Electricity distribution network service providers

Post-tax revenue model handbook

June 2008

AUSTRALIAN
ENERGY
REGULATOR

Inquiries concerning the currency of these guidelines should be addressed to:

Australian Energy Regulator
GPO Box 520
Melbourne VIC 3001
Ph: (03) 9290 1444
Fax: (03) 9290 1457
Email: AERInquiry@aer.gov.au

Amendment record

Version	Date	Pages
1	26 June 2008	22

Contents

Shortened forms

ARR	annual revenue requirement
AER	Australian Energy Regulator
ATO	Australian Tax Office
capex	capital expenditure
CAPM	capital asset pricing model
CPI	consumer price index
DNSP	distribution network service provider
IRR	internal rate of return
MAR	maximum allowed revenue
MWh	megawatt hour
NEM	National Electricity Market
NER	National Electricity Rules
NPV	net present value
opex	operating expenditure
PTRM	post-tax revenue model
PV	present value
RAB	regulatory asset base
RFM	roll forward model
WACC	weighted average cost of capital
WAPC	weighted average price cap

1   Nature and authority

1.1   Introduction

This handbook sets out the Australian Energy Regulator's (AER) post-tax revenue model (PTRM) to be used as part of building block determinations for standard control services of electricity distribution network service providers (DNSPs). The PTRM is a series of Microsoft Excel spreadsheets developed in accordance with clause 6.4.1 of the National Electricity Rules (NER).

1.2   Authority

Clause 6.4.1(c) of the NER requires the AER to develop and publish the PTRM within 6 months of the commencement of that clause, that is, by 30 June 2008.

1.3   Role of the model

DNSPs are required to submit a completed PTRM to the AER as part of their revenue proposals. However, the AER recognises that there may be a need for some flexibility in applying the PTRM in order to account for the particular circumstances a DNSP may face. A number of elements of the PTRM where this may be the case have been identified in this handbook. A DNSP will need to propose and justify a departure from any element of the PTRM for the purposes of addressing its specific circumstances as part of its revenue proposal, which will be considered and assessed by the AER on a case-by-case basis in making its distribution determination.

The PTRM will be used by the AER to determine DNSPs' annual revenue requirements (ARR) using the building block approach as specified in clause 6.4.3 of the NER. The PTRM's purpose is to perform calculations of building block revenue requirements to derive X factors that form part of the control mechanisms for direct control services under clause 6.2.6 of the NER. The PTRM has not been developed with respect to alternative direct control services. Where a DNSP intends to propose multiple control mechanisms, it should consult with the AER on how the PTRM will apply.

1.4   Confidentiality

The AER's obligations regarding confidentiality and the disclosure of information provided to it by a DNSP are governed by the *Trade Practices Act 1974* (Cth), the National Electricity Law and the NER.

1.5   Processes for revision

The AER may amend or replace the PTRM from time to time as provided for by clause 6.4.1(b) of the NER and in accordance with the distribution consultation procedures in clause 6.16 of the NER. The AER will publish a revised version of this handbook to accompany each new version of the PTRM it amends or replaces in the future.

1.6   Version history and effective date

A version number and an effective date of issue will identify each version of this handbook.

2   The model

The PTRM is a set of Microsoft Excel spreadsheets that perform iterative calculations to derive an ARR and X factors for each regulatory year of the regulatory control period from a given set of inputs.[1] The PTRM allows the user to vary the inputs to assess their impact on revenues, X factors and other derived parameters. The PTRM is configured to perform the calculations automatically whenever an input is recorded. If several inputs are to be recorded sequentially, the manual operation of the PTRM is recommended. In this case, Excel's iteration mode of calculations needs to be selected. To do so, select **Options** from the **Tools** menu in Excel, then select the **Calculations** tab. Make sure that **Manual** (rather than **Automatic**) is selected and tick the iteration box.

When the manual mode is selected, a number of macros built in the PTRM (e.g. 'Fix_Te' and 'Set_P0_WAPC') will need to be operated manually. To run the macros, select **Macro** from the **Tools** menu, and then select **Macros**. Highlight the desired macro and select **Run**.

2.1   Input sheet

The **Input** sheet provides for key input variables to be entered in the PTRM. These are automatically linked to corresponding cells in the relevant sheets. Values should be entered into each cell that has light blue shading. The **Input** sheet comprises of the following data tables:

- opening regulatory asset base (RAB)
- forecast real capital expenditure (capex)—as-incurred
- forecast real asset disposals—as-incurred
- forecast real customer contributions—as-incurred
- forecast real net capex—as-incurred
- forecast operating expenditure (opex)
- cost of capital
- values of maximum allowed revenue (MAR) and revenue yield for the current regulatory year
- current and forecast total energy delivered
- current prices by tariff component
- current and forecast quantities by tariff component.

The input data must be recorded in the PTRM in a format that is consistent with that requested by the AER's information templates or other requirements that are published from time to time. Any differences or inconsistencies will need to be explained and justified by the DNSP.

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[1]   The set of Microsoft Excel spreadsheets which constitute the PTRM were created in Microsoft Excel 2003. The AER recommends this or a later version of Microsoft Excel be used in applying these spreadsheets.

Figures 1 and 2 provide an example of the **Input** sheet.

Some inputs may need to be specified outside of the **Input** sheet to capture a specific situation (e.g. tax loss carried forward in the **Analysis** sheet). These cells are also marked with light blue shading and are addressed when they arise.

Figure 1: Input sheet—asset, capex and WACC inputs

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1																	
2					**Input Variables**		Input cells are in blue										
3																	
4																	

Opening Regulated Asset Base for 2009-10 ($m Nominal)

	Asset Class Name	Opening Asset Value	Assets Under Construction	Remaining Life	Standard Life	Opening Tax Value	Tax Remaining Life	Tax Standard Life	Base Financial Year
Asset Class 1	Sub-transmission lines	700.00		30.0	50.0	900.00	30.0	47.5	2009-10
Asset Class 2	distribution lines	600.00		30.0	50.0	700.00	30.0	47.5	
Asset Class 3	substations	300.00		20.0	40.0	200.00	15.0	35.0	
Asset Class 4	distribution transformers	300.00		20.0	40.0	200.00	15.0	35.0	
Asset Class 5	LVS and meters	200.00		10.0	15.0	150.00	5.0	10.0	
Asset Class 6	communications	50.00		2.0	7.0	50.00	2.0	3.0	
Asset Class 7	vehicles	50.00		3.0	5.0	20.00	1.0	2.0	
Asset Class 8	land and easements	100.00		n/a	n/a	20.00	n/a	n/a	
Asset Class 9									
Asset Class 30									
Total		2,300.00	-			2,240.00			

