TRANSGRID REVENUE RESET

An independent review

Prepared for

AUSTRALIAN ENERGY REGULATOR

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EXECUTIVE SUMMARY

The Australian Energy Regulator (AER), in accordance with its responsibilities under the National Electricity Rules (NER) is required to conduct an assessment of the appropriate revenue determination to be applied to the prescribed transmission services provided by TransGrid for the period from 1 July 2009 to 30 June 2014. The previous revenue cap review for TransGrid was conducted by the Australian Competition and Consumer Commission (ACCC). The AER assumed responsibility for the regulation of transmission revenues in the National Electricity Market from the ACCC on 1 July 2005.

PB has been engaged by the AER to conduct a review of aspects of TransGrid's proposal in support of the AER undertaking its revenue determination assessment. The overall objective of PB's engagement is to undertake an assessment of the historical and forecast (ex-ante) expenditure proposals for both capital expenditure (capex) and operational expenditure (opex) – as submitted to the AER by TransGrid. This has enabled PB to formulate an independent view on the reasonableness of the past expenditure, and also the prudence and efficiency of that proposed for the forthcoming regulatory period.

TIMETABLE

The current regulatory period for TransGrid ceases on 30 June 2009. To comply with the NER, the AER is required to publish its final decision two months before the commencement of TransGrid's next regulatory period. Therefore, the AER is required to publish its final decision by 30 April 2009. The new revenue determination for TransGrid will take effect from 1 July 2009.

SCOPE

In this independent review of the TransGrid revenue proposal, PB considers, examines, and provides its expert opinion, on the following key submission items and expenditure categories:

- historical network capital expenditure (capex) over the current regulatory period
- forecast (ex-ante) network capex
- non-system capex (e.g. IT, vehicles, 'support-the-business' costs etc.)
- forecast operational expenditure (opex)
- service standards
- capital governance framework.

In reviewing these matters, and in developing our recommendations, PB has adopted the high-level methodology set out below.

PB'S APPROACH TO THE REVIEW

The approach adopted by PB is both well established and proven and recognises the benefits of a methodology which examines the expenditure proposals in a number of different ways. This multi-dimensional approach combines a high-level ('top-down') assessment with a detailed ('bottom-up') assessment of a number of (carefully) selected projects and expenditure items. Our approach also includes a review of the governance processes and policies employed by TransGrid in making its investment decisions.

This 'multi-dimensional' approach to the review of TransGrid has combined the following key elements:

- a review of TransGrid's governance systems, processes, policy and practice
- benchmarking and comparative analysis ('top-down'), including

  - the impact of proposals on the average age of the TransGrid's asset base
  - analysis at total expenditure level (opex and capex) with other Transmission Network Service Provider (TNSPs)
  - a review of unit costs (obtained from detailed project reviews)
- a detailed examination of a selection of forecast ex-ante projects ('bottom-up')
- a high level examination of a historical capex, across major expenditure categories
- PB's direct experience of other network businesses (including TNSP reviews).

Through this approach PB has developed an independent view on the TransGrid proposal which we believe is robust, credible and defensible.

PB's review has included nine detailed network capex project reviews, and two non-system capex reviews, as well as a review of TransGrid's replacement programs. Our detailed project reviews covered approximately 32% of the total proposed ex-post capex.

The review of TransGrid's historical capex has focussed on understanding significant expenditure variations compared to the April 2005 ACCC allowance, in order to be informed of the how the drivers for any variations could influence the forecast capex proposed for the 2009/10-2013/14 regulatory period.

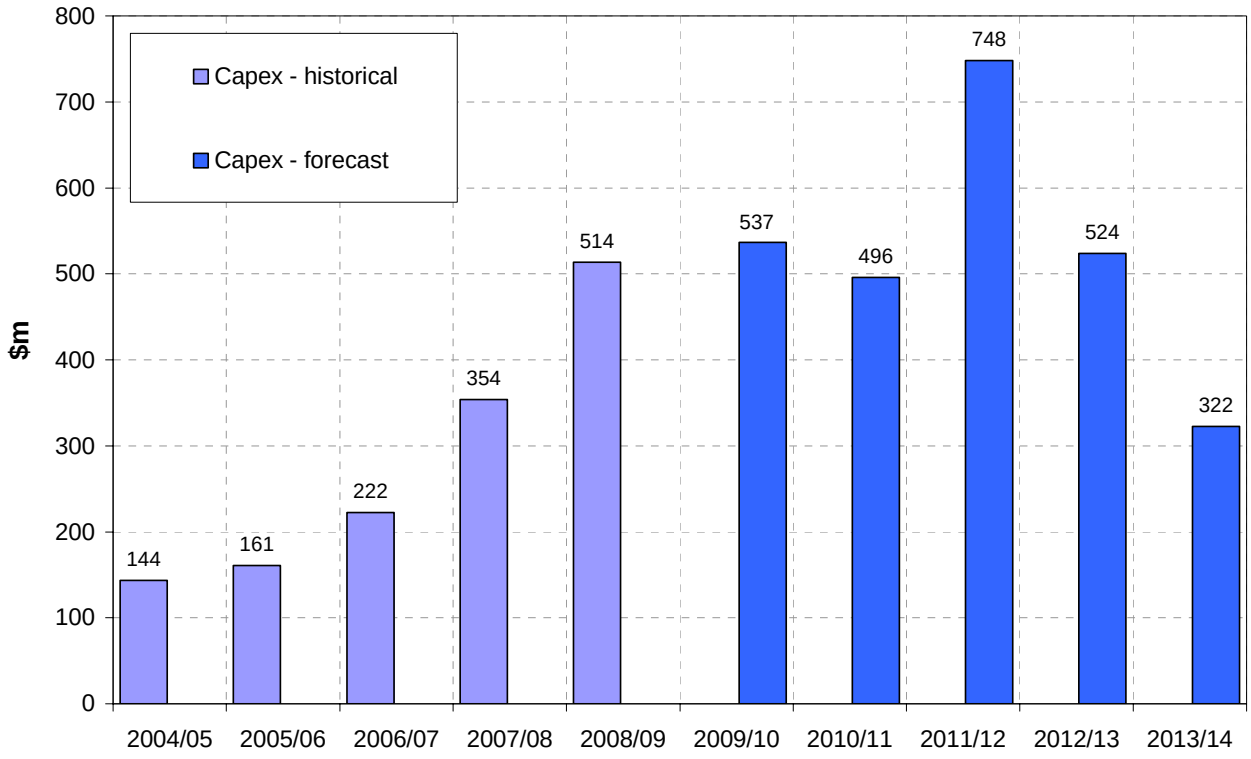
PB enjoyed the full cooperation of TransGrid throughout the process – with unhindered access to appropriate staff and information.

TRANSGRID PROPOSAL

The trend of TransGrid's historical and forecast total capex is shown in Figure E1. The average annual capex spend for 2004/05 to 2008/09 was $279m compared with a forecast annual capex of $525m for the next regulatory period. In real terms, the forecast (ex-ante) capex for 2009/10 to 2013/14 is approximately 88% higher than the expenditure of the previous five year period.

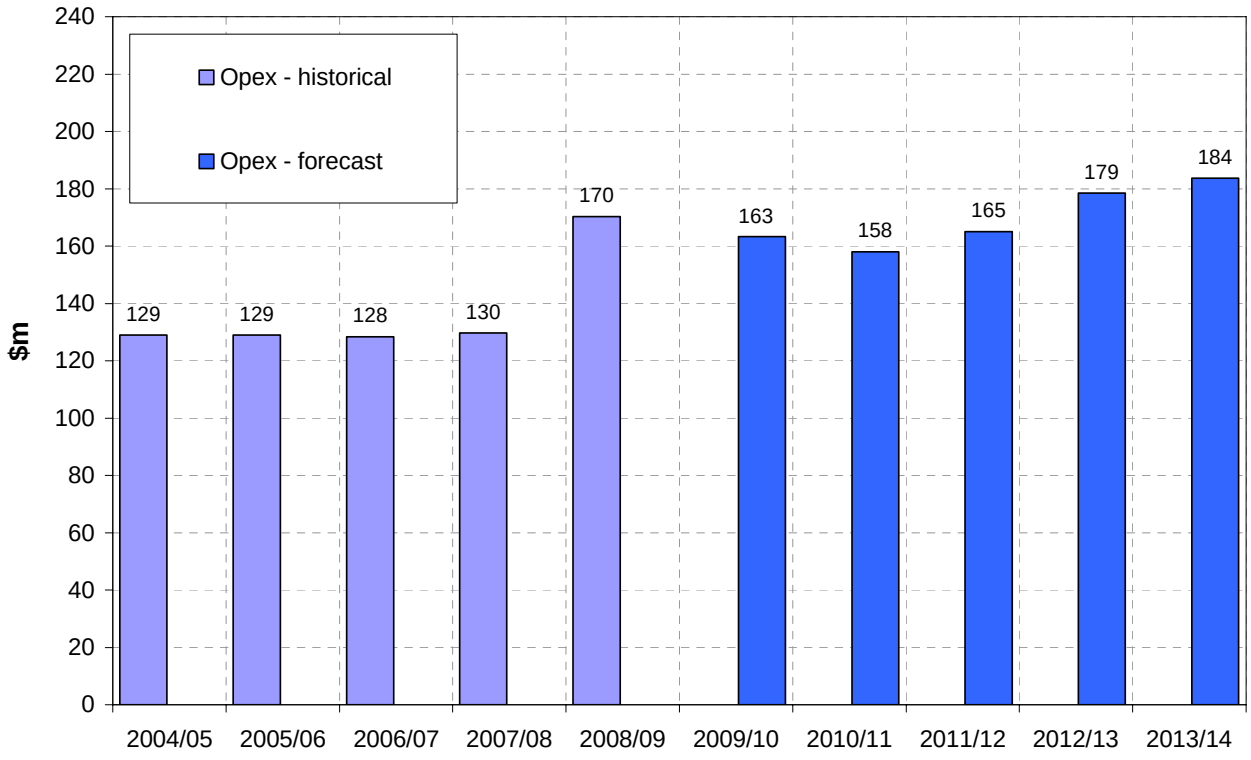
The trend of TransGrid's historical and forecast total opex is shown in Figure E2. The average annual opex spend for 2004/05 to 2008/09 was $137m compared with a forecast annual opex of $170m for the next regulatory period. In real terms, the forecast (ex-ante) opex for 2009/10 to 2013/14 is approximately 24% higher than the expenditure of the previous five year period.

Figure E1 – TransGrid actual and forecast capex (real 07/08)



Source: PB analysis.

Figure E2 – TransGrid actual and forecast opex (real 07/08)



Source: PB analysis - Note 1: The additional opex spend in the 08/09 period relates to additional network support costs associated with a project in Western Sydney.

Through PB's comprehensive review of the TransGrid revenue proposal and the TransGrid organisation, processes, and systems, we have been able to formulate the following key conclusions:

CAPITAL GOVERNANCE AND INVESTMENT DECISION MAKING

As part of the review, and through the detailed project reviews, PB has examined the processes and systems associated with TransGrid's investment decisions and the management of its transmission assets. PB's observations and opinions regarding TransGrid's governance processes and systems include:

- TransGrid is seriously committed to ensuring that appropriate governance process are in place and has undertaken a significant review and restructure of its governance processes as they apply to major capital projects
- TransGrid has evidenced that it is considering non-network alternatives
- no clearly defined criteria are applied to strategic property purchases and there is a risk that property purchased may ultimately not be required, may not be suitable, or the purchase may influence options analysis outcomes.

PB's observations and opinions regarding TransGrid's planning process includes:

- TransGrid's planning and documentation processes appear well structured and consistent with good industry practice and reflective of its reliability based planning obligations under the NER and NSW jurisdictional requirements
- TransGrid's application of alternative analysis (options analysis) is limited, and in cases sampled the documentation has not captured all the information relevant to demonstrating the difference in value between the alternatives considered.

PB's observations and opinions regarding TransGrid's asset management strategy include:

- TransGrid's asset management processes are consistent with good industry practice.

PB's observations and opinions regarding TransGrid's coordination with other parties include:

- TransGrid has an established process for consultation with interested parties which is structured to comply with its obligations under the NER.

HIGH-LEVEL BENCHMARKING AND COMPARATIVE ANALYSIS

PB's observations and opinions regarding the high-level capex and opex benchmarking of TransGrid include:

- TransGrid benchmarks relatively high with a per annum capex to RAB value of around 12.8% – this is not materially different to other businesses
- TransGrid is well below the benchmark group with a per annum non-growth capex to RAB value of around 2.5% – which may be indicative of the age and condition of the plant and equipment and/or indicative of relatively efficient asset replacement strategies
- TransGrid is investing a similar amount of growth related capex per MW increase in peak summer demand compared with its peers
- TransGrid's proposed operating expenditure per dollar of RAB is the second lowest in the benchmark sample group
- TransGrid's investment benchmarks favourably with TNSPs in other NEM jurisdictions.

HIGH-LEVEL REPLACEMENT CAPEX ESTIMATES

PB's observations and opinions regarding TransGrid's replacement capex proposal include:

- TransGrid's proposed network replacement capex is approximately 38% below PB's high-level indicative cap benchmark and on the basis of this simple model, TransGrid's proposed ex-ante replacement capex allowance of $493.4m is not unreasonable.

COST ESTIMATING

PB's observations and opinions regarding TransGrid's cost estimating includes:

- TransGrid's cost estimating database is sound and suitable for the purposes intended
- TransGrid's use of %-based cost estimating factors lacks transparency, consistency in application, and their use is un-auditable
- TransGrid's unit plant and equipment costs benchmarked within PB's anticipated reasonable ranges
- TransGrid's should be encouraged to apply more rigour to the development of its high level project estimates and proposed project definitions, particularly for projects of a significant value.

HISTORICAL NETWORK CAPEX

PB's observations and opinions regarding TransGrid's historical network capex include:

- no issues were identified with regards to augmentation, land & easements, and replacement capex
- no issues or areas of concern were identified with the control of historical capex.

FORECAST NETWORK CAPEX

PB has also reviewed the process and factors that TransGrid has applied in arriving at its proposed ex-ante capex proposal. PB has also undertaken a detailed review of nine projects and the replacement program within TransGrid's proposed ex-ante allowance. These reviews have covered all project categories as well as a broad range of asset types and comprise approximately 32% of the proposed network-related capex allowance of $2.47b. From our review, PB's observations and opinions include:

With regards to the forecast capex allowance methodology:

- the methodology use by TransGrid in the preparation of the capex proposal is systematic, appropriate for this purpose, and has been suitably applied in determining its ex-ante capex proposal.

