



Post–Tax Revenue Model

Electricity Module

Handbook

August 2005

Contents

Glossary	3
1. Introduction.....	4
2. The Basic Model.....	6
2.1 Input Sheet	6
2.2 WACC Sheet.....	10
2.3 Assets Sheet	13
2.4 Analysis Sheet.....	15
2.5 Smoothing Sheet	20
2.6 Price Path Sheet	21
2.7 Chart 1 – MAR Sheet.....	22
2.8 Chart 2 – Building Blocks Sheet.....	23

Glossary

ACCC	Australian Competition and Consumer Commission
AER	Australian Energy Regulator
Capex	Capital expenditure
CAPM	Capital Asset Pricing Model
CPI	Consumer Price Index
IRR	Internal Rate of Return
MAR	Maximum Allowed Revenue
MWh	Megawatt hour
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NER	National Electricity Rules
NPV	Net Present Value
Opex	Operation and maintenance expenditure
PTRM	Post-Tax Revenue Model
PV	Present Value
RAB	Regulatory Asset Base
SRP	Statement of Principles for the Regulation of Transmission Revenues
TNSP	Transmission Network Service Provider
WACC	Weighted Average Cost of Capital

1 Introduction

The National Electricity Rules (NER) establishes a regulatory framework which provides that the Australian Energy Regulator (AER) will determine the maximum allowed revenue (MAR), or revenue cap, for each regulated transmission network service provider (TNSP). The MAR sets out the maximum revenue to be earned with respect to the non-contestable elements of the TNSP's transmission networks. The TNSPs use the MAR requirement to determine their fees and charges for connection to and use of their transmission networks. In preparing a revenue cap decision, the AER use the Post-Tax Revenue Model (PTRM) to model a TNSP's revenue requirement.

In October 2001, the ACCC released its Post-Tax Revenue Handbook which explained how the PTRM is utilised by the ACCC in its regulation of various Australian utilities.¹ The PTRM can be extended to model additional scenarios. The PTRM – Electricity Module is an extension of the original PTRM.

This publication, the PTRM – Electricity Module Handbook explains how the PTRM – Electricity Module is used by the AER in its regulation of TNSPs that participate in the National Electricity Market (NEM).

This handbook describes how the AER has adapted the original PTRM to accommodate the specific requirements of the electricity sector. It explains differences between the PTRM and the PTRM – Electricity Module and should be read in conjunction with the original handbook.

The PTRM – Electricity Module is a simplified version of the cash flow model which deliberately abstracts from the complexity of a revenue cap decision model. However, the basic modelling concepts and approach are identical to that utilised in a revenue cap decision.

This handbook discusses each topic in the PTRM relatively brief. For more detail on key issues please refer to the following publications:

- *Post-Tax Revenue Handbook*, October 2001
- *Statement of Principles for the Regulation of Transmission Revenues*, 8 December 2004 (referred to as Statement of Regulatory Principles or SRP)
- *Draft Statement of Principles for the Regulation of Transmission Revenues*, 27 May 1999
- various ACCC revenue cap decisions – such as those for the New South Wales, Tasmanian, Victorian and South Australian transmission networks.

It should be noted that parameter values used in the modelling (including those in the capital asset pricing model (CAPM) equation) are only examples. While some figures

¹ ACCC, *Post-Tax Revenue Handbook*, October 2001.

may be identical to previous revenue cap decisions this is coincidental, and the values should not be taken to indicate the AER's current thinking.

The AER is releasing the PTRM – Electricity Module and this handbook to enhance transparency in the revenue cap process. The release of the model and handbook should provide more information on the AER's approach for interested parties.

2 The Basic Model

The PTRM – Electricity Module is a set of Microsoft Excel spreadsheets, which perform iterative calculations to derive a MAR, from a given set of inputs. The PTRM – Electricity Module allows the user to vary the inputs in order to assess their impact on MAR, and other derived parameters.

Before using the PTRM – Electricity Module, 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.

To run the ‘Fix_Te’ and ‘Smooth’ macros manually, select *Macro* from the *Tools* menu, and then select *Macros*. To operate ‘Fix_Te’, highlight it and click on *Run*. To operate ‘Smooth’, highlight it and click on *Run*.

2.1 Input Sheet

The **Input** sheet provides for key input variables to be entered in the PTRM – Electricity Module. They are automatically linked to corresponding cells in the relevant worksheets. Values should be entered into each cell with light blue shading. The input variables have been split into six categories:

- regulatory asset base
- capital expenditure (capex)
- operation and maintenance expenditure (opex)
- cost of capital
- demand forecast
- historic information.

Figure 1 shows the input sheet.

There is scope for making inputs into the other worksheets but this is not recommended until operation of the model is understood. There are a few items which may need to be specified outside of this **Input** sheet to capture a specific situation (for example, tax loss carried forward in the **Analysis** sheet). These situations are addressed where they arise.

It should be noted that although the PTRM – Electricity Module allows the input variables to be recorded for up to 10 years, the calculations assume a default regulatory period of 5 years.