Forecast Capital Expenditure – As Incurred ($m Real 2008-09)

Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
Total	145.00	136.00	116.00	116.00	136.00	-	-	-	-	-	
											$ 649.00

Forecast Asset Disposal – Proceeds from sale ($m Real 2008-09)

Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
Total	2.00	2.00	2.00	2.00	2.00	-	-	-	-	-	
											$ 10.00

Forecast Customer Contributions – As Incurred ($m Real 2008-09)

Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
Total	12.00	7.00	7.00	7.00	7.00	-	-	-	-	-	
											$ 40.00

Forecast Net Capital Expenditure – As Incurred ($m Real 2008-09)

Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
Total	131.00	127.00	107.00	107.00	127.00	-	-	-	-	-	
											$ 599.00

Forecast Operating and Maintenance Expenditure ($m Real 2008-09)

Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
Controllable opex	50.00	50.00	50.00	50.00	50.00						
Corporate	10.00	10.00	10.00	10.00	10.00						
carry-over amounts	2.00	1.00 -	1.00								
Other	2.00	2.00	2.00	2.00	2.00						
Debt raising costs	1.09	1.09	1.08	1.08	1.08	-	-	-	-	-	
Total	65.09	64.09	62.08	63.08	63.08	-	-	-	-	-	
											$ 317.41

Cost of Capital

	Value
Nominal Risk Free Rate	6.00%
Inflation Rate	3.00%
Debt Risk Premium	1.10%
Market Risk Premium	6.00%
Utilisation of Imputation (Franking) Credits	50.00%
Proportion of Debt Funding	60.00%
Equity Beta	1.00
Debt Raising Cost Benchmark	0.08%

Figure 2: Input sheet— energy and pricing inputs

Price/ revenue constraint for 2008-09 (Nominal)

	Value
Maximum Allowed Revenue	350.00
Revenue yield (c/kWh)	$ 30.00

Energy Delivered Forecast (MWh)

Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Energy	10,720,000	10,934,400	11,153,088	11,376,150	11,603,673	11,835,746					

Base year prices per tariff component for 2008-09

	Standing Charge ($ per customer per year)	Non TOU Energy (c/kWh)	Peak Energy (c/KWh) BLK 1	Peak Energy (c/KWh) BLK 2	Off Peak Energy (c/kWh) BLK 1	Off Peak Energy (c/kWh) BLK 2	Peak Demand ($/kVa) BLK 1	Peak Demand ($/kVa) BLK 2	Off Peak Demand ($/kVa) BLK 1	Off Peak Demand ($/kVa) BLK 2
	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09
Residential A	200.00	10.00								
Residential B	200.00		20.00	10.00	15.00	10.00	15.00	10.00	10.00	5.00
Residential C	200.00		20.00	10.00	15.00	10.00	15.00	10.00	10.00	5.00
Small Business A	500.00		30.00	10.00	15.00	10.00	15.00	20.00	10.00	5.00
Small Business B	500.00		30.00	10.00	15.00	10.00	15.00	20.00	10.00	5.00
Small Business C	500.00		30.00	10.00	15.00	10.00	15.00	20.00	10.00	5.00
Large Business A	1,000.00		50.00	10.00	15.00	10.00	15.00	30.00	10.00	5.00
Large Business B	1,000.00		50.00	10.00	15.00	10.00	15.00	30.00	10.00	5.00
Large Business C	1,000.00		50.00	10.00	15.00	10.00	15.00	30.00	10.00	5.00

Forecast sales quantities

Tariff quantities			Customer Numbers						Non TOU Energy (kWh)			
Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Residential A	400,000	408,000	416,160	424,483	432,973	441,632	1,000,000,000	1,020,000,000	1,040,400,000	1,061,208,000	1,082,432,160	1,104,080,803
Residential B	100,000	102,000	104,040	106,121	108,243	110,408		0	0	0	0	0
Residential C	100,000	102,000	104,040	106,121	108,243	110,408		0	0	0	0	0
Small Business A	20,000	20,400	20,808	21,224	21,649	22,082		0	0	0	0	0
Small Business B	20,000	20,400	20,808	21,224	21,649	22,082		0	0	0	0	0
Small Business C	20,000	20,400	20,808	21,224	21,649	22,082		0	0	0	0	0
Large Business A	10,000	10,200	10,404	10,612	10,824	11,041		0	0	0	0	0
Large Business B	10,000	10,200	10,404	10,612	10,824	11,041		0	0	0	0	0
Large Business C	10,000	10,200	10,404	10,612	10,824	11,041		0	0	0	0	0
TOTAL	690,000	703,800	717,876	732,234	746,878	761,816	1,000,000,000	1,020,000,000	1,040,400,000	1,061,208,000	1,082,432,160	1,104,080,803

The PTRM can handle expenditure input data for up to a 10-year regulatory control period. Input cells outside of the relevant regulatory control period should be left blank.

Opening regulatory asset base

The opening RAB is the value of assets on which a return will be earned. The **Input** sheet requires a value for the opening RAB (broken into asset classes) at the start of the first regulatory year of the current regulatory control period. The RAB will fluctuate each regulatory year to reflect forecast capex, asset disposals, customer contributions and regulatory depreciation.

The recorded input values are linked to the **Assets** sheet, which also calculates depreciation for the regulatory control period. Notes have also been included for various cells with specific comments and explanations about the relevance of the inputs.

Asset class name

The asset classes/names are recorded in column G. It is important that the asset classes recorded in the RAB section match the asset classes for which capex, disposals and capital contributions are reported in other input cells. This allows the PTRM to model depreciation consistently across the asset classes.

The PTRM is configured to accommodate up to 30 asset classes.[2] The number of asset classes and categories used in the PTRM will vary between DNSPs. However, for each business the asset classes used in the PTRM should be consistent with that used in the AER's roll forward model (RFM), or jurisdictional roll forward calculations where these are used. This allows the closing RAB values determined in the RFM to be used as inputs to the opening RAB values in the PTRM. RAB values by asset class derived from the RFM may be aggregated or disaggregated when forming inputs for the PTRM where this demonstrably improves the accuracy or administrative convenience of asset calculations.

Opening asset value

The opening asset values for each asset class are recorded in column J. These values will be sourced from the AER's RFM or jurisdictional models as appropriate.

Assets under construction

The value of assets under construction for each asset class is recorded in column K.[3] These values should be consistent with those used in the RFM. The total value of assets under construction as at the end of the final regulatory year of the current regulatory control period (cell K37) is rolled into the opening RAB value (cell J37).

