Proposed

Electricity distribution network service providers

Post-tax revenue model handbook

April 2008

AUSTRALIAN
ENERGY
REGULATOR

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Amendment record

Version	Date	Pages
1	**1 April 2008**	**20**

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 the requirements of clause 6.4.1 of Chapter 6 of the National Electricity Rules (NER).

1.2 Authority

Clause 6.4.1(d) of Chapter 6 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

The PTRM will be used by the AER to determine DNSPs' annual revenue requirements (ARR) using the building block approach specified in clause 6.4.3. 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.

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*, the National Electricity Law and the NER.

1.5 Processes for revision

The AER may amend or replace the PTRM from time to time in accordance with clause 6.4.1(b) of the NER and the distribution consultation procedures. A subsequent version of this handbook will accompany each new version of the PTRM.

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 year of the regulatory control period from a given set of inputs. 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—proceeds from sale
- 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 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 provided in the DNSP's submission and information templates. Any differences or inconsistencies will need to be explained by the DNSP.

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

	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Input Variables**		Input cells are in blue										
3													
4													
5	**Opening Regulated Asset Base for 2009-10 ($m Nominal)**												
6			**Asset Class Name**			Opening Asset Value	Assets Under Construction	Remaining Life	Standard Life		Opening Tax Value	Tax Remaining Life	Tax Standard Life	Base Financial Year
7	Asset Class 1		Sub-transmission lines			700.00		30.0	50.0		900.00	30.0	47.5	2009-10
8	Asset Class 2		distribution lines			600.00		30.0	50.0		700.00	30.0	47.5	
9	Asset Class 3		substations			300.00		20.0	40.0		200.00	15.0	35.0	
10	Asset Class 4		distribution transformers			300.00		20.0	40.0		200.00	15.0	35.0	
11	Asset Class 5		LVS and meters			200.00		10.0	15.0		150.00	5.0	10.0	
12	Asset Class 6		communications			50.00		2.0	7.0		50.00	2.0	3.0	
13	Asset Class 7		vehicles			50.00		3.0	5.0		20.00	1.0	2.0	
14	Asset Class 8		land and easements			100.00		n/a	n/a		20.00	n/a	n/a	
27	Total					2,300.00	-				2,240.00			
28													
29	**Forecast Capital Expenditure – As Incurred ($m Real 2008-09)**												
30	Year		2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
51	Total		145.00	136.00	116.00	116.00	136.00	-	-	-	-	-	
52												$	649.00
53	**Forecast Asset Disposal – Proceeds from sale ($m Real 2008-09)**												
54	Year		2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
75	Total		2.00	2.00	2.00	2.00	2.00	-	-	-	-	-	
76												$	10.00
77	**Forecast Customer Contributions – As Incurred ($m Real 2008-09)**												
78	Year		2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
99	Total		12.00	7.00	7.00	7.00	7.00	-	-	-	-	-	
100												$	40.00
101	**Forecast Net Capital Expenditure – As Incurred ($m Real 2008-09)**												
102	Year		2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
123	Total		131.00	127.00	107.00	107.00	127.00	-	-	-	-	-	
124												$	599.00
125	**Forecast Operating and Maintenance Expenditure ($m Real 2008-09)**												
126	Year		2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
127	Controllable opex		50.00	50.00	50.00	50.00	50.00						
128	Corporate		10.00	10.00	10.00	10.00	10.00						
129	Other		2.00	2.00	2.00	2.00	2.00						
130	Carry-over amounts		2.00	1.00 -	1.00	-	-						
131	Debt raising costs		1.09	1.09	1.08	1.08	1.08	-	-	-	-	-	
132	Total		65.09	64.09	62.08	63.08	63.08	-	-	-	-	-	
133												$	317.41
134	**Cost of Capital**												
135			Value										
136	Nominal Risk Free Rate		6.00%										
137	Inflation Rate		3.00%										
138	Debt Risk Premium		1.10%										
139	Market Risk Premium		6.00%										
140	Utilisation of Imputation (Franking) C		50.00%										
141	Proportion of Debt Funding		60.00%										
142	Equity Beta		1.00										
143	Debt Raising Cost Benchmark		0.08%										

