amico, Kim, and Wei (2016)



Notes: BEI refers to break-even inflation estimates. "inf exp" refers to inflation

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1743 Stefania D’Amico, Don Kim and Min Wei (2016), ‘Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices’, Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, p. 1.

1744 Stefania D’Amico, Don Kim and Min Wei (2016), ‘Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices’, Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, p. 1.

1745 Estimated by removing estimated biases and risk premia from the break-even inflation rate.

1746 Mathysen, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, ACCC Working Paper #11, April 2017, paragraphs 36-38.

Source: Stefania D'Amico, Don Kim and Min Wei (2016), 'Tips from TIPS: The informational content of Treasury Inflation-Protected Security prices', Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, 2014-24, p. 69.

Grishchenko and Huang (2012)

Grishchenko and Huang (2012) adjust their estimated inflation risk premium for the effects of illiquidity on TIPS (US indexed government bonds). CEG states that as a result, the inflation risk premium calculated can be considered as the 'net bias', and then uses the figure as the amount by which breakeven inflation overestimates expected inflation.[1747] However the liquidity adjustment ensures that the inflation risk premium is not distorted by liquidity issues. The figures given are the authors' estimate of the inflation risk premium, not a 'net bias'. The purpose of the liquidity adjustment is to isolate the inflation risk premium, in contrast to stating the net effect of inflation risk and liquidity.

Pflueger & Viceira (2015)

Pflueger and Viceira (2015), present a liquidity premium for the US TIPS and UK index-linked gilts (US and UK equivalents to the Australian indexed CGS). CEG submits that while Pflueger and Viceira (2015) find a sizeable liquidity premium in the US, the liquidity premium is smaller in the UK. However, it is likely that the Australian market exhibits more similarity to properties of the US market than UK market. The proportional value represented by indexed bonds in the Australian CGS market is around 7 per cent as at 3rd of February 2017, for the UK the equivalent is 25 per cent and for the US it is 6 per cent.[1748] This suggests that Australia is more likely to have liquidity premiums in line with the US than the UK.

Pflueger and Viceira (2015) regresses breakeven inflation on variables that may indicate liquidity issues and published expected inflation. The component of the regression with variables related to liquidity issues is considered as the liquidity premium. On this regression, CEG states that:[1749]

> Since the coefficients on the variables related to liquidity do not change over time, the model utilised by Pflueger and Viceira (2015) assumes a constant relationship between liquidity premium and the explanatory variables. If these variables do not explain all the movements of liquidity premium across time, the liquidity premium will be over-estimated for some time periods and under-estimated for other time periods. This is because the coefficient is trying to capture the average relationship between the liquidity premium and the explanatory variables. Since Pflueger and Viceira's (2015) sample includes the

[1747] CEG, *Best estimate of expected inflation* pp. 42-43.

[1748] That is, as a proportion of total (nominal and indexed) government securities. Source for UK values: http://www.dmo.gov.uk/index.aspx?page=gilts/about_gilts. Source for US values: https://www.treasurydirect.gov/govt/charts/principal/principal_debt.htm

[1749] CEG, *Best Estimate of Expected Inflation*, September 2016, p. 48.

periods when TIPS are first introduced and the global financial crisis, which exhibits high liquidity premium, the estimation will overestimate the relationship between the liquidity premium and the explanatory variables in other periods.

CEG's submission - that a constant relationship between liquidity premium and variables related to liquidity leads to overestimation - does not necessarily hold. Some movements in liquidity premium may not be explained by movements in variables related to liquidity premium. There is no reason to believe that these unexplained movements in liquidity premium were significantly and reliably in one direction or another during either the immature stage in the TIPS market or the GFC. Variables related to liquidity, such as turnover, may have varied considerably in the immature stage, the GFC, and between.

CEG submits that Pflueger and Viceira (2015) do not test the stability of the estimated coefficient or allow for the removal of the impact of the global financial crisis and introductory period of TIPS. Pflueger and Viceira (2015) do run a separate regression for the period prior to the global financial crisis and finds that the estimated coefficient for two of the liquidity indicators is no longer statistically significant, which may indicate instability in the coefficient. Conversely, we note that there is considerable uncertainty about the extent to which biases and risk premia present in bond break-even rates are time-varying.[1750]

M.3.2 Convexity bias

CEG and AusNet Services submitted that we did not, in our draft determination, attempt to estimate the impact of convexity bias.[1751] CEG submitted that the available academic evidence and its own simulation modelling suggest that potential convexity bias in bond break-even inflation estimates is trivial in magnitude.[1752] CEG submitted that:

- Ang, Bekaert and Wei (2008) find that the convexity bias amounts to less than one basis point.[1753]
- Lehman Brothers (2006) find convexity bias to be 4 basis points.[1754]
- Banco Central do Brasil (2014) finds convexity bias to be close to 1 basis point.[1755]

[1750] Mathysen, Consideration of best estimates of expected inflation: comparing and ranking approaches, ACCC Working Paper #11, 2017, para 71.

[1751] CEG, *Best Estimate of Expected Inflation*, September 2016, p. 42; AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 189-190.

[1752] CEG, *Best Estimate of Expected Inflation*, September 2016, p. 46.

[1753] CEG, *Best Estimate of Expected Inflation*, September 2016, p. 42. CEG also note that Ang, Bekaert, and Wei (2008) is cited in Grishchenko and Huang (2012) [see: CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, p. 3].