Figure 1: Input Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2		Input Variables											
3													
4													
5		Regulatory Asset Base (\$m Year 0)											
6			Category Title	Opening Asset Value	Remaining Life	Standard Life	Historical Tax Value	Tax Remaining Life	Tax Standard Life				
7		Asset Class 1	Transmission	1,000.00	20.0	50.0	1,000.00	20.0	50.0				
8		Asset Class 2	Substation	800.00	30.0	40.0	800.00	30.0	40.0				
9		Asset Class 3	Easement	600.00	n/a	n/a	600.00	n/a	n/a				
10				\$ 2,400.00			\$ 2,400.00						
11													
12		Capital Expenditure (\$m Year 0)											
13		Year	1	2	3	4	5	6	7	8	9	10	
14		Transmission	30.00	10.00	10.00	20.00	20.00						
15		Substation	20.00	20.00	30.00	10.00	10.00						
16		Easement	5.00	3.00	3.00	5.00	5.00						
17			\$ 55.00	\$ 33.00	\$ 43.00	\$ 35.00	\$ 35.00						
18													
19		Operation and Maintenance Expenditure (\$m Year 0)											
20		Year	1	2	3	4	5	6	7	8	9	10	
21		Opex	50.00	50.00	50.00	50.00	50.00						
22			\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00						
23													
24		Cost of Capital											
25			Value										
26		Nominal Risk Free Rate Rf	5.00%										
27		Real Risk Free Rate Rrf	2.94%										
28		Cost of Debt Margin Dm	1.20%										
29		Market Risk Premium MRP	6.00%										
30		Proportion of Franking Credits Attributed Value by Shareholders)	50.00%										
31		Proportion of Equity Funding E/V	40.00%										
32		Debt Beta βd	0.00										
33		Asset Beta βa	0.40										
34													
35													
36		Energy Delivered Forecast (MWh)											
37		Year	0	1	2	3	4	5	6	7	8	9	10
38		Energy	200,000.00	210,000.00	220,000.00	230,000.00	240,000.00	250,000.00					
39													
40													
41		Historic Information (\$m Year 0)											
42			Value										
43		Current MAR	\$ 285.00										
44													

Regulatory Asset Base Input

The regulatory asset base (RAB) is the value of assets on which a return will be earned. The **Input** sheet requires a value for the opening asset base, which is the value of the RAB at the start of Year 1. The RAB will fluctuate each year to reflect new capex, asset disposals and depreciation. In the PTRM – Electricity Module capex occurring within the regulatory period is featured whereas disposals are not. However, the PTRM – Electricity Module could be modified and expanded to suit a particular application.

The values (\$m Year 0) to be recorded in the RAB section should be in accordance with the proforma regulatory assets statement that a TNSP must provide when submitting a revenue cap application. The recorded values are linked to the **Assets** sheet which also calculates depreciation.

Category title

The asset classes/names are recorded in column C. It is important that the number of asset classes recorded in the RAB section matches the number of asset classes identified in the capex section. This allows the PTRM – Electricity Module to model consistent depreciation across the asset classes.

Opening asset value

The opening asset values corresponding with each asset class are recorded in column F.

Remaining life

The remaining life of the asset classes are recorded in column H and set equal to the economic life of the assets.

Standard life

The standard life of the assets is recorded in column I and measures how long the infrastructure would physically last if it had just been built.

Historical tax value

The historical tax value of the assets is recorded in column J.

Tax remaining life

The remaining life of assets for taxation purposes are set (in column K) equal to 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 assets is recorded in column L.

Capital Expenditure Input

Capital investment decisions proceed when they satisfy the regulatory test. The regulatory test is the mechanism set out in the code to assess the economic efficiency of investment decisions.

Capex can be rolled into the asset base when it is scheduled to become operational or when spending is incurred.

Generally, capex falls into three broad categories:

- asset replacement (replacing assets that have passed their useful lives)
- asset refurbishment (prolonging the life of an asset)
- asset augmentation (works to enlarge a network or to increase the capability of a network).

The forecast values (\$m Year 0) to be recorded in the capex section should be in accordance with the proforma capex statement that a TNSP must provide when submitting a revenue cap application. The number of asset classes entered into the

capex section should match the number of asset classes recorded in the RAB section. The forecast capex values are linked to the **Assets** sheet.

Operation and Maintenance Expenditure Input

Opex typically includes items such as wages and salaries, leasing costs, costs associated with maintaining transmission assets, input costs and other service contract expenses paid to third parties. The forecast values (\$m Year 0) are recorded in the opex section for each year. This data is then linked to the **Analysis** sheet.

Cost of Capital Input

The cost of capital section records the following parameters which are linked to the **WACC** sheet:

- nominal risk free rate
- real risk free rate
- debt margin over the risk free rate
- market risk premium
- gamma (proportion of franking credits used)
- gearing ratio
- debt beta
- asset beta.

Energy Delivered Forecast Input

The energy delivered forecast section records this information which will be linked to the **Price Path** sheet. Energy delivered forecasts may be obtained from NEMMCO's statement of opportunities, TNSPs or other relevant industry sources.

Historic Information Input

The historic information section records the current MAR for a TNSP. It will be linked to the **Price Path** sheet and helps provide historical comparison to forecast revenues over the regulatory period.

