Regulatory treatment of inflation

Discussion paper

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AUSTRALIAN ENERGY REGULATOR

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Shortened forms

Shortened Form	Extended Form
ABS	Australian Bureau of Statistics
AER	Australian Energy Regulator
Annual pricing mechanism	Refers to the 'Consumer Price Index minus X' mechanism to determine the revenue level that feeds into the adjustment of prices from year to year.
Asset base	Refers to a regulatory asset base for electricity service providers as prescribed in the National Electricity Rules, or a capital base for gas service providers as prescribed in the National Gas Rules
CEG	Competition Economists Group
CGS	Commonwealth Government Securities, also known as Australian Government Securities
CPI	Consumer Price Index
Energy network	Refers to a network through which a service provider provides electricity network and gas pipeline services
Network services	Refers to electricity distribution, electricity transmission, and/or gas pipeline services
RBA	Reserve Bank of Australia
Regulatory period	Refers to a regulatory control period (for electricity service providers) and/or an access arrangement period (for gas service providers)
Regulatory proposal	Refers to a regulatory proposal, revised regulatory proposal, revenue proposal, revised revenue proposal, access arrangement proposal, or revised access arrangement proposal
Service provider	Refers to an electricity distribution network service provider, electricity transmission network services provider, and/or gas pipeline operator

1 About this consultation

This discussion paper is the first step of our review of the treatment of inflation in our determination of revenue and prices for electricity and gas network services. Recently, the method for estimating expected inflation has been the subject of debate in our regulatory determinations.

Service providers have raised two broad issues. First, they have questioned whether our approach results in the best estimate of expected inflation. Second, they have questioned whether inflation is appropriately compensated in the regulatory framework with particular reference to its treatment in the post-tax revenue model (PTRM) and the asset base roll forward model (RFM). This discussion paper explains the context for each of these issues and invites submissions to inform our consideration.

The general inflation rate is applicable across the economy, and therefore our treatment of inflation generally applies uniformly across all our determinations. As a result of the wide-ranging nature of inflation, we have initiated an industry-wide review to comprehensively consider all inflation-related issues. We have released this discussion paper to facilitate consideration of relevant issues and to encourage stakeholders to contribute to the development of solutions.

Our method for estimating expected inflation is set out in our PTRM. Our approach to adjusting prices, revenues, and asset values to account for inflation is contained in our PTRM, and also in our RFM and annual pricing mechanisms.

We typically apply the PTRM and RFM across all our determinations. The use of these models for electricity service providers is mandated by the National Electricity Rules (NER).[1] While the National Gas Rules (NGR) does not mandate the use of these models for gas service providers, these models (or similar versions) are often used for consistency and expediency.[2] Also, we typically apply annual pricing mechanisms consistently (at a general level) across all of our determinations—that is, we typically use a 'CPI minus X' mechanism to adjust revenues/prices from year to year.

We conduct an industry-wide review before making changes to the models given the widespread use of our PTRM and RFM, and the requirements set out in the NER for consultation.[3]

This paper discusses issues relevant to whether or not we should investigate changes to our PTRM, RFM, and/or annual pricing mechanisms. After considering submissions on this paper, we will set out our assessment of whether or not amendments to these models and mechanisms would be appropriate and the form of any potential amendments, and provide the detail of potential amendments for consultation.

1 See NER, Chapter 6; NGR, part 9.
2 See NGR, Rule 73 and 74.
3 NER, Cls. 6.4.1(b), 6.4.1(c), 6.5.1(b).

We encourage stakeholders to become familiar with these models and mechanisms when participating in this review and providing submissions on this paper. Further detail on these models and mechanisms, and on other relevant aspects of our regulatory framework, is set out in section 2 of this paper. Section 2 also provides further detail on the inflation-issues debated in our recent determinations.

Section 3 of this paper sets out key concepts relevant to the consideration of inflation in the context of regulating revenues/prices of electricity and gas network services.

Section 4 of this paper discusses different methods for estimating inflation expectations.

Section 5 of this paper discusses the potential for a mismatch between inflation expectations and inflation outcomes, and the implications of this mismatch for setting regulated revenue and prices.

There are questions listed throughout this paper. These are questions on which we are particularly interested in hearing the views of stakeholders. A full set of questions is also set out in section 6.

1.1 Invitation for submissions

Interested parties are invited to make written submissions to the Australian Energy Regulator (AER) regarding this paper by the close of business, **29 June 2017**.

Submissions should be sent electronically to: rateofreturn@aer.gov.au

Alternatively, submissions can be mailed to:

Mr Warwick Anderson
General Manager, Network Finance and Reporting
Australian Energy Regulator
GPO Box 3131
Canberra ACT 2601

The AER prefers that all submissions be publicly available to facilitate an informed and transparent consultative process. Submissions will be treated as public documents unless otherwise requested. Parties wishing to submit confidential information are requested to:

- clearly identify the information that is the subject of the confidentiality claim
- provide a non-confidential version of the submission in a form suitable for publication.

All non-confidential submissions will be placed on the AER's website at www.aer.gov.au. For further information regarding the AER's use and disclosure of information provided to it, see the *ACCC/AER Information Policy*, June 2014 available on the AER's website.

Enquiries about this paper, or about lodging submissions, should be directed to the Network Reporting and Finance branch of the AER on (03) 9290 1800.

1.2 Register your interest

Stakeholders that wish to be advised of upcoming consultation or other inflation-related issues should subscribe to the AER website for notifications at www.aer.gov.au/newsletter/subscribe and indicate 'inflation' as a topic of interest to you.

1.3 Next steps

The next key milestone is the initiation of a review of the PTRM and/or RFM if we consider changes should be made. If so, we will initiate this review by publishing an explanatory statement setting out:

- our consideration of inflation-related issues set out in this paper and submissions received on this paper; and
- our view on the need for, and form or, any proposed amendments to the models and mechanisms to address inflation-related issues.

We will commence preparing this explanatory statement once we have received and considered the submissions.

Table 1 summarises indicative timeline for this expected inflation review.

Table 1 Inflation review indicative timeline

Step	Date[1]
AER publishes discussion paper	18 April 2017
AER to establish CCP sub-panel and consumer reference group for inflation review	April 2017
AER to hold stakeholder & consumer engagement workshops on discussion paper	May / June 2017
Submissions on discussion paper due	29 June 2017
Publish AER explanatory statement (initiate PTRM/RFM review)	August 2017
AER to hold stakeholder & consumer engagement workshops on explanatory statement	September 2017
Submissions close on AER explanatory statement[2]	October 2017
Final decision on PTRM/RFM review[3]	November 2017

[1] The NER requires a period of not less than 30 business days for the making of submissions on the proposed amendments and explanatory statement. See NER cll. 6.16(c) and 6A.20(c).

[2] The NER requires the final decision on any model amendments to be completed within 80 business days of publishing the proposed amendments and explanatory statement. See NER cl. 6.16(e) and 6A.20(e).

2 Overview

2.1 The current regulatory framework

Electricity and gas networks tend to exhibit natural monopoly characteristics. We apply an economic regulatory framework to providers of electricity and gas network services to address these natural monopoly properties.

Most aspects of the framework relevant to inflation are identical across electricity distribution networks, electricity transmission networks, gas distribution pipelines and gas transmission pipelines. This discussion paper focuses on the common framework and uses generic terms rather than those legislated in the NER and NGR. Where it is necessary to refer to specific terms, we have used those relating to electricity distribution for convenience.

Under the economic regulatory framework, we determine an efficient level of revenue for service providers. The most common form of control is a 'revenue cap', where we set an allowed revenue and the service provider then seeks to recover this amount (but not more than this amount) from customers.[4] Prices (or tariffs) for specific services will be derived from this overall revenue constraint. Under a revenue cap, any over or under recovery (relative to the allowed cap) in one year is corrected in subsequent year(s).[5] We set revenue to cover efficient costs, but ultimately service providers are free to decide how much to spend on providing regulated services.[6]

We use a building block approach to determine the service provider's annual revenue requirement. The building block method calculates annual revenue as the sum of operating costs, capital costs, and tax liability. Capital costs include the return of capital (depreciation of the asset base) and a return on capital. The return on capital is calculated as the nominal rate of return multiplied by the nominal asset base. Depreciation is typically calculated using the 'straight-line' approach (that is, equal amounts in real terms for each year over the life of the asset).

To calculate each building block we typically use the RFM and PTRM. While the NER mandates the use of these models, the NGR only requires gas service providers to submit:

- financial information on a nominal basis, a real basis, or some other recognised basis for dealing with the effects of inflation[7]

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4 There are other forms of control, such as a weighted average price cap (where we set how much prices are allowed to vary from one year to the next) and an average revenue cap (where we set allowed revenue per unit of energy transported).

5 This differs under other forms of control. Under a weighted average price cap, the service provider bears the gain or loss relative to the allowed cap where volumes differ from forecast. Under an average revenue cap, we will adjust for over or under recovery relative to the allowed cap, but only after adjusting for differences between actual and forecast energy consumption).

6 Subject to compliance with other regulations about service quality.

7 NGR r.73(1).

- a depreciation schedule designed so that an asset is depreciated only once (ie that the amount by which the asset is depreciated over its economic life does not exceed the value of the asset at the time of its inclusion in the capital base (adjusted, if the accounting method approved by the AER permits, for inflation));[8] and
- forecasts and estimates that are arrived at on a reasonable basis and which represent the best possible forecast or estimate possible in the circumstances.[9]

  We intend to construct our PTRM and RFM so that they satisfy these NGR provisions in addition to requirements in the NER.

The RFM is used to establish the asset base from one regulatory period to the next (or rolling forward from one year to the next in the same regulatory period). The opening asset values are then used as inputs to the PTRM. The role of the PTRM is then to determine the total revenue requirement for service providers by calculating each building block then adding the building blocks to determine the annual revenue requirement each year within the regulatory control period. The PTRM then smoothes the revenue profile over the regulatory period, so that the expected revenue over the regulatory control period equals the total revenue requirement (in net present value terms).[10]

We determine annual revenue in nominal terms because it will be in nominal amounts that consumers will be paying. Therefore, we need to take into account expected future inflation to determine what the nominal price levels will be in future periods. The PTRM uses 10 year inflation expectations to convert revenues to nominal values. After determining the nominal annual revenue for each year using the PTRM, 'X-factors' are then used to adjust the yearly revenue amounts to 'smooth' revenues across the regulatory period. The X-factors are percentage changes in real annual revenue from year to year and must follow certain rules in their calculation, which may be set out in control mechanism formulas, in addition to the NER or NGR. For example, in the case of electricity, they are to comprise part of the CPI–X constraint on regulated services, and they must be set such that the following conditions are met:

- The sum of the annual revenue (unsmoothed) and forecast expected revenue (smoothed) are to be equal in net present value (NPV) terms
- the value of expected revenue and the annual revenue in the final regulatory year of the period must be as close as reasonably possible.[11]

Once the revenue for each year has been smoothed using the X-factors the nominal prices or reference tariffs charged for each period can be derived.

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8 NGR r.89(d).

9 NGR r.74(2).

10 In 'net present value' terms means that we discount cash flows (at the relevant weighted average cost of capital) across the regulatory period to reflect the time value of money.

11 The AER in its regulatory determinations has considered a divergence of up to 3 per cent between the expected revenue and annual revenue for the final year of the regulatory period to be reasonable if this can achieve smoother price changes for customers over the regulatory period.

At a general level, our process for determining regulated prices over a standard five year regulatory period is:

1. Determine opening asset value for the next regulatory period from the closing value of the previous regulatory period. This is done using the RFM.
2. Estimate level of efficient costs for the next regulatory period. This is our assessment of operating expenditure, capital expenditure, depreciation, rate of return, and tax.
3. Using the opening asset value and efficient costs, determine the annual revenue for each year of the next regulatory period. This is done using the PTRM and the building block method contained in the model.
4. Calculate 'X-factors', which are the percentage changes in the real (that is, not-inflation-adjusted) annual revenue to smooth the profile from year-to-year. This requires incorporating the annual expected inflation and is done using the PTRM.
5. Prices (or tariffs) are determined in the first year of the next regulatory period based on the nominal revenue for the first year and forecast demand for the first year.
6. For each subsequent year of the next regulatory period, revenue is determined annually by starting with the previous year's approved revenue and applying the applicable control mechanism formula which will adjust for:
    - the X-factor (revised after the annual return on debt update) for that year[12],
    - the amount of actual inflation (as measured by CPI) for the previous year
    - other miscellaneous adjustments arising from the previous year to be carried into the next year, such as service performance amount and cost pass through
7. For these years, prices (or tariffs) are determined so that they comply with the allowed revenue calculated as above, as well as any other constraints on individual prices.