[1754] CEG, *Best Estimate of Expected Inflation*, September 2016, p. 49.

[1755] CEG, *Best Estimate of Expected Inflation*, September 2016, p. 50.

CEG did not cite Apedjinou et al. (2006), which estimated the convexity effect for nominal and indexed US federal government securities. Apedjinou et al (2006) finds a convexity bias of approximately 31 basis points in the 1 year forward inflation rate 10 years forward and a convexity bias of approximately 15 basis points in the 5 year implied forward inflation rate, 5 years forward.[1756]

The estimated convexity bias differs considerably across the studies that separately estimate this bias. Since the estimated size of the convexity effect is dependent on forward rate/yield volatilities,[1757] convexity bias will likely differ depending on which volatility measure is used (historical volatilities or forward-looking implied volatilities), the sample period chosen, or the modelling approach adopted. ACCC Working Paper #11 finds that studies that isolate the effects of convexity bias are complex, which may explain why few studies are undertaken to estimate this bias.[1758]

We consider that the effect of convexity bias on Australian bond-breakeven inflation estimates is unclear. We consider there is potential for estimates of the convexity bias to vary considerably depending on methodological choices, and consider that this creates material risk of bias and regulatory gaming in the estimation of convexity bias and the bond break-even inflation rate.

M.3.3 Inflation risk premium

CEG submitted that Grishchenko and Huang (2012) state that their preferred estimated range of inflation risk premium is 14 basis points to 19 basis points over the period 2004 to 2008.[1759]

However, Grishchenko and Huang find that the average 10 year inflation risk premium is time varying, and ranges from –0.16 to 0.10 per cent depending on the expected inflation proxy used. They attribute the estimated negative inflation risk premium over the first half of the sample period to one or both possibilities: the deflation scare of 2002–2003 and/or the illiquidity of TIPS. While they adjust the estimated inflation risk premium for the effects of illiquidity on TIPS, Grishchenko and Huang note that the adjustment may not remove all the effects of liquidity and therefore the inflation risk premium may be even higher.

Further, Bekaert and Wang (2010) surveys 9 studies that estimate inflation risk premia in the US, UK and Europe. For the sample of US studies they find that the inflation risk premium over a 10 year horizon varies between 50 and 200 basis points. In providing this range, Bekaert and Wang (2010) exclude the Grishchenko and Huang's (2012)

1756 Based on simple difference. See: Kodjo Apedjinou, Priya Misra and Anshul Pradhan (2006), A TIPS Valuation Framework, Fixed Income Research, U.S. Interest Rate Strategy, Lehmann Brothers, p. 8.

1757 See: John Hull, *Options, Futures and Other Derivatives, Seventh Edition*, Pearson Prentice Hall, New Jersey, 2009, p. 672.

1758 Mathysen, *Best estimates of expected inflation: a comparative assessment of four methods*, ACCC Working Paper # 11, April 2017, para 140.

1759 CEG, *Memorandum: inflation compensation - addendum to September 2016 report*, December 2016, pp. 3, 18.

estimates from the range because Bekaert and Wang consider that such estimates do not sufficiently correct for a TIPS liquidity premium.

M.3.4 Biases and premia in inflation swap rates

Multinet, AGN, AusNet Services and CEG submitted that inflation swap-implied inflation estimates will tend to be biased upwards to account for risk premiums and the capital costs of providers of these products.[1760] CEG refers to a study by Campbell, Shiller, and Viceira (2009) to support its submission.

While Campbell, Shiller, and Viceira (2009) do not claim that the biases in inflation swaps are significant,[1761] we note:

- Campbell, Shiller, and Viceira (2009) do not attempt to estimate the size of potential biases in inflation swaps
- Finlay and Olivan (2012),[1762] RBA (2015),[1763] Fleckenstein et al. (2014),[1764] Haubrich et al (2012),[1765] Pflueger and Viceira (2015),[1766] Liu et al. (2015),[1767] and Christensen and Gillan (2012)[1768] all support the view that inflation swaps are likely to provide more reliable estimates of inflation expectations than bond break-even estimates.

M.4 Effect of inflation outcomes on inflation expectations

1760 AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 188-189; CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 66-67; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, p. 230; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp.223-224; AGN, Final Plan: Access Arrangement Information for our Victorian and Albury Natural Gas Distribution Networks: 2018 to 2022, December 2016, p.111; Multinet, Rate of Return Overview, 16 December 2016, p.54.

1761 John Campbell, Robert Shiller and Luis Viceira (2009), 'Understanding Inflation-Indexed Bond Markets', Brookings Papers on Economic Activity, Spring 2009, pp. 108-109.

1762 Richard Finlay and David Olivan (2012), 'Extracting Information from Financial Market Instruments', RBA Bulletin, March Quarter, pp. 45-46.

1763 Reserve Bank of Australia, Statement on Monetary Policy, February 2015, p. 50.

1764 Matthias Fleckenstein, Francis Longstaff and Hanno Lustig (2014), 'The TIPS-Treasury Bonds Puzzle', The Journal of Finance, 69(5), October, pp. 2151-2197.

1765 Joseph Haubrich, George Pennachi and Peter Ritchken (2012), 'Inflation Expectations, Real Rates, and Risk Premia: Evidence from Inflation Swaps', The Review of Financial Studies, 25(2), p. 1590.