2.2 WACC Sheet

The **WACC** sheet calculates the required return on equity, cost of debt, inflation forecast and the weighted average cost of capital (WACC) using the relevant cost of capital parameters from the **Input** sheet. Figure 2 shows the WACC 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 basic building block model. The outcomes of these WACC measures vary with the different revenue profiles generated under alternative regulatory models such as the building block cost of service, price path, NPV and IRR. The original PTRM and its corresponding handbook provide a discussion of these regulatory models. However, for the PTRM – Electricity Module, only the basic building block model is considered.

Figure 2: WACC Sheet

	B	C	D	E	F	G	H
1							
2	Cost of Capital Parameters						
3							
4							
5							
6					Input Data & Calculated Inputs	Basic Building Block Model	
7	Nominal Risk Free Rate	Rf			5.00%		
8	Real Risk Free Rate	Rrf			2.94%		
9	Inflation Rate	f			2.00%		
10	Cost of Debt Margin over rf	Dm			1.20%		
11	Nominal pre-tax cost of debt	Rd			6.20%		
12	Real pre-tax cost of debt	Rrd			4.12%		
13	Market Risk Premium	MRP			6.00%		
14	Corporate Tax Rate	T			30.00%		
15	Effective Tax Rate for Equity (from Relevant Cashflows)	Te			21.48%	21.48%	
16	Effective Tax Rate for Debt (Effective Debt Shield)	Td			30.00%	30.00%	
17	Proportion of Franking Credits Attributed Value by Shareholders	π			50.00%		
18	Proportion of Equity Funding	E/V			40.00%		
19	Proportion of Debt Funding	D/V			60.00%		
20	Debt Beta	β_d			0.00		
21	Asset Beta	β_a			0.40		
22	Equity Beta (uses Te)	β_e			1.00		
23							
24	WACC Analysis						
25							
26					Formula Approximation		
27	Post-tax Nominal Return on Equity(pre-imp)				10.98%	10.98%	
28	Post-tax Real Return on Equity(pre-imp)				8.80%	8.80%	
29	Nominal Vanilla WACC				8.11%	8.11%	
30	Real Vanilla WACC				5.99%	5.99%	
31	Post-Tax Nominal WACC				6.47%	7.57%	
32	Post-Tax Real WACC				4.38%	5.46%	
33	Pre-Tax Nominal WACC				8.64%	8.65%	
34	Pre-Tax Real WACC				6.51%	6.52%	
35	Nominal Tax Allowance				0.53%	0.54%	
36	Real Tax Allowance				0.52%	0.53%	
37							

Weighted Average Cost of Capital

The NER states that in determining a TNSP's revenue cap, the AER must have regard to the TNSP's fair and reasonable WACC.

To establish an appropriate risk adjusted level of return on capital for the TNSP, the AER applies the building block approach which, *inter alia*, combines a benchmark WACC with a RAB value. The AER adopts the cash flow modelling approach as specified in the NER and outlined in the SRP. This approach extracts the parameters relating to business income tax from the WACC formula.

In doing so, the AER explicitly models the tax liabilities (i.e interest expense, depreciation and franking credits) of the TNSP in the cash flow model. The remaining WACC formula, known as the 'vanilla WACC', is the weighted average of the partially grossed-up return on equity and the pre-tax cost of debt:

$$\text{WACC} = r_e (E/V) + r_d (D/V)$$

where:

r_e = required rate of return on equity

r_d = pre-tax cost of debt

E = market value of equity

D = market value of debt

V = market value of equity plus debt.

The PTRM – Electricity Module provides for the return on capital component by applying the nominal vanilla WACC (cell F29) to the RAB.

Cost of Equity

The cost of equity is the expected return required to compensate investors for bearing risks associated with investing in the equity of the relevant electricity transmission company. In this context, the cost of equity is a forward looking concept and determines the return expected by investors on their investment.

Consistent with common financial practice, the AER applies the CAPM to determine the benchmark cost of equity. As illustrated in the following formula, CAPM specifies the average required or expected return given the opportunity cost of investing in the market portfolio, the market's own volatility and the systematic risk of holding equity in the particular company:

$$r_e = r_f + \beta_e(r_m - r_f)$$

where:

r_f = the risk free rate of return

$(r_m - r_f)$ = the market risk premium measured by the return of the market
(r_m) as a whole less the risk free return

β_e = the systematic risk of the individual company's equity relative to the market.

The cost of equity is calculated in cell F27.

Cost of Debt

A common approach among regulators, in calculating the required return for corporate debt, is to add a premium to the yield on a risk free security with an equivalent maturity. Accordingly, the cost of debt is the debt margin plus the risk free rate and the relationship is illustrated as:

$$r_d = r_f + d_m$$

where:

r_d = the cost of debt

r_f = the risk free rate of return

d_m = the debt margin.

The cost of debt is displayed in cell F11.

Further discussion regarding the parameters within the WACC and CAPM framework can be found in the SRP, Post-Tax Revenue Handbook and various regulatory decisions.

2.3 Assets Sheet

The **Assets** sheet (see Figure 3) calculates the value of the RAB for each period in real and nominal terms. It also calculates both regulatory and tax depreciation.