Figure 2: Input sheet— energy and pricing inputs

	E	F	G	H	I	J	K	L	M	N	O	P	Q
145	**Price/ revenue constraint for 2008-09 (Nominal)**												
146			Value										
147	Maximum Allowed Revenue		350.00										
148	Revenue yield ($/MWh)		$ 30.00										
149													
150													
151	**Energy Delivered Forecast (MWh)**												
152	Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	
153	Energy	10,720,000	10,934,400	11,153,088	11,376,150	11,603,673	11,835,746						
154													
155													
156	**Base year prices per tariff component for 2008-09**												
157													
158													
159		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		
160		2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09	2008-09		
161	Residential A	200.00	10.00										
162	Residential B	200.00		20.00	10.00	15.00	10.00	15.00	10.00	10.00	5.00		
163	Residential C	200.00		20.00	10.00	15.00	10.00	15.00	10.00	10.00	5.00		
164	Small Business A	500.00		30.00	10.00	15.00	10.00	15.00	20.00	10.00	5.00		
165	Small Business B	500.00		30.00	10.00	15.00	10.00	15.00	20.00	10.00	5.00		
166	Small Business C	500.00		30.00	10.00	15.00	10.00	15.00	20.00	10.00	5.00		
167	Large Business A	1,000.00		50.00	10.00	15.00	10.00	15.00	30.00	10.00	5.00		
168	Large Business B	1,000.00		50.00	10.00	15.00	10.00	15.00	30.00	10.00	5.00		
169	Large Business C	1,000.00		50.00	10.00	15.00	10.00	15.00	30.00	10.00	5.00		
186													
187													
188													
189	**Forecast sales quantities**												
190													
191	Tariff quantities			Customer Numbers						Non TOU Energy (kWh)			
192	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
193	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
194	Residential B	100,000	102,000	104,040	106,121	108,243	110,408		0	0	0	0	0
195	Residential C	100,000	102,000	104,040	106,121	108,243	110,408		0	0	0	0	0
196	Small Business A	20,000	20,400	20,808	21,224	21,649	22,082		0	0	0	0	0
197	Small Business B	20,000	20,400	20,808	21,224	21,649	22,082		0	0	0	0	0
198	Small Business C	20,000	20,400	20,808	21,224	21,649	22,082		0	0	0	0	0
199	Large Business A	10,000	10,200	10,404	10,612	10,824	11,041		0	0	0	0	0
200	Large Business B	10,000	10,200	10,404	10,612	10,824	11,041		0	0	0	0	0
201	Large Business C	10,000	10,200	10,404	10,612	10,824	11,041		0	0	0	0	0
219	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 year of the current regulatory control period. The RAB will fluctuate each 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 number of asset classes recorded in the RAB section matches the number of asset classes used in the capex input cells. This allows the PTRM to model consistent depreciation across the asset classes.

The PTRM is configured to accommodate up to 20 asset classes.[1] The number of asset classes used in the PTRM will vary between businesses. However, for each business the number of asset classes used in the PTRM must be consistent with that used in the AER's roll forward model (RFM). This allows the closing RAB values determined in the RFM to be used as inputs to the opening RAB values in the PTRM.

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.

Assets under construction

The value of assets under construction for each asset class is recorded in column K.[2] 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 year of the current regulatory control period (cell K27) is rolled into the opening RAB value (cell J27).

Remaining life

The remaining life of the asset classes is recorded in column L, based on the economic life of the assets.[3]

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[1]   The PTRM can be expanded to accommodate additional asset classes, when necessary.

