IPART
New South Wales

Independent Pricing and Regulatory Tribunal

Comparison of financial models - IPART and Australian Energy Regulator

Research — Information Paper
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ISBN 978-1-922127-11-2

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Contents

1 Introduction

This paper compares the financial models used by the Australian Energy Regulator (AER)[1] and IPART for price setting. We describe the main components of the models and provide a broad overview of each regulator's approach to determining costs and prices.[2]

2 Background

The use of a 'building block' approach to determining an agency's revenue requirement is common amongst economic regulators. This approach generally requires the determination of efficient operating costs, a return of capital (or depreciation) and a return on capital. The revenue requirement generated by adding these cost components is converted into tariffs or prices in accordance with the regulator's preferred method of control.

IPART uses the building block approach to price water services (metropolitan water and bulk water) and passenger transport services (rail and, in the future, buses). Until the economic regulatory functions for the NSW electricity distribution sector were transferred to the AER, we also used a building block approach to price electricity and gas distribution services.

Although the basic of the building block approach are well understood, there are differences between regulators with respect to the types of component 'blocks' used and/or how they are calculated. There are also differences in the methodologies that regulators use to convert the cost allowance into price changes, for example a weighted average price cap (WAPC), a revenue cap or actual prices. These differences often reflect the types of incentives that regulators or policy makers wish to give to the regulated entities in question (eg, incentives to improve efficiency).

1 The AER is a Commonwealth Government agency which is responsible for the economic regulation of energy networks and monitoring the wholesale energy markets.

2 The information contained in this paper is provided by IPART in good faith. The information is believed to be accurate and current at the date the paper was released. However, IPART does not guarantee or warrant the completeness or currency of the information provided.

The AER is one of a number of regulators that publish their cost building block and pricing models.[3] In 2009, we compared the AER's model with one of our own models to:

- better understand how the AER approaches building block calculations and constructs its pricing models
- identify any significant differences between the AER's and IPART's models and the reasons for those differences.

Subsequent to our analysis, the AER published a new version of their pricing model for electricity transmission network service providers in December 2010.[4] In addition, IPART recently adopted a post-tax weighted average cost of capital (WACC) approach in its pricing models.[5] This paper describes and compares the key components of the AER's and IPART's updated building block calculation models, focussing on the major differences between them. It also describes how the models are physically composed. The appendices set out in detail how IPART's and the AER's models are constructed.

3 Comparison of models

3.1 Models used

The models examined for this paper are those most recently used by the AER to determine prices for electricity distribution and transmission services and by IPART to determine prices for metropolitan water services.[6] The AER's electricity distribution and transmission services models are useful for comparison purposes because, until 31 December 2007, prices for the distribution sector were regulated by IPART. In subsequently assuming regulatory responsibility for this sector, the AER considered in detail how it should assess costs and set prices within the framework set by the National Electricity Rules (Rules).

The Rules are a subordinate regulatory instrument under the National Electricity Law. The Rules prescribe to a significant degree how the AER must undertake building block calculations and set prices. In contrast, IPART's regulatory framework is less prescriptive.

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3 Other regulators include, for example, the Office of the Gas and Electricity Markets (Ofgem) in the UK, Victoria's Essential Services Commission (ESC) and Western Australia's Economic Regulation Authority.

4 The new PTRM is available on AER's website. *http://www.aer.gov.au/node/9926*. The model adopts the same approach as the previous version.

5 IPART, *The incorporation of company tax in pricing determinations – Final Decision*, December 2011.

6 A generic version of IPART's cost building block approach is available on our website at *http://www.ipart.nsw.gov.au/Home/Industries/Research/Reviews/Financial_Models/IPART_cost_building_block_and_pricing_model*

IPART's cost building block model for metropolitan water services is based largely on past practice and established calculation methodologies. However, IPART considers at each periodic pricing review whether any element needs to be changed given the issues relevant to that particular determination and to changes in regulatory practice (such as switching to a post-tax WACC methodology).[7]

We recommend that readers refer to specific price determination reports if they wish to gain a more detailed understanding of how the approaches were applied in practice and modelling outcomes.

3.2 Main components and differences

The cost building block and pricing model used by the AER is known as the Post-Tax Revenue Model (PTRM). The PTRM is used to determine prices for the standard control services of electricity distribution network service providers (DNSPs) and transmission network service providers (TNSPs). The distribution and transmission network services have separate PTRMs.

The main differences between the PTRM and IPART's model were found to be associated with:

- the building block components
- the timing assumptions used
- how benchmark debt and equity raising costs are taken into account
- how assets are rolled forward
- how the WACC is applied, and
- how prices are set.

Some differences relate to the assumptions used while others relate to the particular building block calculation methodologies adopted by the AER and IPART. Analysing how the components are calculated (that is, the formulae in the models) is therefore an important part of making comparisons.

3.2.1 Building block components

AER's Post Tax Revenue Models[8]

Annual revenue requirement (ARR) = return of assets + post-tax return on assets + opex (excluding carry-over amounts) + carry-over amounts + benchmark tax liability

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7 IPART, *Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services From 1 July 2012 to 30 June 2016,* June 2012 and IPART , *Review of prices for the Sydney Catchment Authority From 1 July 2012 to 30 June 2016,* June 2012.

8 Most of the discussion in this section refers to the distribution PTRM. However, the building block components of the transmission and distribution PTRMs are very similar.

IPART's post-tax building block model

Notional revenue requirement = return of assets + post-tax return on assets + post-tax return on working capital + opex+ benchmark tax liability

The cost building blocks in both the AER and IPART's models include 4 main components: 1) return of assets (depreciation); 2) return on assets; 3) operating expenditure (opex); 4) benchmark tax liability.