With regards to the probabilistic methodology and scenario planning process:

- TransGrid's scenario planning and probabilistic methodology is sound, and represents a robust process that is well documented and evidenced, and the development of the scenario probabilities is well considered, with realistic final scenario probabilities.

With regards to the cost accumulation methodologies and outcomes:

- in general the material escalators are reasonable, however TransGrid's proposed producer's margin escalator has not been reasonably determined and an adjustment is recommended
- TransGrid's proposed steelwork escalation weightings unreasonably weight toward higher escalated components

- the 5 year aggregate weighting of escalator components does not account for the variation in the project work being undertaken from year to year, and an adjustment is recommended to reflect that it should
- TransGrid's proposed s-curves are reasonable
- given recent significant global economic developments, the impacts on the labour and material cost escalation rates should be considered by the AER in making its determination.

With regards to the risk adjustment:

- the methodology used in modelling the risk adjustment is generally sound and appropriate to its application
- the methodology used in determining the cost variance for the cost distributions is not transparent, lacks evidence and is ultimately un-auditable
- the methodology used in determining the cost variance for the cost distributions fails to ensure that only cost variances appropriate to the analysis are captured and adjustments to the risk allowance are recommended.

With regards to replacement or reconfiguration of a connection asset:

- no connection assets were identified that are clearly inappropriately classified.

With regards to deliverability of the ex-ante projects and programs:

- TransGrid has adopted a number of appropriate strategies that will contribute to the successful delivery of a capital program of the size proposed, and should be able to deliver the planned program across the five years to 2013/14.

As an outcome of our review, PB's recommendation of an efficient and reasonable level of forecast network capex is $2,498.2m, a reduction of 4.9% from the original proposal. Adjustments recommended by PB to arrive at this level are detailed in Table E-2.

Table E-2 – Final recommendation for TransGrid's total forecast capex allowance

Expenditure $m (real 2007/08)	Ref.	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Bannaby - South Creek 500 kV lines and substation	5.4.3	-	-	-	-	-	-
Holroyd - Chullora 330 kV cable	5.4.4	-	-	-	-	-	-
Dumaresq - Lismore 330 kV line	5.4.5	(1.2)	(17.6)	(17.6)	-	-	(36.4)
SW NSW microwave & satellite	5.4.6	-	-	-	-	-	-
Wallerawang No.1 &No.2 transformer	5.4.7	(0.3)	-	-	-	-	(0.3)
Cooma 132 kV substation replacement	5.4.8	4.8	4.8	3.8	(6.5)	(25.2)	(18.2)
Beaconsfield West 132 kV GIS replacement	5.4.9	(0.4)	(1.2)	(1.8)	(4.7)	-	(8.1)
Newcastle 330 kV substation transformer replacement	5.4.10	-	-	-	(10.5)	-	(10.5)
Hunter Valley - Central Coast 500 kV line easements	5.4.11	-	-	-	(0.1)	(0.9)	(1.0)
Replacement programs	5.4.12	(0.8)	(2.0)	(1.0)	(0.9)	(0.9)	(5.6)
Escalation adjustments (factors)	5.3.1	(0.4)	(1.6)	(3.3)	(2.6)	(1.3)	(9.4)
Yearly weightings	5.3.2	1.1	1.9	(4.2)	(2.3)	(0.1)	(3.6)
Agreed CAM adjustments	5.4.1	(2.0)	(1.8)	(2.9)	(2.0)	(1.2)	(9.9)
Risk allowance adjustments	5.3.4	(2.4)	(2.2)	(3.4)	(2.4)	(1.4)	(11.7)
Cost estimating factors adjustment	3.5.3	(2.8)	(2.6)	(4.0)	(2.8)	(1.7)	(13.9)
PB total adjustment		(4.4)	(22.3)	(34.3)	(34.8)	(32.6)	(128.6)
TransGrid submitted total ex-ante capex		536.8	495.9	748.0	523.8	322.3	2,626.8
PB total adjustment - %		(0.8%)	(4.5%)	(4.6%)	(6.7%)	(10.1%)	(4.9%)

Source: PB analysis.

CONTINGENT PROJECTS

As a result of PB's review of the proposed contingent projects in accordance with the NER, we have recommended that nine of the 18 contingent projects are included; with the remainder of the projects rejected due to the lack of reasonably specific and objectively verifiable trigger events.

NON-NETWORK CAPEX

TransGrid has forecast its non-network capex for the period 01 July 2009 to 30 June 2014 to be $156.3m ('as incurred', real 2007/08). PB has examined the non-network capex over the ten year period 01 July 2003 to 30 June 2014. Our review included the detailed review of two major categories of non-network capex and has been informed by benchmarking comparisons.

PB's observations and opinions regarding TransGrid's non-network capex proposal include:

- TransGrid's total non-network capex proposal is in line with similar businesses and is reasonable
- TransGrid is expending an equivalent amount to other businesses on business IT
- while TransGrid has a strong IT policy and management governance structure, in some minor areas, policies have not been prescriptively followed – however this did not materially impact on the investment decisions

- TransGrid's process for vehicle expenditure forecasting is sound, the need for investment is reasonable, and the proposed expenditure is efficient.

FORECAST OPERATIONAL EXPENDITURE

PB has undertaken a critical review of TransGrid's opex submission, associated documentation, historical opex performance, and in particular TransGrid's opex model, the underlying model assumptions and forecasting methodologies used to determine the proposed operating expenditure for the next regulatory period. In addition, PB also reviewed the methodology used by TransGrid to allocate costs between opex and capital works.

PB's observations and opinions regarding TransGrid's opex proposal include:

- TransGrid's opex model (version 4.5a) and its inputs incorporates assumptions and forecasting methodologies that produce reasonable projections of operational expenditures
- the Willis Risk Practice Australia report findings and recommendations are reasonable, and are incorporated into TransGrid's opex model (version 4.5a)
- TransGrid's Other Controllable Cost categories forecasts are reasonable
- the base year cost of $114.90m (2007/08) represents a reasonable operational expenditure from which to project future recurring operational costs
- TransGrid's method of forecasting defect rectification expenditures is sound and the forecast defect ratios incorporated into the opex modelling are reasonable
- the methodology used to escalate operational effort in TransGrid's opex model to reflect the impact of the proposed capital works program is reasonable; however, we believe that the valuation of the existing TransGrid assets is low
- we recommend that the forecast additional operational expenditures should be calculated using a current replacement value of the existing network of $7,814m (06/07)
- the efficiency of scale factors incorporated into TransGrid's opex modelling are reasonable
- the methodology used by TransGrid to allocate costs between opex and capital works is reasonable
- the methodology adopted and applied to determine any opex/capex trade-off appears sound
- TransGrid's approach to managing its land and easements should result in lower costs than the current reactive approach
- the projects included in the MOPS listing appear prudent and reasonable costs have been appropriately incorporated in TransGrid's opex model
- the reasonable cost of self insurance to be included in the revenue determination is $3,128,000 per annum – a recommended reduction of $41,000 per annum compared to TransGrid's proposal
- given the uncertainty around the timing of projects, TransGrid's proposed network support payments should be accepted
- the defect rectification included in TransGrid's opex model resulting from new growth-related assets during the next regulatory period should be removed from the annual operating forecasts

Table E3 summarises PB's recommendations for TransGrid's operational expenditure. For completeness this table includes debt and equity raising costs which were not included in the scope of PB's review. PB makes no recommendation in respect of these costs.

The adoption of our recommendations results in total forecast opex for the 5-year regulatory period of $809.9m (real, 2007/08 dollars), a reduction of $38.5m (4.5%) from TransGrid's submitted opex forecast of $848.4m.

Table E-3 – Final recommendation for TransGrid's total opex forecast

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
TransGrid's proposal						
Controllable opex	135.2	144.4	149.7	161.8	166.5	757.6
Debt raising	3.7	4.0	4.3	4.8	5.1	21.9
Equity raising	0.9	1.7	3.1	4.0	4.2	13.9
Self-insurance	1.91	1.91	1.91	1.91	1.91	9.6
Network Support	21.5	6.0	6.0	6.0	6.0	45.5
Total regulatory opex	163.2	158.0	165.0	178.5	183.7	848.4
PB's recommendation						
Controllable opex	131.15	136.97	140.60	150.29	153.93	712.9
Debt raising	3.7	4.0	4.3	4.8	5.1	21.9
Equity raising	0.9	1.7	3.1	4.0	4.2	13.9
Self-insurance	3.13	3.13	3.13	3.13	3.13	15.65
Network Support	21.5	6.0	6.0	6.0	6.0	45.5
Total regulatory opex	160.4	151.8	157.1	168.2	172.4	809.9
Variation	(2.8)	(6.2)	(7.9)	(10.3)	(11.3)	(38.5)

Source: PB and TransGrid.

SERVICE STANDARDS

While the parameters forming the Service Target Performance Incentive Scheme (STPIS) were fixed prior to TransGrid's Revenue Proposal submission, PB has undertaken a review of TransGrid's proposed values for the established parameters. This review includes recommending appropriate targets, collars, caps and weightings.

PB's makes the following observations and recommendations regarding TransGrid's proposed STPIS parameter values:

- TransGrid's historical and current data collection systems are suitable for the accurate reporting of the STPIS parameters
- TransGrid has proposed targets, caps, and collar values that are consistent with the STPIS principles
- TransGrid's proposed weightings are reasonable and provide appropriate incentives to maintain and improve reliability for customers, which is consistent with the objectives for the scheme as set out in clause 1.4 of the STPIS

Adjustments to the targets, caps, and collar values are recommended based on the information presented and revisions to the outage hours associated with TransGrid's ex-ante capital works program. In summary, PB recommends that the values for the six performance parameters shown in Table E-4 be included in TransGrid's performance incentive scheme.

Table E-4 – Recommended performance incentive scheme

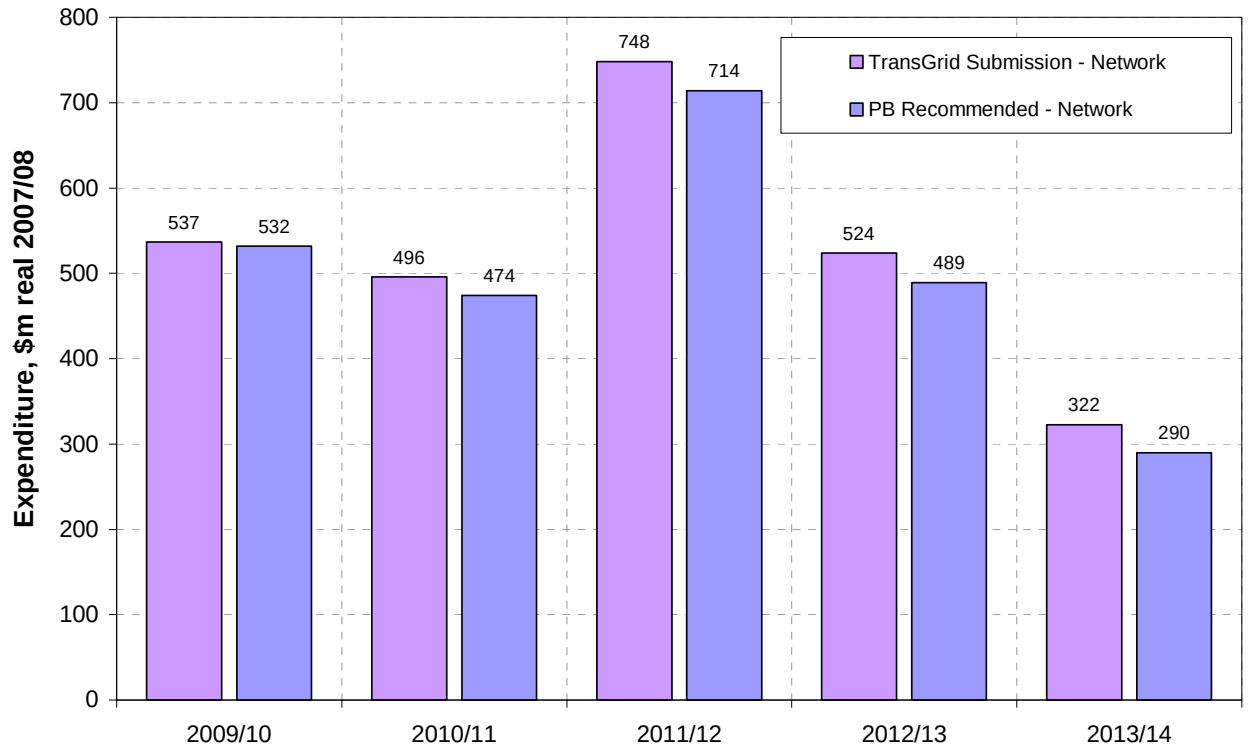
Measure	Unit	Max penalty	Start penalty	Target	Start bonus	Max bonus	Weighting (%)
Transmission line availability	%	98.99	99.20	99.20	99.20	99.31	20
Transformer availability	%	97.26	98.55	98.55	98.55	98.83	15
Reactive plant availability	%	98.65	99.13	99.13	99.13	99.33	10
Loss of supply events > 0.05 system minutes	number	7	4	4	4	2	25
Loss of supply events > 0.25 system minutes	number	2	1	1	1	0	10
Average outage duration (capped 7 days)	minutes	999	824	824	824	649	20

Source: PB analysis.