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[2]   The PTRM can be expanded to accommodate additional asset classes if necessary.

[3]   Inputs for assets under construction will only be relevant for any DNSPs that previously recognised capex on an as-commissioned basis.

Remaining life

The remaining life of the asset classes is recorded in column L, based on the economic life of the assets.[4]

Standard life

The standard life of the asset classes is recorded in column M and measures how long the infrastructure would physically last had it just been built.

Opening tax value

The opening tax value for each asset class is sourced from the closing tax asset value for the current regulatory control period which has been determined in a manner agreed to by the AER or otherwise determined in the RFM and is recorded in column N. Assets valued for tax purposes should include the value of contributed assets.

Tax remaining life

The remaining life of the asset classes for taxation purposes is recorded in column O based on the tax life specified by the Australian Tax Office (ATO) for the category of assets and commissioning date.

Tax standard life

The tax standard life of the asset classes is recorded in column P.

Base financial year

The first regulatory year of the next regulatory control period is recorded in cell Q7.

Forecast real capital expenditure—as-incurred

Forecast capex values for the next regulatory control period are recorded for each regulatory year in rows 41 to 70 (by asset class). Capex is rolled into the RAB when spending is incurred. These inputs must be reported in real terms, as at the end of the regulatory year.

Forecast real asset disposals—as-incurred

Forecast asset disposal values are recorded for the regulatory year in which the disposal is expected to take place, in rows 75 to 104. These inputs must be reported in real terms, as at the end of the regulatory year.

Forecast real customer contributions—as-incurred

Forecast customer contributions (as-incurred) values are recorded for the regulatory year in which the contribution is expected to be made, in rows 109 to 138. These inputs must be reported in real terms, as at the end of the relevant regulatory year.

Forecast real net capital expenditure—as-incurred

This section on forecast net capex does not require inputs to be recorded. For each asset class, forecast net capex is calculated based on the recorded forecast capex less

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[4]   Generally assumed to be the weighted average remaining life of all individual assets in the class.

forecast asset disposals and forecast customer contributions. The treatment of capital contributions in the PTRM reflects a default calculation which should be applicable to most DNSPs. However, the PTRM may be amended by DNSPs in consultation with the AER to allow for alternative methods for treating capital contributions under clause 6.21.2.

Forecast net capex (as-incurred) values are displayed in rows 143 to 172 and form part of the roll forward of the RAB in the **Assets** sheet. These inputs are assumed to be in end of the year terms.

Forecast real operating and maintenance expenditure

Opex typically includes items such as wages and salaries, leasing costs, costs associated with maintaining assets, input costs and other service contract expenses paid to third parties. Any carry-over amounts arising from arrangements in the previous regulatory control period should also be separately identified here. The PTRM only requires one line of forecast opex values to perform its calculations, however, DNSPs may choose to disaggregate opex into various categories. Rows 177 to 180 are provided as inputs for discretionary categories of forecast opex while row 181 provides an indicative calculation of benchmark debt raising cost and is included here based on the practice of treating these costs as an opex line item.

Values for additional opex categories can be recorded by adding rows to this section by using the button labelled **Insert new row** in column Q. These inputs are assumed to be in end of the year terms.

The forecast total opex values (row 182) are linked to the **Analysis** sheet.

Cost of capital

The cost of capital section (rows 186 to 192) records the following parameters:

- nominal risk free rate
- inflation rate
- debt risk premium
- market risk premium
- gamma (utilisation of imputation (franking) credits)
- proportion of debt funding
- equity beta.

Each of these parameters is linked to the **WACC** sheet. The value or methodology for determining each parameter is specified in clause 6.5.2 of the NER.[5]

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[5] In relation to the expected inflation rate, clause 6.4.2(b)(1) requires the AER to specify in the PTRM a methodology that is likely to result in the best estimate of expected inflation. At the time of publishing this handbook, the AER will use a range of indicators to guide it in determining the appropriate expected inflation rate. This methodology may be reconsidered as part of the AER's review of the rate of return in accordance with clause 6.5.4 of the NER.

The allowance for benchmark debt raising cost is also recorded in row 193. This value is based on the notional debt issue size and will ultimately be assessed by the AER as part of a DNSP's proposed opex allowance.

Values of revenue control for the current regulatory year

Cells G197 and G198 record current values of MAR and revenue yields for DNSPs subject to these forms of control and may not be required depending on the form of control mechanism determined by the AER. These values are linked to the **X factor** sheet and are used in example calculations of X factors.

Energy delivered forecast

Row 203 records total forecast energy delivered (disaggregated forecasts are inputted in rows 241 to 269). Energy delivered forecasts may be obtained from the most recent National Electricity Market Management Company statement of opportunities, a DNSP's annual planning report or other relevant industry sources. These data are used in the example calculations of the price constraint under a revenue yield form of control in the **X factor** sheet.

Current pricing data

Prices by tariff component for the final regulatory year of the current regulatory control period are recorded in rows 211 to 238. These data are used in the PTRM's example calculation of a weighted average price cap (WAPC) and may not be required depending on the form of control mechanism determined by the AER. Where used, this section of the model and its dependent calculations (i.e. in the **Forecast revenues** sheet) may need to be amended to incorporate the components and tariff structures of each DNSP.

Forecast sales quantities by tariff component

Forecast quantities relative to each tariff component for the regulatory control period are recorded in rows 243 to 268. These data are used in the PTRM's example calculation for the WAPC and may not be required depending on the form of control mechanism determined by the AER. As for pricing data discussed above, this section of the model and its dependent calculations may need to be amended to suit each DNSP. Where quantities are not available or appropriate for the entire regulatory year (e.g. customer numbers) they will need to be approximated using a method agreed to by the AER.

2.2   WACC sheet

The **WACC** sheet calculates the required return on equity, cost of debt and the weighted average cost of capital (WACC) using the relevant cost of capital parameters from the **Input** sheet.

The effective tax rates derived from the cash-flow analysis are also reported in the **WACC** sheet, including various measures of WACC calculated from the forecast cash-flows in the **Analysis** sheet. The nominal vanilla WACC (cell F27) is multiplied by the opening RAB in the **Analysis** sheet to determine the return on capital building block.

Figure 3 provides an example of the **WACC** sheet.