Figure 3: Assets Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		Asset Roll Forward														
2																
3																
4		Year		0	1	2	3	4	5	6	7	8	9	10		
5																
6		Inflation assumption (CPI % increase)	2.00%		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
7		Cumulative Inflation Index (CPI end period)		100%	102.0%	104.0%	106.1%	108.2%	110.4%	112.6%	114.9%	117.2%	119.5%	121.9%		
8																
9		Initial Asset Base		2,400												
10		Real Capex			57.2	34.3	44.7	36.4	36.4	-	-	-	-	-	-	-
11		Nominal Capex			58.4	35.7	47.5	39.4	40.2	-	-	-	-	-	-	-
12		Real Asset Values														
13		Real Depreciation			76.7	77.8	78.5	79.5	80.2	80.9	80.9	80.9	80.9	80.9	80.9	80.9
26		Transmission			50.0	50.6	50.8	51.0	51.5	51.9	51.9	51.9	51.9	51.9	51.9	51.9
39		Substation			26.7	27.2	27.7	28.5	28.7	29.0	29.0	29.0	29.0	29.0	29.0	29.0
52		Easement			-	-	-	-	-	-	-	-	-	-	-	-
53		Real Residual Asset Value (end period)		2,400	2,380.6	2,337.1	2,303.3	2,260.2	2,216.4	2,135.5	2,054.7	1,973.8	1,892.9	1,812.0		
54		Real Residual Asset Value (start period)		-	2,400.0	2,380.6	2,337.1	2,303.3	2,260.2	2,216.4	2,135.5	2,054.7	1,973.8	1,892.9	1,892.9	
55																
56		Nominal Asset Values														
57		Nominal Depreciation (economic)			30.2	32.4	34.7	37.2	39.6	42.1	44.8	47.5	50.4	53.3		
58		Nominal Residual Asset Value (end period)		2,400	2,428.2	2,431.6	2,444.4	2,446.6	2,447.2	2,405.1	2,360.3	2,312.8	2,262.4	2,209.1		
59		Inflated Nominal Residual Asset Value (start period)		-	2,448.0	2,476.8	2,480.2	2,493.3	2,495.6	2,496.2	2,453.2	2,407.6	2,359.1	2,307.7		
60																
61		Tax Values														
62		Tax Depreciation			76.7	77.8	78.5	79.5	80.2	80.9	80.9	80.9	80.9	80.9	80.9	80.9
75		Transmission			50.0	50.6	50.8	51.0	51.5	51.9	51.9	51.9	51.9	51.9	51.9	51.9
88		Substation			26.7	27.2	27.7	28.5	28.8	29.0	29.0	29.0	29.0	29.0	29.0	29.0
101		Easement			-	-	-	-	-	-	-	-	-	-	-	-
102		Residual Tax Value (end period)		2,400	2,379.4	2,336.0	2,303.1	2,261.5	2,219.9	2,138.9	2,058.0	1,977.0	1,896.1	1,815.1		
103																

Rolling forward the RAB and depreciation

Rolling forward the RAB serves two purposes:

- to establish the asset base on which a rate of return must be earned in any period
- to form the basis for calculating the depreciation expense over any period.

For consistency, 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 capex over the life of the asset, accumulated depreciation should not exceed the initial actual capital cost of the infrastructure.

The RAB is rolled forward using the following equation:

$$\begin{aligned}
 \text{Opening value RAB in next period} &= \text{Closing value of RAB in current period} \\
 &= \text{opening value of assets in current period} \\
 &\quad - \text{depreciation} \\
 &\quad + \text{capex} \\
 &\quad - \text{asset disposals}
 \end{aligned}$$

The RAB and capex data for this sheet is sourced from the **Input** sheet (rows 9 and 10). The modelling of capex can be based on a ‘cash spend’ or a ‘commissioning date’ approach.

For the commissioning date approach, the capex data keyed into the **Input** sheet includes an allowance for interest during construction to finance capex throughout the construction period of an investment project. For the cash spend approach, some slight modifications may be required, but essentially the capex forecast data is provided on an annual basis and keyed into the **Input** sheet so that the RAB is adjusted as expenditure is incurred. In present value (PV) terms, both approaches would deliver the same modelling outcome over the life of the asset.

The PTRM – Electricity Module calculates return on capital based on the opening RAB and capex is not recognised until the year after it is capitalised. Actual capex is incurred evenly throughout the year, so a reasonable assumption is that capex on average takes place half-way through the year. Therefore, to address the timing difference of modelling capex, a half year vanilla WACC is provided (capitalised and recovered over the life of the assets) to compensate for the 6 month period before capex is included in the RAB.²

Straight-line depreciation is calculated in rows 13 to 52. It uses the RAB values and lives, and capex data from the **Input** sheet. In this simplified model three asset classes are used, the individual depreciation profiles of these asset classes can be seen by expanding rows 14 to 52.

Nominal asset values are depicted in rows 57 to 59. To compensate the investor for inflation the residual value at the end of each year is adjusted upwards for the amount of expected inflation in that year. The change in the nominal value of the RAB from period to period is the (economic) depreciation allowance used in the building block framework (row 57).