SUMMARY OF PB EXPENDITURE RECOMMENDATIONS

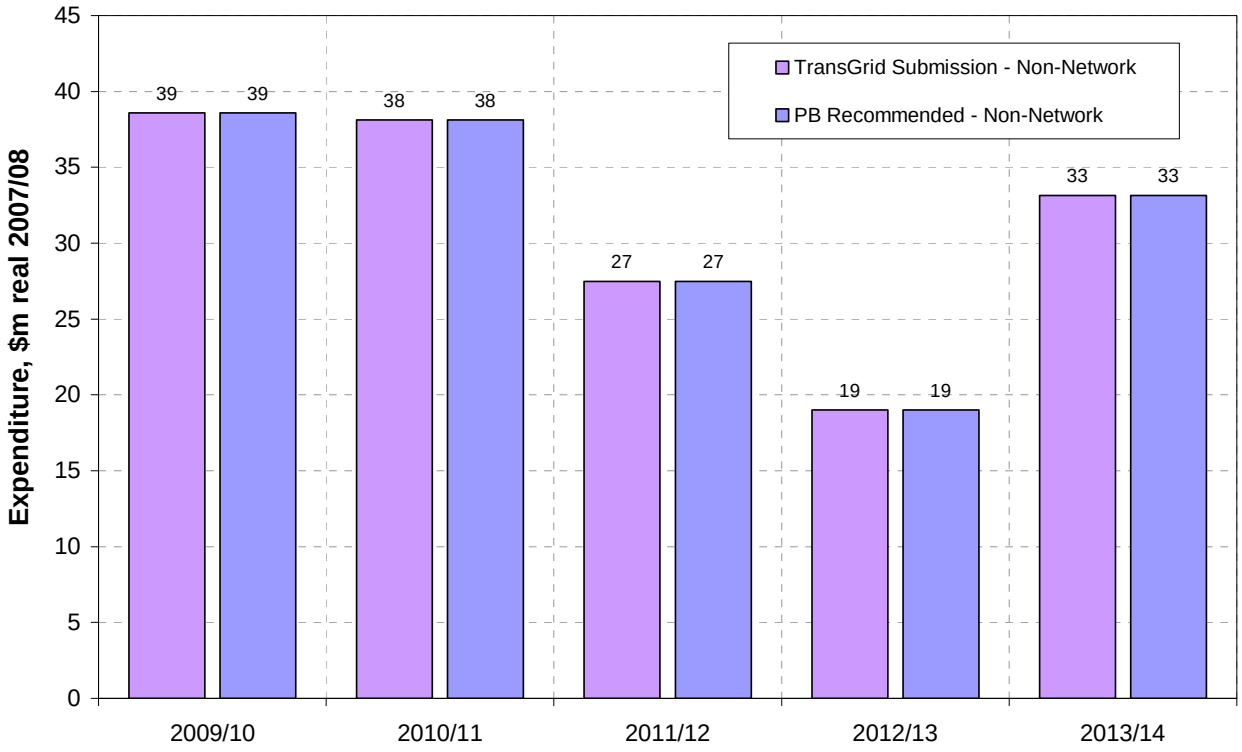
Figures E3 to E5 present PB's recommended adjustments to TransGrid's submission based on the overall findings of our review.

Figure E3 – Adjustments to forecast network capex ($m real 07/08)



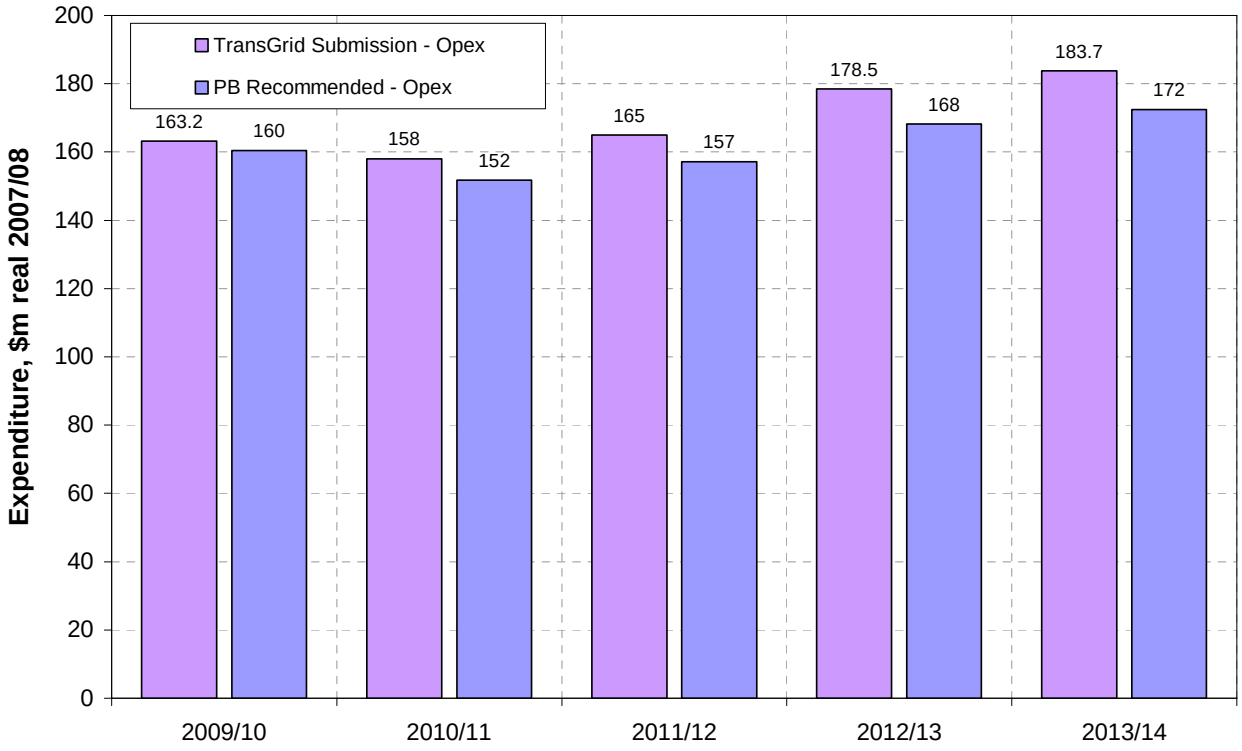
Source: PB analysis.

Figure E4 – Adjustments to forecast non-network capex ($m real 07/08)



Source: PB analysis.

Figure E5 – Adjustments to forecast opex ($m real 07/08)



Source: PB analysis.

1. INTRODUCTION

In this section of the report we provide some background to the review, together with an overview of the requirements of the engagement in the context of the regulatory framework associated with the New South Wales electricity transmission arrangements, and describe the PB approach to the work. We also set out the structure of this report.

1.1 BACKGROUND TO THE REVIEW

The Australian Energy Regulator (AER), in accordance with its responsibilities under the National Electricity Rules (NER), is required to conduct an assessment into the appropriate revenue determination to be applied to the prescribed transmission services provided by TransGrid from 1 July 2009 to 30 June 2014 (the next regulatory control period). The previous revenue cap for TransGrid (2004/05 to 2008/09) was determined by the Australian Competition and Consumer Commission (ACCC) in April 2005. The AER assumed responsibility for the regulation of transmission revenues in the National Electricity Market from the ACCC on 1 July 2005.

After a series of pre-lodgement meetings to facilitate its proposal, TransGrid submitted its revenue proposal and proposed negotiating framework and pricing methodology to the AER on 31 May 2008. The AER conducted a preliminary examination of TransGrid's proposal, as required by the Rules, and found the proposal satisfied the requirements of the AER's Submission Guidelines and the NER.

As part of the AER's assessment, PB Strategic Consulting (PB) has been engaged as an independent expert to review aspects of TransGrid's proposal. Specifically, past and forecast capital expenditure (capex), operational expenditure (opex), associated policies and procedures, and service standards proposals. This review has been conducted with due regard to the NER, particularly chapter 6A. PB's complete terms of reference is included in Appendix A.

1.2 PROJECT OBJECTIVE

PB has been engaged by the AER to conduct a review of TransGrid in support of the AER undertaking its revenue determination assessment. This work has involved conducting a review of, and providing advice to, the AER on TransGrid's capex, its opex and its service standard proposals.

PB is aware of the requirements of the Rules placed on the AER, as well as the Statement of Principles for the Regulation of Electricity Transmission Revenues. In undertaking its review, PB has employed a proven methodical approach, which addresses each of the specific items in the AER terms of reference. This approach is described in more detail in Section 1.4 of this report.

The overall objective of this review is to undertake a high level assessment of the historical capex and a more detailed review of the forecast (ex-ante) expenditure proposals — as submitted to the AER by TransGrid. This assessment has enabled PB to formulate an independent view on the reasonableness, prudence and efficiency of the expenditure for the next regulatory period. The review of TransGrid's capital expenditure extends to its investment in augmentation associated with electricity demand growth and non-demand capex associated with matters such as replacement, refurbishment and non-network items.

It is intended that the results and conclusions of this review by PB will assist the AER in its obligation to determine the regulated revenue requirements associated with TransGrid's electricity transmission assets going forward.

Process and project timetable

The current regulatory period for TransGrid ceases on 30 June 2009. To comply with the NER, the AER is required to publish its final decision two months before the commencement of TransGrid's next regulatory period. Therefore, the AER is required to publish its final decision by 30 April 2009. The new revenue determination for TransGrid will take effect from 1 July 2009.

The PB review timeline, and its coordination with the AER timetable, is shown in Table 1-1. A more detailed description of the PB element of the review process is set out in Section 1.4.1.

Table 1-1 – Project timetable

Action	Date
PB attends briefings and meetings with TransGrid prior to lodgement of revenue proposal.	April - May 2008
PB appointed by AER	28 May 2008
TransGrid submit revenue proposal to AER	31 May 2008
PB to provide preliminary issues and questions	23 June 2008
Key face to face meetings with TransGrid	Week ending 11 July 2008
PB to provide interim draft report on issues	25 July 2008
Public forum	30 July 2008
PB draft report to AER	31 August 2008
TransGrid comment on PB draft report[1]	10 September 2008
PB final report to AER	30 September 2008
AER to release its draft decision (and publication of PB report)	30 November 2008
AER to release its final decision	30 April 2009

1.3 OVERVIEW AND CONTEXT

This section provides some background information regarding TransGrid, and describes the regulatory context within which the PB review has taken place.

1.3.1 About TransGrid

As outlined in its revenue proposal documentation, TransGrid's electricity transmission system incorporates:

- 12,442 kilometres of high-voltage overhead transmission line and underground cable operating at voltages of up to 500 kV
- 83 substations and switching stations
- 48 connection points to generators, located in western NSW, the Central Coast, Hunter Valley and the Snowy Mountains

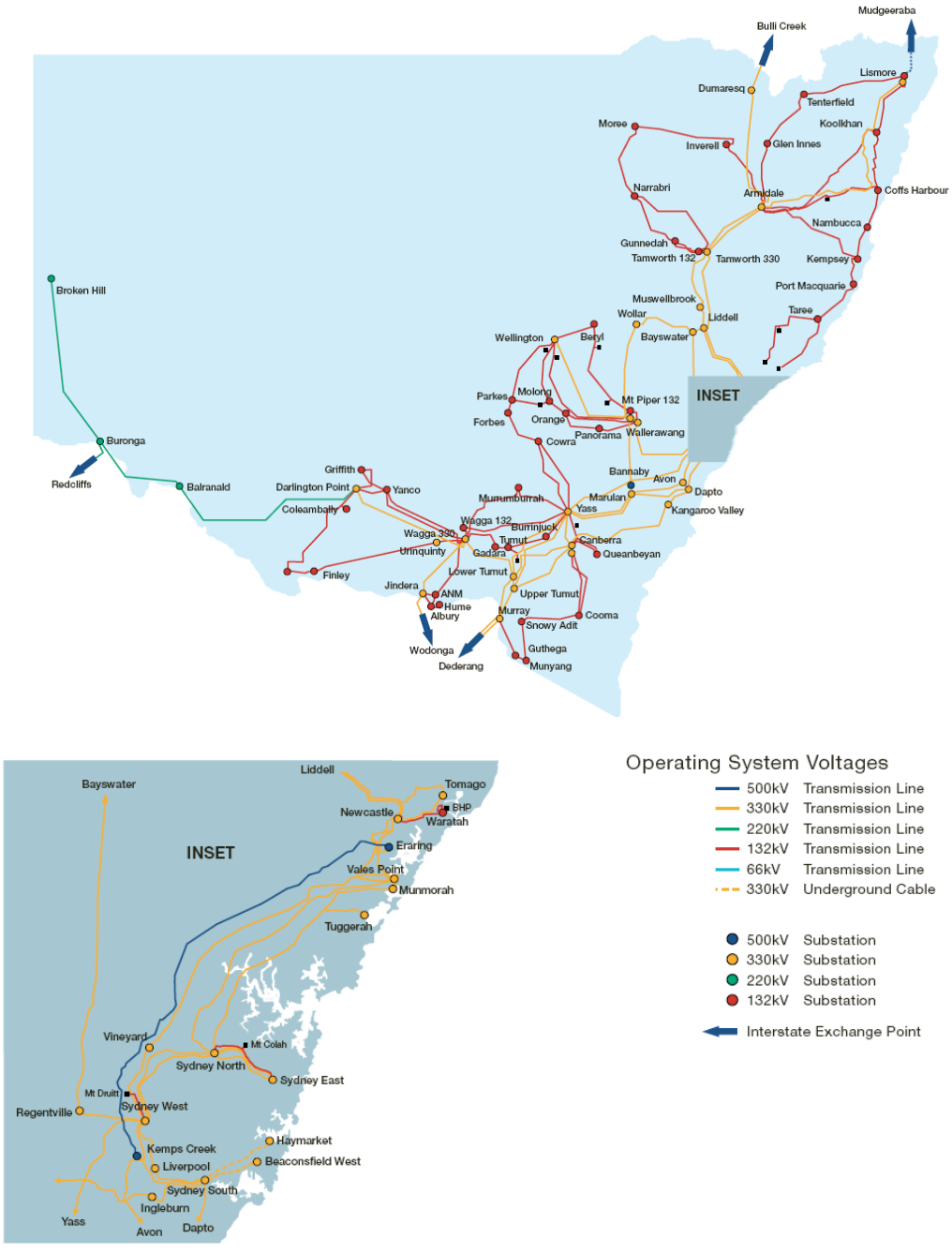
[1] This initial review of PB's report by TransGrid is limited to comments on errors of fact and confidentiality. By agreement with the AER, TransGrid has provided comments on issues not raised prior to the draft report.

- 325 distributor and direct-customer connection points
- five physical interconnectors to Victoria and Queensland.

Approximately 60% of the energy generated in NSW is generated west of the Great Dividing Range but must be delivered to the east coast, where most of the state's load is located. Transmission access to major load centres is constrained by a number of National Parks and Wilderness areas. The geographical operating environment is a major factor in the historical development of the transmission system and in TransGrid's cost structure to operate and maintain it.

The TransGrid geographic electricity transmission region is shown in Figure 1-1; it effectively covers the state of New South Wales.

Figure 1-1 – The TransGrid electricity transmission area



Source: TransGrid revenue proposal document, page 13.

As of 30 June 2007, TransGrid employed 942 staff, had an asset base of $3,929m, a gearing ratio of 46% and an operating profit before tax of $172m[2].

1.3.2 Changes since the last TransGrid revenue cap review

TransGrid's application to the ACCC to re-set its revenue allowance for the period 1 July 2004 to 30 June 2009 was initiated in 2003 and undertaken on the basis of the ex-post regulatory regime that was applicable at that time.

During the course of that review, the ACCC suggested fundamental changes to the regulation of capital investment as part of the publication of its review of the Draft Regulatory Principles – effectively the transition from an ex-post framework (which was perceived to present significant uncertainty and therefore risks to the businesses) to an ex-ante one. On this basis, and after resubmitting its future capex application in accordance with the new framework, TransGrid's forward capex application was the first (in parallel with EnergyAustralia's) to be assessed based on an ex-ante allowance.