Figure 3: WACC sheet

	B	C	D	E	F	G
1						
2	**Cost of Capital Parameters**					
3						
4						
5						
6					**Input Data & Calculated Inputs**	**Basic Building Block Model**
7	Nominal Risk Free Rate		Rf		6.00%	
8	Real Risk Free Rate		Rrf		2.91%	
9	Inflation Rate		f		3.00%	
10	Cost of Debt Margin		DRP		1.10%	
11	Nominal Pre-tax Cost of Debt		Rd		7.10%	
12	Real Pre-tax Cost of Debt		Rrd		3.98%	
13	Market Risk Premium		MRP		6.00%	
14	Corporate Tax Rate		T		30.00%	
15	Effective Tax Rate for Equity (From Relevant Cash flows)		Te		19.66%	19.66%
16	Effective Tax Rate for Debt (Effective Debt Shield)		Td		30.00%	30.00%
17	Utilisation of Imputation (Franking) Credits		γ		50.00%	
18	Proportion of Equity Funding		E/V		40.00%	
19	Proportion of Debt Funding		D/V		60.00%	
20	Equity Beta		βe		1.00	
21						
22	**WACC Analysis**					
23						
24					**Formula Approximation**	
25	Post-tax Nominal Return on Equity(pre-imp)				12.00%	12.00%
26	Post-tax Real Return on Equity(pre-imp)				8.74%	8.74%
27	**Nominal Vanilla WACC**				**9.06%**	**9.06%**
28	Real Vanilla WACC				5.88%	5.88%
29	Post-tax Nominal WACC				7.26%	8.50%
30	Post-tax Real WACC				4.13%	5.34%
31	Pre-tax Nominal WACC				9.58%	9.61%
32	Pre-tax Real WACC				6.39%	6.42%
33	Nominal Tax Allowance				0.52%	0.55%
34	Real Tax Allowance				0.51%	0.53%

2.3   Assets sheet

The **Assets** sheet calculates the value of the RAB for each regulatory year over the next regulatory control period in real and nominal terms. It also calculates both regulatory and tax depreciation. The **Assets** sheet displays 55 years of data so that the effective tax rate can be estimated.

Figure 4 provides an example of the **Assets** sheet.

Figure 4: Assets sheet

	A	B	C	D	E	F	G	H	I	J	K
1											
2		**Asset Roll Forward**									
3											
4		**Year**				**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**
5											
6		Inflation Assumption (CPI % increase)		3.00%			3.00%	3.00%	3.00%	3.00%	3.00%
7		Cumulative Inflation Index (CPI end period)				100%	103.0%	106.1%	109.3%	112.6%	115.9%
8											
9		Opening Regulated Asset Base				2,300.0					
10		Real Capex					134.8	130.7	110.1	110.1	130.7
41		Nominal Capex					138.8	138.6	120.3	123.9	151.5
72											
73		**Real Asset Values**									
74											
75		Real Straight-line Depreciation					135.00	139.47	117.99	104.43	107.54
466		Real Residual RAB (end period)				2,300.0	2,299.8	2,291.0	2,283.1	2,288.8	2,311.9
467		Real Residual RAB (start period)				-	2,300.0	2,299.8	2,291.0	2,283.1	2,288.8
468											
469		**Nominal Asset Values**									
470											
471		Inflation on Opening RAB					69.0	71.1	72.9	74.8	77.3
472		Nominal Straight-line Depreciation					139.1	148.0	128.9	117.5	124.7
473		Nominal Regulatory Depreciation					70.1	76.9	56.0	42.7	47.4
474		Nominal Residual RAB (end period)				2,300.0	2,368.8	2,430.5	2,494.8	2,576.1	2,680.2
475		Inflated Nominal Residual RAB (start period)				-	2,369.0	2,439.9	2,503.4	2,569.7	2,653.3
476											
477		**Nominal Tax Values**									
478											
479		Tax Depreciation					155.0	142.6	122.7	125.5	128.2
870		Residual Tax Value (end period)				2,240.0	2,232.3	2,231.9	2,233.8	2,236.6	2,263.7

Rolling forward the RAB and depreciation

The depreciation in a period must equal the difference between the RAB at the start and end of the period. Further, as depreciation is intended to represent the return of capital over the life of the asset, accumulated depreciation should not exceed the initial actual capital cost of the infrastructure.

The PTRM is configured to use the straight-line method as the default position for calculating depreciation. DNSPs are able to amend the PTRM to incorporate depreciation profiles other than the straight-line method, subject to assessment in accordance with clause 6.5.5 of the NER.

The opening RAB and real forecast net capex values displayed in this sheet (rows 9 to 40) are sourced from the **Input** sheet. Nominal forecast net capex values are displayed in rows 41 to 71. The modelling of capex in the PTRM is based on a full as-incurred approach. Under this approach both the returns on and of capital are calculated based on as-incurred forecast net capex.

Capex is incurred evenly throughout the regulatory year so it is reasonable to assume that, on average, it takes place half-way through the regulatory year. However, the PTRM calculates the return on capital based on the opening RAB for each regulatory year and capex is not added to the RAB until the end of the regulatory year in which the expenditure is incurred. To address this timing difference of modelling the real capex, a half-real vanilla WACC is provided (capitalised and recovered over the life of the assets) to compensate for the six-month period before capex is included in the RAB.[6]

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[6] The half-real vanilla WACC is calculated by the square root of (1 + real vanilla WACC) to account for the compounding effect on an annual rate.

Real asset values are displayed in rows 75 to 467. Real straight-line depreciation is calculated in rows 75 to 465. It uses the opening RAB, forecast capex values and asset lives from the **Input** sheet. The individual depreciation profiles for each asset class can be viewed by expanding rows 76 to 465.

The roll forward of the closing RAB in real terms for each regulatory year is calculated in row 466.

Nominal asset values are displayed in rows 471 to 475. To compensate the DNSP for inflation, the residual value of the RAB at the end of each regulatory year is adjusted upwards for the amount of expected inflation in that regulatory year. This adjustment is calculated in row 471. The change in the nominal value of the RAB from regulatory year to year is calculated by adjusting the closing RAB (row 474) for forecast net capex and the regulatory depreciation allowance. Regulatory depreciation (row 473) is calculated as the nominal straight-line depreciation (row 472), less the inflation adjustment on the opening RAB (row 471).

Depreciation for tax purposes is calculated in rows 479 to 870 and is based on the tax asset values, capex values and tax asset lives from the **Input** sheet. Capex recognised for tax purposes is net of disposals but includes the value of customer contributions. The individual tax depreciation profiles for each asset class can be viewed by expanding rows 480 to 869. Tax depreciation is calculated separately because asset values and asset lives for tax purposes generally differ from that for regulatory purposes. The PTRM applies a straight-line method of tax depreciation. DNSPs may propose alternative depreciation methods and amend the model as part of their proposals for the AER's assessment as provided for in clause 6.5.5 of the NER.