2.1.1 What does the PTRM do?

The PTRM is used to calculate the allowed expected revenue for a network service provider over a given regulatory period. Specifically, the PTRM performs iterative calculations to derive the:

- Annual revenue requirement (unsmoothed);
- Annual expected revenue (smoothed); and
- X factors (converts unsmoothed revenues to smoothed revenues over a given period).

The calculations are for each regulatory year of the regulatory period from a set of given inputs. These inputs include:

- Opening regulatory asset base values and lives;

[12] For more details, see Post tax revenue models (Transmission and distribution) January 2015 amendment. Available at: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/post-tax-revenue-models-transmission-and-distribution-january-2015-amendment.

- Opening tax asset base values and lives;
- Forecast capital expenditure (capex);
- Forecast customer contributions and asset disposals;
- Forecast operating expenditure (opex);
- Revenue adjustments;
- Tax rates;
- Return on equity;
- Return on debt (varies year by year);
- Expected inflation;
- Capital raising costs;
- Forecast demand;
- Current revenue and price; and
- Tariff schedule.

The PTRM then uses these inputs to undertake the building block derivation of total revenue, consistent with the requirements of the NER. Under this approach total revenue is set to equal the total costs of the benchmark network service provider to calculate total unsmoothed revenue for the service provider.

The PTRM then uses X factors to smooth the revenue across the regulatory period. It is important that the revenue is smoothed over the regulatory period so that the prices charged by service providers are not unduly volatile throughout the period. The X factors are calculated using an iterative procedure within the PTRM and must satisfy the condition that the NPV of the unsmoothed revenue is equal to the NPV of the smoothed revenue.

The PTRM then produces final output in the form of tables showing revenue summary, including:

- Building block components;
- Unsmoothed revenue;
- Smoothed revenue;
- X factors;
- Demand forecasts; and
- Indicative price paths

2.1.2 What does the RFM do?

The RFM establishes the method used to roll forward the asset base—that is, increase or decrease from the previous value:[13]

- from one regulatory period to the next regulatory period
- from one year to the next in the same regulatory period.

The closing value of the asset base for a regulatory period as calculated by the RFM becomes the opening asset base to be used for the purposes of making a building block determination for the next regulatory period.

The asset base values from the RFM are inputs into the PTRM, where they are rolled forward from one year to the next on a forecast indicative basis. They are used in the PTRM as part of the calculation of the annual revenue requirements.

The RFM deals with many aspects of asset base estimation, including:[14]

- establishment of the opening asset base for a regulatory period
- adjustments for prudent and efficient capex
- the approach to depreciating the asset base, which may be based on forecast or actual capex
- circumstances where other assets may be removed from or added to the asset base.

The roll forward of the asset base from year-to-year in the regulatory period will reflect:

- additions for actual capex, net of customer contributions
- reductions for the disposal value of assets
- reductions for depreciation
- indexation for actual inflation
- adjustment for the difference between estimated and actual capex for the previous regulatory period
- other adjustments for removal or addition of assets made under certain circumstances (such as a change in service classification under the NER).

2.2 Recent developments

Estimates of inflation are an input into our revenue and pricing decisions. Two measures of inflation are ultimately used: actual inflation and expected inflation. Our estimate of expected inflation is a 10 year forecast (annualised) which aligns with the tenor used to calculate the rate of return. Recently, our approach to estimating annual expected inflation has been the subject of debate in our regulatory determination processes and merits review proceedings. Our approach to measuring actual inflation has been less controversial.

[13] NER, cl. 6.5.1(e) & 6A.6.1(e).
[14] NER, cl. S6.2 & S6A.2.

Prior to 2007 the AER (and the Australian Competition and Consumer Commission (ACCC) before it) had used the breakeven method to estimate expected inflation. The breakeven approach estimates expected inflation, using the Fisher equation, as the difference between yields on inflation-indexed Commonwealth government securities (CGS) and nominal (not indexed) CGS.

In 2007, during our review of AusNet Services' Victorian electricity transmission determination, a consultant for AusNet Services submitted that there were issues of illiquidity in the indexed CGS market. AusNet Services submitted that these liquidity issues were impacting on the yields for those bonds, distorting the breakeven inflation estimate. After investigation, the AER decided to estimate expected inflation using the Reserve Bank of Australia (RBA) forecasts and target band approach, rather than the breakeven approach, in its 31 January 2008 final decision for AusNet Services. This approach has since been set out the PTRM and applied by us consistently for all subsequent determinations.

In June 2015, a consultant on behalf of SA Power Networks (SAPN) and United Energy submitted that the AER should once again use the 10 year bond-breakeven inflation rate as an estimator of expected inflation. The consultant noted that the supply of indexed CGS has increased by over 400%[15] and the number of different maturity dates more than doubled from 3 to 7[16] (4 of the 7 outstanding securities have a maturity of approximately 10 years or less). This lead the consultant to conclude that the shortage in the supply of indexed CGS is no longer a material concern.

Expected inflation became a contentious issue following SAPN's revised proposal in July 2015. Since then, we have received regulatory proposals from 13 businesses and 10 of these have proposed a change to our approach to estimating expected inflation.[17] These proposals submitted that the RBA forecasts and target band approach is, in the current market conditions, resulting in an estimate of inflation that is upwardly biased, and that the breakeven method would provide a better estimate.

In our October 2015 final decisions for Energex, Ergon Energy, and SAPN, we stated that we could not change the method for estimating inflation as it is set out in the PTRM and the PTRM is binding on both service providers and the AER. Any changes to the PTRM must follow the legislated consultation process. We were not in a position to fully evaluate the merits of the RBA forecasts and target band approach, the breakeven approach, or any other methods, in any case. Our decision to apply the approach set out in the PTRM was upheld by the Australian Competition Tribunal (Tribunal) in its October 2016 decision.[18]

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15 From 30 June 2007 to 30 June 2016, indexed CGS by outstanding issue value has increased by over 500%. Historical Statistics, Table H13 Government Securities on issue 30 June 1983 to June 2016. Australian Office of Financial Management, Australian Government.

16 In 2007-08 there were 3 outstanding tenors of indexed CGS. Currently (2016) there are 7 outstanding tenors of indexed CGS. Historical Statistics, Table H13 Government Securities on issue 30 June 1983 to June 2016. Australian Office of Financial.

17 SA Power Networks, CitiPower, Powercor, Jemena Electricity Networks, AusNet Services (distribution), United Energy, ActewAGL Gas, Australian Gas Networks, APTNT, AusNet Services (transmission), Powerlink, TasNetworks, and APTPPL. Only APTNT, Powerlink, and TasNetworks did not criticize our current inflation approach.

18 SAPN appealed to the Federal Court for judicial review of other parts of this Tribunal decision but did not appeal the

In May 2016 we published final decisions for the Victorian electricity distributors, ActewAGL Gas Distribution, APTNT, and Australian Gas Networks' SA distribution network. In our decisions for the Victorian electricity distributors, we maintained that we could not change the method for estimating expected inflation due to the binding effect of the PTRM. For gas businesses, while the PTRM was not binding, there needed to be sufficient consultation from the initial proposal on alternative methods of estimating expected inflation so that we could be satisfied that an alternative method resulted in an estimate that was made on a reasonable basis and was the best in the circumstances.[19] In each case, we also included a consideration of the relative merits of different methods for estimating expected inflation that had been put forward by service providers. This consideration was limited to the information available to us at the time and to the level of analysis that we could reasonably undertake in the time available. We found that there were a number of limitations with the breakeven approach that may cause it to produce biased estimates, and considered that overall the RBA forecasts and target band approach would better contribute to the National Gas and Electricity Objectives, particularly where alternatives had not been subjected to appropriate industry-wide consultation.

United Energy and ActewAGL Gas Distribution filed applications for merits review by the Tribunal of the expected inflation decisions of our May 2016 determinations. United Energy withdrew its ground of review relating to expected inflation following the Tribunal's SAPN decision. The Tribunal's decision in ActewAGL's review is currently reserved but due to be delivered on or before 27 May 2017.

In the course of current revenue reset processes and our review of the RFM, we have received further submissions raising issues about our approach for estimating expected inflation. Even in the context of the RFM review, these submissions focused on the expected inflation method set out in the PTRM. These submissions also proposed several other potential mechanisms to adjust allowed revenue to account for differences between estimated expected inflation and actual inflation in previous periods.[20] Such mechanisms would attempt to address the issue of estimating expected inflation by removing the influence of expected inflation and result in a change to the regulatory framework of setting an annual real rate of return, instead of the fixed rate of return over a regulatory period. Section 5 of this paper discusses the current inflation compensation and the impacts of changes to the current regulatory framework.

The alternative approaches for addressing inflation that have been proposed over the past 12 months are not necessarily consistent with one another.

More recently, the ACCC has published a working paper considering the best estimates of expected inflation (ACCC/AER Working Paper # 11).[21] The paper ranked and compared four different approaches including:

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expected inflation decision.

19 NGR, r.74.

20 APTPPL, *Roma-Brisbane pipeline access arrangement submission*, September 2016, pp. 207–210; SA Power Networks / CitiPower / Powercor, *Letter re: proposed amendment to the Roll Forward Model*, 13 October 2016, pp. 7–8.

21 See ACCC/AER Working Paper #11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017.

1. RBA inflation forecasts and target band (our current method)
2. Bond breakeven inflation rate
3. Zero coupon inflation swaps
4. Surveys.

The working paper concludes that the RBA inflation forecasts and target band method is the best approach to estimating expected inflation. This approach is the most simple, transparent and replicable. The working paper concludes that long-term inflation expectations are anchored within the inflation target band and are relatively stable, and is considered to be relatively congruent with the 10 year market-expected inflation rate.[22] Amongst other things, we are seeking submissions on the ACCC's working paper.

[22] ACCC/AER Working Paper #11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017, pp. 94-104.

3 Key concepts

3.1 What is inflation?

Inflation is a general measure of an increase in prices and fall in the purchasing value of money. Inflation refers to changes in the general or overall price level, rather than prices for particular products. For example, over a period of time the price of oil may increase and the price of bread may decrease, but there may be no change in the overall price level.

The opposite of inflation is deflation: a decrease in the general price level. The NER and NGR refer to inflation,[23] but do not expressly refer to deflation. We consider that the term 'inflation' in the Rules includes deflation as a negative amount of inflation.

The presence of inflation within the economy makes it difficult to compare prices across different time periods. In order to account for inflation, the terms real and nominal are used. The real value of a good has been adjusted for inflation and can therefore be used to compare prices over different periods. Conversely, the nominal value has not been adjusted for inflation.

In economics, the Fisher equation estimates the relationship between real and nominal returns with regard to inflation:

$$(1 + interest\ rate_{nominal}) = (1 + interest\ rate_{real})(1 + inflation\ rate)$$

This equation shows that when inflation in positive the nominal return is greater than the real return.

Real returns (or real prices) are important to use because they are able to illustrate the purchasing power of a return regardless of what happens to price levels in the future. In essence, a real return strips out the effects of inflation and allows the value to be seen in terms of the current period's purchasing power.

3.1.1 Actual inflation measures

There are a number of different measures of actual inflation. The most widely known and used measure is the Consumer Price Index (CPI). The CPI is a measure of changes in the price level of a 'basket' of consumer goods and services purchased by households. The Australian Bureau of Statistics (ABS) monitors changes in the CPI and results are published quarterly.