The building blocks in the AER's PTRM differ to IPART's model in 3 main ways:

- The AER includes carry-over amounts, which are not included by IPART.
- The AER applies a nominal WACC to an indexed RAB and consequently reduces building block depreciation by the inflationary gain on the RAB. IPART applies a real WACC to the RAB.
- The AER includes benchmark debt raising costs in opex, whereas IPART makes provision for benchmark debt raising costs in WACC (and therefore in the return on assets).
- IPART explicitly provides for a return on working capital.

These similarities and differences between the models are described in more detail below.

Carry-overs

The Rules require carry-over amounts to be included in the AER's building block model. The Rules provide for carry-overs because the AER is required, also by the Rules, to apply an Efficiency Benefit Sharing Scheme (EBSS) to electricity network service providers.

The EBSS is an incentive mechanism that provides additional revenue or applies penalties depending on whether the business exceeds or falls short of operating expenditure targets in each year of a regulatory control period. The scheme allows businesses to retain any operating efficiency gain or requires them to bear any loss for a set period, irrespective of the year in that control period in which the efficiency gain or loss was initiated. The EBSS is aimed at providing electricity network service providers with a continuous incentive to improve the efficiency of its operating expenditure (opex).[9]

There is no requirement that IPART use carry-over mechanisms in setting prices. The current metropolitan water model does not provide for carry-overs.

[9] The EBSS will not have a direct financial impact on the NSW (DNSPs) until the 2014 – 2019 regulatory control period for transitional reasons.

Tax liability

Both the AER's PTRM and IPART's model are post-tax models, and a benchmark tax liability is included as a building block cost.[10] Both models use the statutory tax rate, tax depreciation and an adjustment for imputation credits to calculate the benchmark tax liability. Similarly, both models include capital contributions[11] and tax losses carried forward in the tax liability calculation. Detailed formulae can be found in Appendix A.

IPART calculates the tax liability in nominal terms and converts it to a real tax liability[12], whereas the AER's tax liability is nominal. This reflects the fact that the IPART model forecasts building block costs in real terms, whereas the AER models forecast these costs in nominal terms.

One minor difference between the models relates to where the adjustment is made for imputation credits: the AER adjusts for imputation credits as a separate line item in the building block revenue calculation, while IPART adjusts for imputation credits in the calculation of the benchmark tax liability. The effect of adjustment for imputation credits is the same.

Return on assets

Like IPART, the AER calculates returns using the standard CAPM model and debt margin formulas. Both models use a post-tax "vanilla" WACC, which comprises a post-tax return on equity and a pre-tax return on debt (see section 2.2.5 below).[13]

The AER applies a nominal vanilla WACC to an indexed RAB, and makes the adjustment for inflation indexation, which is applied to the RAB, in the depreciation cost building block (see below). In contrast, IPART applies a real vanilla WACC to the RAB, and therefore does not need to adjust the depreciation cost building block for inflation indexation.[14]

The AER applies the WACC to the opening value of the RAB each year, and inflates capex by a half-year of WACC to compensate for lost return on new assets due to the mid-year timing assumption (see section 2.2.2). In contrast, IPART applies the WACC to the opening value plus 50% of capex so that the return on new assets is immediately included in revenue.

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10 A worked example of IPART's approach to calculating benchmark tax liabilities can be found on our website. Also, the generic cost building block model (also available on our website) shows how IPART calculates a benchmark tax liability. The worked example is available at *http://www.ipart.nsw.gov.au/Home/Industries/Research/Reviews/Company_Tax*.

11 Capital contribution consists of both cash and in-kind contributions. In-kind contributions are known as assets free of charge. The AER's transmission model does not make provision for capital contributions because, for transmission, capital contributions are rare.

12 In the generic version of IPART's cost building block model costs can be forecast in nominal prices.

13 However, IPART's model includes the option to use a pre-tax WACC.

14 IPART indexes the RAB in the forecast period only if it calculates costs in nominal terms. IPART usually prefers to forecast costs in real terms.

IPART calculates a mid-year value of return on and of assets in the cost building blocks, because it is assumed revenue is received evenly through the regulatory year rather than in full at year-end (see discussion of timing assumptions below). Because of this, IPART recognises a need for an explicit working capital allowance and therefore includes a return on working capital in the cost building blocks. The AER's return on and of assets are year-end values, and no allowance is made for working capital because the cash flow timing assumptions offset the working capital requirements.

The AER splits the return on assets into return on equity and return on debt by multiplying the nominal residual RAB value by the proportion of equity or debt funding. It does this to identify the interest payments that it needs to calculate the building block tax liability. The AER also uses these returns in its cash flow analysis, to compare return to debt and equity holders. In contrast, IPART calculates a single return on assets, and calculates interest and dividend payments separately as part of the financial statements and ratio analysis. Splitting the return on assets does not, of itself, affect the cost building blocks.

Return of assets (depreciation)

The AER and IPART both calculate depreciation using the straight-line method.

The PTRM is a nominal model. To ensure that inflation is not double-counted – that is, entities do not receive inflation costs rolled forward in the RAB and also included in the nominal vanilla WACC (discussed above) - the inflation component in the opening RAB is deducted from depreciation calculations.[15] This adjusted depreciation amount becomes the return of capital building block allowance.

Formulae A2 and A3 below show how the AER calculates depreciation. The existing asset value (opening RAB) is depreciated based on the remaining life of the assets. For expenditure on new assets, a half-year WACC allowance is provided to compensate for the 6-month period before a return on capex is provided (this reflects the AER's mid-year capex assumption). The adjusted capex value is depreciated using the standard life of the assets. The standard life measures how long the infrastructure would physically last had it just been built.

15 Email correspondence with Toby Holder from the AER, 24 August 2009.

A2.