1766 Carolin Pflueger and Luis Viceira (2015), 'Return Predictability in the Treasury Market: Real Rates, Inflation, and Liquidity', Working Paper, pp. 12, 16.

1767 Zhuoshi Liu, Elisabeth Vangelista, Iryna Kaminski and Jon Relleen (2015), 'The informational content of market-based measures of inflation expectations derived from government bonds and inflation swaps in the United Kingdom', Staff Working Paper No. 551, Bank of England, p. 2.

1768 Jens Christensen and James Gillan (2012), 'Could the US Treasury Benefit from Issuing More TIPS?', Federal Reserve Bank of San Francisco, Working Paper Series, pp. 1-37.

Multinet, AGN, AusNet Services and CEG submitted that recent inflation outcomes support the use of the bond break-even approach, stating that:

- Bond break-even inflation estimates have responded materially to the sustained low inflation outcomes over the last three years, unlike estimates from the RBA forecasts and target band approach. CEG appears to suggest that recent low inflation outcomes inform long-term inflation expectations.[1769]
- Break-even inflation accurately predicted the recent fall in inflation below the bottom of the RBA's target range – more accurately than RBA forecasts. CEG appears to suggest that inflation expectations are informed by bond-breakeven estimates, due to the model's greater predictive power.[1770]

In support of this submission CEG presented a number of charts[1771] that compared inflation outcomes against inflation estimates from the bond break-even approach and the RBA forecasts and target band approach. We note that the charts submitted by CEG examine only recent data and short-term inflation outcomes. However, our task is to estimate 10-year expected inflation (see section 3.4.4).

We consider it plausible that inflation expectations may be informed by the inflation estimates of an estimation approach that has historically been an accurate predictor of inflation outcomes. However, we consider that there is likely to be a material difference in short-term and long-term expectations of inflation.

Similarly, we consider it plausible that forward-looking expectations may be informed by recent outcomes. However, the impact of this effect is likely overstated by CEG – the effect is tempered by the potential for transient inflation shocks. Shocks may cause outcomes to vary from expectations, and we would not expect all shocks to be routinely and completely reflected in the formation of subsequent expectations, particularly when there is a greater distance between the recent outcomes and the term of the forward expectation. For example, the most recent quarterly inflation outcome would likely have a greater effect on 1-year forward expectations than 10-year forward expectations.

There is considerable evidence in the academic literature finding that long term inflation expectations are relatively stable over time, informed by and anchored within

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[1769] CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 13-15, 28; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp. 223-229; AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp.223-224; AGN, Final Plan: Access Arrangement Information for our Victorian and Albury Natural Gas Distribution Networks: 2018 to 2022, December 2016, pp.108-109; Multinet, Rate of Return Overview, 16 December 2016, pp.47-48, 50-53.

[1770] CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 13-15, 18-21; AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 188, 190-191 AusNet Services Gas Distribution, *Gas Access Arrangement Review 2018-2022: Access Arrangement Information*, 16 December 2016, pp. 223-229.

[1771] See Figures 2, 3, 5, 6, 7, and 8 in CEG, *Best Estimate of Expected Inflation*, September 2016.

the RBA’s target band, and do not respond significantly to inflation surprises.[1772] While Finlay and Wende (2011) find that the contemporaneous rate of inflation has a strong influence on short term inflation expectations, Gillitzer and Simon (2015); Finlay and Wende (2011); Leu and Sheen (2006); and Jaaskela and McKibbin (2010) find that long-term expectations are relatively stable.[1773]

Sack (2000) and Christensen et al (2004) suggest that the bond break-even estimates may be more volatile than long term inflation expectations because the 10 year bond break-even may be sensitive to relatively volatile short term inflation expectations.[1774] Christensen et al. (2004) warns that, when inflation expectations are term varying, there can be problems with estimating bond break-even inflation estimates from coupon paying bonds, rather than zero coupon bonds. The problem is that bond break-even estimates are more sensitive to changes in short term inflation expectations than changes to long-term expectations.[1775] The result is that short term inflation expectations can easily depart from relatively stable long term inflation expectations, and shocks to inflation expectations of the shortest term will have a larger effect on the break-even estimates because it will positively influence all subsequent coupon payments. Therefore, 10-year break-even inflation estimates may appear to move in line with short-term inflation outcomes simply because of the structuring of bond cash flows and not because long term inflation expectations have changed.

Therefore to produce the best estimate of expected inflation, we should place limited weight on short term inflation outcomes. As stated in section M.1, there is a role for short-term forecasts (in contrast to short-term outcomes) to inform our 10-year inflation estimate. We consider that the RBA's short-term forecasts appropriately incorporate information from recent inflation outcomes, and that the RBA forecasts and target band

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[1772] See, e.g., Christian Gillitzer and John Simon (2015), ‘Inflation Targeting: A Victim of Its Own Success?’, RDP 2015–09, August, *Reserve Bank of Australia Discussion Paper*, pp. 1–37; Richard Finlay and Sebastian Wende (2011), ‘Estimating Inflation Expectations with a Limited Number of Inflation-indexed Bonds’, *Research Discussion Paper, Reserve Bank of Australia*, RDP 2011–01, March, pp. 1–35; Shawn Chen-Yu Leu and Jeffery Sheen (2006), ‘Asymmetric Monetary Policy in Australia’, *The Economic Record*, 82, Special Issue, September, pp. S85–S96; and Jarkko Jaaskela and Rebecca McKibbin (2010), ‘Learning in an Estimated Small Open Economy Model’, RDP 2010–02, March, *Reserve Bank of Australia Discussion Paper,* pp. 1–45. These studies consider a much longer time frame than the limited selection examined by CEG.