Other measures of inflation may differ in the types of products and prices that are tracked over time. For example, commodity price indices measure changes in prices of specific commodities such as gold and iron ore. Core price indices may exclude certain goods and services whose prices are relatively more volatile (due to supply and demand factors in those specific markets), and this volatility may make it more difficult to track underlying

[23] NER, Chapter 6; NGR, Part 9.

trends in the overall price level. Producer price indices measure changes in price from the seller's perspective and the 'basket' of producer goods and services can be further classified by industries. Another common measure is the GDP deflator. It is a measure of inflation across all final goods and services produced within the economy during the period. Unlike some price indices (like CPI) the GDP deflator is not based on a fixed basket of goods and services, instead the basket is able to change with people's consumption and investment behaviours.

3.1.2 Why use the CPI as the measure of actual inflation?

The choice of which actual inflation measure is most suitable involves balancing timeliness, stability and simplicity. Despite being somewhat narrower in scope than other options available, the CPI is the most suitable method for measuring inflation due to its simplicity, relative timeliness and high degree of credibility and familiarity. The ABS describes the principal purpose and uses of CPI in the following terms: [24]

> *…The Australian CPI is specifically designed to provide a general measure of price inflation for the household sector as a whole. It measures changes over time in the prices of consumer goods and services acquired by Australian households. Measuring inflation for industry price determinations the use of the CPI is appropriate in circumstances where a measure of general price inflation is required. A major role of the index is as an input to the conduct of general economic policy, in particular monetary policy by the Reserve Bank of Australia.*

Other measures of actual inflation are subject to limitations which make them a less appropriate measure compared to the CPI. The GDP deflator offers a broad coverage of prices in the entire economy producing economy wide inflation, instead of just the narrow consumer basket used by CPI. However, it is not a practical option for use in industry revenue determinations given its longer publication lag and frequent revisions. Producer price indices offer the potential of greater alignment with the industry subject to regulation, but in practice it may be difficult to find a close match of the regulated networks. Also, there is a concern whether producer prices appropriately incorporate productivity improvements to the same extent as consumer or retail prices.

CPI is therefore the most appropriate measure of actual inflation because of its timeliness, stability and simplicity. It is widely used as the primary measure of inflation by regulators and government agencies across Australia.

Additionally, the NER provide that the revenue or prices for regulated electricity network services are to apply a 'CPI minus X' control mechanism.[25] The NER also provide that the value of a regulated electricity network's asset base is to be adjusted from one period to the next by increasing it for actual inflation, and that the measure of inflation is to be consistent with that used in the control mechanism (that is, CPI).[26]

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[24] ABS Cat 6461.0, *Consume Price Index: Concepts, Sources and Methods*, 2005, Chapter 5.

[25] More precisely, standard control services are to be controlled by a prospective CPI minus X mechanisms, or some incentive-based variant of CPI minus X. See: NER cl. 6.2.6(a).

[26] NER cl. 6.5.1(e)(3).

The NGR does not mandate the use of CPI when determining prices or asset values, but rather provides that financial information must be based on some recognised basis for dealing with the effects of inflation.[27] We consider that CPI is a well-recognised measure of inflation, and is the most appropriate measure for the reasons outlined above.

3.1.3 Monetary policy

As a measure of the overall change in prices, inflation is often considered as a loss of value of currency. That is, inflation from 1 January 2015 to 1 January 2016 means that one dollar could be used to buy more goods and services on the 1st of January 2015 than one dollar could be used to buy on the 1st of January 2016. As less goods and services could be bought with a single dollar, the relative value of the dollar has decreased.

Similar to any other product, changes in the value of money (that is, inflation) may be affected by changes in the supply of and demand for money. The RBA is tasked with conducting monetary policy to control inflation through increasing or decreasing the money supply (or by slowing or accelerating growth in the money supply). The RBA Governor and the Federal Treasurer have agreed that the appropriate target for monetary policy is an inflation rate of 2 to 3 per cent.[28]

3.2 Best estimate of expected inflation

3.2.1 Expectations, forecasts, and outcomes

We are required to estimate expected inflation, but the inflation outcome may turn out to be different to the original expectation. A difference between an initial expectation and the ultimate outcomes does not necessarily mean that the expectation was not the best possible expectation available at the time.

The Competition Economics Group (CEG) submitted that expectations involve consideration of the probability of all possible outcomes, and may not simply reflect the most likely outcome.[29]

3.2.2 What is 'best'?

The NER states that the PTRM for electricity distribution and transmission must specify: ‘a methodology that the AER determines is likely to result in the best estimates of expected inflation.’[30] The NGR states that an estimate must be arrived at on a reasonable basis and must represent the best forecast or estimate possible in the circumstances.[31]

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27 NGR r. 73(1).

28 On average, over the business cycle. See: *Statement on the Conduct of Monetary Policy*, 19 September 2016.

29 That is, the mean, median, and modal outcomes may not equate. Competition Economists Group, *Best estimate of expected inflation*, September 2016, page 9.

30 National Electricity Rules, Version 74, 6.4.2(b)(1) and 6A.5.3(b)(1).

31 National Gas Rules, r.74.

We, in conjunction with the development of the ACCC/AER working paper #11, consider that there are four approaches that could be employed to derive the best estimates of expected inflation:

- The AER's current approach, which is a 10 year geometric annualised average of the RBA's forecast headline rate forecast 1 and 2 years ahead[32] and the midpoint of the RBA target inflation band of 2 to 3 per cent for years 3 to 10;
- The 10 year bond breakeven inflation rate (BBIR) implied by the difference between the yields-to-maturity on nominal and indexed CGS;
- The 10 year expected inflation rate implied from zero coupon inflation swaps; and
- Survey-based approaches of expected inflation.

The ACCC/AER working paper #11 ranks the four approaches with respect to best estimates of expected inflation informed by five assessment criteria:

- relative congruence with the market-expected inflation rate (whether estimates of a particular approach more closely correspond to the market-expected inflation rate)
- robustness
- transparency
- replicability
- simplicity.

These issues are also relevant to the reasonableness of the basis upon which an estimate is arrived at.

We propose to employ the criteria to help us assess which method is likely to result in the best estimate of expected inflation in line with clauses 6.4.2(b)(1) and 6A.5.3(b)(1) in the NER and rule 74 in the NGR. We invite submissions on these proposed criteria.

3.3 An efficient allowed rate of return

We incorporate inflation in the PTRM, annual pricing review and the RFM. Inflation also affects many of the inputs to these models. These effects are individually accounted for in the current methodology. This section explores the current methodology and the issue of appropriately accounting for inflation, correct compensation for inflation risk and the term of the inflation expectations used.

3.3.1 Appropriately accounting for inflation

Inflation has an effect on revenues, costs faced and asset values of the networks. Inflation also impacts the inputs and outputs of the PTRM and RFM models. After adjusting for these considerations, the current models set an approximate real rate of return over the total of the regulated asset base.

[32] Where the RBA forecast headline inflation rate 1 and 2 years ahead is a range, the midpoint of the range is used.

The NER and NGR require use of a nominal WACC in setting total annual revenues. [33] The NER also require the RAB to be indexed and maintained in real terms.[34] The NGR require the capital base to be depreciated in a manner that ensures that an asset is depreciated only once and that asset values are adjusted for inflation.[35] Inflation is thus accounted for in both returns on and of capital. [36] To avoid double compensation for inflation we adjust by removing the indexation of asset base amount from total revenue. We subtract this amount from the depreciation building block. The approach provides for the same total annual revenue and asset base as if a real WACC is used in combination with an indexed asset base.

3.3.2 Risk and return

While in expectation the networks receive a set real return on the overall regulated asset base, inflation risk may be present due to lag effects. This may present inflation risk to the networks. However, electricity service providers are likely to be compensated for these risks through the current setting of parameters in the PTRM as are gas service providers who propose use of the PTRM or a model with similar settings.

The equity beta calculated for the benchmark efficient entity (BEE) through the return on equity is based on equity returns of Australian energy utility firms we consider reasonably comparable to the BEE.[37] If inflation risk due to regulation meant that the networks' faced systemic risk, then the calculated betas in the CAPM is likely to be higher than otherwise. The businesses are therefore likely to be compensated for their current levels of inflation risk.

The calculations for the appropriate return on debt are also sensitive to the networks' current level of risk. This is due to the BEE's credit rating being based on the networks' observed credit ratings. If inflation risk was significant and did change the networks' probability of defaulting on debt, then we would expect it to be captured in the networks' credit ratings.

3.3.3 Investment term

The length of years considered in the inflation expectations is an important consideration as inflation expectations can vary depending on the number of years included. In choosing the length used for inflation expectations we match the duration to that of the nominal risk free rate used in the nominal vanilla return on capital calculations.[38] The nominal risk free rate

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[33] NER, cl. 6.5.2(d), 6A.6.2 and NGR r. 87.

[34] NGR, 89(d) states an … asset is depreciated only once (i.e. that the amount by which the asset is depreciated over its economic life does not exceed the value of the asset at the time of its inclusion in the capital base (adjusted, if the accounting method approved by the AER permits, for inflation)).

[35] If the accounting method approved by the AER permits (NGR r.89(d)).

[36] NER, cl. 6.5.2(d), 6A.6.2.

[37] AER, *Rate of Return Guideline*, (2013), p. 15.

[38] AER, *Final Decision: SP AusNet transmission determination 2008–09 to 2013–14*, 31 January 2008, p. 107; AER, *Revised access arrangement by GasNet Australia (Operations) for the Principal Transmission System*, 30 April 2008, p. 66.

used in the calculation of the return on debt and the return on equity is the 10 year CGS rate. We therefore use 10 year expected inflation estimates.

Debt contracts (and therefore our return on debt calculations) are based on prices investors are willing to pay. These prices reflect investor expectations of the risk free rate, debt risk premium and inflation over their investment horizon at the time they raise this debt. Service providers, have in the past agreed that this horizon (or term) for the return on debt is 10 years. Therefore, while debt contracts may fix the nominal cost of debt, this cost incorporates investor expectations of inflation over the next 10 years. The term in these inflation expectations are what we want to match.

4 Methods for estimating expected inflation

The ACCC/AER working paper #11 contains a detailed analysis of four methods for estimating expected inflation. The four methods assessed in the working paper are summarised in Table 2. We encourage stakeholders to read the ACCC/AER working paper #11 in tandem with this paper and provide submissions on its content and conclusions.

Table 2 Methods for estimating inflation expectations

Method	Description
RBA inflation target (our current method)	A 10 year geometric annual average of the RBA's forecast headline inflation rate 1 and 2 years ahead[39] and the midpoint of the RBA target inflation band (currently 2 to 3 per cent) for 3 to 10 years ahead.
Bond break-even	The 10 year bond breakeven inflation rate is implied by the difference between the yields-to-maturity on 10-year nominal Commonwealth Government Securities (CGS) and 10-year indexed CGS.
Zero coupon inflation swaps	Estimates of the 10-year market expectations of inflation are calculated from an inflation swap-implied term structure of the expected inflation rates.
Surveys	The survey-based measures of inflation expectations approach uses inflation expectations obtained from surveys of professional forecasters, market economists and other groups. In Australia, publicly available survey measures of expected inflation are limited to 2 years ahead.

We have used the RBA inflation target method to estimate expected inflation in our gas and electricity network determinations since 2008. Prior to 2008 we had generally used the bond breakeven method. We switched to the RBA inflation target method in 2008 due to concerns about bias in the bond breakeven inflation estimates caused by low liquidity in the Australian indexed bond market. Recently, some service providers have proposed using the bond breakeven method again, submitting that previous liquidity concerns are no longer relevant.[40]

Zero-coupon inflation swaps is another well-recognised method for estimating expected inflation. No stakeholders have recently proposed using the zero-coupon inflation swaps method, but the method was considered by CEG in a report submitted to us by several service providers.[41]

The ACCC/AER working paper also considered using surveys to estimate expected inflation. The RBA inflation target method is, in effect, a type of survey approach (where one entity, the RBA, is surveyed) but other survey-based approaches may also be used.

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[39] Where the RBA forecast headline inflation rate 1 and 2 years ahead is a range, the midpoint of the range is used.

[40] Proposals by SA Power Networks, CitiPower, Powercor, Jemena Electricity Networks, AusNet Services (distribution), United Energy, ActewAGL Gas, Australian Gas Networks, and AusNet Services (transmission).