2.4   Analysis sheet

The **Analysis** sheet itemises the basic costs, or building blocks, of the DNSP, which are then added together to calculate the ARR. In other words, the **Analysis** sheet is where the data from the **Input** sheet is combined with the calculations in the **Assets** and **WACC** sheets to estimate a DNSP's revenue requirement. The **Analysis** sheet displays 55 years of data so that the effective tax rate can be estimated.

The **Analysis** sheet also includes an analysis of the forecast cash flows. This analysis provides rate of return measures estimated from forecast revenues and costs, including: expected post and pre-tax returns on equity, effective tax rates, the effective cost of debt and selected measures of the WACC.

Figure 5 below provides an example of the **Analysis** sheet.

Figure 5: Analysis sheet

	A	B	C	D	E	F	G	H	I	J	K
1											
2		**Post-Tax Building Block Cash Flow Model**									
5		**Year**				2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
6											
7		Inflation Assumption (CPI % increase)					3.00%	3.00%	3.00%	3.00%	3.00%
8		Cumulative Inflation Index (CPI end period)				100.0%	103.0%	106.1%	109.3%	112.6%	115.9%
9											
10		RAB (start period)		(nominal value)			2,300.0	2,368.8	2,430.5	2,494.8	2,576.1
11		- Equity		40.00%			920.0	947.5	972.2	997.9	1,030.4
12		- Debt		60.00%			1,380.0	1,421.3	1,458.3	1,496.9	1,545.6
14		**Revenue Building Blocks**									
15		Nominal Vanilla WACC		9.06%			208.4	214.6	220.2	226.0	233.4
16		Return on Asset									
17		- Return on Equity		12.00%			110.4	113.7	116.7	119.8	123.7
18		- Return on Debt		7.10%			98.0	100.9	103.5	106.3	109.7
19											
20		Return of Asset (regulatory depreciation)					70.1	76.9	56.0	42.7	47.4
21											
22		Opex (includes carry-over amounts)					67.0	68.0	67.8	71.0	73.1
23											
24		Tax Payable					13.3	19.6	20.3	15.8	18.0
25		Less Value of Imputation Credits		50.00%		-	6.7 -	9.8 -	10.2 -	7.9 -	9.0
26											
27		**Annual Revenue Requirement**					**352.14**	**369.29**	**354.23**	**347.63**	**362.89**
28											
29		**Additional tax income**									
30		- capital contributions					12.4	7.4	7.6	7.9	8.1
31											
32		**Tax Expenses**									
33		- Opex					67.0	68.0	67.8	71.0	73.1
34		- Tax Depreciation					155.0	142.6	122.7	125.5	128.2
35		- Interest					98.0	100.9	103.5	106.3	109.7
36		**Total Tax Expenses**					320.0	311.5	294.1	302.7	311.1
37											
38		**Tax Calculation**									
39		Taxable Income					44.5	65.3	67.8	52.8	59.9
40		- Pre-tax Income (excludes carry-over amounts)					44.5	65.3	67.8	52.8	59.9
41		- Tax Loss Carried Forward				0.00	-	-	-	-	-
42		**Tax Payable**		30.00%			13.3	19.6	20.3	15.8	18.0
43		Value of Imputation Credits		50.00%			6.7	9.8	10.2	7.9	9.0
44				(intermediate tax calculation)			13.3	19.6	20.3	15.8	18.0
45											
46		**Cash Flow Analysis Below This Line**									
47											
48		**Net Present Values**									
49		RAB (start period)		**Project NPV Check**		(0.0)	2,300.0	2,368.8	2,430.5	2,494.8	2,576.1
50		PV for Returns on and of Asset Only				2,817.7	278.4	291.5	276.2	268.7	280.8
51		PV for Capex Only				522.4	138.8	138.6	120.3	123.9	151.5
52		PV for end of period assets				4.7	-	-	-	-	-
53											
54		**Nominal Cash Flow Analysis**									
55		Capital Expenditure				2,300	138.8	138.6	120.3	123.9	151.5
56		Interest Payments				-	98.0	100.9	103.5	106.3	109.7
57		Repayment of Debt				(1,380) -	41.3 -	37.0 -	38.6 -	48.7 -	62.5
58											
59		**Nominal Cash Flow to Equity Holders**									
60		- Pre-tax	Te =	19.66%	13.27%	(920)	89.6	98.8	101.1	95.2	91.0
61		- Post-tax			10.66%	(920)	76.2	79.2	80.8	79.3	73.0
62		- Post-tax + Value of Imputation Credits			12.00%	(920)	82.9	89.0	90.9	87.3	82.0
63		**Real Cash Flow to Equity**									
64		- Pre-tax			9.97%	(920)	86.9	93.1	92.5	84.6	78.5
65		- Post-tax			7.44%	(920)	74.0	74.7	73.9	70.5	63.0
66		- Post-tax + Value of Imputation Credits			8.74%	(920)	80.5	83.9	83.2	77.5	70.7
67		**Net Cash Flow to Debt**									
68		Deduction Utilised to Reduce Tax					98.0	100.9	103.5	106.3	109.7
69		Unutilised Deductions Carried Forward					-	-	-	-	-
70		Net Cash Flow to Debt	Td =	30.00%	4.97%	(1,380)	27.3	33.6	33.9	25.7	14.4
71		**Nominal Cash Flows to Assets**									
72		Cash flow to Asset			9.61%	(2,300)	146.3	162.7	166.1	152.7	138.3
73		Cash flow to Asset Post-tax			8.50%	(2,300)	132.9	143.1	145.7	136.9	123.9
74		Cash flow to Asset Real			6.42%	(2,300)	142.0	153.3	152.0	135.7	119.3
75		Cash flow to Asset Real Post-tax			5.34%	(2,300)	129.0	134.9	133.4	121.6	103.8
76		Check on Vanilla WACC Cash Flow (nom)			9.06%	(2,300)	139.6	152.9	155.9	144.8	129.3
77		Check on Vanilla WACC Cash Flow (real)			5.88%	(2,300)	135.5	144.1	142.7	128.7	111.5
78											
79		**Further Dissection of Cash Flows**									
80											
81		**Return on Equity**									
82		Cash flow with Imputation					82.9	89.0	90.9	87.3	82.0
83		Add back Capex					138.8	138.6	120.3	123.9	151.5
84		Less Nominal Depreciation of RAB					(70.1)	(76.9)	(56.0)	(42.7)	(47.4)
85		Add Debt Repayment					(41.3)	(37.0)	(38.6)	(48.7)	(62.5)
86		**Gives Nominal Return to Equity**					**110.4**	**113.7**	**116.7**	**119.8**	**123.7**
87		Less Inflation in Equity Component					(27.6)	(28.4)	(29.2)	(29.9)	(30.9)
88		**Gives Real Return to Equity**					**82.8**	**85.3**	**87.5**	**89.8**	**92.7**
89		%ROE (1 year)					12.00%	12.00%	12.00%	12.00%	12.00%
90		%real ROE (1 year)					8.74%	8.74%	8.74%	8.74%	8.74%
91											
92		Equity at Start of Period					920.0	947.5	972.2	997.9	1,030.4
93											
94		**Regulatory Control Period Analysis**									
95											
96		Revenue				-	352.1	369.3	354.2	347.6	362.9
97		Less Opex				-	(67.0)	(68.0)	(67.8)	(71.0)	(73.1)
98		Less Interest					(98.0)	(100.9)	(103.5)	(106.3)	(109.7)
99		Less Tax				-	(13.3)	(19.6)	(20.3)	(15.8)	(18.0)
100		Plus Imputation Credits				-	6.7	9.8	10.2	7.9	9.0
101		Less Capex				(2,300.0)	(138.8)	(138.6)	(120.3)	(123.9)	(151.5)
102		Less Loan Repayments				1,380.0	41.3	37.0	38.6	48.7	62.5
103		RAB Residual Value									1,072.1
104		Post-tax Return on Equity				(920.0)	82.9	89.0	90.9	87.3	1,154.1
105											
106		IRR (during regulatory control period)			12.00%						
107		Target (during regulatory control period)			12.00%						