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

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

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 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 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 year in rows 31 to 50 (by asset class). Capex is rolled into the RAB when spending is incurred. These inputs are assumed to be in end of the year terms.

Forecast real asset disposals—proceeds from sale

Forecast asset disposal values are recorded for the year in which the disposal is expected to take place, in rows 55 to 74. These inputs are assumed to be in end of the year terms.

Forecast real customer contributions—as-incurred

Forecast customer contributions (as-incurred) values are recorded for the year in which the contribution is made, in rows 79 to 98. These inputs are assumed to be in end of the year terms.

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 forecast asset disposals and forecast customer contributions. The treatment of capital contributions in the proposed 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 103 to 122 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 127 to 130 are provided as inputs for discretionary categories of forecast opex while row 131 automatically calculates 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 132) are linked to the **Analysis** sheet.

Cost of capital

The cost of capital section (rows 136 to 142) 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.[4]

The allowance for benchmark debt raising cost is also recorded in row 143. The value of the debt raising cost allowance is based on the notional debt issue size and is determined according to the framework set out in *Debt and equity raising transaction costs: Final report to the ACCC*, a 2004 report by the Allen Consulting Group.

Values of revenue control for the current year

Cells G147 and G148 record current values of MAR and revenue yields for DNSPs subject to these forms of control. These values are linked to the **X factor** sheet and are used in setting values of the X factor.

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[4] 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. For the time being, the AER will use a range of indicators to guide it in determining the appropriate forecast inflation.

Energy delivered forecast

Row 153 records total forecast energy delivered (disaggregated forecasts are inputted in rows 191 to 219). 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 setting the price constraint under a revenue yield form of control in the **X factor** sheet.

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
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		19.07%	19.07%
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				7.28%	8.52%
30	Post-tax Real WACC				4.15%	5.36%
31	Pre-tax Nominal WACC				9.57%	9.59%
32	Pre-tax Real WACC				6.37%	6.40%
33	Nominal Tax Allowance				0.51%	0.53%
34	Real Tax Allowance				0.49%	0.51%

2.3   Assets sheet

The **Assets** sheet calculates the value of the RAB for each 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

	B	C	D	E	F	G	H	I	J	K
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
31	Nominal Capex					138.8	138.6	120.3	123.9	151.5
52										
53	**Real Asset Values**									
54										
55	Real Straight-line Depreciation					135.00	139.47	117.99	104.43	107.54
316	Real Residual RAB (end period)				2,300.0	2,299.8	2,291.0	2,283.1	2,288.8	2,311.9
317	Real Residual RAB (start period)				-	2,300.0	2,299.8	2,291.0	2,283.1	2,288.8
318										
319	**Nominal Asset Values**									
320										
321	Inflation on Opening RAB					69.0	71.1	72.9	74.8	77.3
322	Nominal Straight-line Depreciation					139.1	148.0	128.9	117.5	124.7
323	Nominal Regulatory Depreciation					70.1	76.9	56.0	42.7	47.4
324	Nominal Residual RAB (end period)				2,300.0	2,368.8	2,430.5	2,494.8	2,576.1	2,680.2
325	Inflated Nominal Residual RAB (start period)				-	2,369.0	2,439.9	2,503.4	2,569.7	2,653.3
326										
327	**Nominal Tax Values**									
328										
329	Tax Depreciation					155.0	142.6	122.7	125.5	128.2
590	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 under
clause 6.5.5.

The opening RAB and real forecast net capex values displayed in this sheet (rows 9 to
30) are sourced from the **Input** sheet. Nominal forecast net capex values are displayed
in rows 31 to 51. 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 can be incurred evenly throughout the year so it is reasonable to assume that,
on average, it takes place half-way through the year. However, the PTRM calculates
the return on capital based on the opening RAB for each year and capex is not added
to the RAB until the end of the year in which the asset 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.[5]

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[5]   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 55 to 317. Real straight-line depreciation is calculated in rows 55 to 315. 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 56 to 315.