[41] CEG, *Measuring Expected Inflation for the PTRM*, June 2015.

As investor expectations are unobservable, direct comparison of the relative accuracy of the different methods is not possible. Comparison of the estimates from the different methods against inflation outcomes may provide some insight, but expectations and outcomes may not be equivalent.

The ACCC/AER working paper reviewed the four different estimation methods.

The ACCC/AER working paper ranked the four different estimation methods as follows:

1. RBA inflation target method

   The working paper found 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 working paper found 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.[42]

2. Inflation swaps

   The working paper found inflation swaps to be the best 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. The working paper found that, in the absence of addressing these issues, it is not better than the RBA target band approach.[43]

3. Bond break-even

   The working paper found bond breakeven estimates to be the third-best method, and that there are a number of potential biases and risk premia that should be considered when using this method. The working paper considered there to be a greater number of potential biases and risk premia in bond breakeven estimates than swap-implied estimates, and that bond breakeven estimates are more volatile than swap-implied estimates. The working paper found that there is a lack of consensus on how to adjust for these risk premia.[44]

4. Surveys

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[42] ACCC/AER Working Paper # 11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017 paragraphs 201-204.

[43] ACCC/AER Working Paper # 11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017 paragraphs 218-221.

[44] ACCC/AER Working Paper # 11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017, paragraphs 212.

The working paper ranked surveys the fourth-best method on the basis that publicly available survey data is limited to 2-year forecasts. Further, the working paper found that long-term inflation expectations are anchored to the RBA's target band, therefore as long as this anchoring remains, a simpler approach may be to simply use the RBA target band.[45]

The ACCC/AER working paper #11 found 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.[46]

The working paper also found 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.[47] In that case, these methods may be subject to higher potential for bias (than the RBA inflation target method) in proposed model specifications.

Question 1: Explain why you agree or disagree that the RBA inflation target method is more likely to provide best estimates of expected inflation than swap-implied estimates and bond breakeven estimates?

Question 2: Explain why you agree or disagree that inflation swaps are a more robust and congruent market-based estimate of expected inflation than bond breakeven estimates?

Question 3: Do you agree that we should not rely on swap-implied estimates or bond breakeven estimates? Should we place some weight on estimates from each of the four methods?

Further discussion of the advantages and disadvantages of the four estimation methods is contained in the following subsections. Stakeholders should read the ACCC/AER working paper #11 for a detailed analysis of methods for estimating inflation expectations.

4.1 RBA inflation target

[45] ACCC/AER Working Paper # 11, April 2017, paragraphs 217-220.

[46] 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 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.

[47] ACCC/AER Working Paper #11, *Consideration of best estimates of expected inflation: comparing and ranking approaches,* April 2017, paragraph 141.

Estimates of expected inflation calculated using the RBA inflation target method are consistently close to the midpoint of the RBA target band and have been relatively stable over time.

The ACCC/AER working paper #11 found that, overall, the academic literature supports the view that long-term inflation expectations are:[48]

- relatively stable over time
- anchored to the RBA's target band, and
- do not respond significantly to inflation surprises.

In this context, estimates from the RBA inflation target method may likely reflect best estimates of expected inflation.

However, if the RBA inflation targeting is (or becomes) perceived to have lost its effectiveness and expectations are not anchored within the target band, then estimates from the RBA inflation target method may not be the best estimates of expected inflation.

Question 4: Do you consider that monetary policy has (or is perceived to have) lost its effectiveness in influencing economic activity and as a result inflation expectations?

Question 5: In light of potential anchoring of long-term inflation expectations to the RBA's target band, explain whether you consider we should simply estimate expected inflation based solely on the RBA target band, without adjusting for the RBA's short-term (2-year) inflation forecasts?

Question 6: Provide reasons as to whether or not you agree that the RBA's short-term (2-year) forecasts are likely to outperform private-entity forecasts? If our approach is to continue to combine short-term inflation forecasts with the RBA target band, should we use the RBA's 2-year forecasts or use other survey estimates instead and why?

4.2 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

[48] See ACCC/AER Working Paper # 11, *Consideration of best estimates of expected inflation: comparing and ranking approaches,* April 2017, paragraph 38. See also: 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.

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.[49]

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/AER 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.

Table 3 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 than the floating leg 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/AER 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.[50] 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	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. The lag on the Australian zero coupon inflation swap is moderate. Bloomberg and Zine-eddine (2014) identify the lag as 3 months. 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

[49] In practice, only one cash payment is actually made, being the difference between the pre-determined fixed rate and the actual CPI.

[50] 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.

	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. 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 required and there is no supply limitation. Observations of Australian data suggest that this liquidity premia may be negligible.[51] 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/AER Working Paper # 11, pp. 75 - 76.

Despite these potential biases, the ACCC/AER working paper #11 notes a number of studies that suggest that inflation swaps may provide better estimates of expected inflation than the breakeven method.[52]

Question 7: Do you consider that swap-implied estimates are materially affected by various risk premia and biases? If so, do you consider that those biases and premia can be estimated robustly and removed from the swap-implied estimates?

4.3 Bond breakeven estimates

The bond breakeven 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:

$$expected\ inflation = \frac{1+interest\ rate_{nominal}}{1+interest\ rate_{real}} - 1$$

[51] See ACCC/AER Working Paper #11, *Consideration of best estimates of expected inflation: comparing and ranking approaches,* April 2017, pp. 81 - 85.

[52] 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.

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/AER 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 Table 4.

Table 4 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 in indexed bond yields: 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 in indexed bond yields: 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 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 to short term inflation expectations when calculated from coupon-paying bonds	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 for and supply of indexed and nominal CGS that are unrelated to changes to inflation 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/AER Working Paper # 11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017, pp. 33-36.

The ACCC/AER working paper #11 found 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 working paper also finds that the modelling and estimation required to

adjust breakeven estimates for these potential biases and risk premia may be complex, contentious, and difficult to scrutinise. The working paper noted that 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.[53] 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.

Question 8: Do you consider the limited tenors of indexed CGS are likely to result in the swap-implied forward inflation curve better reflecting the decomposition of market-implied forward inflation rates than the bond breakeven-implied forward inflation curve?

Question 9: Do you consider that bond breakeven estimates are materially affected by various risk premia and biases? If so, do you consider that those biases and premia can be estimated robustly and removed from the bond breakeven estimates?

4.4 Surveys

The RBA obtains or undertakes surveys of consumer inflation expectations, business inflation expectations, union officials' inflation expectations, and market economists' inflation expectations. These surveys report expectations from 3 months to 2 years ahead. Consensus Economics surveys Australian inflation expectations up to 10 years ahead, but this data is not publicly available.

Survey-based estimates of long term inflation expectations are considered to be reasonable or even superior proxies for market expectations of inflation in a number of Australian and international studies of inflation expectations.[54]

Ang et al. (2007)[55] find that survey estimates of expected inflation outperform other forecasting methods. The potential result is that survey expectations may correspond more

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[53] 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.

[54] ACCC/AER Working Paper #11, *Consideration of best estimates of expected inflation: comparing and ranking approaches*, April 2017, paragraph 179.

[55] Andrew Ang, Geert Bekaert and Min Wei (2007), *'Do Macro Variables, Asset Markets or Surveys Forecast Inflation Better?'* Journal of Monetary Economics, 54, pp. 1163-1212.

closely with market expectations of inflation simply because the market may be more heavily informed by superior forecasts.

Survey-based estimates of inflation are subject to the general concerns associated with any survey:

- The surveys' target respondents and whether they can be expected to make informed judgments about inflation expectations, the incentives of the respondents, and the potential for 'herding' behaviour. Changes in survey respondent composition over time should also be considered.
- Wording of survey questionnaires—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.
- Survey response rate and non-response bias.

Another potential concern with survey estimates is that many are based on median or trimmed mean inflation expectations. Market expectations of inflation correspond to market-determined probability weighted averages of all anticipated inflation outcomes. Even if survey respondents and the market share the exactly same probability distribution of anticipated inflation outcomes, expectations may differ if the probability distribution is skewed.[56]

Conversely, surveys can reflect information that is not well summarised by historical data or econometric equations (such as changes in tax laws, perceived shifts in long run inflation goals of policy or perceptions of policy credibility).

Question 10: Should we consider survey-based estimates of 10-year inflation, even if the data cannot be publicly reported?

[56] Wesley Phoa and Michael Shearer (1998), *Advanced Fixed Income Analytics*, Frank J. Fabozzi and Associates, New Hope, pp. 108-110.

5 The treatment of inflation in the regulatory framework

In this chapter we discuss the current inflation compensation framework and describe other possible frameworks. In particular we consider whether the approximate real return the networks receive over the regulated asset base is appropriate and whether there are preferable options. The chapter contains five parts:

- a description of the role of inflation in the regulatory framework,
- previous submissions on inflation made by networks,
- the current framework, and
- other possible frameworks.

5.1 Role of inflation in the regulatory framework

The allowed rate of return is a key determinant of allowed revenue in our decisions. The rate of return provides a service provider with revenue to service the interest on its loans and to give a return on equity to shareholders. The allowed rate of return must 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 network services.[57]

Inflation is included at multiple stages in the calculation of the allowed rate of return. The values used for inflation is dependent on the available information at the time, as well as whether inflation or expected inflation is the source of (efficient) financing costs for the network. This leads to different inflation values being used during the PTRM, annual pricing decisions and the RFM processes.

When we calculate the nominal WACC for use in the PTRM, the only information available is expected inflation as future inflation is unknown. This is also true for investors when deciding to invest in debt or equity. Hence, expected inflation is implicitly included when setting the appropriate rate of return for debt and equity due to investors also not knowing future inflation. An expectation of inflation over a 10 year period is then deducted in the depreciation step when setting annual revenue to offset the expected inflation in the nominal WACC. The end result of the PTRM is X factors that describe the path of future revenue growth in real terms that are then carried forward into future years of the regulatory period.

Other building blocks in the PTRM (such as operating expenditure) are initially inputted as 'real' values of a base year. The PTRM converts these other building blocks in to the X factors (X factors are in 'real' terms).

During the annual pricing decisions and reference tariff variations the X factors are combined with actual inflation to create the allowed revenue for the coming year. In this way the prices

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

faced by consumers and the revenues received by the networks change by actual inflation, but are constant in real terms (while ignoring other non-inflation factors).

At the end of the regulatory period, the RFM process rolls forward the regulated asset base—that is, increases or decreases the asset base from the previous value.[58] To do this actual inflation is used along with actual capital expenditure and approved depreciation values.

In effect the service provider has its revenue adjusted by actual inflation in each annual revenue adjustment and its asset base is adjusted only at the end of each regulatory period.

Figure 1 describes the different inflation values used in the process (in this case a 'partially lagged' approach).[59] The diagram should generally be read top-to-bottom reflecting the broad timing of AER regulatory processes:

- The top section shows the relevant years and CPI measures.
- The next section shows the 2011–15 PTRM from an October 2010 decision, where we used a forecast of inflation to set revenues for the full five year period.
- The next section shows the annual revenue adjustments, used to set revenue outcomes (customer prices) each year within the period. For 2011, this decision was made in December 2010 and used the forecast inflation from the PTRM. For 2012 to 2015, the decision is made in December of the preceding year, using lagged inflation outcomes to adjust revenue.
- The bottom section shows the 2011–15 RFM from an April 2016 decision, where we used inflation outcomes to calculate the closing RAB (and so the opening RAB for the 2016–20 regulatory control period). There can be some variability here in the application of lagged or un-lagged inflation to various components within the RFM. This figure is an illustrative overview of the partially-lagged approach to RFM inflation, which is the standard approach currently in the AER's RFM template.

Figure 2 describes the impact of inflation on compensation. These are further described in section 5.3.

[58] NER, cl. 6.5.1(e).

[59] For more information on the lagged approaches in the RFM, see: AER, *Explanatory statement - Proposed amendment - Electricity distribution network service providers - Roll forward model (version 2)*, 31 August 2016.