Nominal straight-line depreciation = real straight-line depreciation (A3) x cumulative inflation index

A3.

$$Real\ Straight\ line\ depreciation = \frac{Opening\ RAB}{remaining\ life} + \frac{forecast\ net\ capex \times (1 + real\ vanilla\ \ WACC)^{1/2}}{standard\ life}$$

Note:

$$(1 + real\ vanilla WACC)^{1/2} = \sqrt{(1 + \text{real vanilla WACC})}$$

Forecast net capex = capex - capital contributions[16] *– asset disposals*

The AER's calculation of net capital expenditure is based on forecast capex less forecast asset disposals and, for distribution assets, forecast customer contributions. The estimated disposal value of assets is subtracted from new asset values. In IPART's model, disposals are deducted from the opening RAB rather than capex net of capital contributions. We depreciate the existing assets by their remaining life and new assets by the standard life.

Formulae I2 and I3 illustrate how IPART calculates depreciation for the first year of a control period and then for the following years. Because of our mid-year assumption for capex, only half of the disposals and capex are included in the calculation. That is, in the first year of an asset's life, only 50% of capex is recognised as new assets. Similarly, in the year an asset is disposed, 50% of the disposals are subtracted from the opening RAB.

I2.

$$Straight\ \ line\ depreciation_{yr1} = \frac{(opening\ \ RAB_1 - disposals_1 \times 50\%)}{remaining\ \ life} + \frac{net\ \ capex_1 \times 50\%}{standard\ \ life}$$

I3.

$$Straight\ \ line\ depreciation_{yr\,n} = \frac{(opening\,RAB_1 - \sum_{i=1}^{n-1} disposal_{\ i} - disposals_{\ n} \times 50\%)}{remaining\ \ life} + \frac{\sum_{i=1}^{n-1} net\ capex_{\ i} + net\ capex_{\ n} \times 50\%}{standard\ \ \ life}$$

$$n > 1 \qquad i = 1, 2, ..., n$$

Net capex = capex – cash capital contributions

16 The transmission PTRM does not include capital contributions, because these are very rare for transmission assets.

Remaining life = remaining life of opening assets as the beginning of year 1

IPART calculates the year-end value of depreciation to roll the RAB forward. However, because it is assumed that revenue is received throughout the year (and on average, at mid-year), this amount is discounted by a half-year pre-tax WACC before it is included as the cost building block item.

Operating expenditure

There are no significant differences between how the AER and IPART treat opex, with a single exception. The exception is that the AER includes debt raising costs as an operating cost, whereas IPART makes provision for debt raising costs in the debt margin component of the WACC (see section 2.2.3).

As with all costs, the AER model uses nominal dollars and IPART normally uses real dollars. IPART can convert dollars to either nominal or real, depending on the regulatory requirement.

Table 2.1 summaries the building block components and compares how the two models calculate each component. Appendix A decomposes the building blocks in more detail.

Table 3.1 Building block components

Building block components	In model		Comments on the difference in calculation
	AER	IPART	
Carry-over amounts	Yes	No	Inclusion of carry-over amounts for DNSPs is a requirement of the National Electricity Rules. These amounts arise from the Efficiency Benefit Sharing Scheme.
Benchmark tax liability	Yes	Yes	Both the AER and IPART use a post-tax WACC model, which includes tax liability as a separate building block component. Both use a vanilla post-tax WACC.
Return on asset	Yes	Yes	The AER applies a nominal vanilla WACC to an indexed RAB and makes an adjustment for inflationary gain in building block depreciation (see below). IPART applies a real WACC to the RAB. IPART adjusts the year-end value of return on assets to a mid-year value.[a] AER provides a year-end value. IPART includes provision for debt-raising costs in the debt margin component of the WACC, whereas the AER includes these costs in opex.
Return of asset (depreciation)	Yes	Yes	The AER's model adjusts building block depreciation for inflationary gain[b]. IPART does not need to make such an adjustment. IPART adjusts the year-end value of depreciation to a mid-year value.[a] AER gives a year-end value.
Return on working capital	No	Yes	The AER excludes return on working capital because it provides year-end values for return on and of assets.
Opex	Yes	Yes	The AER includes benchmark debt raising costs as opex, whereas IPART makes provision for debt raising costs in the WACC There are no other differences in the treatment of opex. The AER adjusts for inflation because it is a nominal model.

a IPART calculates the year end-value of the return on assets, then adjusts the year-end value of to a mid-year value by discounting it by a half-year of the post-tax WACC. It does the same for depreciation.

b The building block depreciation amount is the RAB depreciation minus the indexation component of the RAB (ie, the inflationary gain). This avoids compensating the business twice for inflation.

3.2.2 Timing assumptions

Assumptions about the timing of expenditure affect the treatment of capex and building block revenue. Under a "mid-year assumption", it is assumed that revenue arises or expenditure occurs evenly throughout the regulatory year. A "mid-year value" means the value of expenditure or revenue in the middle of each regulatory year. A "year-end value" means the value of expenditure or revenue on the final day of each regulatory year (including opportunity costs).

Table 3.2 shows the timing assumptions used by the PTRM and IPART models.

Table 3.2 Timing assumptions

	AER		IPART	
	Assumptions	**Adjustments**	**Assumptions**	**Adjustments**
Capex	Mid-year assumption	Capex × (1+real vanilla WACC)$^{1/2}$	Mid-year assumption	Capex × 50%
Cost building blocks	Year-end values		Mid-year values	Mid-year value of depreciation and return on assets Eg year-end depreciation/ (1+ real post-tax WACC)$^{1/2}$ Return on working capital provided.

Note:

$(1+real\ vanilla\ WACC)^{1/2} = \sqrt{(1+\text{real vanilla WACC})}$

$(1+real\ post-tax\ WACC)^{1/2} = \sqrt{(1+\text{real post - tax WACC})}$. A nominal WACC is used in a nominal model.