[1773] Christian Gillitzer and John Simon (2015), ‘Inflation Targeting: A Victim of Its Own Success?’, RDP 2015-09, August, Reserve Bank of Australia Discussion Paper, pp. 1-37; Shawn Chen-Yu Leu and Jeffery Sheen (2006), ‘Asymmetric Monetary Policy in Australia’, The Economic Record, 82, Special Issue, September, pp. S85-S86. Richard Finlay and Sebastian Wende (2011), ‘Estimating Inflation Expectations with a Limited Number of Inflation-indexed Bonds’, Research Discussion Paper, Reserve Bank of Australia, RDP 2011-01, March, pp. 3-4, 13-15, 22; Jarkko Jaaskela and Rebecca McKibbin (2010), ‘Learning in an Estimated Small Open Economy Model’, RDP 2010-02, March, Reserve Bank of Australia Discussion Paper, pp. 1-45.

[1774] Brian Sack (2000), ‘Deriving Inflation Expectations from Nominal and Inflation-Indexed Treasury Yields’, Division of Monetary Affairs, Board of Governors of the Federal Reserve System, Washington DC,16 May, pp. 1-24; Ian Christensen, Frederic Dion and Christopher Reid (2004), ‘Real Return Bonds, Inflation Expectations, and the Break-Even Inflation Rate’, Bank of Canada Working Paper 2004-43, November, p. 5, 39-40.

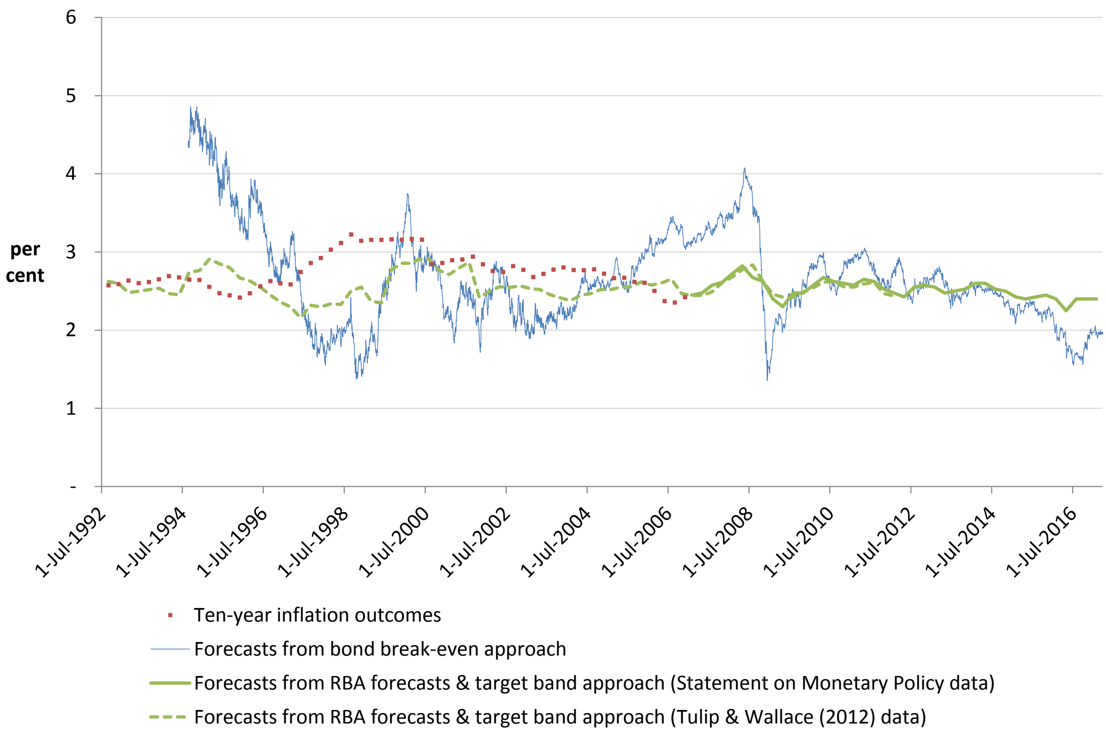
[1775] Ian Christensen, Frederic Dion and Christopher Reid (2004), ‘Real Return Bonds, Inflation Expectations, and the Break-Even Inflation Rate’, Bank of Canada Working Paper 2004-43, November, p. 5, 39-40.

approach provides an appropriate balance between short-term forecasts and the anchoring of long-term expectations to the RBA's target band.

Similarly, for estimating 10-year inflation, there is limited benefit in examining the relative accuracy of different estimation approaches for predicting short-term inflation outcomes. For the bond break-even approach in particular, we find that inflation estimates from this approach may be distorted by a number of potentially time-varying biases and risk premia (see section 3.4.4). To this extent, it is unlikely that investor expectations would be informed by the short-term predictive power of the break-even approach – if biases are time-varying, the size of such biases may change in response to prevailing conditions in the financial market.[1776]

10-year inflation expectations may be informed to some extent by the accuracy of an estimation approach at predicting 10 year inflation outcomes. Figure 3-27 shows 10-year inflation outcomes since the start of inflation targeting, 10-year estimates from the break-even approach, and 10-year estimates from the RBA forecasts and target band approach.