Figure 1 Overview of the partially-lagged approach to RFM inflation

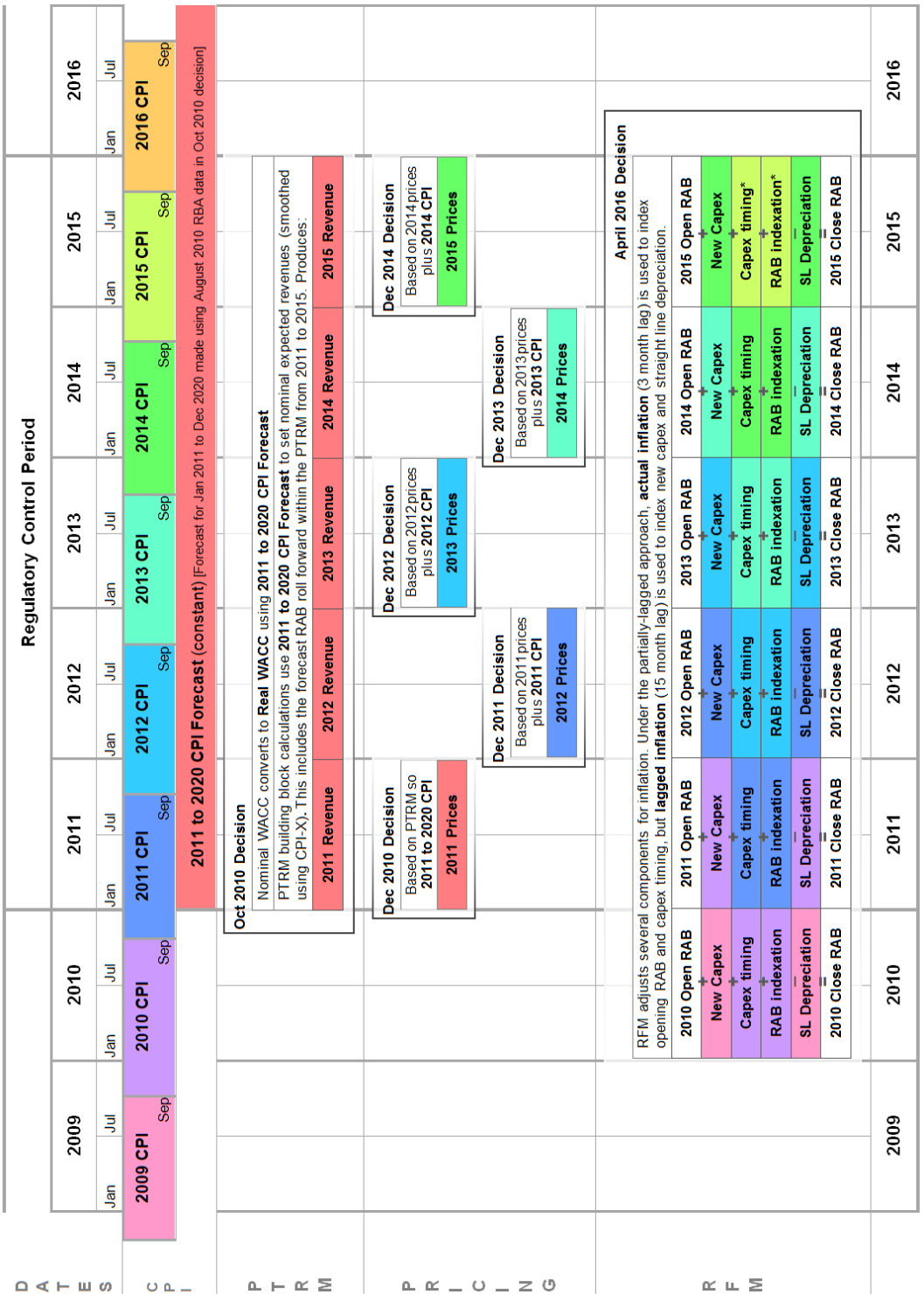
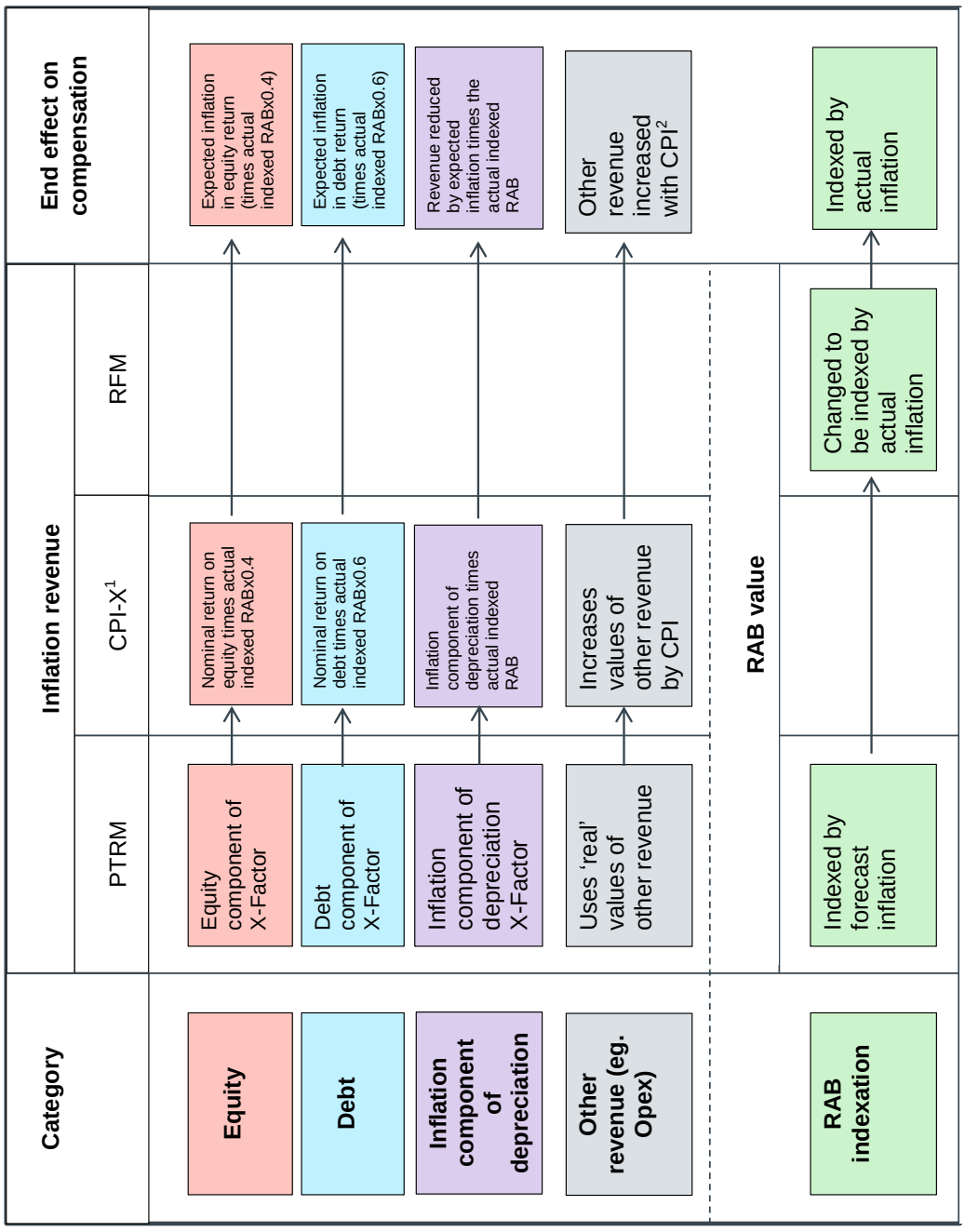


Figure 2 Effect of inflation on investor compensation



1. Applies in years two to five of the regulatory period.
2. Applies in years two to five of the regulatory period. In year one, the other revenue is increased by expected inflation.

5.2 Previous submissions made by service providers

During the amendment process for the RFM in 2016, we received submissions from businesses on the holistic treatment of inflation and inflation expectations in the PTRM, annual revenue adjustment and RFM processes.

The submissions we received supported an overarching framework for assessing inflation, rather than looking at the RFM inflation in isolation.[60] They stated that this holistic assessment demonstrated that the AER's treatment of inflation was inappropriate, in that it exposed the service providers to material revenue shortfalls in current inflation conditions. However, all five submissions focused on the AER's expected inflation as the principal cause for this revenue shortfall.[61] For example, the ENA submitted a report by Frontier Economics which stated:[62]

> Thus, the main issue that we consider in this report is the prospect that the AER's approach to forecasting expected inflation over the regulatory control period is not the best unbiased forecast commensurate with the prevailing conditions in the market.

The AER's method for estimating expected inflation is specified in the PTRM, not the RFM.[63] This was acknowledged in submissions made by AusNet Services, AGN, ENA and SCP, who explicitly noted that changes to the approach for estimating expected inflation might be beyond the scope of this RFM update.[64] For example, the ENA stated:[65]

> ENA and its members are keen to collaboratively engage with the AER to more fully consider the issues raised in this note beyond the RFM review, and would value further broader discussions with AER and other stakeholders on potential options to address them in future determination processes.

The submissions we received supported the AER's proposed approach to updating actual inflation in the RFM.[66] It appeared that these stakeholders did not seek to amend any aspect

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60 However, in some cases the submissions considered only the interactions between the PTRM and RFM, rather than PTRM, RFM and annual revenue adjustments.

61 AusNet Services, *Letter re: Proposed amendments to the electricity distribution roll forward model (RFM)*, 13 October 2016, p. 4; AGN, *Untitled letter*, 13 October 2016, p. 1 ; JEN, *Letter re: Response to proposed amendments to the distribution roll forward model*, 13 October 2016, p. 4; SCP, *Letter re: Proposed amendment to the roll forward model*, 13 October 2016, p. 8; ENA, *Letter re: Roll forward model (distribution) - 2016 proposed amendments - Proposal for future collaborative work on treatment of inflation*, 25 October 2016, p. 1.

62 Frontier Economics, *Comment on treatment of inflation in the AER's PTRM and the RFM, A report prepared for the Energy Networks Association*, October 2016, p. 1.

63 See AER, *Final decision: Amendment, Electricity transmission and distribution network service providers, Post-tax revenue models (version 3)*, 29 January 2015, *Appendix B: Distribution PTRM*; AER, *Draft decision, AusNet Services transmission determination, 2017–18 to 2021–22, Attachment 3 – Rate of return*, July 2016, pp. 3-129 to 3-138 (expected inflation is a common issue between distribution and transmission); and AER, *Better regulation, Explanatory statement, Rate of return guideline*, December 2013, p. 47.

64 AusNet Services, *Letter re: Proposed amendments to the electricity distribution roll forward model (RFM)*, 13 October 2016, p. 8; AGN, *Untitled letter*, 13 October 2016, p. 1; and SCP, *Letter re: Proposed amendment to the roll forward model*, 13 October 2016, pp. 6–8.

65 ENA, *Letter re: Roll forward model (distribution) - 2016 proposed amendments - Proposal for future collaborative work on treatment of inflation*, 25 October 2016, p. 1.

66 Only two submissions (AusNet Services and SCP) directly addressed the choice between all-lagged and partially-lagged inflation approach when updating for actual inflation outcomes, as set out in section 3.1. The other three submissions

of the RFM to account for this issue.[67] In other words, they agreed with the current treatment of inflation in the RFM, but wanted us to consider changing the expected inflation treatment in other components of the regulatory process. Hence, we did not make any changes to the amended RFM in response to this issue and are now consulting on this as part of this discussion paper for initiating the PTRM review.

Since the RFM amendment process we have received a submission from APTPPL to adjust for differences between expected inflation and outturn inflation.[68] The submission stated that there is a mismatch between the allowed revenues which reflect a forecast of inflation and the roll forward of the asset base which reflect actual inflation. This mismatch is said to present inflation risk to the business, which it is not able to manage.

To address the stated mismatch, APTPPL proposed to annually recalculate the relevant X factors to incorporate actual (outturn) inflation—similar to the annual return on debt update.