Since TransGrid's previous ex-ante review, there have been a number of changes to the changes to the ex-ante regulatory framework for transmission businesses, including:

- the AER has been established as a national regulator[3]
- the AER released its Compendium of Electricity Transmission Regulatory Guidelines in August 2005 (including the ACCC's final Statement of principles for the regulation of electricity transmission revenues (the SRP)
- the economic regulation of electricity transmission network service providers has been formalised as part of the consultation and completion of the NER Chapter 6A review
- and the AER's guidelines for revenue proposal submissions, including the information templates have been refined and finalised.

1.3.3 The regulatory framework and process

The ex-ante arrangements continue to provide the businesses with an incentive-based (CPI-X) framework. The form of regulation is the establishment of a revenue cap to apply to TransGrid for the regulatory period (of at least 5 years). In setting the maximum allowable revenue (MAR) for the next regulatory period the AER uses the 'building block' model. The MAR is determined, in its simplest form, as the sum of the return on capital[4], depreciation, opex plus an allowance for tax[5]. An asset-base roll-forward equation is used to adjust the value of the RAB to reflect depreciation and capital expenditure within the period.

Under the revised regulatory framework, the focus is placed on providing capital investment efficiency incentives at the start of the regulatory period. The framework provides for an ex-ante capex allowance and a provision for contingent projects.

Ex-ante allowance

The ex-ante allowance sets expectations on the level of investment which will be rolled into the RAB at the end of the regulatory period. It covers the majority of TransGrid's forecast expenditure.

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2 TransGrid Annual Report 2007.

3 For those jurisdictions participating in the National Electricity Market only; excludes Western Australia.

4 Weighted Average Cost of Capital (WACC) times the value of the Regulatory Asset Base (RAB).

5 Inclusion of the term for business (income) tax is a consequence of the application of a post-tax (nominal) WACC. Where previously, a pre-tax (real) WACC has been applied, no separate allowance for tax was included in the allowed revenue calculation.

The AER will determine the ex-ante allowance on the basis of an assessment of expected investments during the regulatory period. An important feature is that the allowance does not include approval of capex at a project-specific level. Although the AER may have included specific (expected) projects in determining the revenue allowance, this does not mean that TransGrid is obliged to develop those particular projects during the regulatory period.

With regard to the investments covered by the ex-ante capex allowance, the calculation of the closing RAB at the end of the regulatory period will be in accordance with the written down value of the *actual* investment during the period in question[6].

Contingent projects

The allowance for contingent projects is to provide for large and uncertain investments. The AER will exclude a project from the main ex-ante capex allowance if the expected error resulting from including the project in the main allowance is more than 5% of the total revenue required or greater than $10m[7] in the first year of the period. Projects excluded from the main allowance must be linked to defined drivers or 'triggers', such as the potential establishment of a new large single load customer or a new generator. Contingent project status will not normally be granted where expenditure is linked to more general drivers such as regional load growth etc, and those that can not be objectively verified.

1.4 APPROACH TO THE WORK

In this section we provide an overview of the methodology used by PB in this review and the limits to, and exclusions from, the work. We also set out the structure of the report and provide details on the presentation of expenditure amount in the report.

In this independent review of TransGrid's expenditure proposals, PB has considered, examined and provided its expert opinion, on the following key submission items and expenditure categories:

- historical network capital expenditure (capex) over the current regulatory period
- the future (ex-ante) network capex allowance
- the historical and future non-network capex (e.g. IT, vehicles, 'support-the-business' costs etc.)
- the historical and forecast operational expenditure (opex)
- the service target performance incentive scheme
- the capital governance framework for TransGrid

In reviewing and in developing our recommendations associated with these items, PB has adopted the high-level methodology set out below.

1.4.1 PB methodology (high level)

The approach adopted by PB is both well established and proven, and recognises the benefits of a methodology which examines the expenditure proposal in a number of different ways. This multi-dimensional approach combines a high-level ('top-down') assessment with a detailed ('bottom-up') assessment of a number of (carefully) selected projects and expenditure items. Our approach also includes a review of the governance processes and policies employed by TransGrid in making its investment decisions.

6 Compendium of Electricity Transmission Regulatory Guidelines, AER, August 2005.

7 Quantified in terms of its impact on the maximum allowed revenues (i.e. return plus deprecation).

In summary, the PB multi-pronged approach to the review of TransGrid has combined the following key elements:

- a review of TransGrid's governance systems, processes, policy and practice
- benchmarking and comparative analysis ('top-down')
- impact of proposals on the average age of the TransGrid asset base
- a review of unit costs (obtained from detailed project reviews)
- a detailed examination of a selection of projects, both ex-ante and ex-post ('bottom-up')
- PB's direct experience of other network businesses (including TNSP reviews).

Each of these elements of the PB methodology is described more fully below.

Review of the TransGrid governance, systems and processes

An important part of the PB review is the evaluation of the governance framework within which TransGrid makes it investment decisions. The culture of the business can have a major impact on the way in which the business invests. PB has examined the structure, strategies, policies, processes and procedures adopted by TransGrid in the development of its expenditure proposals, and have used the outcome of this review to reach an independent view on the robustness and appropriateness of the TransGrid proposal.

In undertaking our review, we have also considered the interface between TransGrid and the distribution network service providers with a view to determining whether, in the view of PB, there is effective coordination between the organisations.

The outcome of the PB review of TransGrid's investment decision-making framework is set out in Section 2 of this report.

Benchmarking and comparative analysis

In the experience of PB, the underlying drivers associated with the expenditure on a large and complex electricity transmission network are seldom simple and are often affected by a number of local and network-specific issues. This usually means that conclusions which result from the direct comparison with other businesses need to be drawn with care. Nevertheless, PB believes that this top-down benchmarking provides an extremely valuable high-level 'sense-check' — often providing focus and direction for more detailed analysis and review. PB believes that this represents an important element of the development of an independent view of prudence and efficiency.

As with any benchmarking or comparison exercise, the results must be read with an understanding of the assumptions made and knowledge of any inconsistencies between data sets. PB's benchmarking and comparative analysis of the TransGrid revenue reset proposal is included in Section 3 of this report.

Detailed project reviews

The detailed project reviews are a key aspect of the PB approach and provide a 'bottom-up' assessment of selected elements of the proposed expenditure program. Most of the detailed project review analysis undertaken by PB as part of this review is for capital expenditure (network system capex and non-system capex) — although our review has also focused on specific elements of the opex.

The detailed review and assessment of a selection of specific projects has enabled us to:

- confirm (or otherwise) adherence with TransGrid's own investment decision making and governance framework

- obtain a detailed understanding of the project in order to ascertain the robustness and reasonableness of the proposed project costs
- identify items which have some systemic, or generic, characteristics or qualities which may lead to adjustments across the wider capex program
- gain an understanding of the prevailing business culture and attitudes.

PB's findings following its detailed review of selected projects are described in Sections 4 and 5 of this report. Detailed analysis, which underpins our recommendations on each specific project review, is included in the appendices to this report.

The PB experience of other TNSP expenditure plans

In undertaking a review of the TransGrid expenditure proposals, the PB project team has drawn on its experience of expenditure reviews of network businesses in general, and electricity transmission businesses in particular. While most of the PB team's expertise has been drawn upon in each of the main 'prongs' of the approach described above, the direct experience of the team in transmission revenue resets adds an additional value dimension to the methodology.

The multi-dimensional approach described above aims to reflect an economic and pragmatic balance between the effort required to undertake the independent review, and the robustness and credibility of the review findings and recommendations.

1.4.2 Assessment of prudence and efficiency

PB has considered prudence and efficiency in the context of the high-level review framework set out above.

Prudence

In the context of transmission capital expenditure, we consider *prudence* as being the careful and practical management, or stewardship, of the transmission system. It can be viewed as the ability to identify both the required objective (need) and also when it should be addressed (timing). It can also be thought of as being the exercise of carefully managing the capex process to achieve the required objective (need). When dealing with an electricity transmission system, the required objective can include a complex and interacting set of requirements (objectives) – such as ensuring planning standards are met, reducing asset failure risk, minimising maintenance costs, complying with standards and regulatory obligations, etc. Hence there are a range of factors that influence the question of prudent expenditure.

These factors include:

- planning standards
- asset failure risks and asset condition
- maintenance and operational practices
- compliance obligations
- external stakeholder requirements
- available technology (know-how)
- feedback and post implementation review of previous work (learning).

Prudence can also be considered as that level of ownership, management and investment decision-making that might reasonably be expected from other TNSP's exercising good industry practice and operating under similar conditions.

Efficiency

Efficiency of expenditure can be thought of as the ability to accomplish the required objective (or functional specification) at the optimum level of expenditure (scope and cost). Hence there are a range of (primarily technical) factors that influence the question of efficient expenditure given the nature of the need for expenditure; in particular:

- project scope (work bundling)
- site conditions (constraints, environment, latent matters, etc)
- equipment availability
- procurements processes
- equipment type and specification requirements
- network characteristics and network operations
- adjacent works
- documentation quality (record quality).

Further to this, the issues of prudence and efficiency are not independent. That is, the factors that influence the question of prudence also influence the question of efficiency and vice-versa. Moreover, these factors can influence in varying and sometimes contradictory ways. Trade-offs may need to be made that can impact on efficiency, and which can speak to the issue of prudence. Hence, prudent and efficient management, while embodying objective elements, is very much a subjective skill that requires considerable expertise, and know-how (i.e. technology).

As part of its detailed review, PB has assessed TransGrid's asset management framework and planning processes and how they interact to facilitate prudent and efficient expenditure. In assessing the prudence and efficiency of TransGrid's ex-ante capex and opex, PB has applied consideration of the factors outlined in this section to the detailed reviews, as well to the broader capex programs, processes, procedures and systems.

1.4.3 Review process

The process adopted by PB in undertaking this review is summarised by the steps below.

1. a series of pre-lodgement meetings to facilitate communication and protocols during the revenue submission review and gain an initial understanding of its contents
2. an introductory ('kick-off') meeting with AER and TransGrid
3. selection by the AER and PB of a sample of projects for detailed review
4. a week-long TransGrid presentation to PB on the submission details and responses to initial questions
5. an ongoing series of meetings between PB, the AER and TransGrid to discuss opex, capex (system and non-system), contingent projects and service standards
6. submission by TransGrid of projects packs for detailed review and scrutiny
7. PB review of project information 'packs' and issue of follow-up questions to TransGrid
8. further on-site meetings with TransGrid staff on detailed expenditure items
9. internal analysis and deliberation by PB
10. production of independent draft review report, checked for errors of fact and confidentiality by the AER and TransGrid

Excluding the pre-lodgement meetings, the PB process set out above has been completed in a time period of approximately 12 weeks.

Pre-lodgement meetings

A key initiative embraced by the AER, TransGrid and PB as part of this review involved a series of pre-lodgement meetings between the parties. The objective of the meetings was:

- to ensure agreement from all parties to the principles of conduct during the review
- 'page turn' the draft revenue proposal against the AER Submission Guidelines
- discuss the list of documents that can be made available during the review
- for TransGrid to provide briefings on methodologies used to develop the proposal and provide an indication of expenditure levels.

As part of these meetings, the following principles for the conduct of review were agreed:

- the AER, TransGrid, PB would work cooperatively
- principle of transparency between all parties on a 'no surprises' basis
- willingness by all to consider each party's opinion
- prior to lodgement TransGrid will consult on areas where its not clear and seek guidance on a compliant approach acceptable to the AER
- TransGrid agreed to provide all available information
- during the review TransGrid would be given the opportunity to explain any issues raised
- TransGrid would acknowledge errors found in its proposal during the review, and undertake to correct errors irrespective of whether they increased or decreased the revenue proposal
- discussions on areas of conflicting perspectives between TransGrid and PB would be addressed in meetings chaired by the AER, as required.

An issues register was established to log questions and queries

A register was established as a means of formally recording issues and questions which arose during the review process to record all of the questions and ensure that responses are logged and outstanding queries tracked. TransGrid took responsibility for maintaining and issuing the register (to both AER and PB) on a regular basis.

Following the submission of TransGrid's revenue proposal, PB sought further information from TransGrid as part of its review of the proposals, principally through meetings and additional (formal) questions. These were duly recorded on the issues register.

TransGrid must satisfy the AER that its proposal meets the requirements of the Rules

Under the new Chapter 6A framework for transmission determinations, PB understands that the onus is on the TNSP to positively satisfy the AER that its proposal meets the requirements of the Rules. The AER must not approve a proposal if it is not so satisfied. This review by PB aims to assist the AER making its determination in this respect.

It is important to note that the onus has not been on PB, or the AER, to 'extract' information from TransGrid in order to undertake its review; rather that TransGrid is obliged to provide sufficient information for the purposes of supporting its expenditure claims[8]. In this report PB

[8] PB not asking for information does not, in itself, represent an omission by PB in its responsibilities to provide the AER with an (independent) view on the prudence and efficiency of the levels of expenditure proposed by the businesses.

aims to clearly identify any elements of PB's conclusions that are based on gaps, omissions or inadequacies in the information that has been provided by TransGrid.

1.4.4 Validity of expenditure figures

Following the submission of its proposal, TransGrid submitted additional information following a formal request by the AER. PB commenced its review on the basis of the expenditure figures contained within this proposal.

During the review by PB, and as a result of the detailed project examinations and discussions with relevant experts within the business, TransGrid has, in some cases, revised some of its expenditure plans. Any such departures from the original proposals are highlighted in the appropriate section of this report.

Representation of costs

In accordance with the AER's submissions requirements (and the TransGrid proposal), the following standards have been adopted for the representation of expenditure amounts:

- all historical amounts in the years 2004/5-2006/07 are presented in nominal terms, and those in 2007/08 and 2008/09 are in real 2007/08 terms
- all forecast (ex-ante) amounts are presented in real terms (2007/08).

Unless noted as an exception, all other forecast costs are in 2007/08 terms.

It should be noted that nominal expenditure amounts may have been converted to 2007/08 real values where comparisons and trending of historical and forecast expenditures have been undertaken. Where this has occurred it has been achieved using (consistent) published actual CPI rates and is clearly indicated in the relevant section of the report. In some of the PB analysis, the 2005 determination figures have also been converted to 2007/08 terms to allow like-for-like comparison with the historical expenditure proposals — as presented in the current submission (suitably converted from nominal to 2007/08 real as described above).

PB also highlights that some table figures may not summate due to rounding errors.