The roll forward of the closing RAB in real terms for each year is calculated in row 316.

Nominal asset values are displayed in rows 321 to 325. To compensate the DNSP for inflation, the residual value of the RAB at the end of each year is adjusted upwards for the amount of expected inflation in that year. This adjustment is calculated in row 321. The change in the nominal value of the RAB from year to year is calculated by adjusting the closing RAB (row 324) for forecast net capex and the regulatory depreciation allowance. Regulatory depreciation (row 323) is calculated as the nominal straight-line depreciation (row 322), less the inflation adjustment on the opening RAB (row 321).

Depreciation for tax purposes is calculated in rows 329 to 590 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 330 to 589. 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 methods for the AER's assessment under Chapter 6 and amend the model as part of their proposals.

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

	B	C	D	E	F	G	H	I	J	K
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**			(4.7)	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										
53	**Nominal Cash Flow Analysis**									
54	Capital Expenditure				2,300	138.8	138.6	120.3	123.9	151.5
55	Interest Payments				-	98.0	100.9	103.5	106.3	109.7
56	Repayment of Debt				(1,380) -	41.3 -	37.0 -	38.6 -	48.7 -	62.5
57										
58	**Nominal Cash Flow to Equity Holders**									
59	- Pre-tax	**Te =**	**19.07%**	13.23%	(920)	89.6	98.8	101.1	95.2	91.0
60	- Post-tax			10.71%	(920)	76.2	79.2	80.8	79.3	73.0
61	- Post-tax + Value of Imputation Credits			12.00%	(920)	82.9	89.0	90.9	87.3	82.0
62	**Real Cash Flow to Equity**									
63	- Pre-tax			9.93%	(920)	86.9	93.1	92.5	84.6	78.5
64	- Post-tax			7.48%	(920)	74.0	74.7	73.9	70.5	63.0
65	- Post-tax + Value of Imputation Credits			8.74%	(920)	80.5	83.9	83.2	77.5	70.7
66	**Net Cash Flow to Debt**									
67	Deduction Utilised to Reduce Tax					98.0	100.9	103.5	106.3	109.7
68	Unutilised Deductions Carried Forward					-	-	-	-	-
69	Net Cash Flow to Debt	**Td =**	**30.00%**	4.97%	(1,380)	27.3	33.6	33.9	25.7	14.4
70	**Nominal Cash Flows to Assets**									
71	Cash flow to Asset			9.59%	(2,300)	146.3	162.7	166.1	152.7	138.3
72	Cash flow to Asset Post-tax			8.52%	(2,300)	132.9	143.1	145.7	136.9	120.3
73	Cash flow to Asset Real			6.40%	(2,300)	142.0	153.3	152.0	135.7	119.3
74	Cash flow to Asset Real Post-tax			5.36%	(2,300)	129.0	134.9	133.4	121.6	103.8
75	Check on Vanilla WACC Cash Flow (nom)			9.06%	(2,300)	139.6	152.9	155.9	144.8	129.3
76	Check on Vanilla WACC Cash Flow (real)			5.88%	(2,300)	135.5	144.1	142.7	128.7	111.5
77										
78	**Further Dissection of Cash Flows**									
79										
80	**Return on Equity**									
81	Cash flow with Imputation					82.9	89.0	90.9	87.3	82.0
82	Add back Capex					138.8	138.6	120.3	123.9	151.5
83	Less Nominal Depreciation of RAB					(70.1)	(76.9)	(56.0)	(42.7)	(47.4)
84	Add Debt Repayment					(41.3)	(37.0)	(38.6)	(48.7)	(62.5)
85	**Gives Nominal Return to Equity**					**110.4**	**113.7**	**116.7**	**119.8**	**123.7**
86	Less Inflation in Equity Component					(27.6)	(28.4)	(29.2)	(29.9)	(30.9)
87	**Gives Real Return to Equity**					**82.8**	**85.3**	**87.5**	**89.8**	**92.7**
88	%ROE (1 year)					12.00%	12.00%	12.00%	12.00%	12.00%
89	%real ROE (1 year)					8.74%	8.74%	8.74%	8.74%	8.74%
90										
91	Equity at Start of Period					920.0	947.5	972.2	997.9	1,030.4
92										
93	**Regulatory Control Period Analysis**									
94										
95	Revenue				-	352.1	369.3	354.2	347.6	362.9
96	Less Opex				-	(67.0)	(68.0)	(67.8)	(71.0)	(73.1)
97	Less Interest				-	(98.0)	(100.9)	(103.5)	(106.3)	(109.7)
98	Less Tax				-	(13.3)	(19.6)	(20.3)	(15.8)	(18.0)
99	Plus Imputation Credits				-	6.7	9.8	10.2	7.9	9.0
100	Less Capex				(2,300.0)	(138.8)	(138.6)	(120.3)	(123.9)	(151.5)
101	Less Loan Repayments				1,380.0	41.3	37.0	38.6	48.7	62.5
102	RAB Residual Value									1,072.1
103	Post-tax Return on Equity				(920.0)	82.9	89.0	90.9	87.3	1,154.1
104										
105	IRR (during regulatory control period)			12.00%						
106	Target (during regulatory control period)			12.00%						