13

Building block approach to deriving cash flows

Clause 6.4.3 requires the AER to apply the building block approach to assess the revenues required by a DNSP to recover the full cost of providing the regulated service. The revenue requirement includes a commercial return on its investment.

The key building blocks are:

- the return on capital (row 15) comprising:
    - the post-tax return on equity (row 17)
    - the cost of debt (or the interest payments incurred) required to service borrowings (row 18)
- regulatory depreciation or return of capital (row 20)
- opex (row 22)
- net tax liabilities payable (the figure is net in the sense that it is the annual tax payable by the DNSP (row 24) less the value of imputation credits available to investing shareholders (row 25)).

The costs are determined for each regulatory year of the next regulatory control period to derive the ARR (row 27).

As a result of the PTRM's particular timing assumptions, i.e. all cash flows except capex are assumed to occur on the same (final) day of each regulatory year, there is no need to provide DNSPs an allowance for working capital in the modelling.

Taxation and related costs and benefits

Tax is payable on revenue less tax costs recognised by the ATO. Tax-deductible costs include interest or debt servicing, depreciation allowances and opex (rows 33 to 35).

Spreadsheet calculations

Tax payable by the DNSP for each regulatory year is calculated in rows 33 to 44, in three steps:

1. Pre-tax income is calculated as the ARR plus the value of customer contributions, less the estimated total tax expense (row 40).

2. Tax loss carried forward is calculated (row 41).

3. Taxable income (row 39) is then the sum of the above.

The tax costs (rows 33 to 35) used in calculating the pre-tax income for the regulatory year are the same as those in the building blocks (rows 18 and 22) with the exception of depreciation. In the case of the building blocks, regulatory depreciation (row 20) is calculated based on the economic life of the asset (see rows 75 to 465 and 471 to 473 of the **Assets** sheet). Tax depreciation is generally based on a much shorter tax life or calculated in a different way (see rows 479 to 869 of the **Assets** sheet).

The tax payable is recognised as a building block cost and added to the revenue building blocks (row 24). Offsetting this tax cost is the benefit shareholders receive from imputation credits (gamma). This offsetting benefit is equal to gamma multiplied by the tax payable and is recorded in rows 25 and 43.

Cash flow analysis

Calculations in the cash flow analysis section provide a comprehensive check on the validity of determinations to ensure that the outcomes are consistent with the assumptions forming the basis of the building block approach. The **Analysis** sheet is designed to check the desired rate of return on equity that can be expected from the regulated revenue stream.

Net present values

The total returns on and of capital (comprising the RAB and capex) is calculated in row 50. The present value (PV) for these cash flows at the start of the first regulatory year of the next regulatory control period is calculated in cell F50. The PV for capex is calculated in cell F51 and the PV of the end of period assets is calculated in cell F52. The sum of the PV of the returns on and of the RAB and capex, less the residual value of assets is calculated in cell F49. This 'project net present value (NPV) check' should be equal to zero, which indicates that the asset is receiving the correct returns.

Net cash flows available to equity holders

Net nominal pre-tax cash flows to equity holders (row 60) are represented by nominal revenues less:

- opex
- capex
- interest payments
- any repayment of debt.

Net nominal post-tax cash flow to equity holders (row 61) is obtained by further deducting the tax expense of the business. Row 62 adds back the value of imputation credits to calculate the net post-tax benefits available to equity holders in a period.

The internal rate of return (IRR) of the net cash flows over the life of the assets is calculated in column E. The key IRR is the net post-tax returns to equity holders inclusive of imputation credits (r_e), as that is conceptually the return indicated by the capital asset pricing model (CAPM) calculation. The CAPM determined r_e should be validated by the estimated cash flows (row 62).

The corresponding real cash flows and the respective IRRs are calculated in rows 64 to 66.

The difference in the IRR applying to pre-tax and post-tax cash flows to equity allows the effective rate of tax ($T_e = 1 - r_{post}/r_{pre}$) to be calculated (cell D60). This can then be used as an input to the formula-based WACC calculations.

It is important to note that the formula-based WACC calculations will only provide an approximation of the actual WACC outcomes implied by the cash flow calculations. In practice, T_e is generally below the corporate tax rate for assets that can be depreciated at a faster rate for tax purposes.

Net cash flows necessary to service debt and the effective debt shield

The cost of debt is reduced by the value of the 'debt shield' (row 68) in calculating tax liabilities. Where the interest expense in a regulatory year reduces taxable income by a corresponding amount, the net cost of debt for investors is reduced by the corporate tax rate.

However, where the taxable income is so low that the full interest deduction is not required to reduce tax liabilities to zero, the value of the debt shield benefit is deferred to the following regulatory year. This effect is analysed in rows 68 to 70. That part of interest expense used to defer tax is calculated in each regulatory year (row 68) and the unused part carried forward is embodied in the tax loss carried forward calculation (row 69). This allows the net cost to the firm of paying debt holders, after taking account of the tax concession, to be calculated.

The IRR calculation (cell E70) represents the effective cost of debt, which is generally well below the nominal cost of debt based on the current interest rates.