The PTRM adopts a mid-year assumption for capex. The model calculates the return on capital based on the opening RAB for each year. Capex is not added to the RAB until the end of the year in which the expenditure is incurred. The mid-year assumption is put into effect by providing a half-year WACC allowance (see formula A3, page 6). The half-year WACC allowance is depreciated over the life of the asset.

IPART also makes a mid-year assumption for capex, but applies the assumption differently. In effect, PART assumes that half of the capex is incurred at the beginning of the year and the other half occurs at the end of the year. For this reason, only half of forecast capex is incorporated into the estimation of depreciation and the return on assets (see formulae I2 and I3, page 7) in the first year of that asset's existence. Both IPART and the AER treat asset disposals and capital contributions in the same way as they treat capex.

The AER's PTRM adopts year-end values for both depreciation and return on assets in building block revenue. Like the AER, IPART calculates year-end values for depreciation and return on assets. However, IPART adopts mid-year values in the building block revenue requirement. This leads to the adjustment of the allowance for depreciation and return on assets by discounting them by six months of the post-

tax WACC. Given these strict timing assumptions, IPART recognises a need for an explicit working capital allowance and therefore includes a return on working capital in the cost building blocks.

3.2.3 Benchmark equity raising costs

A firm may be required to raise additional external equity funding as a source of equity capital. In this case, it may incur equity raising costs. The AER allows benchmark equity raising costs associated with capex for both DNSPs and TNSPs, but only under certain circumstances. Specifically, the AER considers that

> ...equity raising costs are a legitimate cost for a benchmark efficient firm only where external equity funding is the least–cost option available. A firm should only be provided an allowance for equity raising costs where cheaper sources of funding, for instance, retained earnings are insufficient, subject to the gearing ratio and other assumptions about financing decisions being consistent with regulatory benchmarks.[17]

The allowance for the benchmark equity raising cost is included in RAB. This means that the costs are amortised over the weighted average standard life of the RAB for the purposes of providing the equity raising cost allowance associated with the forecast capex over the next regulatory control period.[18]

Equity raising costs were previously calculated in a separate workbook using the PTRM outputs and simply included as capex inputs back into the PTRM. However, in December 2010 the AER incorporated the calculation of these costs into the PTRM for TNSPs. The AER agreed with Grid Australia that calculations for benchmark equity raising costs should be included in the PTRM.[19]

IPART does not provide an allowance for benchmark equity raising costs.

3.2.4 Asset roll forward

The AER has a separate Roll Forward Model (RFM) to determine the value of the opening regulatory asset base (RAB) for DNSPs and TNSPs. The RFM rolls forward the RAB for each year of the regulatory control period in question to reflect actual capex and depreciation incurred in each year. The closing RAB figure calculated by the RFM then becomes an input to the PTRM as the opening RAB for the following regulatory control period. The forecast RAB is rolled forward in the PTRM. IPART rolls forward the RAB for both periods within the one model.

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17 Australian Energy Regulator, *New South Wales distribution determination – Final decision, 2009-10 to 2013-14*, 28 April 2009, pp 188-189.

18 Australian Energy Regulator, *New South Wales distribution determination – Final decision, 2009-10 to 2013-14*, 28 April 2009, p 194.

19 Australian Energy Regulator, *New South Wales distribution determination – Final decision, 2009-10 to 2013-14*, 28 April 2009, p 194.

19 Australian Energy Regulator, *Amendment electricity transmission network service providers post-tax revenue model handbook – Final decision*, December 2010.

In relation to rolling forward the asset base to the start of the new determination period, the first difference is that the AER uses actual rather than allowed depreciation.[20] IPART's model permits a choice between actual or allowed depreciation, although regulatory practice since 2004 has generally been to use allowed rather than actual depreciation.

The second difference is that the AER fully compensates for the difference between actual and forecast net capex in the last year before the start of the existing determination.[21] IPART does not make an explicit adjustment for this difference.

The AER's approach is largely prescribed under the Rules. The Rules require that the RAB should be adjusted for the difference between any estimated capex and actual capex for the last year of the previous control period and the adjustment must also remove any benefit or penalty associated with any difference between the estimated and actual capex.

In setting the opening RAB the AER recognises capex on an "as-incurred" basis.[22] This approach is consistently adopted in the AER's distribution models (RFM and PTRM). However, in the transmission RFM and PTRM, a "hybrid" approach is adopted: the return on capex is calculated "as incurred" and return of capex is calculated "as commissioned".[23] In comparison, IPART's building block model uses "as-incurred" capex.[24]

Finally, the AER and IPART treat the 'mid-year assumption' differently. As noted above, the AER's capex is rolled into the RAB inclusive of a half year WACC adjustment, whereas IPART recognises half of the capex for the adjustment.

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20 "Actual" depreciation means depreciation that is calculated on the basis of actual net capex and asset lives. "Allowed" depreciation means the depreciation that was forecast at the previous determination, but adjusted for actual inflation. The Rules require the roll forward of TNSP assets to be based on actual depreciation, and the practice has been to also use actual deprecation for DNSP assets. For gas network service providers, the AER has mostly used allowed depreciation.

21 For example, the AER adjusts for the difference in 2003/04, the year before the beginning of the 2004/05 – 2008/09 determination period.

22 The "as-incurred" basis assumes that the economic life of an asset would commence at the time spending is incurred.

23 The "as-commissioned" basis assumes that the economic life of an asset would commence at the time an asset is commissioned and enters service.

24 In practice, large projects may be rolled into the RAB only once they are commissioned. Similar to the AER, IPART then calculates a return on capex and includes this amount in the value of the asset that is rolled into the RAB. Examples of such assets include the desalination plant for Sydney Water's and the Epping-Chatswood Rail Link for CityRail.