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 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 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 34 to 36).

Spreadsheet calculations

Tax payable by the DNSP for each 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 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 55 to 315 and 321 to 323 of the **Assets** sheet). Tax depreciation is generally based on a much shorter tax life or calculated in a different way (see rows 329 to 589 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 year of the next regulatory control period is calculated in cell F50. The PV for capex is calculated in cell F51.

Note that the net present value (NPV) check on the returns is only relevant for depreciable assets (i.e. not applicable to easements).

Net cash flows available to equity holders

Net nominal pre-tax cash flows to equity holders (row 59) are represented by nominal revenues less:

- opex
- capex
- interest payments
- any repayment of debt in the period.

Net nominal post-tax cash flow to equity holders (row 60) is obtained by further deducting the tax expense of the business. Row 61 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 61).

The corresponding real cash flows and the respective IRRs are calculated in rows 63 to 65.

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 D59). 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 67) in calculating tax liabilities. Where the interest expense in a 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 a later period. This effect is analysed in rows 67 to 69. That part of interest expense used to defer tax is calculated in each period (row 67) and the unused part carried forward is embodied in the tax loss carried forward calculation (row 68). 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 E69) 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 95 to 106 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 over the regulatory control period. Rows 95 to 106 are essentially an expansion of the calculations used to derive row 61—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 calculation of X factors under the weighted average price cap (WAPC) constraint. Prices are sourced from the **Input** sheet and escalated by inflation measured using the consumer price index (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.

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 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 under clause S6.1.3. The AER will assess this in accordance with the provisions listed above, but may also consider 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 values of inflation (row 7), the rate of discount (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.

X factors under the WAPC

Values of X, including a P-naught, are inputted in row 30. 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 24. 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 I27.

X factors under the revenue yield

Values of X, including a P-naught, are inputted in row 69. These are used, along with forecast inflation, to 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 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 I66.

X factors under the revenue cap

Values of X, including a P-naught, are inputted in row 49. These are used, along with forecast inflation, to derive a nominal smoothed MAR for each 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 year is listed in cell I45.

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.