Figure 3-27 Comparison of inflation outcomes against break-even and RBA forecasts



Source: AER analysis; ABS CPI (6401.0): weighted average of eight capital cities: all groups; RBA interest rate statistics (F16): indicative mid-rates of Australian government securities; RBA Statements on Monetary

[1776] See, e.g., Carolin Pflueger and Luis Viceira (2015), 'Return Predictability in the Treasury Market: Real Rates, Inflation, and Liquidity', Working Paper, pp. 27-28.

Policy from February 2007 to February 2017; 'Forecast date by event date' data file from Tulip & Wallace (2012).

We note that the introduction of the Goods and Services Tax (GST) in 2000 is likely to have affected a one-off change in the CPI. This specific one-off change is unlikely to have affected subsequent long-term inflation expectations. However, the change to CPI may persist in 10-year measures of CPI outcomes. Restricting measures of 10-year CPI outcomes to those that exclude the transient effect of the introduction of the GST limits the amount of data available.[1777] Consequently, direct comparisons of estimates from the RBA forecasts and target band approach or the bond break-even approach to inflation outcomes may be limited.

Figure 3-27 shows that 10-year inflation outcomes appear relative stable, consistent with the findings of Gillitzer and Simon (2015); Finlay and Wende (2011); Leu and Sheen (2006); Jaaskela and McKibbin (2010); Kuttner and Robinson (2010); Paradiso and Rao (2012); and Mallick (2015).[1778] The estimates from the RBA forecasts and target band approach also appear relatively stable, in contrast to the bond break-even estimates which appear more volatile.[1779] During the GFC bond break-even estimates were particularly volatile, perhaps reflecting the approach's sensitivity to short term inflation shocks that may not manifest in long term inflation expectations.

M.5 Break-even estimates are a statistically significant predictor of nominal CGS yields

AusNet Services and CEG submitted that falling 10 year break-even inflation is a statistically significant explanatory variable when regressed against nominal CGS yields. CEG submitted that if break-even inflation estimates are an accurate measure of expected inflation, then most of the recent fall in nominal CGS yields is due to falling inflation expectations rather than falling required real returns.[1780]

[1777] 22 quarterly data points from September 2011 to December 2016.

[1778] Christian Gillitzer and John Simon (2015), ‘Inflation Targeting: A Victim of Its Own Success?’, RDP 2015-09, August, Reserve Bank of Australia Discussion Paper, pp. 1-27; Richard Finlay and Sebastian Wende (2011), ‘Estimating Inflation Expectations with a Limited Number of Inflation-indexed Bonds’, Research Discussion Paper, Reserve Bank of Australia, RDP 2011-01, March, pp. 1-35; Shawn Chen-Yu Leu and Jeffery Sheen (2006), ‘Asymmetric Monetary Policy in Australia’, The Economic Record, 82, Special Issue, September, pp. S85-S96; Jarkko Jaaskela and Rebecca McKibbin (2010), ‘Learning in an Estimated Small Open Economy Model’, RDP 2010-02, March, Reserve Bank of Australia Discussion Paper, pp. 1-45; Ken Kuttner and Tim Robinson (2010), ‘Understanding the flattening of the Phillips Curve’, North American Journal of Economics and Finance, 21(2), pp. 110-125; Antonio Paradiso and Bhaskara Rao (2012), ‘Flattening of the Phillips curve and the role of the oil price: An unobserved component model for the USA and Australia’, Economics Letters, 117(1), pp. 259-262; Debdulal Mallick (2015), ‘A Spectral Representation of the Phillips Curve in Australia’, Faculty of Business and Law, School Working Paper, Economic Series, SWP 2015/7, pp. 1-48.

[1779] Figure 3-27 shows daily bond break-even estimates, while RBA forecasts and CPI outcomes are quarterly. Nonetheless, a quarterly series of bond break-even estimates also appears more volatile than estimates from the RBA forecasts and target band approach.

[1780] AusNet Transmission Group Pty Ltd, *Transmission Revenue Review 2017-2022 Revised Revenue Proposal*, 21 September 2016, pp. 190-191; CEG, *Best Estimate of Expected Inflation*, September 2016, pp. 13-14.

CEG regressed daily changes in nominal CGS yields on daily changes in breakeven inflation and find that breakeven inflation estimates largely explain changes in nominal CGS yields. CEG repeats their analysis with quarterly data instead of daily over a longer timeframe from December 2005 to June 2016. There are a number of problems evident from the analysis. First, it does not appear that CEG included any other explanatory variables in its regression analysis.[1781] There may be a number of other factors that affect nominal CGS yields and breakeven inflation rates, including the various biases and premia outlined above, short term inflation expectations and the effect the coupon payments.[1782] If the regression model does not account for these factors it will suffer from omitted variable bias and its explanatory power will be severely diminished.