Table 3.3 Asset roll forward comparison

	AER	IPART
RAB roll forward to the start of the new determination period	Opening RAB = closing RAB of previous year + actual capex net of capital contributions and disposals (WACC adjusted) -actual straight line depreciation +indexation on opening RAB + adjustment for the difference between actual and forecast net capex in year before start of existing determination	Opening RAB = closing RAB of previous year + actual capex net of capital contributions - actual disposals - allowed depreciation (adjusted for inflation) + indexation on opening RAB plus 50% of capex and disposals
Forecast real RAB	Opening real RAB = closing real RAB of previous year -real straight line depreciation of opening RAB + real capex net of capital contributions and disposals (WACC adjusted)	Opening real RAB = closing real RAB of previous year - real straight line depreciation of opening RAB , 50% of capex and 50% of disposals + real capex net of capital contributions - real disposals
Forecast nominal RAB	Opening nominal RAB = closing nominal RAB of previous year -nominal straight line depreciation + nominal capex) net of capital contributions and disposals (WACC adjusted + indexation on opening RAB	Opening nominal RAB = closing nominal RAB of previous year - nominal straight line depreciation + nominal capex net of capital contributions - nominal disposals + indexation on opening RAB plus 50% of capex and disposals

Note: In the AER models, capital contributions apply only in the distribution PTRM.

3.2.5 WACC calculation

The WACC is the rate a company is expected to pay its debt holders (cost of debt) and shareholders (cost of equity) to finance its assets. The cost of capital is weighted by the return required by the two sources of funding available to a business - equity and debt, and their proportion used by the business. For capital-intensive industries, the WACC is one of the key drivers of the building block revenue requirement.

Both the AER and IPART use post-tax vanilla WACC formulations. The only difference is that the AER uses a nominal WACC while IPART uses a real WACC. As previously discussed, this has implications for the depreciation and return on asset components of the building block revenue requirement (see section 2.2.1).

Under the Rules, the rate of return for electricity distribution and transmission networks must be calculated as a nominal post-tax WACC. Therefore, a nominal 'vanilla' WACC is used to determine the return on capital. This WACC is also used to discount cash flows over the regulatory control period.

AER's nominal vanilla WACC formula:

$$WACC^{nominalvanilla} = R_e.\left(\frac{E}{D+E}\right) + R_d.\left(\frac{D}{D+E}\right)$$

where R_e is the nominal post-tax return on equity, R_d is the nominal pre-tax return on debt, $\frac{E}{D+E}$ is the proportion of equity, $\frac{D}{D+E}$ is the proportion of debt.

IPART uses the same WACC formula as the AER, except that it converts the WACC to a real value.

IPART's real vanilla WACC formula:

$$WACC^{realvanilla} = \frac{\left(1+\left\{R_e.(\frac{E}{D+E}) + R_d.(\frac{D}{D+E})\right\}\right)}{(1+\Pi)} - 1$$

where R_e is the return on equity, R_d is the return on debt, $\frac{E}{D+E}$ is the proportion of equity, $\frac{D}{D+E}$ is the proportion of debt, and (1+Π) is the inflation adjustment.

Both IPART and the AER's include WACC calculations in their models. IPART's approach to WACC calculation is usually discussed in detail in our reports.

3.2.6 Pricing mechanisms

The Rules require prices for DNSPs and TNSPs to be set based on a CPI - X approach. The Rules provide 5 optional pricing mechanisms for DNSPs.[25] Under all forms of pricing control, the X factors must be set such that the following conditions are met:

- The annual revenue requirement (ARR) and forecast revenues are equal in NPV terms.
- The value of expected revenues and the ARR in the final year of the regulatory control period must be as close as reasonably possible.

25 For details on the five options allowed, see clause 6.2.5 (b) of the NER.

The current distribution PTRM provides for 3 price control mechanisms:

1. *Weighted average price cap (WAPC).* X factors represent real price changes and are used to escalate prices and derive a forecast revenue amount.
2. *Revenue cap.* X factors represent real revenue changes and are used to escalate the maximum allowed revenue for each year of the regulatory control period.
3. *Revenue yield (average revenue cap, in $/MWh).* X factors derive a nominal revenue yield value for each year of the regulatory control period. The value of the revenue yield is multiplied by the forecast energy throughput to derive forecast total revenue.

In the transmission PTRM, only a revenue cap is used because of the Rules.

Under the *Independent Pricing and Regulatory Tribunal Act 1992* (Act), IPART is permitted to fix maximum prices or establish a methodology for fixing maximum prices for monopoly services. As such, IPART uses price cap mechanisms for the monopoly service providers that are regulated under the Act (including water and passenger rail).[26]

For IPART, X factors/prices do not necessarily have to be set to achieve NPV neutrality. Whether or not we seek NPV neutrality depends on the business and the particular considerations attending a pricing review.

In the water sector, IPART has traditionally set actual prices. In the past we have used four different types of price path:

- Glide path.
- P_0 glide path.[27]
- Revenue = cost each year.
- NPV equivalence.

IPART's model shows how prices are derived given the preferred price path.

In other industries, such as retail electricity and retail gas, IPART uses a WAPC.

3.3 Features of IPART's and the AER's spreadsheet models

The AER's building block models are simpler than IPART's (eg, contain fewer calculations and worksheets) partly because many elements of cost and price setting are set by the Rules and do not need to be informed by the model. They are also built for use by both the AER and network businesses. DNSPs and TNSPs use the PTRM to calculate their estimated annual revenue requirements (which forms part of their

26 Some sectors, including energy, are regulated under other legislation.

27 It is noted that the P_0 glide path may yield the same results as the NPV equivalence method. An NPV neutral position can be reached when P_0 is large enough (in absolute terms).

revenue reset proposals). The AER uses the PTRM to make its determinations of revenue requirements.