Depreciation for tax purposes is calculated in rows 62 to 101. This is because asset values for tax purposes may differ from that for regulatory purposes. For example, taxation concessions such as accelerated depreciation would cause assets to be written off more quickly for tax purposes.

² The half year vanilla WACC is calculated by the square root of $(1 + \text{vanilla WACC})$ to account for the compounding effect on an annual rate.

2.4 Analysis Sheet

The **Analysis** sheet itemises the basic costs, or building blocks, of the TNSP which are then summed together to calculate the MAR. To put it another way, the **Analysis** sheet is where the data from the **Input** sheet is combined with the calculations in the **Assets** and **WACC** sheets to estimate the TNSP's revenue requirement (see Figure 4).

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.

Building block approach to deriving cash flows

The AER applies a building block approach to assessing the revenues required by a TNSP to ensure it is able to cover the full cost of providing the regulated service including a commercial return on its investment.

The key building blocks are:

- the post tax return on equity (row 16)
- the cost of debt or the interest payments incurred that are required to service borrowing (row 17)
- depreciation or return of capital (row 19)
- opex (row 21)
- net tax liabilities payable (the figure is net in the sense that it is the annual tax payable by the TNSP (row 23) less the value of imputation credits available to investing shareholders (row 24)).

The costs are calculated in nominal dollars (dollars of the day) terms.

The costs are determined for each year of the period under review to derive the actual revenue requirement. As costs can fluctuate from year to year, the revenue requirement is smoothed over time (see **Smoothing** sheet in section 2.5 for more detail).