1.4.5 Limits to, and exclusions from, the work

The work undertaken by PB is limited to an independent review of the TransGrid expenditure proposals and an assessment of the proposed service standards. The work undertaken by PB does not aim to address issues associated with WACC, depreciation (including economic or standard asset lives), the negotiating framework or transmission use of system prices. The scope of PB's work also excludes deliberations on tax.

1.5 REPORT STRUCTURE

The structure and sequencing of this report is as follows:

- Section 2 – sets out a review of TransGrid's internal arrangements, including governance and processes
- Section 3 – sets out a review of expenditure program, including benchmarking
- Section 4 – sets out a high-level review of historical and 'work in progress' capex
- Section 5 – sets out a review of forecast capex, including detailed ex-ante project reviews
- Section 6 – sets out a review of historical and forecast non-network capex, including detailed ex-ante project reviews

- Section 7 – sets out a review of opex, including recurrent and non-recurrent costs and capex-opex trade-off
- Section 8 – sets out a review of the proposed service standards, including definitions and targets
- PB's conclusions and recommendations are set out in the concluding section.

Amongst other references, the detailed project reviews are included in the appendices to this report.

1.5.1 Subsequent updates

It should be noted that this review has been undertaken by PB based on information provided by TransGrid with their submission documentation, and in response to questions and discussions between TransGrid, the AER, and PB seeking clarification of the information provided in TransGrid business documentation.

Subsequent to the finalisation of PB's draft report[9] TransGrid provided considerable additional information in regards to a number of projects. Consequently, this information was not taken into account in the draft report. The final report however includes separate sections that specifically address the impact of the subsequent information on of PB's views and recommendations.

It should also be noted that this revised information does not include the impact of the 2008 Annual Planning Report (APR), as this matter is treated separately in PB's supplementary report "TransGrid Revenue Reset - APR 2008 Supplementary Report - An Independent Review - Prepared for the Australian Energy Regulator".

[9] Information received after 20 August 2008 was not included in the draft report due to project timelines.

2. REVIEW OF INTERNAL ARRANGEMENTS

In this section of the report we describe the TransGrid governance, systems and investment decision-making processes as presented to us; we set out PB's processes for undertaking the review of TransGrid's internal arrangements and provide our independent view on the effectiveness of the internal arrangements.

2.1 GOVERNANCE AND SYSTEMS

Corporate governance deals with the set of policies, processes, and regulations affecting the way in which a business is directed and administered. It is a diverse subject that captures issues ranging from accountability and stakeholder relationships through to a focus on economic efficiencies and optimisation. In the context of TransGrid's revenue submission, we focus predominantly on the businesses governance associated with capex approval.

In this Section we describe and evaluate TransGrid's internal organisation, policies and procedures as they relate to the ongoing development of its network and the management of its expenditure. The purpose of the evaluation is to confirm that TransGrid's capex and opex justification and investment processes are effective in ensuring that its regulated allowance is sufficient to meet its legal and regulatory obligations but, at the same time, ensuring that unnecessary or inefficient expenditure is avoided.

2.1.1 Previous TransGrid governance processes

The ACCC determined a Revenue Cap for TransGrid for the current regulatory period in April 2005[10]. During this process the ACCC's consultants and the ACCC were critical of the governance processes used by TransGrid. In particular, the MetroGrid project was identified as a project that did not appear to have appropriate governance processes applied as both the scope and cost of the project changed significantly without appropriate review and authorisation.

In response to the issues raised during the previous Revenue Cap decision and in recognition that a significant future program of capital projects was planned, TransGrid undertook a significant review and restructure of the governance processes that apply to major capital projects. This has involved the introduction of new approval processes, some restructuring of the organisation, new reporting processes, new project monitoring processes and, importantly, some cultural change within the organisation.

2.1.2 Organisational structure

TransGrid's organisational structure is shown in Figure 2-1. The structure displays clear delineation between functions. The key features of the structure relating to governance are:

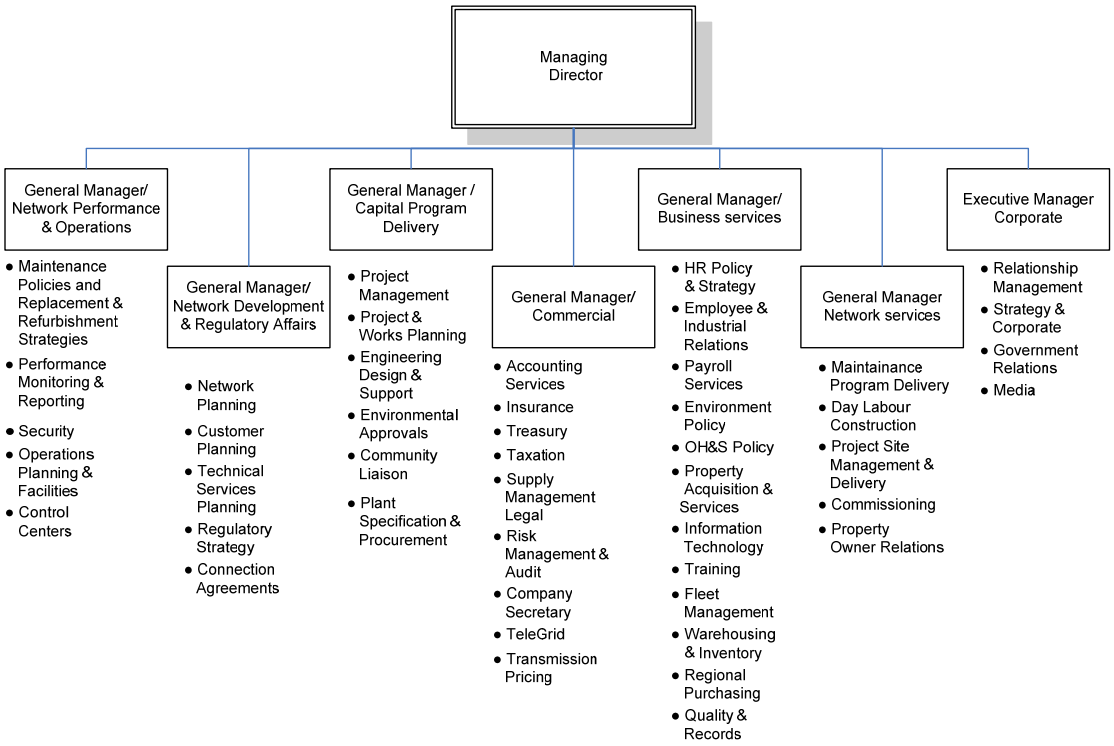
- network planning is carried out in the Network Development & Regulatory group
- refurbishment planning is carried out Network Performance & Operations group
- project planning including engineering design and approvals is carried out in the Capital Program Delivery group
- maintenance, commissioning and project site management are carried out in the Network Services group.

[10] Final Decision NSW and ACT Transmission Network Revenue Cap TransGrid 2004–05 to 2008–09 (ACCC, 27 April 2005).

- property acquisition, inventory management and purchasing are carried out in the Business Services group

PB considers this structure is appropriate to govern the program of capital and operating works planned by TransGrid.

Figure 2-1 –TransGrid's corporate structure



Source: TransGrid slides.

2.1.3 Current practices and processes – major capital projects

In this section we examine the documented processes that TransGrid applies to Major Capital Projects. In addition to the processes that apply to Major Capital Projects, there are other elements of governance that relate to minor projects, non-network projects and other aspects of program delivery that are not covered by the Major Capital Projects procedure. These other elements of program delivery are examined in section 2.1.4.

TransGrid has developed a Corporate Governance Framework[11] for major capital projects that comprises four main elements: Project Decision Gates, Post Project Review, a Capital Works Steering Committee and Major capital works program reporting. For the purposes of TransGrid's approval processes, major capital works are projects of a value greater than $1m.

The framework was presented to the TransGrid Board and approved in May 2005. At this time, the Capital Program Steering Committee had already been established and the Board was informed of organisational changes and was requested to approve the major projects governance process. Since that time TransGrid has further developed the processes and organisational structure to better meet the needs of the substantial capital works program planned for the remainder of the current regulatory period and the next regulatory control period.

11 GD EG G3 003 – Corporate Governance Framework for Expenditure on Major Capital Works Projects.

Project decision gates (DG's)

The process adopted by TransGrid for major capital projects requires a project to pass two formal decision gates. The first gate, DG1, initiates expenditure on the regulatory test, detailed design and specification, environmental impact assessment and community consultation. DG1 is preceded by a project phase that results in the development of a Project Scoping Report. The cost associated with the development of a Project Scoping Report is relatively minor and is, effectively, an extension of the network planning process. As the project passes DG1 the cost estimate is prepared to a +/- 25% accuracy.

The second gate, DG2, commits to construction of the project. This generally occurs at the time that TransGrid is ready to enter into a construction contract, effectively once the detailed design for the project has been completed and the outcome of a tender process for construction (or design and construction) is known. Projects passing DG2 are approved with a +/- 5% cost estimate.

Associated with the project decision gates are the roles and responsibilities of parties involved in Major Capital Works Governance. These roles and responsibilities are detailed in the TransGrid procedure[12]. The TransGrid Board is responsible for DG1 and DG2 approval of any project greater than $10m. The Managing Director is responsible for DG1 and DG2 approval of projects between $1m and $10m. The roles and responsibilities of other General Managers involved in the capital delivery process and the role of the Capital Works Steering Committee is also detailed in the TransGrid procedure.

Decision gates are commonly used by companies in the project development phase. Some organisations, such as those required to competitively bid projects, use processes with many decision gates in order to minimise the risk and cost associated with project development where there is considerable uncertainty about the outcome of bid process. Whilst the process used by TransGrid relies on a minimal number of gates, it does provide appropriate governance control at the key expenditure points and seems reasonable for the type of projects undertaken by TransGrid.

Also included in the corporate governance framework is a requirement to refer projects that exceed the initial DG1 estimates back to the General Manager/ND&RA before proceeding to DG2. The purpose of this step is to ensure that any project where the scope, cost or timing has changed significantly from the original DG1 estimate is reassessed before proceeding to the construction phase. TransGrid provided a number of examples including the Macarthur substation development where there were changes in scope, timing or cost between DG1 and DG2. These cases demonstrate that TransGrid is following the defined process to manage these potential variations.

Post project review

The TransGrid process for major projects provides for formal reporting of projects following their completion. For projects greater than $10m this involves the Project Manager presenting the results to the TransGrid Board. The purpose of post project reviews is to ensure that there is formal review of the project outcomes, to report on project delivery performance and to highlight any contractual issues that may have arisen with suppliers and contractors engaged to deliver the project. The post project review is also a key method of ensuring that any learning from the project is formally identified and fed back into future projects, thereby developing a culture of continuous improvement.

TransGrid has provided PB with the Post Project Review procedure[13] along with an example of the review report for the Rebuild and Upgrade of Glen Innes 132/66 kV Substation. We note that there is some minor inconsistency between the Post Project Review procedure and the Corporate Governance Framework in respect of the definition of a Major Project. Also we would expect the Post Project Review procedure to outline the requirement for presentation of

12 GD EG G3 003 – Corporate Governance Framework for Expenditure on Major Capital Works Projects.

13 EG PG G3 411 Post Project Review.

the report to the Board. We surmise this inconsistency has arisen as the Post Project Review procedure pre-dates the Corporate Governance Framework. However, this inconsistency is minor and, in the view of PB, does not have a material impact on project governance.

Capital works steering committee

This committee, established under the Corporate Governance Framework, has Terms of Reference formally documented[14]. The members of the committee include all the General Managers responsible for aspects of delivery of the capital program along with the Managing Director. The committee is responsible for steering the delivery of the capital program, overseeing approval of project variations, and monitoring efficiency and effectiveness of the program. Primarily the committee's role is to provide an oversight to the capital program with the General Manager/Capital Program Delivery retaining overall responsibility for delivery of the program.

PB has reviewed the documents associated with the Capital Works Steering Committee. This includes the Terms of Reference, minutes of meetings and some samples of project reports presented at the meetings. The minutes of the meetings clearly detail actions arising from the meeting and provide assurance that the capital program is reviewed in detail by the committee. The minutes also indicate that all of the key General Managers attend the meetings along with the key reports to the General Managers – where these reports have some important role in the delivery of the capital program.

In PB's view, the attendance of the General Managers at these meetings along with the level of detail of the minutes indicates that TransGrid is seriously committed to both ensuring appropriate governance process are in place regarding its investments, and to the outright delivery of the capital program.

Major capital works program reporting

All major capital projects are reported monthly to either the Board (for projects greater than $10m) or to the Capital Works Steering Committee. Project reports are generated for all projects that have passed DG1. The purpose of the monthly reporting is to provide key decision makers with information on the delivery of milestones and any changes to cost or project scope.

In addition to the monthly reporting of individual projects, TransGrid presents a monthly report of the Annual Schedule of Project Commencements, a report on the progress of Feasibility Studies and Planning Studies and a quarterly report on current and future committed expenditure for Major Capital Works. TransGrid is continuing to evolve the format of capital reports to improve their content and ease of understanding. A simplified project report containing only key elements has been developed for the Board with a more detailed report for the Capital Program Steering Committee.

In PB view the detail presented in the reports is appropriate for the audience (Capital Program Steering Committee or Board). PB considers that the level of reporting is sufficient to ensure that uncontrolled variations to scope, cost or timing should not occur without approval of the appropriate parties.

SKM review

In early 2008, TransGrid commissioned SKM to undertake a review of TransGrid's capital governance framework[15]. SKM noted improvements in procedures that have enhanced the delivery of capital programs. In addition, SKM noted one area where TransGrid could make further improvements to enhance the effectiveness of Post Project Reviews. SKM concluded that:

14 Refer GD EG G3 004 Capital Works Program (CAPEX) Steering Committee – Terms of Reference.

15 Review of Capital Governance, SKM, 2 June 2008, page 10.

Overall, SKM considers the TransGrid capital governance framework to be in line with good electricity industry practice.

PB agrees with SKM's conclusion, and considers that the capital governance framework developed by TransGrid is appropriate for its major capital expenditure projects.

2.1.4 Current practices and processes – other aspects

In this section we examine the elements of governance that relate to minor projects, non-network projects and other aspects of program delivery that are not covered by the Major Capital Projects procedure.

Project management

Following project approval, good governance is demonstrated by sound project management processes, comprehensive project reporting and appropriate monitoring. Project reporting and monitoring is discussed in the Major Capital Projects section above.

TransGrid has provided PB with a copy of its Project Management Manual[16]. This manual is a draft version dated January 2008. The manual provides a set of guidelines to project managers for projects of differing types and sizes. The manual is based on well recognised project management processes and revolves around a set of matrices that describe the task within each project management activity and act as a check-list for project managers.