The AER models include a cash flow analysis, which serves as a check to ensure consistency of outcomes with the assumptions adopted in the building block calculations. The AER models do not contain other financial analyses, calculate actual prices or calculate typical customer bills (see Table 2.2).

IPART's pricing models are more complex than the AER's as they are constructed predominantly for use by IPART and regulatory staff and used to facilitate regulatory decision-making. The majority of calculations are contained in the one model to avoid errors.

IPART's model includes a profit and loss analysis, balance sheet analysis and cash flow analysis. In addition to the financial statement analyses, IPART calculates credit ratios to provide an indication of a particular scenario's impact on the credit-worthiness of the regulated business. The model also produces bills for a range of 'typical' customers. In additions, the model has data management functions, ie, provisions to store different sets of inputs (eg, opex, capex and demand). These functions enable users to choose the relevant inputs for analysis.

Table 3.4 matches the corresponding elements of the AER's distribution PTRM and IPART's metropolitan water model. Appendices D, E and F contain pictorial 'maps' of the 2 models, showing the relationship between the major work sheets in each model.

Table 3.4 Matching the corresponding components of the AER's model to IPART's model

Model component	Worksheets in the model	
	AER	**IPART**
Inputs	Input	Import
	Equity raising cost-capex	Cost assumptions
		Pricing Assumptions
Pricing mechanisms		
- setting tariffs	X factor or Smoothing	Scenario (inputs)
		Tariffs (detailed calculations)
RAB roll forward		
- Roll forward to the start of the new determination period	RFM model	RAB worksheet
- Forecast RAB	Assets	RegAssets
Costs and revenues		
- Costs	Assets and Analysis	Costs
		Tax allowance
- Revenues	Forecast revenues or Smoothing	Revenue requirement
		Target revenue
WACC	WACC	'Scenario'
Other analysis	Analysis	Tariffs
		Book Assets
		Financial Statements
		Ratios
		Typical customer bills

Appendices

A IPART and AER's formulae for calculating tax liability

For both IPART and the AER, the amount of tax liability allowed for is the corporate tax rate multiplied by taxable income adjusted for the value of franking credits. While the formulae are slightly different, they produce the same result.

IPART uses the following formula to calculate tax liability[28].

I1.

$$T = \max\left[0, \frac{Y - A}{(1+\Pi_c)} \cdot \left[\frac{t.(1-\gamma)}{1-t.(1-\gamma)}\right]\right]$$

Where T is the real tax liability, $(1+\Pi_c)$ is the cumulative inflation adjustment, Y is nominal taxable income (further explained below), t is the corporate tax rate, γ is the value of imputation credits in percentage and A is accumulated tax losses.

Nominal taxable income (Y) is calculated by:

$$Y = R.(1+\Pi_c) + CC - OPEX.(1+\Pi_c) - TD - I$$

Where R is real allowable regulated revenue (not including tax)[29], $(1+\Pi_c)$ is the cumulative inflation adjustment, CC is nominal capital contributions (cash and non-cash), $OPEX$ is real allowed operating costs, TD is nominal tax depreciation[30] and I is nominal interest payments.

Accumulated tax losses are calculated in the same way as the ATO:

$$A_{t+1} = \max[0, A_t - Y_t]$$

where t is the year ie, accumulated losses are equal to previous accumulated losses less taxable income. If this is less than zero then accumulated losses are equal to zero. In addition to capturing the way the ATO calculates tax liability, this formula allows for the value of franking credits, as all Australian regulators do in some way.

The AER uses the following formula to calculate tax liability.

A1.

$$T = Y - \Gamma$$

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28 This explanation is drawn from IPART, *The incorporation of company tax in pricing determinations – Final Decision,* December 2011, pp 14-15.

29 That is, R is the sum of regulatory depreciation, a post-tax return on capital and operating expenditure.

30 Tax depreciation is different from regulatory depreciation (return of assets) because asset values and asset lives for tax purposes are different from those for regulatory purposes.

Where T is the nominal tax liability, Y is nominal tax payable and Γ the value of imputation credits in dollars.

$$Y = \max\left[0, \frac{(R - OPEX - TD - I + TLCF) \times t}{1 - (1 - \gamma) \times t}\right]$$

$$\Gamma = \gamma \times Y$$

Where R is nominal regulated revenue[31], $OPEX$ is nominal operating costs, TD is nominal tax depreciation[32] and I is nominal interest payments, $TLCF$ is tax loss carried forward, t is the corporate tax rate, γ is the value of imputation credits in percentage.

31 That is, R is the sum of regulatory depreciation, a post-tax return on capital and operating expenditure.

32 Tax depreciation is different from regulatory depreciation (return of assets) because asset values and asset lives for tax purposes are different from those for regulatory purposes.

B Building block components

Table B.1 Building block components

	AER's PTRM		IPART's metropolitan water model	
Building block components	**Formulae**	**Related formulae**[a]	**Formula**	**Related formula**
Return of asset (Depreciation)	Nominal regulatory depreciation = nominal straight-line depreciation - inflation on opening RAB	A2, A3,	Regulatory depreciation = (straight-line depreciation + allocation of corporate depreciation) / (1+ real post-tax WACC)$^{1/2}$ **b**	I2, I3
Return on assets	Return on equity = nominal opening RAB of equity × post-tax nominal return on equity (pre-imputation) plus Return on debt = nominal opening RAB of debt × pre-tax nominal return on debt	A2, A3, A4, A5, A6, A7,A8 A2, A3, A4, A5, A6, A7,A9	Return on assets =[(opening RAB + capex net of capital contribution × 50% - disposals × 50%) ×(1+ inflation rate**b**) × real post-tax WACC] / (1+ real post-tax WACC)$^{1/2}$ **b**	
Return on working capital	N/A		Return on working capital = (real post-tax WACC × net working capital) / (1+ real post-tax WACC)^{½} **b**	
Carry-over amounts	Carry-over amounts = Carry-over amounts × cumulative inflation index		N/A	
Tax liability	Nominal tax liability = nominal tax payable- nominal value of imputation credits	A1	Real tax liability = [(nominal taxable income – nominal accumulated tax losses)x adjustment for corporate tax rate and imputation credits**d**] × deflator	I1
Opex	Opex (excludes carry-over amounts) = (controllable opex + corporate + other + debt raising costs) × cumulative inflation index		Opex = water opex + wastewater opex+stormwater opex + corporate opex + bulk water purchase cost**c**	

a Related formulae expands the formulae in Appendix A.1 further into its components. These can be found in Appendix A.2.