For example, reference has been made previously to the effect of coupon payments on the estimate of breakeven inflation. Deacon and Derry (1994) note that:

> the fact that a break-even inflation rate is derived from only two gilt prices—one index-linked and one conventional—means that it is particularly vulnerable to distortions produced by the specific pair of stocks selected. For instance, when matching stocks by maturity there may be two conventionals of roughly equal maturity but widely-differing coupons. The difference in the break-even rates derived using the different stocks can be significant…[1783]

CEG's regression analysis does not appear to take into account the effect of coupon payments which in turn may undermine the explanatory power of the model.

Second, the regression analysis itself appears to suffer from a specification issue. By regressing breakeven inflation on nominal CGS yields, CEG is attempting a regression of the form:

$$Nominal\ CGS\ yields = \beta_0 + \ \beta_1 * Breakeven\ inflation + \varepsilon$$

Now, the Fisher equation provides a relationship between an expected rate of inflation, nominal interest rates and real interest rates:

$$1 + i = (1 + r)(1 + \pi)$$

Where i is nominal yields, r is the real return and π is breakeven inflation. This equation can then be substituted into the original linear regression equation to obtain:

$$Nominal\ CGS\ yields = \beta_0 + \beta_1\left(\frac{1+i}{1+r} - 1\right) + \ \varepsilon$$

1781 It should be noted that CEG has not supplied us with the regression specification, however the lack of detail provided by CEG in their report would imply that other variables were not considered in the regression.

1782 Refer to the discussion undertaken in Hayden's working paper at pp 27-31.

1783 Mark Deacon and Andrew Derry, 'Estimating market interest rate and inflation expectations from the prices of UK government bonds' [1994](3) *Bank of England Quarterly Bulletin* 232, 236-37.

It is immediately clear that the variable representing nominal interest rates appears on both sides of the equation, which when run, would result in a specification error in the regression. A regression that is incorrectly specified will likely produce results that are biased.

Alternatively, the previous equation can be rewritten as:

$$Real\ CGS\ yields = \beta_0 + (\beta_1 - 1)\pi + \varepsilon$$

This regression equation postulates a relationship between the indexed yield and the breakeven rate. It is likely that these two variables are unrelated, and, as a result, the estimated coefficient of the breakeven rate, in this regression equation, would be close to zero. This implies an estimate for β_1 of approximately one, similar to the original estimated regression.

In fact, the reason why CEG arrive at an estimate slightly different from one for the slope coefficient in their two regressions (Figures 11 and 12) is due to a slight correlation between the indexed yields and the breakeven rate.[1784] This is likely due to random chance rather than any long-run relationship. The fact that CEG's estimates for an 8-month horizon shows negative correlation, whilst CEG's estimate for a ten and a half year horizon shows positive correlation may be evidence of this.

What this regression shows, is not that there is a relationship between the breakeven rate and nominal yields, but rather, that there is no relationship between indexed yields and the breakeven rate.

Further, CEG's daily analysis only extends to the period spanning December 2015 – August 2016. Even if breakeven inflation is a statistically significant explanatory variable for falling nominal CGS yields over this time, it may not necessarily be so over a longer time period. As discussed, both the break-even inflation estimates and nominal CGS yields are susceptible to short term inflation expectations due to differences in the size and timing of coupon payments across maturities.[1785] CEG's quarterly analysis undertaken from December 2005 to June 2016 is also problematic due to its limited sample size (approximately 40 observations).

Notwithstanding the previous discussion, even if falling breakeven inflation is a statistically significant explanatory variable for falling nominal CGS yields, it may still

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1784 This can be shown by the following equation:

$$i = \beta_0 + (\beta_1 - 1)\pi + u_t$$

By OLS estimation,

$$\beta_1 - 1 = \frac{\mathrm{cov}(i, \pi)}{\mathrm{var}(\pi)}$$

If the indexed yield and breakeven rate were uncorrelated, their covariance would be zero, leading the original slope coefficient of β_1 to be one. If they are positively correlated, the RHS would be positive, leading β_1 to be greater than one.

1785 See, e.g. Ian Christensen, Frederic Dion and Christopher Reid (2004), 'Real Return Bonds, Inflation Expectations, and the Break-Even Inflation Rate', *Bank of Canada Working Paper 2004–43*, November, pp 39-40.

not be suitable as an estimator for market expectations of inflation. There are likely other variables that affect breakeven inflation estimates, such as biases and premia which would result in divergent outcomes for breakeven inflation and market expectations of inflation.

M.6 APTPPL's proposed revenue model

APTPPL proposed a varied version of our post-tax revenue model that alters the treatment of inflation in our revenue modelling. APTPPL proposed, in its submitted revenue model, for the value of its projected capital base to be adjusted for lagged actual inflation, rather than expected inflation during the course of the 2017–22 access arrangement period.

APTPPL submitted that its changes to our post-tax revenue model are to address 'mismatch' between the adjustment of asset values for inflation in the post-tax revenue model compared to the asset base roll-forward model. APTPPL stated:

> The indexation on the opening capital base used in the depreciation calculation is based on the AER's forecast of inflation over the access arrangement period …
>
> When the AER subsequently rolls forward the capital base using its Roll Forward Model, it applies the actual out-turn inflation to the indexation of the capital base.
>
> This presents a mis-match where the allowed revenues reflect a forecast of inflation and the roll forward of the capital base reflects actual inflation. This presents inflation risk to the business, which it is not able to manage.