In Section 4 of this report, PB has examined a number of historical capex projects completed by TransGrid. There have been a number of projects where the project scope and timing of project commencement has changed. However, once the project has commenced, projects are generally delivered on-time and within the approved budget. This provides an indication that TransGrid's project management processes are effective in controlling project costs and delivery timetables.

Network planning processes

The Major Capital Projects processes discussed in the previous section effectively commence when a Project Scoping Report has been produced. The processes that proceed the scoping phase of a project are also relevant to governance as it is these processes that establish the need for a particular project. There are a number of drivers for a project and these are identified through processes such as network load forecasting, maintenance assessment and connection enquiries.

TransGrid has produced a document titled Network Planning and Documentation[17] that describes the process used for network planning, identifies the parties responsible for steps within the process and describes the documentation associated with network plans. The document shows the seven processes that might generate the need for a project. The ND&RA group is responsible for identifying the needs and performing detailed planning and options development.

The processes outlined in the Network Planning and Documentation document indicate that TransGrid has defined clear responsibility for identifying the need for projects and further, TransGrid has identified the full range of processes that might generate the need for a project.

Consideration of non-network alternatives

TransGrid is required, through the National Electricity Rules, to consider non-network alternatives to network augmentation. TransGrid has established processes to consider

16 Project Management Manual, Draft Version1.01, January 2008.

17 Refer Document No: ND NP G2 002.

non-network alternatives, and further, can demonstrate situations where non-network alternatives have been implemented.

The network planning process document[18] describes the requirement to consider non-network alternatives during the planning phase of project development. TransGrid has provided the example of the 500 kV Western Upgrade as a project where a non-network alternative has been utilised to defer network augmentation by one year. The example is illustrative of TransGrid's consideration of non-network alternatives as required by the NER.

Procurement

Major construction projects are all competitively procured. As part of this review, TransGrid has provided to PB a list of all significant contracts awarded since July 2006 which includes both construction and equipment supply contracts. It is apparent from the list, that no single supplier is awarded the majority of any particular type of work. In PB's opinion this is indicative of appropriate procurement processes.

Wherever possible, TransGrid sources equipment from more than one supplier. This provides some competitive procurement tension and minimises the risk from failure of a supplier. This approach is also used for services such as design services where more than one supplier of design services is engaged to provide similar services. In one area, TransGrid is applying an 'alliance' approach to delivering some projects. While an alliance approach does not involve suppliers competing at an individual project level, the selection of the alliance partner can still be competitive, and the type of project (which is technically complex) is an appropriate project type to be delivered by an alliance partner.

Governance of projects less than $1m

TransGrid's documented governance framework does not apply to small projects with a value of less than $1m. These projects are covered by TransGrid's Sub Delegations of Authority and the project management processes are also applied to these projects.

TransGrid has 27 small projects planned for the next regulatory control period. This represents 16% of the total number of projects, however the total value of these projects is less than $15m or less than 1% of total planned project expenditure.

TransGrid does have controls in place through the delegation of authority and project management processes to ensure these projects are appropriately governed. Given that these projects only account for a very small proportion of total expenditure, PB considers that it is appropriate that these small projects do not have a specific governance framework applied and further, we consider that these projects will be adequately governed where the project management and delegations of authority procedures are applied.

Non-network expenditure – vehicles

TransGrid implemented a new policy for management of vehicles in 2006. Having reviewed this policy documentation and TransGrid's process (at a high level), PB has formed the view that TransGrid has an effective system for managing vehicles that ensures that expenditure on vehicles is minimised over the life of the vehicle.

IT system expenditure governance

TransGrid has a current documented Information Technology Strategy. This document provides, at a high level the expenditure proposed for IT over the next regulatory control period. The majority of the expenditure (90%) is planned for cyclical replacement of existing systems and hardware.

18 ND NP G2 002, Network Planning Process and Documentation, 28 May 2008.

Contained within the Information Technology Strategy is a section on IT Governance. This section details the roles of each of the parties involved in IT processes such as the development of project business cases, decisions on IT architecture and development of IT principles. Generally decisions relating to IT are made by TransGrid Executive, the IT Executive Committee or the Chief Information Officer. In PB's view, the governance matrix that indicates the various roles relating to IT endorsement and approval is clear and the authorisations outlined are suitable and appropriate.

In reviewing IT project approval documentation, PB has noted some cases where projects did not appear to reflect governance procedures. In some cases projects had been approved but the project documentation was not signed by all the parties that should have approved the project. In another instance a business case to undertake a particular project had been prepared after the project had commenced. We do not consider these breaches affect the validity of expenditure on projects but they do indicate that TransGrid may, at times, act without following due process and there is therefore a risk that project expenditure could be incurred without considering the need for the expenditure or the alternatives to that expenditure (which may be lower cost alternatives).

Early purchase of property

TransGrid has $288m planned in the next regulatory period for land and easements. This expenditure covers the purchase of land and easements for projects that have passed through Decision Gates 1 or Gates 1 and 2, and also the purchase of land for projects that have yet to reach Decision Gate 1. This expenditure on land before a project reaches Decision Gate 1 is termed as the strategic 'early purchase of property'. TransGrid has made these strategic property purchases ahead of the project to remove the risk of delays or loss of an available and critical site for a given project.

As part of its review, PB has questioned TransGrid about the process used to identify property to be purchased where the need for the project that requires the property has not yet been established. TransGrid has provided a board paper[19] that discusses the requirement to purchase property associated with the 500 kV development and 330 kV developments. This paper provides general information to the Board regarding the early purchase of property and notes that further board submissions will be made as planning and assessment of project alternatives reach key stages. While the Board has been informed of the potential need to purchase property, it is not clear to PB what criteria are applied to these early property purchases.

PB considers there is a risk that property may be purchased that is either not required or not suitable, or that property is acquired that may influence the outcome of the options analysis[20]. While recognising the importance of acquiring land for transmission infrastructure, PB considers that lack of a clearly documented process that applies to the purchase of property – where the property is to be acquired prior to the project receiving formal justification – is an issue that has the potential to lead to inconsistent and inefficient site and easement expenditure. In PB's view, such a process should take account of factors such as:

- the likely need and timing of the proposed project
- the possibility that options are available that satisfy the project need without acquiring the specified land
- the scarcity of land
- the rate of land development
- the implication of purchasing specified land that may not be required.

19 TransGrid Board Paper, 20 April 2006, File 2005/3593.

20 Where an options analysis is performed it should take account of existing infrastructure and resources. Where property has already been purchased, the property becomes an item of existing infrastructure and therefore has the potential to change the outcome of the options analysis.

2.2 PLANNING PROCESS

In this section, PB provides an overview of TransGrid's network investment decision-making processes. We also provide an independent view on the effectiveness of these processes in the context of this review. At a high level, TransGrid's planning process informs around 74% (the augmentation component) of the entire forecast capex allowance and it deals with the need to expand the network as demand, generation and inter-regional power flows vary over time.

TransGrid's network planning process is set out in the document entitled 'Network Planning Processes and Documentation'[21]. This document defines the planning governance arrangements, actions and responsibilities for planning within TransGrid, planning documentation, and the NER planning consultation process.

TransGrid's approach to network planning, which sets out the planning requirements, the network planning criteria, design and operation criteria used by TransGrid, is documented in the Annual Planning Report (APR) published by TransGrid in June each year. The Main System Planning Criteria – Application[22] defines the specific reliability and planning criteria required to meet TransGrid's statutory obligations.

The following outline is based largely on these three documents.

2.2.1 Planning obligations

Under the requirements of the National Electricity Rules (NER), specific NSW legislation, and the requirements imposed by environmental legislation and other statutes, TransGrid has obligations to plan for future NSW transmission needs, including interconnection with other networks.

The primary documentation relevant to TransGrid's network planning obligations includes:

- NSW Energy Services Corporations Act, 1995
- National Electricity Law
- National Electricity Rules
- NEMMCO's Statement of Opportunities
- GD EG G3 003 Corporate Governance Framework for Expenditure on Major Capital Works Projects
- ND NP G2 002 Network Planning Processes and Documentation
- GD NW G3 001 Technical Services Planning Procedure
- ND NP G2 001 Annual Planning Review and Publication of the Annual Planning Report
- ND NP G2 004 Load Forecasting.

Under the NER, TransGrid's planning obligations are sets out in schedule 5.1, and in particular clause S 5.1.2.1 of the NER states that:

> *"Network Service Providers must plan, design, maintain and operate their transmission networks to allow the transfer of power from generating units to Customers with all facilities or equipment associated with the power system in service and may be required by a Registered Participant under a connection agreement to continue to allow the transfer of power with certain facilities or*

21 Refer Document No. ND NP G2 002.

22 Refer 2003/5997, May 2008.

plant associated with the power system out of service, whether or not accompanied by the occurrence of certain faults (called "credible contingency events").”

The NER also requires that TransGrid consults with market participants and other interested parties, and that TransGrid applies the AER’s Regulatory Test to development proposals.

Under NSW legislation, TransGrid's planning obligations are linked with the licence obligations placed on Distribution Network Service Providers (DNSP). The mandatory DNSP licence conditions introduced by the Department of Energy Utilities and Sustainability in 2005 also require TransGrid to plan its network to enable the DNSP licence requirements to be met unless specifically agreed otherwise with the affected distribution network owner or major directly connected end-use customer. These specific obligations are discussed further in Section 2.2.3 below.

To meet these obligations, TransGrid has in place a governance structure that assigns specific delegated authority and responsibility for the network planning processes to the General Manager/Network Development & Regulatory Affairs[23]. For larger projects (over $1m), TransGrid’s governance processes is set out in ‘Corporate Governance Framework for Expenditure on Major Capital Works Projects’[24]. TransGrid’s overall governance structure is discussed further in Section 2.1 of this report.

2.2.2 Planning process and documentation

TransGrid has a formal documented network planning process in place which aims to facilitate compliance with its network planning obligations under the NER, NSW jurisdictional requirements and other relevant statutes. This planning process focuses on both a short-time frame of one to five years which supports network developments with short lead-times, and on the longer-term time frame of five to 20 years which provides for the orderly economic development of the transmission network.

Figure 2-2 shows an overview of TransGrid’s network planning process, key documentation, as well as the critical approval points. In general this process requires that an assessment of network and non-network options occurs prior to the project passing the first of two decision gates. Upon passing the first decision gate, the project is subjected to a regulatory consultation in accordance with NER requirements, and prior to funding approval (decision gate 2).

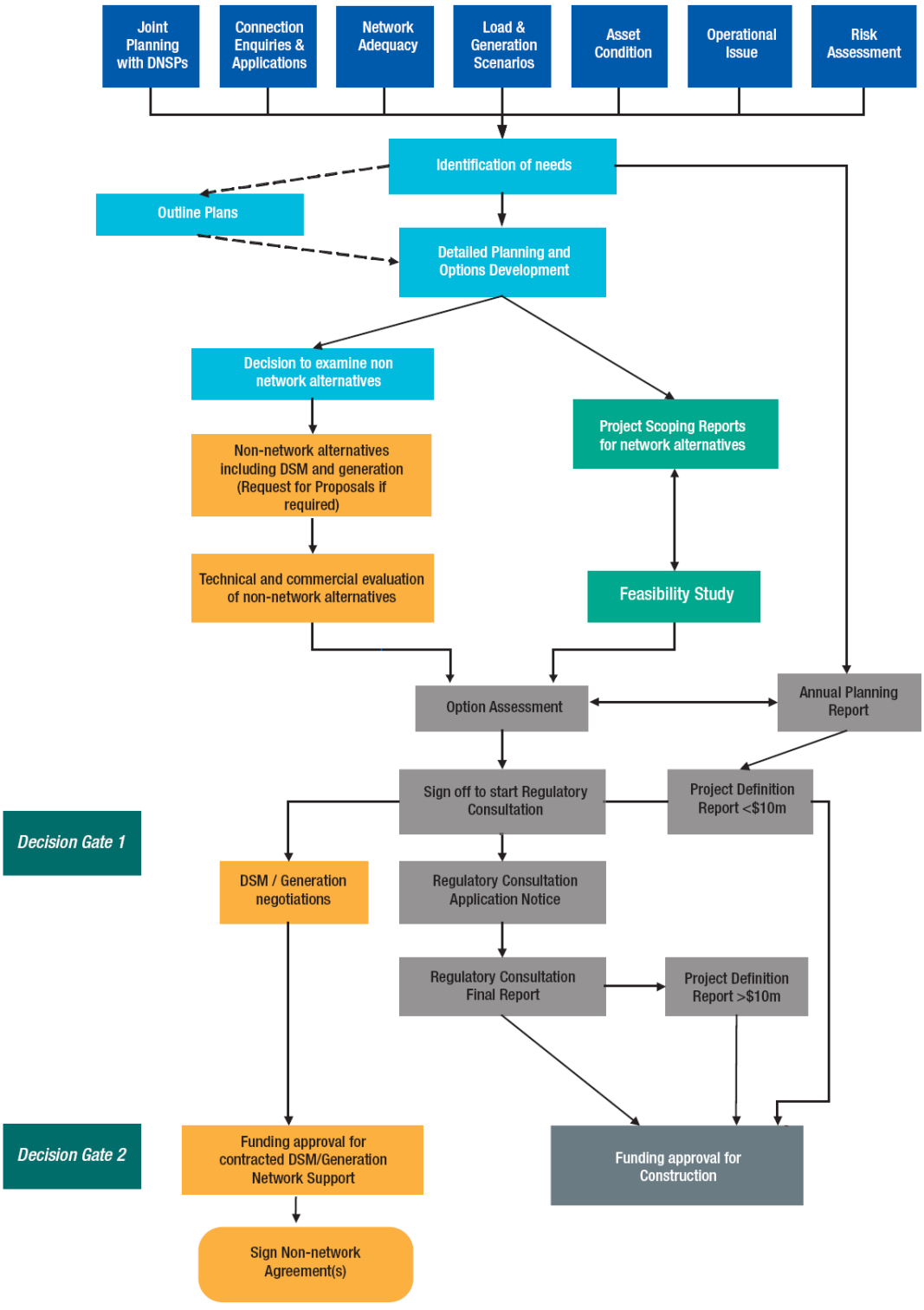
The overall planning process shown in Figure 2-2 involves planning at three levels; specifically:

- connection planning – is concerned with the connection of loads and generators and specifically the capability of the local network to support the proposed connection
- network planning within the NSW region – is concerned with the development of the main 500 kV, 330 kV and 220 kV transmission network in response to load growth and generation requirements. This also involves interstate interconnection power transfers. A further aspect of this planning activity is the assessment of the adequacy of 132 kV systems in conjunction with DNSPs
- inter-regional planning – is concerned with the development of interconnectors between regions and of augmentations within regions that have a material effect on inter-regional power transfer.