b When real building block costs are calculated, inflation is set to zero and a real post-tax WACC is used to calculate the return on working capital and to discount the return on and of assets to mid-year values.

c Bulk water purchase costs only applicable as the IPART model that is used in this comparison is for the metropolitan-water businesses.

d Adjustment for corporate tax rate and imputation credits = $\frac{t \cdot (1 - \gamma)}{1 - t \cdot (1 - \gamma)}$ where t is the corporate tax rate, γ is the value of imputation credits in percentage.

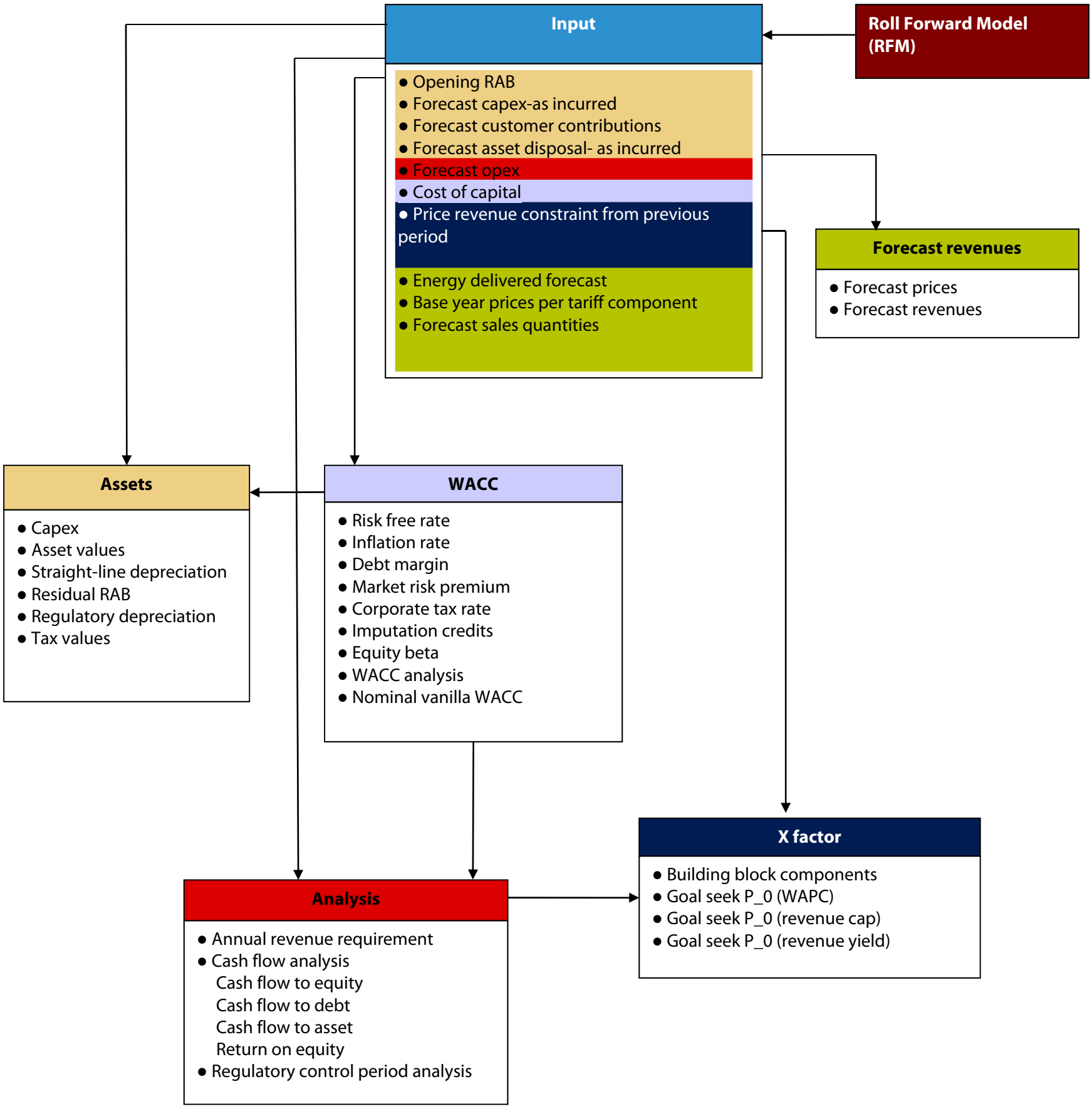
Table B.2 Related formulae

Items	Formulae
A2. Nominal straight-line depreciation	*Nominal straight-line depreciation = real straight-line depreciation × cumulative inflation index*
A3. Real straight-line depreciation	$Real\ Straight\ line\ depreciation = \frac{OpeningRAB}{remaining\ life} + \frac{forecast\ net\ capex \times (1 + real\ vanilla\ WACC)^{1/2}}{standard\ life}$ *Forecast net capex = capex - capital contributions (DNSPs only) – asset disposals*
I2. Straight-line depreciation (Year 1)	$Straight\ \ line\ depreciation_{yr1} = \frac{(opening\ RAB - disposals_1 \times 50\%)}{remaining\ life} + \frac{net\ capex_1 \times 50\%}{standard\ life}$ *Net capex = capex - capital contributions*