Figure 4: Analysis Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2		Post-Tax Building Block Cash Flow Model														
3		Cash Flow Analysis														
4																
5		Year				0	1	2	3	4	5	6	7	8	9	10
6		Inflation assumption (CPI increase)				2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
7		CPI Index (end period)				100.0%	102.0%	104.0%	106.1%	108.2%	110.4%	112.6%	114.9%	117.2%	119.5%	121.9%
8																
9		RAB (start period)				Nominal value	2,400.0	2,428.2	2,431.6	2,444.4	2,446.6	2,447.2	2,405.1	2,360.3	2,312.8	2,262.4
10		- Equity				40.00%	960.0	971.3	972.6	977.7	978.6	978.9	962.0	944.1	925.1	905.0
11		- Debt				60.00%	1,440.0	1,456.9	1,458.9	1,466.6	1,468.0	1,468.3	1,443.1	1,416.2	1,387.7	1,357.5
12																
13		Revenue Building Blocks														
14		Nominal Vanilla WACC				8.11%										
15		Return on Asset														
16		- Return on Equity				10.98%	105.4	106.6	106.8	107.3	107.4	107.5	105.6	103.6	101.6	99.3
17		- Return on Debt				6.20%	89.3	90.3	90.5	90.9	91.0	91.0	89.5	87.8	86.0	84.2
18																
19		Return of Asset (economic depreciation)					30.2	32.4	34.7	37.2	39.6	42.1	44.8	47.5	50.4	53.3
20																
21		Opex					51.0	52.0	53.1	54.1	55.2	-	-	-	-	-
22																
23		Tax Payable					20.8	21.6	22.2	22.9	23.6	24.2	24.5	24.8	25.1	25.3
24		Less Value of Imputation Credits				50.00%	(10.4)	(10.8)	(11.1)	(11.5)	(11.8)	(12.1)	(12.3)	(12.4)	(12.5)	(12.7)
25																
26		Maximum Allowable Revenue					286.2	292.1	296.1	301.0	305.0	252.7	252.1	251.4	250.5	249.5
27																
28		Tax Expenses														
29		- Opex					51.0	52.0	53.1	54.1	55.2	-	-	-	-	-
30		- Tax Depreciation					76.7	77.8	78.5	79.5	80.2	80.9	80.9	80.9	80.9	80.9
31		- Interest					89.3	90.3	90.5	90.9	91.0	91.0	89.5	87.8	86.0	84.2
32		Total Tax Expenses					216.9	220.1	222.0	224.6	226.5	172.0	170.4	168.8	167.0	165.1
33																
34		Tax Calculation														
35		Taxable Income					69.3	72.0	74.0	76.4	78.6	80.7	81.7	82.6	83.5	84.4
36		- Pre-tax income					69.3	72.0	74.0	76.4	78.6	80.7	81.7	82.6	83.5	84.4
37		- Tax loss carried forward					0.0	-	-	-	-	-	-	-	-	-
38		Tax payable				30.00%	20.8	21.6	22.2	22.9	23.6	24.2	24.5	24.8	25.1	25.3
39		Value of Imputation Credits				50.00%	10.4	10.8	11.1	11.5	11.8	12.1	12.3	12.4	12.5	12.7
40		(intermediate tax calculation)					20.8	21.6	22.2	22.9	23.6	24.2	24.5	24.8	25.1	25.3
41																
42		Cash Flow Analysis Below This Line														
43																
44		Net Present Values														
45		RAB (start period)	Project NPV Check -	25.4		2,400.0	2,428.2	2,431.6	2,444.4	2,446.6	2,447.2	2,405.1	2,360.3	2,312.8	2,262.4	
46		PV for Returns on and of Asset only			2,552.9	224.8	229.3	231.9	235.4	238.0	240.6	239.9	239.0	238.0	236.8	
47		PV for Capex only			178.2	58.4	35.7	47.5	39.4	40.2	-	-	-	-	-	
48																
49		Nominal Cash Flow Analysis														
50		Capital Expenditure				2,400.0	58.4	35.7	47.5	39.4	40.2	-	-	-	-	-
51		Interest Payments				-	89.3	90.3	90.5	90.9	91.0	91.0	89.5	87.8	86.0	84.2
52		Repayment of Debt				(1,440.0)	-	16.9	-	2.0	-	7.7	-	1.4	-	0.4
53																
54		Nominal Cash Flow to Equity Holders														
55		- Pre-tax	Te =	21.48%	12.28%	(960.0)	104.5	116.1	112.8	117.9	119.0	136.4	135.8	135.0	134.2	133.3
56		- Post-tax			9.64%	(960.0)	83.7	94.5	90.5	95.0	95.4	112.2	111.3	110.3	109.2	108.0
57		- Post-tax + val of Imputation Credits			10.98%	(960.0)	94.1	105.3	101.7	106.4	107.2	124.3	123.5	122.7	121.7	120.7
58		Real Cash Flow to Equity														
59		- Pre-tax			10.08%	(960.0)	102.4	111.6	106.3	108.9	107.7	121.1	118.2	115.3	112.3	109.4
60		- Post-tax			7.49%	(960.0)	82.1	90.8	85.3	87.7	86.4	99.6	96.9	94.1	91.3	88.6
61		- Post-tax + val of Imputation Credits			8.80%	(960.0)	92.3	101.2	95.8	98.3	97.1	110.4	107.5	104.7	101.8	99.0
62		Net Cash Flow to Debt														
63		Deduction Utilised to Reduce Tax					89.3	90.3	90.5	90.9	91.0	91.0	89.5	87.8	86.0	84.2
64		Unutilised Deductions Carried Forward					-	-	-	-	-	-	-	-	-	-
65		Net Cash Flow to Debt	Td =	30.00%	4.34%	(1,440.0)	45.6	61.2	55.6	62.3	63.3	89.0	89.5	90.0	90.5	90.9
66		Nominal Cash Flows to Assets														
67		Cashflow to Asset			8.65%	(2,400.0)	176.9	204.4	195.5	207.5	209.6	252.7	252.1	251.4	250.5	249.5
68		Cashflow to Asset Post-tax			7.57%	(2,400.0)	156.1	182.8	173.3	184.5	186.0	228.5	227.6	226.6	225.4	224.2
69		Cashflow to Asset Real			6.52%	(2,400.0)	173.4	196.4	184.3	191.7	189.8	224.4	219.5	214.5	209.6	204.6
70		Cashflow to Asset Real Post-tax			5.46%	(2,400.0)	153.0	175.7	163.3	170.5	168.5	202.9	198.1	193.4	188.6	183.9
71		Check on Vanilla WACC Cash Flow(nom)			8.11%	(2,400.0)	166.5	193.6	184.4	196.0	197.8	240.6	239.9	239.0	238.0	236.8
72		Check on Vanilla WACC Cash Flow(real)			5.99%	(2,400.0)	163.2	186.1	173.8	181.1	179.2	213.6	208.8	204.0	199.1	194.3
73																
74		Further Dissection of Cash Flows														
75																
76		Return on Equity														
77		CF with Imputation					94.1	105.3	101.7	106.4	107.2	124.3	123.5	122.7	121.7	120.7
78		add back Capex					58.4	35.7	47.5	39.4	40.2	-	-	-	-	-
79		less Nominal Deprec of RAB					(30.2)	(32.4)	(34.7)	(37.2)	(39.6)	(42.1)	(44.8)	(47.5)	(50.4)	(53.3)
80		plus Debt Repayment					(16.9)	(2.0)	(7.7)	(1.4)	(0.4)	25.3	26.9	28.5	30.2	32.0
81		less Net Pre-tax Allowance for Tax (if any)					-	-	-	-	-	-	-	-	-	-
82		gives Nominal Return to Equity					105.4	106.6	106.8	107.3	107.4	107.5	105.6	103.6	101.6	99.3
83		less Inflation in Equity Component					(19.2)	(19.4)	(19.5)	(19.6)	(19.6)	(19.6)	(19.3)	(18.9)	(18.5)	(18.1)
84		gives Real Return to Equity					86.2	87.2	87.3	87.8	87.8	87.9	86.4	84.7	83.0	81.2
85		%ROE (1 year)					10.98%	10.98%	10.98%	10.98%	10.98%	10.98%	10.98%	10.98%	10.98%	10.98%
86		%real ROE (1 year)					8.80%	8.80%	8.80%	8.80%	8.80%	8.80%	8.80%	8.80%	8.80%	8.80%
87																
88		Equity at Start of Period					960.0	971.3	972.6	977.7	978.6	978.9	962.0	944.1	925.1	905.0
89		True Equity					960.0	971.3	972.6	977.7	978.6	978.9	962.0	944.1	925.1	905.0
90																
91		5 Year Analysis														
92																
93		Revenue				-	286.2	292.1	296.1	301.0	305.0	252.7	252.1	251.4	250.5	249.5
94		less Opex				-	(51.0)	(52.0)	(53.1)	(54.1)	(55.2)	-	-	-	-	-
95		less Interest				-	(89.3)	(90.3)	(90.5)	(90.9)	(91.0)	(9				

Operation and Maintenance expenditure

Opex is expressed as a single line item in the cash flow analysis.