5.3 Current inflation compensation

In this section we consider the current inflation compensation over a single year with a minor simplification: the lagged inflation effects considered in the recent RFM review are not included to keep the analysis tractable.[69] The lagged effects are considered in section 5.4.2.

The main finding is that the compensation for inflation is roughly equivalent to CPI over the entirety of the regulated asset base if certain conditions are met.

5.3.1 Efficient debt financing

Usually debt investors receive a set nominal return over the period to maturity which by necessity includes expected inflation (as networks typically do not issue inflation linked bonds). The magnitude of inflation compensation demanded by investors for the networks' bonds is not observable due to liquidity risk premium, inflation risk premium, etc. However, it is included in the yield curves used to set the nominal rate of return for debt (amongst other items). This allows the AER to correctly compensate for inflation expectations in the debt allowance as part of the return on capital building block.

During the creation of X factors for the PTRM the calculated return is adjusted using expected inflation. The return is then adjusted during the annual revenue pricing process using actual inflation.

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[67] addressed the use of actual inflation outcomes in the RFM without commenting specifically on the lag that should be used. There is one exception. The SA Power Networks/CitiPower/Powercor submission identifies several potential options for dealing with the issue. One of these options entails an adjustment to the RAB to offset the claimed residual impact of the difference between expected and actual inflation over the previous regulatory control period. This might be implemented in the RFM. However, the submission noted that it would likely require changes to the NER, and so it is also beyond the scope of this RFM update. SA Power Networks/CitiPower/Powercor, *Letter re: Proposed amendment to the roll forward model*, 13 October 2016, p. 7.

[68] APTPPL, *RBP Access Arrangement revision submission 2017-22*, September 2016, p. 205.

[69] Appendix C demonstrates that, due to the CPI-X framework, the form of compensation is the same in each year of the regulatory control period.

The allowed revenue for inflation in the debt component in a given year can be described as:

$$Debt\ inflation\ comp = Exp\ Inf_{WACC\ Debt} \times RAB \times 0.6$$

Where $Exp\ Inf_{WACC\ Debt}$ is the unobserved inflation component of BEE's debt and RAB is the asset base.

The actual inflation cost for the networks in relation to debt inflation faced by networks is:

$$Actual\ debt\ inflation\ costs = Exp\ Inf_{WACC\ Debt} \times RAB \times 0.6$$

5.3.2 Inflation for operating expenditure and revenue adjustment

The operating expenditure allowance and revenue adjustments are set in real terms initially and then adjusted by outturn inflation during the annual pricing process.[70] This is appropriate given that the majority of non-finance costs that firms face are likely to vary with inflation (wages, etc). Due to the direct offsetting nature of the compensation and costs relating to the non-financial items we do not consider inflation compensation for the non-financial items in the analysis below. It is important to note, however, a change to the CPI-X framework would affect the inflation compensation of these items.

5.3.3 Reduction due to natural effect of inflation on asset base growth

Expected inflation is deducted in the depreciation step of the PTRM (using the estimates of expected inflation) when a nominal rate of return is used in combination with an inflation adjusted asset base. This is because the value of a network's assets will, after accounting for depreciation and capital expenditure, increase along with inflation to preserve the real value. This means the expected inflation on the networks' assets that is received by investors has to be deducted from the network's allowed revenues to prevent double compensation for inflation.[71] The total amount of the deduction is calculated as below (note it is impacted by the CPI-X adjustment).

$$Revenue\ inflation\ adjustment\ for\ RAB\ inflation = -RAB \times Exp\ Inf_{10\ year\ est}$$

Where CPI is outturn inflation, $Exp\ Inf_{10\ year\ est}$ is the estimated inflation rate and RAB is the regulated asset base.

The increase in the asset base due to inflation is (in the RFM):

$$RAB\ inflation = CPI \times RAB$$

The increase in the RAB is incorporated in expectation in the PTRM due to the unknown nature of future inflation. At the RFM step, the amount is adjusted for outturn inflation.

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[70] The exception is the first year of the regulatory control period, which uses the inflation forecast (with ten year term) included in the just-released regulatory decision.

[71] For further information see Section 3.3.1.

5.3.4 Efficient equity financing

Equity investors receive the residual component of revenue after incorporating all costs. In practice this is a mixture of outturn inflation and inflation expectations.

During the PTRM process a nominal rate of return for equity is calculated and is then adjusted using inflation expectations (similar to debt). This incorporates an expected measure of inflation rather than actual inflation. The return is then transformed back into a nominal value during the annual revenue pricing process using outturn inflation.

The allowed revenue for inflation in the equity component can be described as:

$$Equity\ inflation\ comp = Exp\ Inf_{WACC\ Equity} \times RAB \times 0.4$$

Where $Exp\ Inf_{WACC\ Equity}$ is the unobserved inflation component of BEE's equity and RAB is the regulated asset base.

The actual received inflation compensation varies with outturn inflation and is the residual of allowed revenue minus the paid out compensation for inflation.

$$Actual\ inflation\ compensation\ for\ equity\ received = \left(CPI - Exp\ Inf_{10\ year\ est}\right) \times RAB + Exp\ Inf_{WACC\ Equity} \times RAB \times 0.4$$

Where CPI is outturn inflation, $Exp\ Inf_{10\ year\ est}$ is the estimated inflation rate, $Exp\ Inf_{WACC\ Equity}$ is the unobserved inflation component of BEE's equity and RAB is the regulated asset base.

If the expected value of outturn inflation and the 10 year expected inflation estimate are equivalent (i.e. E(CPI) = $\mathrm{Exp\ Inf}_{10\ \mathrm{year\ est}}$) then the allowed equity return and that received are equivalent in an NPV sense. However, actual expected equity returns increase if the 10 year inflation expectations estimate is biased downward. This leads to incentives for the networks to ensure that the 10 year inflation expectation estimate is as low as possible.

Question 11: Is there an adjustment to the PTRM that could be made to remove the incentive to insert bias in to the inflation expectation? Does this adjustment still achieve the same inflation compensation outcomes?

5.3.5 Inflation compensation over the total asset base

The above compensation can be combined to consider the compensation received over the entire asset base.

$$Inflation\ compensation\ received\ for\ total\ network\ assets = \left(0.6 \times Exp\ Inf_{WACC\ Debt} + 0.4 \times Exp\ Inf_{WACC\ Equity} - Exp\ Inf_{10\ year\ est}\right) \times RAB + CPI \times RAB$$

Where CPI is outturn inflation, $Exp\ Inf_{10\ year\ est}$ is the estimated inflation rate, $Exp\ Inf_{WACC\ Debt}$ is the unobserved inflation component of BEE's debt, $Exp\ Inf_{WACC\ Equity}$ is the unobserved inflation component of BEE's equity and RAB is the regulated asset base.

The compensation is equivalent to CPIxRAB (considered a set real return) if the expected inflation values are equivalent for debt, equity and the 10 year estimation method. Namely if $Exp\ Inf_{WACC\ Debt} = Exp\ Inf_{WACC\ Equity} = Exp\ Inf_{10\ year\ est}$. This is, however, unlikely due to the return on debt being calculated using the trailing average approach. $Exp\ Inf_{WACC\ Debt}$ is actually the simple average of the past ten years of inflation expectations.

5.4 Other possible frameworks

As mentioned in section 5.3, the current framework allows an approximate real return for the networks' regulated assets. In general, assets that do not vary one to one with inflation (i.e. not set in real terms) often require an inflation risk premium. These are present in assets such as nominal CGS.[72] If as part of the PTRM review, it was decided to move away from an overall real return it may increase inflation risks and change investors' required returns. This could end up causing higher prices for consumers.

There also may be a preference to receive set dollar (nominal) value returns, as investors and analysts set their targets in nominal terms. If this is the case then investors may wish to receive set nominal returns and may require lower returns.

There is also a question of what consolidation is most appropriate to consider. Presently the approximate real return is set over the entire regulatory asset base. However, inflation risk premiums are set on individual securities such as issued debt and equities. It is arguable whether the focus should be on ensuring the most appropriate inflation compensation variability at the regulatory asset level or at the security level.

There are four broad options:

1. A set real return can be provided for the total of the regulated asset base. This is closest to the current framework.
2. A set nominal return for the entirety of the asset base.
3. A set real return for equity holders.
4. A set nominal return for equity holders.

Overall, each of these choices will be NPV neutral except with respect to the risk premiums on the issued securities.

Question 12: Should inflation compensation be set in real or nominal terms? Should inflation compensation be set in real or nominal terms at the regulatory asset base level or at the equity and debt level? Explain why your selection is preferable.

[72] See Chapter four for details.

5.4.1 Implementing a chosen framework

There are multiple possible ways to achieve the objective of a set return. For example adjustments could involve annual updating, a method proposed by RBP, or wholesale changes to the PTRM or RFM.[73] Changes must, however, have regard to the relevant items in the NER, should minimise impact to other building blocks and not reduce regulatory stability and certainty.

Question 13: Are there preferable changes to achieve the appropriate inflation compensation that have regard to the relevant items in the NER, minimise impact to other building blocks and do not reduce regulatory stability and certainty?

5.4.2 Using lagged CPI

For section 5.3, we mostly abstracted away from the issue of lags in the compensation for inflation. However, there are a number of alternative approaches to the treatment of inflation in the RFM. They can be distinguished by the degree of lag applied to the inflation series used to convert nominal values within the RFM. There is always a six month implementation lag to allow for the publication of CPI data and implementation in the annual pricing approval process.[74]

However, in addition to the implementation lag, there may be an additional year of delay added to some inflation series used to convert some elements within the RFM. By convention, these approaches are labelled with regard to this additional lag.

- the 'partially-lagged' approach uses inflation lagged by one year for some elements within the RFM, and un-lagged inflation (actual inflation) for others
- the 'all-lagged' approach uses inflation lagged by one year for all elements within the RFM[75]
- the 'un-lagged' approach uses un-lagged inflation (actual inflation) for all elements within the RFM.[76]

In the most recent RFM review, the stakeholders appeared comfortable with the current lag structures. If changes are made to other parts of the inflation treatment though this may not be the case.

Question 14: Are there changes to the inflation lag approaches that can be made that ensure appropriate matching of inflation periods? If so, how are they materially better?

5.4.3 Adjustments to returns

[73] APTPPL, *RBP Access Arrangement revision submission 2017-22*, September 2016, p. 205.

[74] In some historical decisions the delay was only three months; but for all decisions under the present DNSP RFM the delay will be six months.

[75] With the six month implementation lag, this means an eighteen month delay in the inflation index.

[76] With the six month implementation lag, this means a six month delay in the inflation index.

As mentioned in section 3.3, the networks are compensated for the current level of inflation risk through the setting of parameters in the PTRM, annual revenue adjustment and RFM processes.

The equity beta calculated for the BEE through the return on equity is based on the actual networks' equity returns and the debt yield curve used to calculate the return on debt is based on the networks' actual credit ratings. If the inflation compensation did change then these would be incorporated into future beta calculations and credit ratings. However, as we use historical data to inform these, changes in risk may not be immediately incorporated.

Other parameters may also change. If risk levels were to fall, then the service providers may choose to issue more debt. The appropriate gearing ratio then may differ from the current approach.

Question 15: If changes are made to reduce inflation risk, should the median credit rating or the equity beta be adjusted in the short term? Are there other parameters that also should be adjusted?

6 List of questions

Question 1: Explain why you agree or disagree that the RBA inflation target method is more likely to provide best estimates of expected inflation than swap-implied estimates and bond breakeven estimates?

Question 2: Explain why you agree or disagree that inflation swaps are a more robust and congruent market-based estimate of expected inflation than bond breakeven estimates?

Question 3: Do you agree that we should not rely on swap-implied estimates or bond breakeven estimates? Should we place some weight on estimates from each of the four methods?

Question 4: Do you consider that monetary policy has (or is perceived to have) lost its effectiveness in influencing economic activity and as a result inflation expectations?

Question 5: In light of potential anchoring of long-term inflation expectations to the RBA's target band, explain whether you consider we should simply estimate expected inflation based solely on the RBA target band, without adjusting for the RBA's short-term (2-year) inflation forecasts?