To address this mismatch issue, APTPPL's proposed revenue model included the following variations from our published post-tax revenue model:

- A second inflation series is added (in row 431 of the PTRM inputs page) in addition to the original expected inflation parameter that is also retained.
- The new inflation series is an annually-varying series, with separate rates identified for each year. This contrasts with the original expected inflation parameter which was a single annual figure applied across the whole access arrangement period.
- APTPPL proposes that the new inflation series is initially forecast and then updated with new forecasts annually.
- APTPPL proposes that the new inflation series is initially forecast, but then annually updated to reflect actual inflation outcomes as they become known.

We do not accept APTPPL's proposed revenue model for the following reasons:

- APTPPL's proposed revenue model includes two separate and inconsistent estimates of forecast inflation. APTPPL has included a new series of annually-varying inflation estimates, and this new series is used to adjust the nominal value of APTPPL's capital base over the access arrangement period.[1786] However, a single inflation rate applicable across the whole access arrangement period is then used in the conversion of the annual aggregate revenue requirement into X-factors.[1787] These two sets of inflation forecasts are not consistent.[1788] We do not consider that this approach reflects the best forecast or estimate available in the circumstances.

- Our published post-tax revenue model generally operates to provide X-factors as the end result and we consider this is an important element of a revenue model in order to achieve the NGO and RPPs. X-factors represent the percentage change in real aggregate revenue/tariffs from year to year. Typically, these X-factors (or percentage changes) are then applied to prices from the previous year, in tandem with actual observed inflation, to determine prices for the next year. This process ensures that actual inflation is 'passed-through' into prices, and that the real change in prices provides to the regulated business the real rate of return and real value of aggregate revenue as determined by the AER. Therefore, under this approach, the real value of our revenue determinations is not eroded or expanded by inflation shocks.
- APTPPL's proposed revenue model change ultimately this outcome of the revenue modelling and tariff variation process. In particular, APTPPL's revenue model uses actual inflation outcomes as the estimate of expected inflation, such that the inflation values in the revenue modelling align with the inflation values to be used in the tariff variation process. The end result appears that the real value of the aggregate revenue determined in our access arrangement determination is not set but will vary as actual inflation outcomes vary. This may materially alter the risk profile of APTPPL, with consequences for determining a rate of return that is commensurate with these risks.

Generally, a regulatory determination process has defined milestones and engagement steps. This enables stakeholders to effectively engage in the regulatory process and for service providers to clearly articulate original proposals and revised proposals to the extent necessary to respond to our draft decisions. A revenue model is a critical component of a regulatory proposal for allowing stakeholders to examine the implications of various elements of a proposal on final revenue and pricing outcomes.

In its access arrangement proposal, APTPPL noted that their proposed inflation annual update is similar to our annual debt update:[1789]

> APTPPL considers that a better approach would reflect the observed changes in inflation as reference tariffs are varied. In the gas regulatory framework (in contract to that applying to the electricity industry), this could be accomplished

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1789 APTPPL, *Roma to Brisbane Pipeline: access arrangement submission*, September 2016, p. 205.

through the Access Arrangement Tariff Variation Mechanism, within the process now being implemented by the AER for annual update of the tariff for changes in the return on debt.

However, we consider APTPPL's proposed revenue model treatment of inflation raises a number of matters that require robust testing including the interaction between its proposed revenue model, asset base roll-forward model, and annual tariff variation mechanisms. We do not consider that the implications of APTPPL's proposed revenue model have been sufficiently addressed in APTPPL's regulatory proposal to support a decision that the proposed method for estimating inflation is the best in the circumstances and arrived at on a reasonable basis. We consider the research, analysis and reasoning submitted to us should be subject to review through a comprehensive process similar to that undertaken in the application of the return on debt annual update.[1790] This will allow for the effective engagement with all stakeholders. Our recently initiated industry-wide review of the treatment of inflation would be an appropriate avenue for this consultation.

In the absence of sufficiently robust and extensive consultation, and in light of the concerns outlined above, we do not consider that APTPPL's proposed treatment of inflation in its revenue model would contribute to the achievement of the National Gas Objective.

[1790] The application of our return on debt update was considered in full: during the Guideline process and subsequently was subject to the post tax revenue model amendment process.

N Equity and debt raising costs

In addition to compensating for the required rate of return on debt and equity, we provide an allowance for the transaction costs associated with raising debt and equity. We include debt raising costs in the opex forecast because these are regular and ongoing costs which are likely to be incurred each time service providers refinance their debt. On the other hand, we include equity raising costs in the capex forecast because these costs are only incurred once and would be associated with funding the particular capital investments.

Our draft decision forecasts for debt and equity raising costs are included in the opex and capex attachments, respectively. In this appendix, we set out our assessment approach and the reasons for those forecasts.

N.7 Equity raising costs

We determine no equity raising costs for the 2018–22 period in this draft decision. APTPPL-RBP adopted our approach and submitted it will not incur equity raising costs over the 2018–22 period in its proposal and revised proposal.[1791] Therefore, we accept its proposal.

Equity raising costs are transaction costs incurred when a service provider raises new equity from outside its business. We use a benchmark approach to determine these costs and this approach allows the costs of two means by which a service provider could raise equity from outside its business—dividend reinvestment plans and seasoned equity offerings. Equity raising costs are an unavoidable aspect of raising equity that a prudent service provider acting efficiently would incur. Accordingly, we provide an allowance to recover an efficient amount of equity raising costs. This is where a service provider's capex forecast is large enough to require an external equity injection to maintain the benchmark gearing of 60 per cent.