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

Figure 6: X factor sheet

	B	C	D	E	F	G	H	I
2	**X factor calculations**							
3								
4	**Year**		**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**
5								
6								
7	**Discount rate**	9.06%						
8	orecast inflation	3.00%						
9								
10		**Building block components**						
11		Return on capital		208.38	214.61	220.21	226.03	233.39
12		Return of capital		70.05	76.90	56.02	42.69	47.38
13		O&M		64.98	66.93	68.93	70.99	73.13
14		Carry-over amounts		2.06	1.06 -	1.09	-	-
15		Benchmark Tax liability		6.67	9.79	10.17	7.91	8.99
16				$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
17								
18								
19	**Price cap calculation**							
20								
21	**Building block requirement ($m)**			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
22		NPV	**$1,387.39**					
23								
24	**Smoothed Forecast Revenue ($m)**		$ 299.55	$ 338.42	$ 348.44	$ 358.75	$ 369.36	$ 380.29
25		NPV	**$1,387.39**					
26								
27		Difference in NPVs	**-$0.00**		Difference between final year revenue and requirement			**4.79%**
28								
29				**P_0**	**X_1**	**X_2**	**X_3**	**X_4**
30				5.02%	2.00%	2.00%	2.00%	2.00%
31								
32								
33								
34								
35								
36								
37	**Revenue cap calculation**							
38								
39	**Building block requirement ($m)**			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
40		NPV	**$1,387.39**					
41								
42	**Maximum allowed revenue ($m)**		$ 350.00	**$ 331.85**	**$ 345.22**	**$ 359.13**	**$ 373.61**	**$ 388.66**
43		NPV	**$1,387.39**					
44								
45		Difference in NPVs	**$0.00**		Difference between final year revenue and requirement			**7.10%**
46								
47								
48				**P_0**	**X_1**	**X_2**	**X_3**	**X_4**
49				7.95%	-1.00%	-1.00%	-1.00%	-1.00%
50								
51								
52								
53	**Revenue yield/ Average revenue cap calculation**							
54								
55	**Building block requirement ($m)**			$ 352.14	$ 369.29	$ 354.23	$ 347.63	$ 362.89
56		NPV	**$1,387.39**					
57								
58								
59	Forecast energy throughput (MWh)		10,720,000	10,934,400	11,153,088	11,376,150	11,603,673	11,835,746
60								
61	**Revenue yield ($/MWh)**		$ 30.00	$ 28.11	$ 29.82	$ 31.64	$ 33.56	$ 35.61
62								
63	**Smoothed revenue requirement ($M)**		$ 321.60	$ 307.36	$ 332.60	$ 359.91	$ 389.47	$ 421.45
64		NPV	**$1,387.39**					
65								
66		Difference in NPVs	**$0.00**		Difference between final year revenue and requirement			**16.14%**
67								
68				**P_0**	**X_1**	**X_2**	**X_3**	**X_4**
69				9.03%	-3.00%	-3.00%	-3.00%	-3.00%
70								
71								

The **X factor** sheet also calculates the expected ARR and forecast revenues in real terms (rows 94 to 96) 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
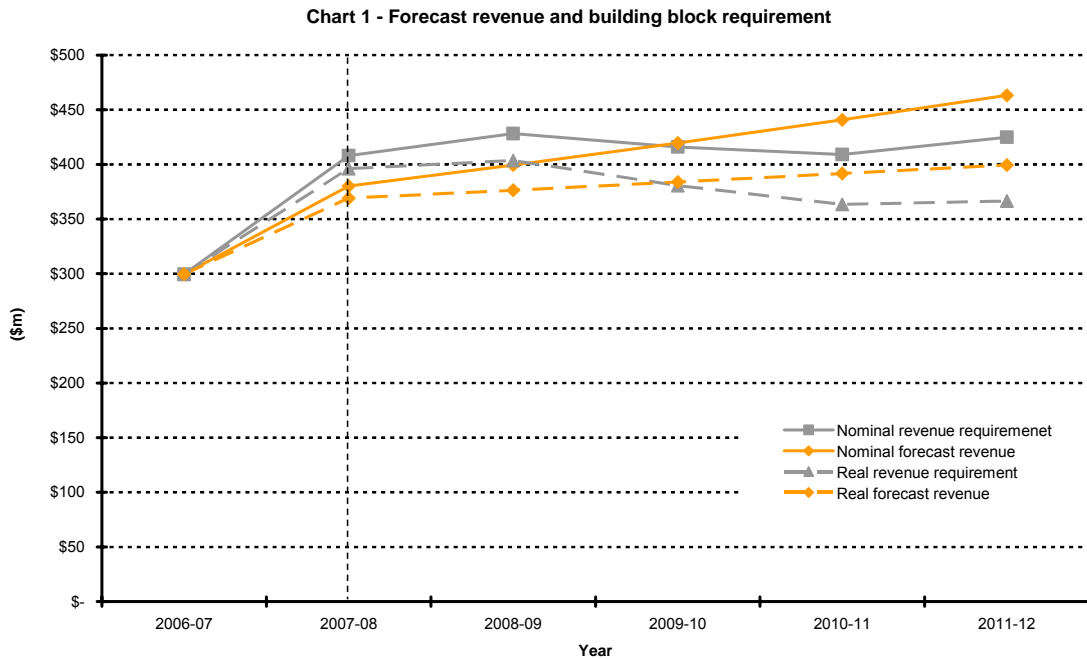
2.8 Chart 2–Price path sheet