Nominal cash flows to assets and calculation of WACC estimates

The cash flows to the different sources of capital (debt and equity) have been presented above, but the cash flows to the assets as a whole are of interest since these aggregate numbers characterise the nature of the regulated business.

The IRRs from these cash flows are the WACC estimates expected from the application of the regulatory framework and have greater validity than any formula-based approximations. They are summarised in the WACC sheet along with the formula-based approximations. It should be noted that the WACC outcomes are calculated for reporting purposes only. They are not required for setting revenues since the modelling already provides the requisite revenue forecasts.

Regulatory control period analysis

Rows 96 to 107 provide an additional analysis of the cash flow to equity holders over a regulatory control period.

The purpose of this section is to confirm that the desired r_e target remains throughout the regulatory control period. Rows 96 to 107 are essentially an expansion of the calculations used to derive row 62 – that is, cash flow to equity holders inclusive of the value of imputation credits.

2.5 Forecast revenues sheet

The **Forecast revenues** sheet is relevant to the example calculation of X factors under the WAPC constraint. Prices are sourced from the **Input** sheet and escalated by forecast changes in the CPI and X factors from the **X factor** sheet to derive notional prices for each year of the regulatory control period. These prices are multiplied by the forecast quantity data from the **Input** sheet to derive a notional forecast revenue

amount, which is intended to equal (in NPV terms) the building block requirement in the **X factor** sheet.

The calculations in this sheet are automated and do not require inputs. This sheet is, however, based on a generic tariff structure and will require amendment by each DNSP to suit its own tariff schedules. DNSPs using the PTRM for forms of control other than a WAPC will not be required to use this sheet. Pricing data in this sheet has no relationship with the information to be provided by DNSPs to the AER under clause 6.8.2(c)(4) or Part I of the NER.

2.6   X factor sheet

The **X factor** sheet reflects the requirements of clause 6.2.6 and 6.5.9 regarding the setting of X factors, namely, that they are to comprise part of the CPI-X constraint on direct control services, and that they must be set such that the following conditions are met:

- the ARR and forecast revenues are to be equal in NPV terms
- the value of expected revenues and the ARR in the final regulatory year of the period must be as close as reasonably possible.

DNSPs must propose X factors in submitting a completed PTRM with its building block proposal in accordance with clause S6.1.3(6) of the NER. The AER will assess this in accordance with the provisions listed above, but may also consider other relevant factors such as price stability, cash-flow adequacy and longer term pricing goals.

The PTRM provides for X factor calculations under three basic forms of control, namely a revenue yield, WAPC and revenue cap. DNSPs may need to amend these calculations if they are inconsistent with the control mechanisms determined under clause 6.2.5.

The rate of discount (row 7), values of forecast inflation (row 8) and building block revenue requirements (rows 11 to 15) are sourced from previous parts of the model and are used for the calculations in all three forms of control.

Through these calculations the X factor is simply a price or revenue adjustment mechanism. It does not relate to actual productivity improvements in the operations of a DNSP. However, this does not mean that the AER ignores productivity improvements when assessing a DNSP's revenue proposal. Instead, the PTRM requires any expectation of productivity gains to be included directly into the forecasts of costs.

X factors under the WAPC

Values of X, including a P-naught, are inputted in row 31. These are used, along with the inflation estimate, to escalate prices in the **Forecast revenue** sheet and derive a forecast revenue amount which is listed in row 25. While values for X are inputted, for simplicity users can activate a goal seek macro using the button **Goal seek P_0 (WAPC)** to set a P-naught value which equates the NPV of the forecast revenue and the NPV of the ARR.

The percentage difference between the value of the ARR and forecast revenue is listed in cell I28.

X factors under the revenue cap

Values of X, including a P-naught, are inputted in row 50. These are used, along with the expected inflation rate, to derive a nominal smoothed MAR for each regulatory year of the regulatory control period. The value of the MAR is escalated directly by CPI-X. A goal seek macro can be activated using the button **Goal seek P_0 (revenue yield)** to set a P-naught value which equates the NPV of the MAR and the NPV of the ARR over the regulatory control period.

The percentage difference between the value of the ARR and MAR in the final regulatory year is listed in cell I46.

X factors under the revenue yield

Values of X, including a P-naught, are inputted in row 70. These are used, along with expected inflation rate, to derive a nominal revenue yield value for each regulatory year of the regulatory control period. The value of the revenue yield is multiplied by the forecast energy throughput to derive a forecast revenue value. Similar to the WAPC, a goal seek macro can be activated using the button **Goal seek P_0 (revenue yield)** to set a P-naught value which equates the NPV of the forecast revenue and the NPV of the ARR.

The percentage difference between the value of the ARR and forecast revenue is listed in cell I67.

Figure 6 provides an example of the **X factor** sheet.

Figure 6: X factor sheet

	Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
	X factor calculations						
	Discount rate	9.06%					
	Forecast inflation	3.00%					
	Building block components						
	Return on capital		$ 208.38	$ 214.61	$ 220.21	$ 226.03	$ 233.39
	Return of capital		$ 70.05	$ 76.90	$ 56.02	$ 42.69	$ 47.38
	O&M		$ 64.98	$ 66.93	$ 68.93	$ 70.99	$ 73.13
	Carry-over amounts		$ 2.06	$ 1.06	-$ 1.09	$ -	$ -
	Benchmark Tax liability		6.67	9.79	10.17	7.91	8.99
			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89

Price cap calculation

Building block requirement ($m)			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
	NPV	$1,387.39					
Smoothed Forecast Revenue ($m)		$ 299.55	$ 338.42	$ 348.44	$ 358.75	$ 369.36	$ 380.29
	NPV	$1,387.39					
Difference in NPVs		-$0.00	Difference between final year revenue and requirement				4.79%

	P_0	X_1	X_2	X_3	X_4
	5.02%	2.00%	2.00%	2.00%	2.00%

Revenue cap calculation

Building block requirement ($m)			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
	NPV	$1,387.39					
Smoothed revenue cap ($m)		$ 350.00	$ 331.85	$ 345.22	$ 359.13	$ 373.61	$ 388.66
	NPV	$1,387.39					
Difference in NPVs		$0.00	Difference between final year revenue and requirement				7.10%

	P_0	X_1	X_2	X_3	X_4
	7.95%	-1.00%	-1.00%	-1.00%	-1.00%

Revenue yield/ Average revenue cap calculation

Building block requirement ($m)			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
	NPV	$1,387.39					
Forecast energy throughput (MWh)		10,720,000	10,934,400	11,153,088	11,376,150	11,603,673	11,835,746
Revenue yield ($/MWh)		$ 30.00	$ 28.11	$ 29.82	$ 31.64	$ 33.56	$ 35.61
Smoothed revenue requirement ($M)		$ 321.60	$ 307.36	$ 332.60	$ 359.91	$ 389.47	$ 421.45
	NPV	$1,387.39					
Difference in NPVs		$0.00	Difference between final year revenue and requirement				16.14%