While the rate of return guideline does not set out an approach for estimating these costs, we apply an established method for estimating equity raising costs. We initially based our method for determining benchmark equity raising costs on the 2007 advice from Allen Consulting Group (ACG).[1792] We amended this method in our 2009 decisions

[1791] APT Petroleum Pipelines Pty Ltd, *Roma to Brisbane pipeline proposed revised access arrangement, effective 1 July 2017 to 30 June 2022*, September 2016; APT Petroleum Pipelines Pty Ltd, *Post tax revenue model (PTRM)*, September 2016.

[1792] ACG, *Estimation of Powerlink's SEO transaction cost allowance-Memorandum*, 5 February 2007.

for the ACT, NSW and Tasmanian electricity service providers.[1793] We further refined this approach, as discussed and applied in the 2012 Powerlink decision.[1794]

N.8 Debt raising costs

Debt raising costs are transaction costs incurred each time debt is raised or refinanced. These costs may include arrangement fees, legal fees, company credit rating fees and other transaction costs. Debt raising costs are an unavoidable cost of raising debt that would be incurred by a prudent service provider, and data exists such that we can estimate them. Accordingly, we provide an allowance to recover an efficient amount of debt raising costs.

Draft decision

We determine debt raising costs using our benchmark based approach. APTPPL-RBP has accepted our approach for forecasting debt raising costs in its proposal.1795 We accept APTPPL-RBP's proposal and determine debt raising costs of $1.3 million ($ 2016–17) over the 2018–22 period for this final decision, as set out in Table 3-44.

We are satisfied that the debt raising costs estimate of $1.3 million contributes towards a total opex forecast that reasonably reflects efficient, prudent and realistic costs. Consistent with the approach applied to recent decisions (including AusNet Services distribution), we consider that it is important to forecast debt raising costs based on a benchmark approach rather than a service provider's actual costs.[1796] This is to be consistent with the benchmark based forecast of the cost of debt used in the rate of return building block. This should give APTPPL-RBP a reasonable opportunity to recover its efficient costs.

Table 3-44 AER's final decision on debt raising costs (million, $ 2016–17)

	2018–19	2019–20	2020–21	2021–22	2022–23	Total
	0.3	0.3	0.3	0.3	0.3	1.3

Source: AER analysis.

Note: Columns may not add to total due to rounding for presentation in table.

AER's assessment approach

[1793] AER, *Final decision, ACT distribution determination 2009–10 to 2013–14*, April 2009, appendix H; AER, *Final decision, NSW distribution determination 2009–10 to 2013–14*, April 2009, appendix N; AER, *Final decision, TransGrid transmission determination 2009–10 to 2013–14*, April 2009, appendix E; AER, *Final decision, Transend transmission determination 2009–10 to 2013–14*, April 2009, appendix E.

[1794] AER, *Final decision, Powerlink Transmission determination 2012-13 to 2016-17*, April 2012, pp. 151-152.

[1795] APT Petroleum Pipelines Pty Ltd, *Roma to Brisbane pipeline proposed revised access arrangement, effective 1 July 2017 to 30 June 2022*, September 2016, pp. 188-9.

[1796] AER, *Final decision AusNet Services determination 2016–20 - Attachment 3 - Rate of return* - May 2016, Appendix K.

Our standard approach to forecasting debt raising costs is based on the approach in a report from the Allen Consulting Group (ACG), commissioned by the ACCC in 2004.[1797] However, we relied on updated market data from 2008–13, as submitted in a recent report by PricewaterhouseCoopers (PwC) during the rate of return guideline process.[1798] The approach uses a five year window of up to date bond data to reflect current market conditions. Where PwC has updated the data or the method, we have compared it against our standard approach and we are broadly satisfied it is reasonable.

The ACG method involves calculating the benchmark bond size, and the number of bond issues required to rollover the benchmark debt share (60 per cent) of the RAB. Our standard approach is to amortise the upfront costs that are incurred using the relevant nominal vanilla WACC over a ten year amortisation period. This is then expressed in basis points per annum (bppa) as an input into the post-tax revenue model (PTRM). This rate is multiplied by the debt component of a service provider's projected RAB to determine the debt raising cost allowance. The ACG approach recognises that credit rating costs can be spread across multiple bond issues, which lowers the benchmark allowance (as expressed in bppa) as the number of bond issues increases.

Our decision on the unit costs and components of APTPPL-RBP's benchmark rate of debt raising transaction costs is set out in Table 3-45.

Table 3-45 Benchmark debt raising costs (basis points per annum)

Number of bonds	Value	1 bond issued
Amount raised		$250m
Arrangement fee		7.02
Bond Master Program (per program)	$56,250	0.30
Issuer's legal counsel	$15,625	0.08
Company credit rating	$77,500	0.42
Annual surveillance fee	$35,500	0.14
Up-front issuance fee	5.20bp	0.70
Registration up-front (per program)	$20,850	0.11
Registration- annual	$7,825	0.31
Agents out-of-pockets	$3,000	0.02
Total (basis points per annum)		9.1

[1797] The Allen Consulting Group, *Debt and equity raising transaction costs: Final report*, December 2004.

[1798] PricewaterhouseCoopers, *Energy Networks Association: Debt financing costs*, June 2013, p. i.

O Averaging periods - confidential appendix