[23] This delegated authority is set out in Section 5.2 of ND NP G2 002.

[24] Refer document No. GD EG G3 003.

Figure 2-2 – Overview of TransGrid's planning process and documentation



Note: Process within orange boxes relates to the non-network stream

Source: TransGrid 2008, 'Network Planning Processes and Documentation', Revision No: 0, Issue Date: 28 May 2008, Document No: ND NP G2 002, page 8.

TransGrid also has an accelerated planning process[25]. The accelerated forward planning process is used for medium term planning where capital estimates are required prior to the completion of detailed planning studies. This process is designed to complement the full planning process and includes a high level options analysis, preliminary application of the regulatory test and an estimate of the cost and timing of the project. ND NP G2 002 notes that the essential difference between the standard and accelerated process is the level of analysis undertaken. It is also noted, that for the production of the ex ante revenue cap submission, the accelerated planning process is used.

TransGrid's primary planning documentation is listed in Appendix B of this report. While TransGrid produces a range of planning documentation, the key planning documents from the perspective of the ex-ante regulatory review are:

- Strategic Network Development Plan – this is TransGrid's strategic vision for its network, and enables longer-term issues to be taken into account when developing options for shorter-term requirements
- Annual Planning Report (APR) – is produced annually by 30th June to provide information to market participants and interested parties on the nature and location of emerging network constraints. This document also sets out TransGrid's network planning criteria
- Generation Scenarios Report – is produced for the development of the revenue reset ex-ante capex submission, and for major main grid network developments. This document sets out a probabilistic assessment of the generation development scenarios possible under a given range forecast scenarios (e.g. economic growth, forecast load, climate change, etc)
- Project Scoping Report (PSR) – is produced for each network constraint or replacement need and sets out the information needed to carry out investigation of one or more network options. The document provides a brief statement of the driver and timing, a detailed description of the options to be investigated, and details of the information required (e.g. cost estimates, project timing, practicability, etc)
- Project Definition Report (PDR) – is produced for all network changes or augmentations, and provides a definition of what is to be constructed, the proposed timing, the a description of the need, the projects relationship to other works, a detailed technical description of the work, along with any other technical information necessary to complete the project
- Project Option Scope and Estimate Reports – is produced for each option where feasibility assessment and costing is required. The document summaries the identified need, the option to address the need, as well as summary costing and feasibility information. This document is generally prepared under the accelerated forward planning process for a revenue reset
- Project Evaluation Summary – is produced for each identified need, and provides a summary of the need to be addressed, the available options, and the options analysis, along with a preliminary application of the Regulatory Test. Full sensitivity testing is not undertaken unless such testing is necessary to reasonably determine the most efficient solution. This document is prepared under the accelerated forward planning process for a revenue reset.

TransGrid produces other planning documentation, (refer Appendix B), however not all documents are required for all projects.

[25] Refer ND NP G2 002.

2.2.3 Planning criteria

Under the requirements of the NER (and in particular the obligations set out in Schedule 5.1), specific NSW legislation, the requirements imposed by environmental legislation and other statutes, TransGrid has obligations to plan for future NSW transmission needs, including interconnection with other networks.

TransGrid's planning obligations are also linked with the licence obligations placed on DNSPs under NSW legislation. The mandatory DNSP licence conditions introduced by the Department of Energy Utilities and Sustainability in 2005 specify "n-1, 1 minute" reliability standards for sub-transmission lines and zone substations supplying certain specified minimum loads (e.g. 15 MVA for urban and non-urban areas). Implied in these licence conditions is the requirement for TransGrid to plan its network to enable the DNSP licence requirements to be met unless specifically agreed otherwise with the affected distribution network owner or major directly connected end-use customer. This standard can be modified under certain circumstances; specifically[26]:

- where agreed, levels of supply interruption for particular single outages before network augmentation is undertaken can be accepted (e.g. radial supplies)
- where requested, no inadvertent loss of load (other than interruptible or dispatchable) following an outage of a section of busbar, or coincident outages of agreed combinations of two circuits, two transformers, or a circuit and a transformer (e.g. supply to the inner metropolitan/CBD area)
- the NEMMCO operated main transmission network should have sufficient capacity to accommodate NEMMCO's operating practices without inadvertent loss of load (other than interruptible or dispatchable) or uneconomic constraints on the energy market (generation re-dispatch following a first contingency such that within 30 minutes the system will again be 'secure' in anticipation of the next critical credible contingency).

In the APR, TransGrid notes that in general the NER and NSW jurisdictional requirements imply that the following planning principles are observed[27]:

- with the system in its normal state with all elements in service, or following a credible contingency, the electrical and thermal ratings of equipment will not be exceeded, and stable control of the interconnected system will be maintained, with system voltages maintained within acceptable levels
- a quality of electricity supply at least to NER requirements is to be maintained
- a standard of connection to individual customers as specified by Connection Agreements is to be provided
- as far as possible, connection of a customer is to have no adverse effect on other connected customers
- environmental and social constraints are to be satisfied
- acceptable safety standards are to be maintained
- the NSW transmission network is to be developed at the least economic cost whist meeting the constraints imposed by the above factors
- system losses are to be reduced where economic
- sufficient network capability is required to allow maintenance in accordance with TransGrid's asset management strategies.

26 TransGrid 2007, "NSW Annual Planning Report 2007", Appendix 1, page 58.

27 TransGrid 2007, "NSW Annual Planning Report 2007", Appendix 1, page 59.

Under the requirements of the NER, TransGrid's network must meet certain specific minimum technical requirements. These requirements include the minimum level of credible contingency events that are to be considered in planning the network, transmission line and equipment ratings, protection requirements, network stability, and frequency and voltage performance specifications. In addition to the NER requirements, TransGrid also takes into account the historical performance of the network, the sensitivity of loads to interruption, and TransGrid's asset maintenance procedures.

In response to these requirements, TransGrid has developed a set of deterministic planning criteria that are initially applied to identify potential constraints that are then subject to further detailed assessment.

Main transmission network

The main transmission network includes most of the network operating at 500 kV, 330 kV and 220 kV. It essentially consists of the transmission network that connects the major power stations, load centres and interregional interconnectors. In planning this network to comply with the NER requirements (noted above) and NSW jurisdictional requirements, TransGrid considers:

- overall load growth and generation requirements as well as the influence of interregional power transfers on the network and its ability to withstand a network disturbance. This involves planning to avoid widespread shortages of supply, support for economic generating patterns, supporting maintenance cost reductions, and minimising network losses
- NEMMCO's imperative to operate the network in a secure manner. Hence planning analysis concentrates on security of supply under sustained outage conditions consistent with NEMMCO's operating principles that require supply to load connection points to be satisfactory after any single contingency[28]. TransGrid assesses the risk of forced outages under two levels of load forecast (summer and winter):
    - Under the 50% probability of exceedance forecast, the system must be capable of withstanding a single contingency event under all reasonably probable generation dispatch patterns or interconnection flow with a prior outage (following failure) of a single item of reactive
    - Under the 10% probability of exceedance forecast, the system must be able to withstand a single contingency event under a limited set of generation dispatch patterns or interconnection flows
- maintenance of voltage control capability under all conditions - TransGrid assumes reactive power support within the rated capability given by performance standards can be provided by all on-line generators. Reactive power support beyond this may be procured under service agreements
- TransGrid applies probabilistic-based security analysis in the consideration of network adequacy. This takes account of probable load patterns, generation and load dispatch, and generator availability
- emerging connection point load requirements are considered along with consideration of the costs involved in re-dispatch in the energy and ancillary services markets to manage single contingencies
- inter-regional planning – specifically TransGrid's planning considers the scope for network augmentations to reduce constraints that affect generator dispatch and which may satisfy the regulatory test

[28] A single contingency is defined as the forced outage of a single transmission circuit, a single generating unit, a single transformer, a single item of reactive plant or a single busbar section. Following the outage the system will be able to be secured by re-dispatching generation so as to withstand the impact of a second contingency.

- sufficient network capability to enable maintenance in accordance with TransGrid's asset management strategies is also allowed for through the planning process.

The specific planning criteria developed by TransGrid are summarised in Table 2-1. These criteria determine the system power transfer capability, the ability to supply the system load and design requirements for the system from a system planning perspective.

Table 2-1 – TransGrid main system planning criteria

Load level	Generation dispatch	Prior outage	Contingency level
Up to maximum area load	Interconnector loaded to limit	Nil	N-1
10% PoE	Limited patterns – major thermal generators operating and high interconnector flows	Nil	N-0
	As above	Nil	N-1
	Limited range after re-dispatch	Nil	N-2
50% PoE	All probable patterns	One reactive source	N-0
	As above	One reactive source	N-1
	Limited range after re-dispatch	One reactive source	N-2
Light load	All patterns – limited units on line	Nil	N-0
	As above	Nil	N-1

Source: TransGrid Main System Planning Criteria – Application File 2003/5997, May 2008.

Networks supplied from the main transmission network

Networks supplied from the main transmission network are associated with the supply to local loads, and are not generally impacted by generation dispatch (although embedded generation exist). These networks do not have to be considered by NEMMCO in determining network constraints, although ancillary services may need to be provided for single contingency events. In planning this network to comply with NSW jurisdictional requirements, TransGrid considers:

- supply to major load areas and sensitive loads – a limited number of circuits supply some load areas and individual smelters. There are double circuit line sections that supply significant loads and load areas and in order to avoid exposure a multiple circuit failure event, contingency levels that exceed 'n-1' are assessed
- outages for planned maintenance are considered by planning for 75% of the peak load to be supplied during the maintenance outage
- for urban and suburban areas; that suitable connection point capacity is available to meet DNSP expected peak loadings and achieve the "n-1, 1 minute" reliability standard. For the inner Sydney metropolitan network the jointly developed (with EnergyAustralia) “modified n-2” reliability standard requires that peak load can be supplied under the following contingencies:

- simultaneous outage of a single 330 kV cable and any 132 kV feeder or 330/132 kV transformer, or
- outage of any section of 132 kV busbar

- for non urban areas; augmentation of connection point supply is considered when the forecast peak load at the end of the planning horizon exceeds the 'n-1' criteria. In non-urban areas an agreed level of risk of loss of supply may also be accepted, and augmentations may be undertaken when:
    - forecast load exceeds firm capacity by an agreed amount
    - the period that load is at risk exceeds an agreed time, or
    - an agreed amount of energy is at risk.

For Country Energy, the criteria is a fully duplicated supply ('n-1' reliability) to a load area of 15 MW or more, and a switched alternative supply if the load exceeds about 5 MW. In some cases provision is made for under-voltage load shedding where parts of the network are not able to withstand the forced outage of a single circuit line at time of peak load.

Other criteria

In addition to the general considerations and criteria set out above, TransGrid also has other specific network planning criteria which are noted below:

- transformer augmentation – when considering transformer augmentation allowance is made for transformer cyclic ratings, connection point load transfers, and maintenance requirements. Outages of single transformers, single-phase units, or the supplying transmission line are allowed for
- low probability events – TransGrid takes measures to minimise the impact of network disturbances from low probability events where practical, through control systems in accordance with the NER. Low probability events include extreme loads that can occur under extreme weather conditions, loss of several transmission lines (e.g. during bushfires), etc
- protection requirements – TransGrid applies the protection requirements as specified by the NER
- transient stability – is assessed in accordance with the requirements of the NER, and where practical high-speed protection systems are preferred when addressing transient stability issues
- steady state stability – is assessed in accordance with the requirements of the NER and where practical the optimum adjustment of existing plant control system settings is preferred when addressing steady state stability issues
- thermal ratings – are line and equipment dependant; specifically:
    - transmission lines - typically a 15 minute probabilistic-based contingency rating and a short-time emergency rating are applied to selected lines with design temperature of 100 degrees Celsius or less
    - transformers are rated at specification with provision use of the short-time rating during the outage of a parallel transformer or transmission line
    - 330 kV cables are rated in accordance with the manufacturer's recommendations
    - line terminal equipment is rated to manufacturers' specifications.
- reactive support and voltage stability – in order to ensure maintenance of voltage stability, TransGrid applies the requirements and specifications of the NER. To achieve the requirements TransGrid maintains a reactive power margin or a power transfer margin over the point of voltage instability. TransGrid assumes that reactive power support within the rated capability of all on-line generators is available. Reactive plant is installed up to the capability defined by limit equations,

and TransGrid aims to make maximum use of existing reactive sources before new installations are considered. For the main network, under high load (not maximum), allowance is made for the unavailability of a single major reactive element. In addition allowance is made for the outage of two successive circuits or both circuits of a double circuit line under reasonably probable power transfer

- transmission line voltage and conductor sizes determined by economic considerations – design voltages are chosen within the standard nominal range of 132 kV, 220 kV, 275 kV, 330 kV, and taking into account transformation costs. Conductor sizes are chosen based on losses, radio interference and field strength considerations in order to reduce the overall cost of energy and network services
- short-circuit rating – high voltage substation equipment specific to withstand a maximum short-circuit duty in accordance with the applicable Australian Standard. Operating constraints are enforced to ensure fault duties are limited to the specific rating. Short circuit duty calculations are based on contributions from all sources that are capable of supplying the fault with normally open connections treated as open
- substation switching arrangements – TransGrid generally now uses a mesh or 'breaker-and-a-half' arrangement. A single busbar zone forced outage is provided for with the main network planned so that the outage will not result in the outage of any base-load generating unit. At peak loads over 120 MVA a 132 kV bus section circuit breaker would be considered necessary or when supplying more than two feeders.

Based on the factors described above, TransGrid undertakes scenario based planning to assess network capability under a number of NEM load/generation scenarios. This involves the development of a range of scenarios that are based on consideration of a number of relevant factors, such as generation costs, government policy impacts, energy technology and energy development (e.g. gas pipeline projects). These scenarios are then used in modelling the network under forecast load/generation and inter-regional interconnector flows. Reference should be made to Section 5.2 for a further discussion of TransGrid's application of scenarios based planning.

Notwithstanding specific findings as part of detailed project reviews and the rigour of its project options analysis, in PB's view, TransGrid's high-level planning process is consistent with good industry practice and employs sound practices to inform the degree of augmentation in the transmission network. In particular, PB notes the consultative and pragmatic approach adopted by TransGrid when planning for the Sydney CBD network. PB is of the opinion that TransGrid has well-structured and well-documented policies and processes to support its transmission planning role, however there appear to be some opportunities to aid project selection processes through the assessment of relative changes in market benefits, such as reduced transmission losses and market constraints.