Question 6: Provide reasons as to whether or not you agree that the RBA's short-term (2-year) forecasts are likely to outperform private-entity forecasts? If our approach is to continue to combine short-term inflation forecasts with the RBA target band, should we use the RBA's 2-year forecasts or use other survey estimates instead and why?

Question 7: Do you consider that swap-implied estimates are materially affected by various risk premia and biases? If so, do you consider that those biases and premia can be estimated robustly and removed from the swap-implied estimates?

Question 8: Do you consider the limited tenors of indexed CGS are likely to result in the swap-implied forward inflation curve better reflecting the decomposition of market-implied forward inflation rates than the bond breakeven-implied forward inflation curve?

Question 9: Do you consider that bond breakeven estimates are materially affected by various risk premia and biases? If so, do you consider that those biases and premia can be estimated robustly and removed from the bond breakeven estimates?

Question 10: Should we consider survey-based estimates of 10-year inflation, even if the data cannot be publicly reported?

Question 11: Is there an adjustment to the PTRM that could be made to remove the incentive to insert bias in to the inflation expectation? Does this adjustment still achieve the same inflation compensation outcomes?

Question 12: Should inflation compensation be set in real or nominal terms? Should inflation compensation be set in real or nominal terms at the regulatory asset base level or at the equity and debt level? Explain why your selection is preferable.

Question 13: Are there preferable changes to achieve the appropriate inflation compensation that have regard to the relevant items in the NER, minimise impact to other building blocks and do not reduce regulatory stability and certainty?

Question 14: Are there changes to the inflation lag approaches that can be made that ensure appropriate matching of inflation periods? If so, how are they materially better?

Question 15: If changes are made to reduce inflation risk, should the median credit rating or the equity beta be adjusted in the short term? Are there other parameters that also should be adjusted?

Appendix A: Relevant legislative provisions

National Electricity Rules (NER)

The following provisions from Chapter 6 (electricity distribution) of the NER are mirrored in Chapter 6A (electricity transmission).

Rule 6.3.1(c) provides that a building block proposal must be prepared in accordance with the PTRM. The PTRM is the model prepared and published by us in accordance with Rule 6.4.1(a) of the NER.

Rule 6.4.2(b)(1) provides that the PTRM must establish a "method" that we determine "is likely to result in the best estimates of expected inflation".

Rule 6.4.3(a)(1) specifies that one of the building blocks used to calculate the annual revenue requirement is an amount for indexation of the RAB and refers to Rule 6.4.3(b)(1). Rule 6.4.3(b)(1) provides that this RAB indexation building block is to be a negative amount equal to the increase in the RAB value due to inflation indexation. Rule 6.4.3(b)(1) states:

> *(1) for indexation of the regulatory asset base:*
>
> *(i) the regulatory asset base is calculated in accordance with clause 6.5.1 and schedule 6.2; and*
>
> *(ii) the building block comprises a negative adjustment equal to the amount referred to in clause S6.2.3(c)(4) for that year*

Rule 6.5.1 provides that the value of the RAB is to be adjusted via the RFM. Rule S6.2.3(c)(4) provides that the regulatory asset base (RAB) is to be indexed to inflation and states:

> *(c) Method of adjustment of value of regulatory asset base*
>
> *The value of the regulatory asset base for a distribution system as at the beginning of the second or a subsequent year (the later year) in a regulatory control period must be calculated by adjusting the value (the previous value) of the regulatory asset base for that distribution system as at the beginning of the immediately preceding regulatory year (the previous year) in that regulatory control period as follows:*
>
> *…*
>
> *(4) The previous value of the regulatory asset base must be increased by an amount necessary to maintain the real value of the regulatory asset base as at the beginning of the later year by adjusting that value for inflation.*

The purpose of the RFM is to adjust the value of the RAB from one regulatory control period to the next. Rule 6.5.1(e)(3) requires that the RFM set out the method for determining the roll forward of the RAB for distribution systems under which:

> *(3) the roll forward of the regulatory asset base from the immediately preceding regulatory control period to the beginning of the first regulatory year of a subsequent regulatory control period entails the value of the first mentioned regulatory asset base*

being adjusted for actual inflation, consistently with the method used for the indexation of the control mechanism (or control mechanisms) for standard control services during the preceding regulatory control period.

The deduction from the annual revenue requirement is needed to avoid "double counting" of inflation. Under the NER, a nominal rate of return is used in combination with an inflation-adjusted RAB. Without any adjustment, service providers a compensated twice for the effects of inflation – once through the rate of return and again through indexation of the RAB.

Rule 6.5.2(a) provides that the RAB (which is indexed to inflation) is to be applied to the rate of return to determine the return on capital building block. Rule 6.5.2(d)(2) provides that this rate of return is to be a nominal rate of return.

Rule 6.5.2(e)(3) provides that 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". An estimate of expected inflation may be considered to be a "financial parameter".

Rule 6.4.1(c) requires the PTRM to be "in force" at all times. As noted by the Australian Competition Tribunal in the Application by SA Power Networks, this means that the PTRM:[77]

is not merely that the PTRM be available for use. Secondly, the PTRM cannot be amended at a whim. It can only be amended under the distribution consultation procedures. There would be little point in the rule makers establishing such a significant "gatekeeping" requirement if the PTRM were little more than a tool in which to submit a proposal.

Rule 6.4.1(b) provides that the AER may, from time to time, and in accordance with the distribution consultation procedures, amend or replace the PTRM. The distribution consultation procedure is the procedure set out in Part G of Chapter 6 of the NER (s6.16) and provides for a consultation and decision making process.

Rule 6.5.1(b) requires us in accordance with the distribution consultation procedures, develop and publish a model (the 'roll forward model' or 'RFM') for the roll forward of the RAB. Rule cl 6.5.1(c) provides that we may amend or replace the RFM from time to time in accordance with the distribution consultation procedures.

The distribution consultation procedures provide that:

- Before making a decision on a guideline, methodology, model, scheme, test or amendment; the AER must publish a proposed guideline, methodology, model, scheme, test or amendment along with an explanatory statement.
- The explanatory statement must set out the applicable legislative requirements and our reasons for our proposal.
- The AER must invite written submissions on its proposal and allow for no less than 30 business days for the making of submissions.

[77] Australian Competition Tribunal, *Application by SA Power Networks* [2016] ACompT 11, para 603.

- Within 80 business days of publishing a proposed guideline, methodology, model, scheme, test, amendment, or invitation for submissions; the AER must make its final decision and reasons. The AER may extend the timeline but only if “the consultation involves issues of unusual complexity or difficulty” or “the extension of time has become necessary because of circumstances beyond the AER's control”.
- In making its final decision, the AER must have regard to submissions and include a summary of each issue raised and the AER’s response.
- The AER may publish issues, consultation, and discussion papers and may hold conferences and information sessions.

National Gas Rules (NGR)

The NGR are somewhat less prescriptive than the NER.

The NGR do not require gas business to use the PTRM, though the businesses are not prohibited from using it either. The NGR do not expressly state that the AER is to determine an estimate of expected inflation. However, it is clear from Rules 73 and 89 that an estimate of inflation is a required component of an access arrangement proposal.

Rule 73 provides that financial information provided by a gas network operator must be provided with some recognized basis for dealing with the effects of inflation. Rule 89(1)(d) provides that the depreciation schedule should be designed so that an asset is depreciated only once (i.e. that the amount by which the asset is depreciated over its economic life does not exceed the value of the asset at the time of its inclusion in the capital base (adjusted, if the accounting method approved by the AER permits, for inflation)).

There is no specific requirement in the NGR for the capital base to be indexed for inflation (as there is in the NER). Rule 89, however, by allowing for depreciation to be adjusted and in combination with a mandated nominal rate of return (see next paragraph), seems to allow for an accounting method that maintains the real value of the asset base by indexing it to inflation. In practice, most gas businesses propose using the PTRM. Hence businesses generally propose the basis for dealing with the effects of inflation (pursuant to rule 73) and the accounting method for adjusting depreciation for inflation (pursuant to rule 89) as set out in our PTRM.

The rate of return provisions of the NGR largely mirror those in the NER. Rule 87(4)(b) provides that the rate of return is to be estimated on a nominal basis. Rule 87(5)(c) provides that 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”. An estimate of expected inflation may be considered to be a “financial parameter”.

Rule 74 provides that a forecast or estimate must be arrived at on a reasonable basis and must represent the best forecast or estimate possible in the circumstances.

Appendix B: AER inflation approach in previous decisions

Expected inflation has several uses in the PTRM. Its primary use is to convert real inputs to nominal values, and to convert the nominal vanilla WACC to a real vanilla WACC. This appendix provides a historical overview of expected inflation thought since the inception of the PTRM to the recent Australian Competition Tribunal (Tribunal) deliberations.

Prior to 2007/2008

From the first PTRM to 2008, the approach used for expected inflation was to measure the difference in the yields between nominal Commonwealth Government Securities (CGS) and inflation-indexed CGS using the Fisher equation.[78,79] This method was widely used by other regulators at the time and was seen to have the benefit of being based on market expectations.[80]

SP AusNet determination (2007/2008)

In 2007, SP AusNet (now branded as AusNet Services) sought to revise the expected inflation methodology to account for alleged biases in the Fisher equation. These biases were said to arise from an apparent downward bias in indexed CGS bonds given the scarcity of such bonds and high institutional demand at the time.[81]

SP AusNet proposed to change the methodology for its 2008-14 electricity transmission determination. In its original proposal, SP AusNet suggested increasing the yield on inflation indexed CGS by 20 basis points before applying the Fisher equation to account for the alleged downward bias caused by supply and demand conditions peculiar to indexed CGS.[82] The bias was calculated by comparing spreads between corporate inflation linked bonds and corporate nominal bonds to inflation linked CGS and nominal CGS respectively. We did not accept the methodology, considering it non-compliant with the first proposed PTRM and not resulting in the best estimate of expected inflation. However, we did consider the scarcity of indexed CGS to be problematic. After consulting with the Reserve Bank of Australia (RBA) and the Australian Treasury, we adopted the upper band of the RBA's target range (3 per cent) as expected inflation for its draft decision.

In its revised proposal, SP AusNet broadly agreed to our draft decision of using a more general approach to forecasting inflation and submitted that we should use inflation forecasts from a number of independent forecasters, including economic consultants and retail

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78 Statement of Principles for the Regulation of Transmission Revenues (1999), AER, pp. 83.

79 The Fisher equation is f = (1+ rf) / (1+rrf) – 1 where f equals forecast inflation, rf equals the yield on nominal CGS (as proxy for the nominal risk free rate), and rrf equals the yield on inflation-indexed CGS (as proxy for the real risk free rate).

80 Statement of Principles for the Regulation of Transmission Revenues (1999), AER, pp. 83.

81 Bias in Indexed CGS Yields as a Proxy for the CAPM Risk Free Rate (2007), NERA Economic Consulting.

82 For more information, see: SP AusNet letter to AER – Bias in CGS markets as a proxy for real risk-free rate (2007), SP AusNet, pp. 2.

banks.[83] SP AusNet believed the weight of these forecasts suggested an inflation forecast at the midpoint of the RBA's stated target range (2.5 per cent).[84]

We produced our final decision for SP AusNet in January 2008 after considering SP AusNet's revised proposal and submissions from ElectraNet, Energy Users Coalition of Victoria (EUCV) and TransGrid on inflation (discussed below). Our final decision was to use available forecasts from the RBA and, for periods when forecasts were not available, combine these with the mid-point of RBA's target band.

In making its final decision we considered a number of potential methodologies. Details on our thoughts on three methodologies are below.