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
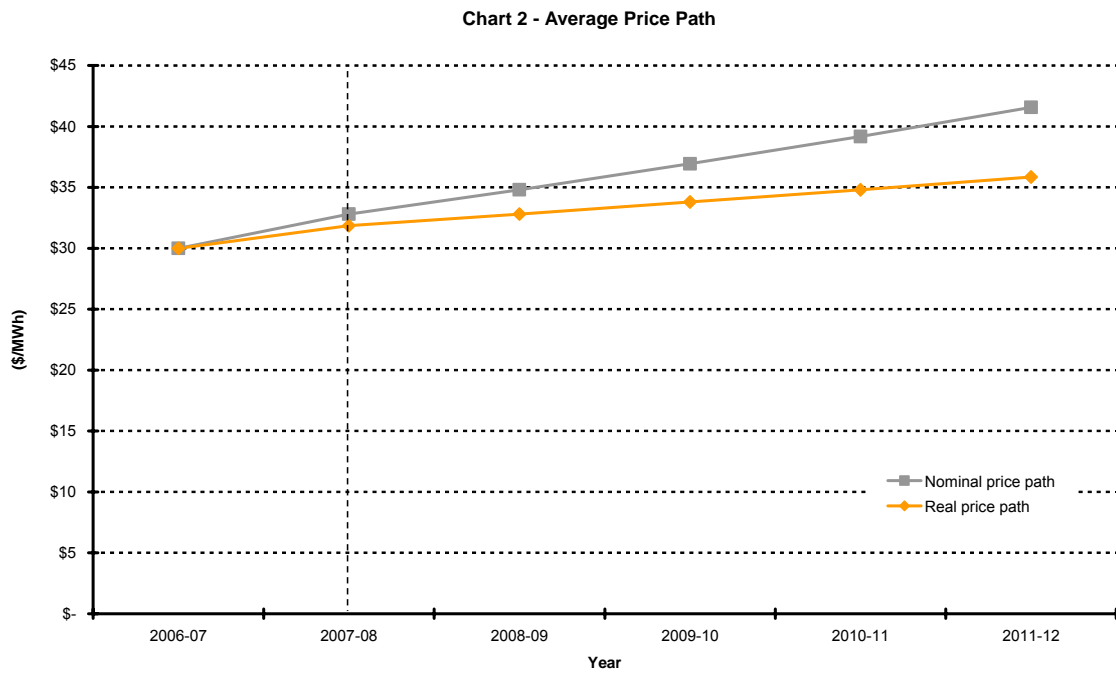
2.9 Chart 3–Building Blocks sheet

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

- net tax costs
- regulatory depreciation
- opex
- 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