	P_0	X_1	X_2	X_3	X_4
	9.03%	-3.00%	-3.00%	-3.00%	-3.00%

The **X factor** sheet also calculates the expected ARR and forecast revenues in real terms by taking the nominal revenues and dividing by the inflation forecast over the next regulatory control period. These and other summary data are used to generate charts in the following sheets.
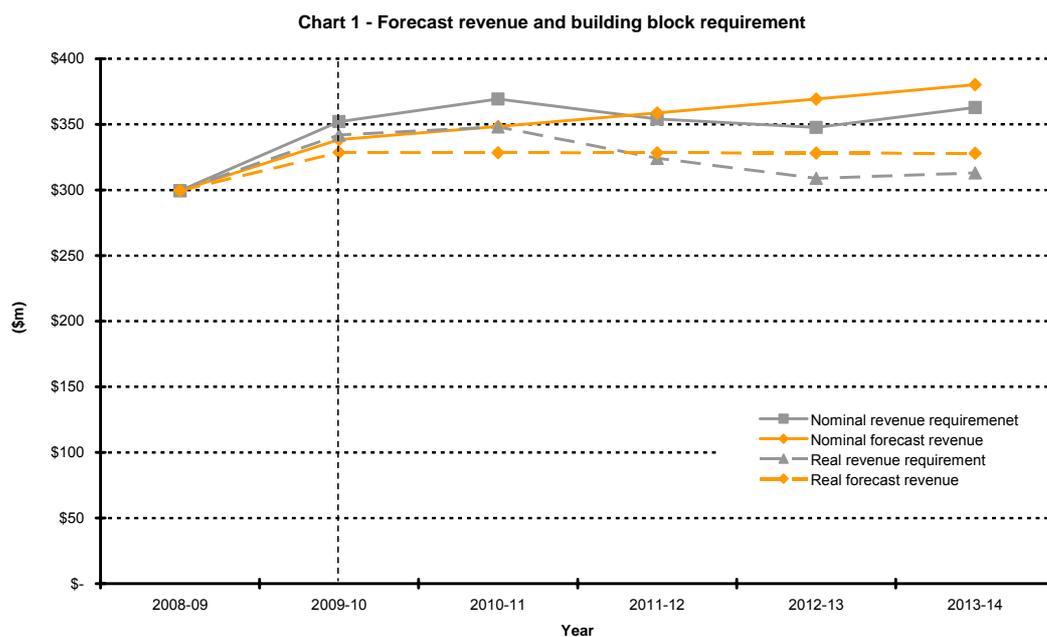
2.7 Chart 1–revenues sheet

The **Chart 1–revenues** sheet displays a chart that incorporates the:

- nominal and real ARR

- nominal and real forecast revenues derived under the WAPC constraint

This information is sourced from the **X factor** sheet. Figure 7 provides an example of the **Chart 1–revenues** sheet.

Figure 7: Chart 1–revenues

Chart 1 - Forecast revenue and building block requirement

Legend:
- Nominal revenue requiremenet
- Nominal forecast revenue
- Real revenue requirement
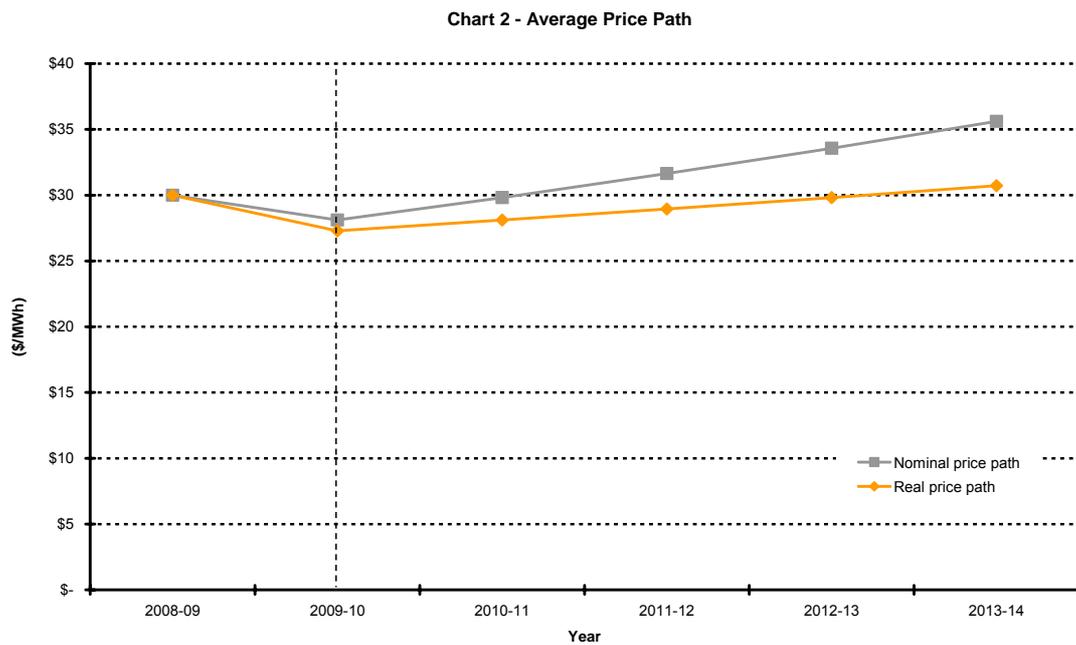- Real forecast revenue

2.8 Chart 2–Price path sheet

The **Chart 2–Price path** sheet displays a chart that incorporates the value of average prices (approximated by total revenues divided by total energy sales, or the revenue yield value) in nominal and real terms. This information is sourced from the **X factor** sheet.

Figure 8 provides an example of the **Chart 2–Price path** sheet.

Figure 8: Chart 2–Price Path

Chart 2 - Average Price Path

2.9 Chart 3–Building Blocks sheet

The **Chart 3–Building Blocks** sheet displays the ARR and the various building block cost components:

- net tax costs
- regulatory depreciation
- opex (including any carry-over amounts)
- return on capital.

This information is sourced from the **Analysis** sheet. Figure 9 provides an example of the **Chart 3–Building blocks** sheet.

Figure 9: Chart 3–Annual revenue requirement components

Chart 3 - Annual Revenue Requirement Components