I3. Straight-line depreciation (Year n)	$Straight\ \ line\ depreciation_{yr\ n} = \frac{(opening\ RAB_1 - \sum_{i=1}^{n-1} disposal_{\ i} - disposals_{\ n} \times 50\%)}{remaining\ \ life} + \frac{\sum_{i=1}^{n-1} net\ capex_{\ i} + net\ capex_{\ n} \times 50\%}{standard\ \ \ life}$ $n > 1 \qquad i = 1, 2, ..., n$ *Net capex = capex - capital contributions*
A4.Nominal opening RAB of equity or debt	*Nominal opening RAB of equity or debt = end period nominal residual RAB × proportion of equity or debt funding*
A5. End period nominal residual RAB	*End period nominal residual RAB = end period real residual RAB × cumulative inflation index*
A6. End period real residual RAB	*End period real residual RAB = end period real residual RAB of previous year - real straight line depreciation + real capex adjustment*
A7. Real capex adjustment	*Real capex adjustment = forecast net capex × (1+real vanilla WACC)* $^{1/2}$
A8. Post-tax nominal return on equity (pre-imputation)	*Post-tax nominal return on equity (pre-imputation) = nominal risk free rate + equity beta × market risk premium*
A9. Post-tax nominal return on debt (pre-imputation)	*Pre-tax nominal return on debt = nominal risk free rate + cost of debt margin*

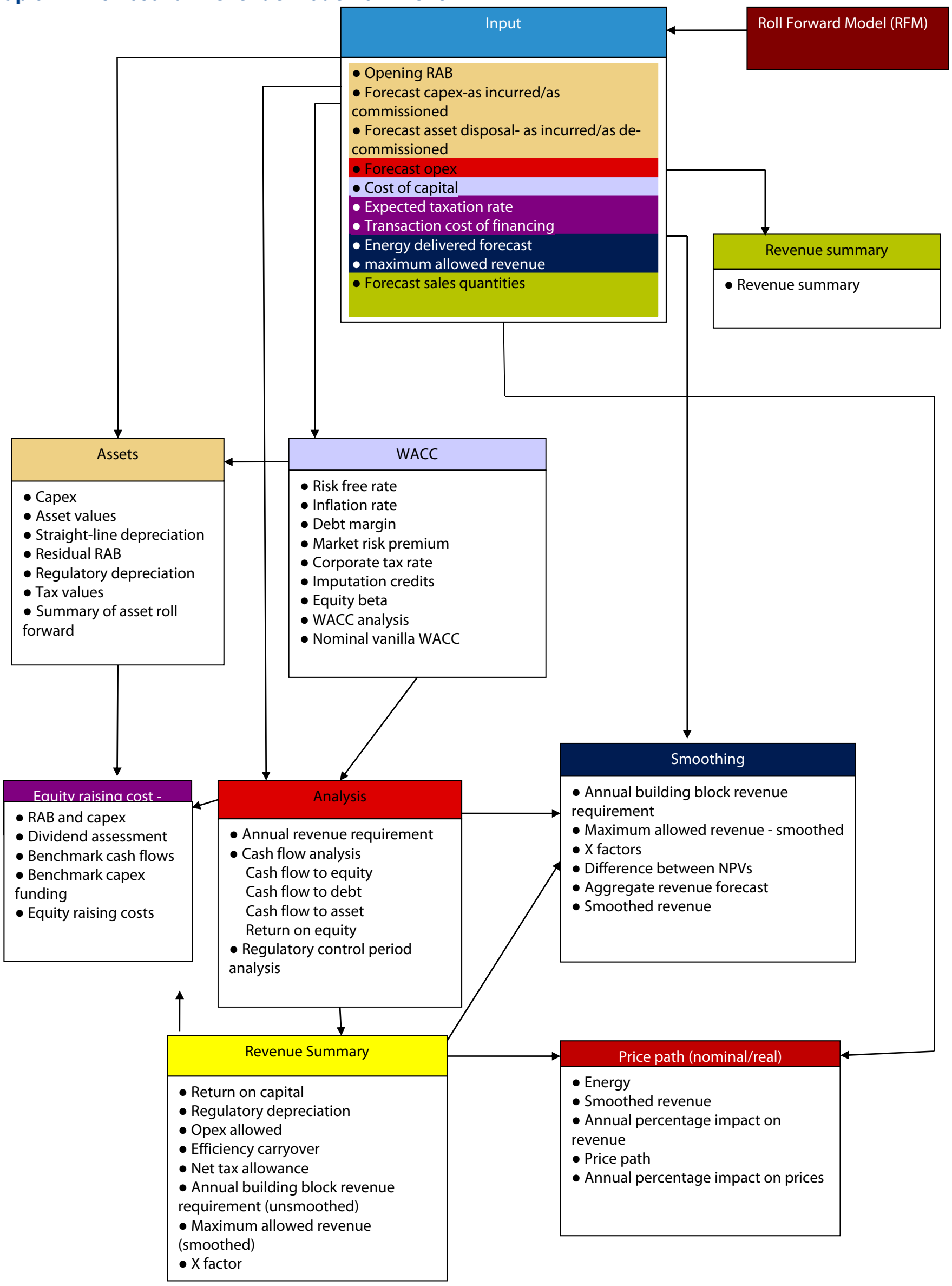
Note:

$(1 + real\ vanilla\ WACC)^{1/2} = \sqrt{(1 + \text{real vanilla WACC})}$

C Map of AER's Post Tax Revenue model for DNSPs



D Map of AER's Post Tax Revenue model for TNSPs



E Map of IPART's metropolitan water model