The costs are forecast using historical information, projected cost drivers and industry benchmarks. These costs are treated as pass through items in establishing regulated revenues.

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, accelerated depreciation allowances and opex (rows 29 to 31).

Spreadsheet calculations

Tax payable by the TNSP in each period is calculated in rows 29 to 38, in three steps:

1. Pre-tax income is calculated as MAR less the estimated total tax expense (row 36).
2. Tax loss carried forward is calculated (row 37).
3. Taxable income (row 35) is then the sum of the above.

The tax costs (rows 29 to 31) used in calculating the pre-tax income in the period are the same as those in the building blocks (rows 17 and 21) with the exception of depreciation. In the case of the building blocks, depreciation (row 19) is calculated on the economic life of the asset (see row 56 of the **Assets** sheet). Tax depreciation is generally based on a much shorter tax life (accelerated depreciation) or calculated in a different way. This is specified in the **Assets** sheet (row 61).

The tax payable is recognised as a building block cost and added to the revenue building blocks (row 23). 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 24 and 39.

Cash flow analysis

Cash flow analysis is fundamental to the AER's revenue cap decisions. It provides a comprehensive check on the validity of decisions to ensure that the outcomes are consistent with the assumptions forming the basis of the decision. The **Analysis** sheet is designed to check that the desired rate of return on equity can be expected from the regulated revenue stream.

Net Present Values

The total returns on and of asset is calculated in Row 46. The PV for these cash flows at the start of Year 1 is calculated in cell F46. The PV for capex is calculated in cell F47. The PV can be used to show that the PTRM – Electricity Module is providing

the correct returns to the asset. The project net present value (NPV) check (cell F45) for the RAB should be equal to zero which indicates that the asset is receiving the correct returns. Note that the 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 55) 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 56) is obtained by further deducting the tax expense of the business. Row 57 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 CAPM calculation. The CAPM-determined r_e should be validated by the estimated cash flows (row 57).

The corresponding real cash flows and the respective IRRs are calculated in rows 59 to 61.

The difference in the IRR applying to pre-tax and post-tax cash flows to equity allows the effective rate of tax ($T_e = 1 - r_{\text{post}} / r_{\text{pre}}$) to be calculated. 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 substantially below the corporate tax rate for assets that can use accelerated depreciation.

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 63) 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 (T).

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 63 to 65.

That part of interest expense used to defer tax is calculated in each period (row 63) and the unused part carried forward is embodied in the tax loss carried forward calculation (row 64). This allows the net cost to the firm of paying debt holders, after taking account of the tax concession, to be calculated.

The IRR calculated (cell E65) 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.

Further dissection of cash flows

Rows 77 to 89 consider a further breakdown of net post-tax cash flow benefits available to equity holders.

Five year analysis

Rows 93 to 104 provide an additional analysis of the cash flow to equity holders over a period of five years, the typical regulatory period.

The purpose of this section is to confirm that the desired r_e target remains over one regulatory period. Rows 93 to 104 are essentially an expansion of the calculations used to derive row 57; that is, cash flow to equity holders inclusive of the value of imputation credits.

2.5 Smoothing Sheet

It is common for the revenue stream resulting from the building block approach to be volatile over the regulatory period (for example, due to the lumpiness of capex). The volatility associated with the calculated revenues, designed to deliver expected cost recovery, is regarded as undesirable as it can lead to correspondingly volatile prices to end users. Accordingly, the AER prefers to smooth the time profile of revenues by constraining it to follow a CPI-X path to prevent volatility in the revenues.

The **Smoothing** sheet applies the smoothing methodology to the ‘unsmoothed’ forecast revenues. Under this approach, revenues are increased annually by CPI-X where the X smoothing factor is set such that the NPV of the smoothed revenues is equivalent to the NPV of the unsmoothed revenue stream. This allows some cost recovery to be diverted to adjacent years within the regulatory period. For the PTRM – Electricity Module, the revenue in the first year is left unchanged and the X smoothing factor is calculated to achieve the desired NPV equivalence.

The X smoothing factor is simply a price adjustment mechanism does not relate to actual productivity improvements in operations. However, this does not mean the AER ignores productivity improvements when assessing a TNSP’s revenue requirements. Instead, the AER includes any expectation of productivity gains directly into the forecasts of costs.

Figure 5: Smoothing Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2		Revenue Smoothing														
3																
4		Year	0	1	2	3	4	5	6	7	8	9	10			
5																
6			Current MAR													NPV
7		Aggregate Revenue Forecast (\$m)	\$ 285.00	\$ 286.23	\$ 292.13	\$ 296.08	\$ 301.02	\$ 305.03	-	-	-	-	-			\$1,175.90
8																
9		Smoothed Revenue (\$m)		\$ 286.23	\$ 291.11	\$ 296.07	\$ 301.11	\$ 306.25	-	-	-	-	-			\$1,175.90
10																
11		X Factor	0.29%													
12																

The unsmoothed revenue forecasts (row 7) are sourced from the **Analysis** sheet. This revenue stream is then automatically smoothed according to the smoothing principle described above and recorded in row 9. The NPVs for the unsmoothed and smoothed revenues (in cells P7 and P9 respectively) should be equal. The resulting X smoothing factor is shown in cell C11.