CGS bonds and the Fisher equation

Our view on the bias in using CGS bond yields was strongly influenced by the commentary of the RBA and Australian Treasury, which stated that the Fisher equation produced inflation forecasts at odds with other indicators (such as surveys), and that it appeared principally caused by a reduction in the supply of indexed CGS, depressing the yields of the bonds.[85,86]

We also rejected views by the EUCV that movements in the Fisher equation results reflected changes in inflation expectations.[87] We considered that movements in the Fisher equation could reflect changes in the magnitude of the bias as well as changing inflation expectations. Distinguishing between the two effects was too problematic for the indicator to be useful.[88]

Inflation swaps

The EUCV proposed using implied inflation forecasts from inflation swaps as expected inflation, whereas NERA suggested little if any weight should be placed on this method given the relative illiquidity of the market.[89] We agreed with NERA that, at the time, insufficient liquidity was in the inflation swap market to produce a robust inflation forecast. We also were of the opinion that the method contained an inflation risk premium and was better suited as a 'sanity check' rather than using the method directly.[90]

Independent forecasts

In the absence of a robust market based estimate, we favoured independent forecasts of inflation. However, we did not agree with SP AusNet and NERA on using various forecasts from independent consultants and retail banks.[91] Instead we preferred the RBA's forecasts, as the RBA was (and still is) responsible for monetary policy in Australia and its control of

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83 These included the Econtech report, BIS, SKM, ABS, Access, Treasury, RBA, CBA, ANZ, NAB, Westpac and HSBC.

84 For more information, see: AER SP AusNet Draft Determination: Inflation Expectations (2007), NERA Economic Consulting.

85 Letter to ACCC, (2007), Reserve Bank of Australia.

86 The Treasury Bond Yield as a Proxy for the CAPM Risk-free Rate, (2007), Australian Treasury.

87 EUCV, EUCV Submission on draft decision SP AusNet revenue proposal (2007), p. 29.

88 For more information, see: Final Decision SP AusNet Transmission Determination 2008-2014 (2008), AER, p. 102.

89 AER SP AusNet Draft Determination: Inflation Expectations – TransGrid (2007), NERA, p. 6.

90 Draft Decision SP AusNet Transmission Determination 2008-2014 (2008), p. 123.

91 AER SP AusNet Draft Determination: Inflation Expectations (2007), NERA Economic Consulting.

official interest rates and commentary had a significant impact on both outturn inflation and inflation expectations.[92]

To create an estimate of inflation expectations beyond the available forecast period we used advice from the RBA and the Australian Treasury.

In advice to the ACCC, the RBA advised that:

> *Given inflation expectations have been firmly anchored by the Bank's inflation-target regime for some time, a rough estimate of a real risk free rate would be the nominal government bond less the centre of the inflation target bank (ie the nominal yield less 2 ½ per cent).93*

In similar advice from the Australian Treasury:

> *We suggest that [when] working with nominal yields and, where a real return is required, making an inflation adjustment based on the mid point of the RBA's 2 to 3 per cent rant, is entirely reasonable. Since the independence of the Reserve Bank Board in conducting monetary policy was formalise in March 1996, annual inflation has averaged 2.5 per cent.*
>
> *…*
>
> *We therefore recommend that the ACCC use the mid point of the RBA's target band for inflation (i.e. 2.5% per annum) as the best estimate of inflation.94*

The results of these choices ended with a result similar to that of using several independent forecasts.

From 2008 to 2015

Between 2008 and the beginning of 2015 we completed 43 determinations and access arrangements. These used the current method of using available forecasts from the RBA and, for periods when forecasts were not available, combining these with the mid-point of RBA's target band.

2015 to present

Inflation again became a contentious issue following SA Power Networks' (SAPN) revised proposal in July 2015. Since then, we have received regulatory proposals from 13 businesses and 10 of these have proposed a change to our approach to addressing inflation.[95] These proposals submit that the RBA forecasts and target band approach is, in the current market conditions, resulting in an estimate of inflation that is upwardly biased, and that the Fisher equation method would provide better estimates.

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92 Final Decision SP AusNet Transmission Determination 2008-2014 (2008), AER, p. 103.

93 Letter to ACCC, (2007), Reserve Bank of Australia.

94 The Treasury Bond Yield as a Proxy for the CAPM Risk-free Rate, (2007), Australian Treasury.

95 SA Power Networks, CitiPower, Powercor, Jemena Electricity Networks, AusNet Services (distribution), United Energy, ActewAGL Gas, Australian Gas Networks, APTNT, AusNet Services (transmission), Powerlink, TasNetworks, and APTPPL. Only APTNT, Powerlink, and TasNetworks did not criticize our current inflation approach.

In our October 2015 final decisions for Energex, Ergon Energy, and SAPN, we stated that we could not change the method for estimating inflation as it is set out in the PTRM and we are required to follow the PTRM.[96] We did not evaluate the merits of the RBA forecasts and target band approach, the Fisher equation approach, or any other methods. This decision was upheld by the Tribunal in its October 2016 decision.[97]

In May 2016 we published final decisions for Victorian electricity distributors, ActewAGL Gas Distribution, APTNT, and Australian Gas Networks' SA distribution network. In these decisions we maintained that we could not change the method for estimating expected inflation (for electricity businesses) due to it being set out in the PTRM. However, we also included a consideration of the relative merits of different methods for estimating expected inflation. This consideration was limited to the information available to us at the time. We found that there were a number of limitations with the Fisher equation approach that may cause it to produce biased estimates, and considered that overall the RBA forecasts and target band approach would better contribute to the National Gas and Electricity Objectives. We acknowledged that our examination of the relative merits of different approaches was limited by the time available and consequent lack of consultation, and noted that these issues would be best resolved through an industry-wide review.[98]

United Energy and ActewAGL Gas Distribution filed applications for merits review of our May 2016 determinations by the Australian Competition Tribunal. United Energy withdrew its appeal of inflation following the Tribunal's SAPN decision (ActewAGL continued on the basis that the NGR did not, unlike the NER, require it to use the PTRM and therefore the SAPN Tribunal decision did not apply). The Tribunal heard ActewAGL's appeal in November 2016 and will likely hand down its decision in early 2017.

Recently, through ongoing resets and our review of the RABRFM (RFM), we have received submissions proposing to implement mechanisms to adjust allowed revenue or prices to account for differences between estimated expected inflation and actual inflation in previous periods.[99] Such mechanisms would address the issue of estimating expected inflation by removing the influence of estimated expected inflation.

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96 Final Decision SAPN Determination 2016 to 2020 – Attachment 3 (2015), AER, p. 254.

97 Application by SA Power Networks [2016] ACompT 11, Australian Competition Tribunal, cl. 619.

98 Final Decision ActewAGL Distribution Access Arrangement 2016 to 2021 - Attachment 3 (2016), AER, p.160-161.

99 APTPPL, Roma-Brisbane pipeline access arrangement submission, September 2016, pp. 207-210.

Appendix C: Extending the Annualised Compensation

In section 5.3.1 we described debt compensation in any given year as

$$Debt\ inflation\ comp = Exp\ Inf_{WACC\ Debt} \times RAB \times 0.6$$

Where $Exp\ Inf_{WACC\ Debt}$ is the unobserved inflation component of the BEE's debt and RAB is the regulated asset base.

This appendix demonstrates that this is an appropriate representation for years one, two and three of the regulatory control period. The same process can be extended to each of the remaining years and can be applied to the other inflation compensation components discussed in section 5.3.

First year

The first year is usually a special case in our current framework. The annual revenue for the first year is set prior to its commencement, just after the release of the final decision. The nominal revenue figure from the AER's final determination is used without adjusting for inflation. This means that the inflation compensation in the debt component is only from the nominal vanilla WACC. First year inflation compensation for debt:

$$Debt\ inflation\ comp_{t=1} = Exp\ Inf_{WACC\ Debt} \times RAB_{t=0} \times 0.6$$

Where $Exp\ Inf_{WACC\ Debt}$ is the unobserved inflation component of the BEE's debt and RAB is the regulated asset base at the start of the first year.

Second year

The second year inflation compensation for debt is adjusted by the CPI-X process. This involves adjustments by the expected inflation component initially and then an adjustment for outturn CPI. This can be described as below:

$$Debt\ inflation\ comp_{t=2} = \frac{(1 + CPI_{t=1})}{(1 + Exp\ Inf_{10\ year\ est})} \times Exp\ Inf_{WACC\ Debt} \times \widehat{RAB_{t=1}} \times 0.6$$

Where $CPI_{t=1}$ is the outturn inflation that occurred in first year, $Exp\ Inf_{10\ year\ est}$ is the estimated inflation rate, $Exp\ Inf_{WACC\ Debt}$ is the unobserved inflation component of BEE's debt and $\widehat{RAB_{t=1}}$ is the regulated asset base **in the PTRM** at the start of the second year.

In the PTRM, the RAB is adjusted by expected inflation in each year.[100]

$$\widehat{RAB_{t=1}} = \left(1 + Exp\ Inf_{10\ year\ est}\right) \times RAB_{t=0}$$

[100] To simplify we abstract away from depreciation and capital expenditure. These effects will not change the result.

We can then show the inflation compensation in terms of the original RAB ($RAB_{t=0}$) by substituting the adjusted RAB into the $Debt\ inflation\ comp_{t=2}$ formula:

$$Debt\ inflation\ comp_{t=2} = (1 + CPI_{t=1}) \times Exp\ Inf_{WACC\ Debt} \times RAB_{t=0} \times 0.6$$

This is the same compensation from the first year but is adjusted by CPI. We also know that the actual RAB will vary with CPI from the first year to the second year:

$$RAB_{t=1} = (1 + CPI_{t=1}) \times RAB_{t=0}$$

We can therefore describe the inflation compensation allowed in the second year for debt in terms of the actual RAB at the beginning of the second year:

$$Debt\ inflation\ comp_{t=2} = Exp\ Inf_{WACC\ Debt} \times RAB_{t=1} \times 0.6$$

This is in the equivalent form as the inflation compensation in the first year and the general case used in section 5.3.1.

Third year

The third year inflation compensation for debt is also adjusted by the CPI-X process. This involves adjustments by the expected inflation component initially for two years and then an adjustment for two years of outturn CPI. This is described as below.

$$Debt\ inflation\ comp_{t=3} = \frac{(1 + CPI_{t=2}) \times (1 + CPI_{t=1})}{(1 + Exp\ Inf_{10\ year\ est})^2} \times Exp\ Inf_{WACC\ Debt} \times \widehat{RAB_{t=2}} \times 0.6$$

Where $CPI_{t=2}$ is the outturn inflation that occurred in first year, $Exp\ Inf_{10\ year\ est}$ is the estimated inflation rate, $Exp\ Inf_{WACC\ Debt}$ is the unobserved inflation component of BEE's debt and $\widehat{RAB_{t=2}}$ is the regulated asset base **in the PTRM** at the start of the third year.

In the PTRM the RAB is adjusted by expected inflation in each year.[101]

$$\widehat{RAB_{t=2}} = \left(1 + Exp\ Inf_{10\ year\ est}\right) \times \widehat{RAB_{t=1}}$$

and

$$\widehat{RAB_{t=1}} = \left(1 + Exp\ Inf_{10\ year\ est}\right) \times RAB_{t=0}$$

Therefore the RAB in the PTRM for the start of the third year ($\widehat{RAB_{t=2}}$) can be described in terms of the initial RAB.

$$\widehat{RAB_{t=2}} = \left(1 + Exp\ Inf_{10\ year\ est}\right)^2 \times RAB_{t=0}$$

We can then show the inflation compensation in terms of the initial RAB ($RAB_{t=0}$) by substituting the adjusted RAB into the $Debt\ inflation\ comp_{t=3}$ formula:

$$Debt\ inflation\ comp_{t=3} = (1 + CPI_{t=2}) \times (1 + CPI_{t=1}) \times Exp\ Inf_{WACC\ Debt} \times RAB_{t=0} \times 0.6$$

[101] To simplify we abstract away from depreciation and capital expenditure. These effects will not change the result.

This is the same compensation from the first year but is adjusted by CPI in year 1 and year 2. Given that the actual RAB will vary with CPI from year to year we have:

$$RAB_{t=2} = (1 + CPI_{t=2}) \times (1 + CPI_{t=1}) \times RAB_{t=0}$$

We can therefore describe the inflation compensation allowed in the third year for debt in terms of the actual RAB at the beginning of the third year:

$$Debt\ inflation\ comp_{t=3} = Exp\ Inf_{WACC\ Debt} \times RAB_{t=2} \times 0.6$$

This is in the equivalent form as the compensation in the second year, the first year and the general case used in section 5.3.1. The same can be done for the remaining years in the regulatory control period.