2.6 Price Path Sheet

The NER requires the AER to set the MAR for TNSPs but does not require the AER to set or administer transmission prices. Therefore, the **Price Path** sheet is for illustrative purposes only. It aims to provide an indication of the impact that the AER's revenue decision may have on transmission prices.

Figure 6: Price Path Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2		Price Path Analysis																
3																		
4		Year	0	1	2	3	4	5	6	7	8	9	10					
5																		
6		Energy (MWh)		200,000	210,000	220,000	230,000	240,000	250,000	-	-	-	-	-				
7																		
8		Smoothed Revenue (\$m)		285,000,000	286,229,039	291,107,165	296,068,428	301,114,244	306,246,055	-	-	-	-	-				
9																		
10		Price Path (\$/MWh)	\$	1,425.00	\$	1,362.995	\$	1,323.214	\$	1,287.254	\$	1,254.643	\$	1,224.984	-	-	-	-
11																		
12		Annual Percentage Impact on Prices			-4.35%	-2.92%	-2.72%	-2.53%	-2.36%	-	-	-	-	-				
13																		
14																	Total Average	-15% -3%

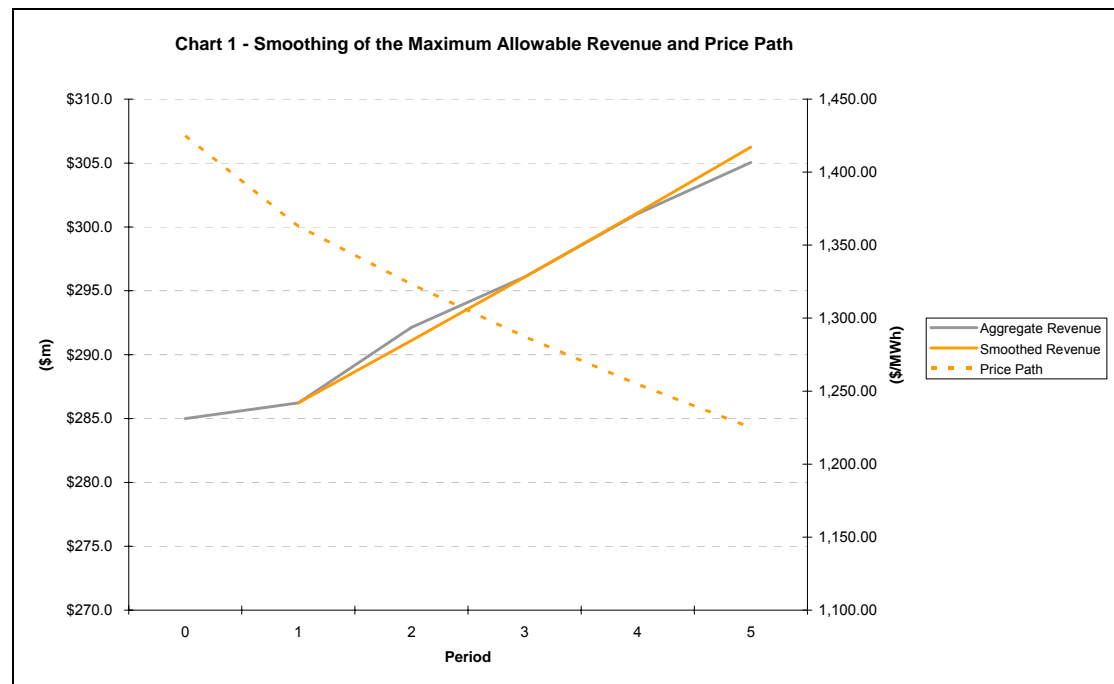
The energy delivered forecasts are sourced from the **Input** sheet and the smoothed revenues are sourced from the **Smoothing** sheet. They are displayed in rows 6 and 8.

The price path is calculated as the smoothed revenue divided by energy delivered forecast (row 10 = row 8/row 6). The network pricing provisions of the code are a more complex set of calculations and details on pricing outcomes should be sought from individual TNSPs. In row 12, the annual percentage impact on prices is calculated to approximately show how much transmission pricing is expected to change each year over the regulatory period.

2.7 Chart 1 – MAR Sheet

The **Chart 1 – MAR** sheet displays a chart which incorporates:

- the unsmoothed revenue forecasts (\$m) from the **Smoothing** sheet
- the smoothed revenue stream (\$m) from the **Smoothing** sheet
- the price path (\$/MWh) from the **Price Path** sheet



2.8 Chart 2 – Building Blocks Sheet

The **Chart 2 – Building Blocks** sheet displays the MAR and the various building block cost components, including:

- net tax costs
- regulatory depreciation
- opex
- return on capital

This information is sourced from the **Analysis** sheet.