Based on the documentation presented, and interactions with staff during our review of TransGrid's revenue proposal, sufficient evidence exists to support the view that the documented planning process and policies are well implemented within the business.

2.3 ASSET MANAGEMENT

In this section, PB provides an overview of TransGrid's asset management processes. We also provide an independent view on the effectiveness of these processes in the context of this review. At a high level, TransGrid's asset management process informs around 20% (the non-load driven component) of the entire forecast capex allowance and it deals with the need to replace aging and poor performing assets and comply with standards. The asset management process also fundamentally informs the vast majority of TransGrid's opex.

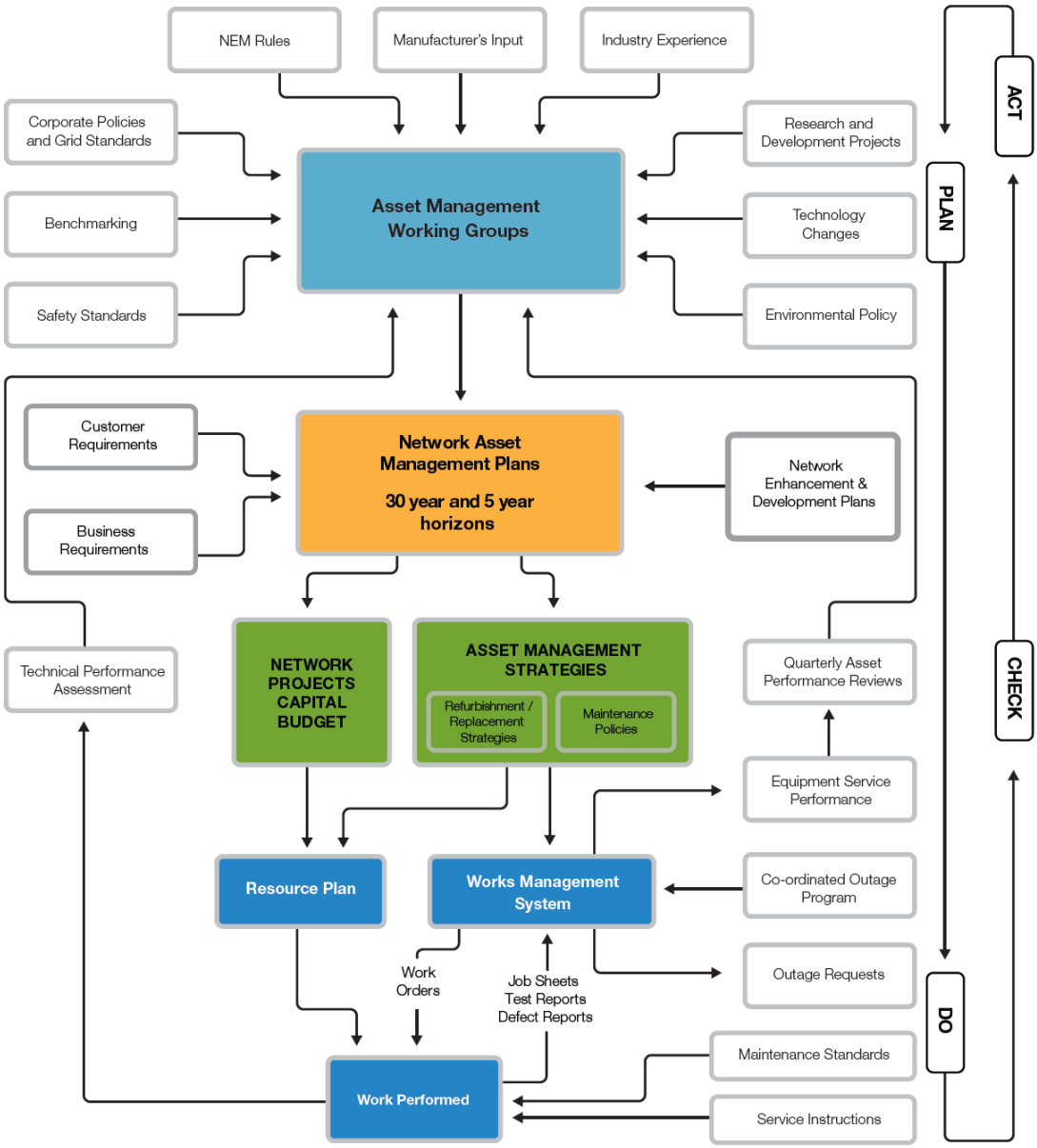
TransGrid's high level asset management process is set out in its Network Management Plan and supported by specific asset management policies and strategies that cover each of asset

classes on the TransGrid network. The process, illustrated in Figure 2-3, identifies the asset management process inputs, the relationships between planning, management, reporting and execution roles and the policy documentation. The outputs of the asset management process are documented in the 5 year and 30 year network asset management plans which outline the TransGrid's asset strategy over medium and long term planning horizons.

The key observations regarding the asset management plan are:

- the integrated 'Plan-Do-Check-Act' cycle that informs the entire businesses operational practices
- the numerous inputs, such as manufacturers advice, safety standards and benchmarking
- the continuous improvement captured through technical performance (condition) assessments as a result of work performed.

Figure 2-3 – TransGrid asset management process



Source: TransGrid Network Management Plan 2009-2014, page 40.

The following summary presents the key internal documentation based on the TransGrid's asset management process, which outlines the businesses specific asset management strategies and policies in detail:

- GM AS C1 001 Telecommunications Maintenance Policy 08-09
- GM AS C5 001 - Communications Asset Management Strategy (Rev 8)
- GM AS D1 001 Control Systems Maintenance Policy
- GM AS D5 001 - Control Systems Asset Management Strategy (Rev 1)
- GM AS L1 001 Transmission Line Maintenance Policy
- GM AS L1 002 - Easement Maintenance Policy
- GM AS L5 001 Transmission Line Strategy
- GM AS L5 002 Transmission Line Easements Strategy
- GM AS P1 001 Protection Maintenance Policy
- GM AS P5 001 Protection Asset Strategy
- GM AS S1 001 Substation Maintenance Policy
- GM AS S1 005 Underground Cable Asset Maintenance Policy
- GM AS S1 011 Network Security Inspection and Maintenance Policy
- GM AS S5 001 Asset Management Strategy - Substations
- GM AS S5 002 Asset Management Strategy - Underground Cables
- GMASM1001 Metering Maintenance Policy
- GMASM5001 Metering Asset Strategy
- Public Electrical Safety and Awareness Plan
- Bushfire Risk Management Plan.

The policy documents set out the responsibilities of the company in regard to each specific asset type to which it relates including consideration of health and safety, environment, legal requirements, and maintenance policies together with specific strategies for particular asset types.

The existing network assets are managed in accordance with the Network Management Plan in order to achieve:

- a safe transmission system, managed in an environmentally responsible manner and complying with all statutory requirements
- a reliable and cost effective transmission system minimising the number of forced and emergency outages
- maximum availability of transmission plant to reduce system losses and uneconomical generating patterns
- optimum life of assets.

The asset management documents define TransGrid's maintenance policy which includes the condition assessment requirements applicable to each asset type. The maintenance policy is based on regular inspection and condition based maintenance and refurbishment achieved by the adoption of the following principles:

- maintenance is minimised in accordance with reliable plant performance using a risk methodology
- maintenance costs are to be minimised in accordance with corporate objectives of safety, reliability and availability

- maintenance is to performed be in accordance with Quality Assurance principles
- condition monitoring by in service inspection is preferred where practical
- maintenance is carried out in accordance with environmental and safety considerations
- computer based systems are used for planning maintenance work, tracking work execution, and for recording of asset and condition data
- maintenance methods are defined in the grid maintenance standards in accordance with the requirements of the QA system
- new plant is preferably of a proven, low maintenance and reliable design
- plant history performance data is to be available for reports and asset management review.

In PB's view, the TransGrid asset management process is consistent with good industry practice and employs condition monitoring and condition based replacement triggers to maximise the life of assets. PB is of the opinion that TransGrid has well-structured and well-documented policies and processes to support its core transmission service provision role.

Furthermore, based on the documentation presented, and interactions with staff during our review of TransGrid's revenue proposal, sufficient evidence exists to support the view that the documented asset management process and policies are very well implemented within the business.

2.4 COORDINATION WITH OTHER PARTIES

In accordance with clause 5.6.6(b) of the NER, TransGrid consults with interested parties before it commits to construct a network augmentation with an estimated capitalised cost of over $10m. The consultation process includes the preparation of an application notice, which must include the following information:

- details of the proposed new large transmission asset
- reasons why the new asset is needed (the need)
- all reasonable alternatives, including potential non-network solutions
- relevant technical details
- analysis of the ranking of the alternatives
- an augmentation technical report prepared by the Inter-Regional Planning Committee (if and only if the asset is likely to have a material inter-network impact, and the applicant has not received the consent to proceed from all TNSPs whose transmission networks would be materially affected by the proposed new asset
- details of how the application meets the regulatory test.

The consultation process allows interested parties to respond to the notice and TransGrid must respond to any submissions received.

On completion of the consultation process, TransGrid prepares a final report which is circulated to interested parties setting out the details of any submissions received from interested parties and its response to each such submission.

This described consultation process is not required for augmentations with an estimated capitalised cost of below $10m. In this case, before the construction of new small transmission network assets (with a value of between $1m and $10m) proceeds, TransGrid must publish an 'intention to construct' notice within its APR and consult with interested parties on any submissions received in accordance with clause 5.6.6A of the NER. If such a project is not included in the APR or has changed significantly from what was published in the APR, then

TransGrid is required to issue a separate report to interested parties – as specified in section 5.6.6A(c) of the NER.

TransGrid also conducts joint planning sessions with major generators, and the NSW DNSPs. This joint planning is described in more detail in Section 2.2 of this report. These planning sessions are held largely on an as needed basis, but typically at least annually, and provide an opportunity to consult on capital projects that impact each of the parties. A joint demand forecasting meeting is also held with the NSW DNSPs on an annual basis.

2.5 PB COMMENTS AND CONCLUSIONS

As part of our high-level review of TransGrid's internal arrangements, and as informed through our detailed project reviews, PB makes the following observations regarding TransGrid's governance and systems:

- TransGrid has implemented a sound process for governance of major projects including documented procedures, clear responsibility, reporting and monitoring. This process which involves projects passing through two key decision gates appears to be working well
- projects and non-network expenditure such as vehicles and IT systems are based on plans and approval processes that are appropriate
- it appears that in some cases, the approval process for IT projects has not been followed. One project appears to have commenced before approval and another project document doesn't contain all of the authorising signatures. While there is no evidence that inappropriate investments have been made in IT, there is a risk that project expenditure could be incurred without considering the need for the expenditure or the alternatives to that expenditure (which may be lower cost alternatives)
- PB considers that the lack of a clearly documented process that applies to the purchase of property, where the property is to be acquired prior to the project receiving formal justification, is an issue that has the potential to lead to inconsistent and inefficient site and easement expenditure.

PB makes the following observations regarding TransGrid's planning process:

- TransGrid's planning and documentation processes appear to be well structured and are consistent with good industry practice. The processes are well defined and integrated within the business with appropriate review points that align with critical decisions. Both the process and the supporting documentation appear to be consistently applied across the organisation
- TransGrid's transmission system planning process is based on specific and documented criteria that reflects its reliability-based planning obligations under the NER and NSW jurisdictional requirements
- the formal processes detailed by TransGrid demonstrate a prudent approach to forward planning, structured primarily to meet its regulatory reporting requirements of forecasting future network constraints and the associated forward capital expenditure requirements
- TransGrid undertakes scenario based planning to assess network capability under a number of NEM load/generation scenarios. This involves the development of a range of scenarios that are based on consideration of a number of relevant factors, such as generation costs, government policy impacts, energy technology and energy development (e.g. gas pipeline projects). PB believes that this represents good industry practice
- there are clear opportunities for TransGrid to supplement the project selection processes through the assessment of relative changes in market benefits, such as reduced transmission losses and market constraints

- with regards to the application of alternative analysis within the planning process, based on our detailed review, PB is of the view that TransGrid's documented options analysis is limited, and in sampled cases does not capture all the information relevant to demonstrating the difference in value between the alternatives considered. In our view, the quality and completeness of the options analysis is below good industry practice, and this represents a weakness in a generally sound process
- with regard to the capital works planning process, PB notes that the high level capital estimates and options assessments derived from the accelerated planning process are unlikely to be of a standard that will satisfy the regulatory consultation process without further assessment. However, for the purpose of preparing the forward capital work program estimate included in the TransGrid Revenue Proposal, PB considers it reasonable that a number of projects may be subject to the accelerated process. We are however of the view that more rigour needs to be applied to proposed project definitions and the associated cost estimates, particularly for projects of a significant value.

PB makes the following observations regarding TransGrid's asset management strategy:

- the TransGrid asset management process is consistent with good industry practice and employs condition monitoring and condition based replacement triggers to maximise the life of assets. PB is of the opinion that TransGrid has well-structured and well-documented policies and processes to support its core transmission service provision role that is consistent with good industry practice
- based on the documentation presented during our review of TransGrid's revenue proposal, sufficient evidence exists to support the view that the documented asset management process and policies are generally well implemented within TransGrid.

PB makes the following observations regarding TransGrid's coordination with other parties:

- TransGrid has an established process for consultation with interested parties before it decides to construct a significant network augmentation. This process is structured to comply with its obligations under the NER
- TransGrid conducts joint planning sessions with major generators, and the NSW DNSPs. These planning sessions are held largely on an as needed basis, but typically at least annually, and provide an opportunity to consult on capital projects that impact each of the parties. A joint demand forecasting meeting is also held with the NSW DNSPs on an annual basis. In PB's view this co-ordination is critical, especially given the strategic nature and significant costs associated with investment around the inner Sydney area.

3. REVIEW OF THE EXPENDITURE PROGRAM

The approach adopted by PB in its review of the TransGrid expenditure proposals combines a high-level ('top-down') assessment with a detailed ('bottom-up') assessment of a number of selected projects and expenditure items. In this section we provide a general overview of the TransGrid proposals and compare historical and (proposed) forecast expenditures. We also set out the results of PB's high-level benchmarking and comparative analysis, undertaken as part of the 'top-down review' of the TransGrid proposals.

Specifically, the section includes details of the following items and analysis; an overview of the total business expenditure proposals; benchmarking of the TransGrid proposals, at a total expenditure per business level, with other TNSPs (opex and capex); an assessment of the impact of the proposals on the average age of the TransGrid asset base; and a review of unit costs (obtained from detailed project reviews).

Each of these elements is described in more detail below.

3.1 OVERVIEW OF THE EXPENDITURE PROGRAM

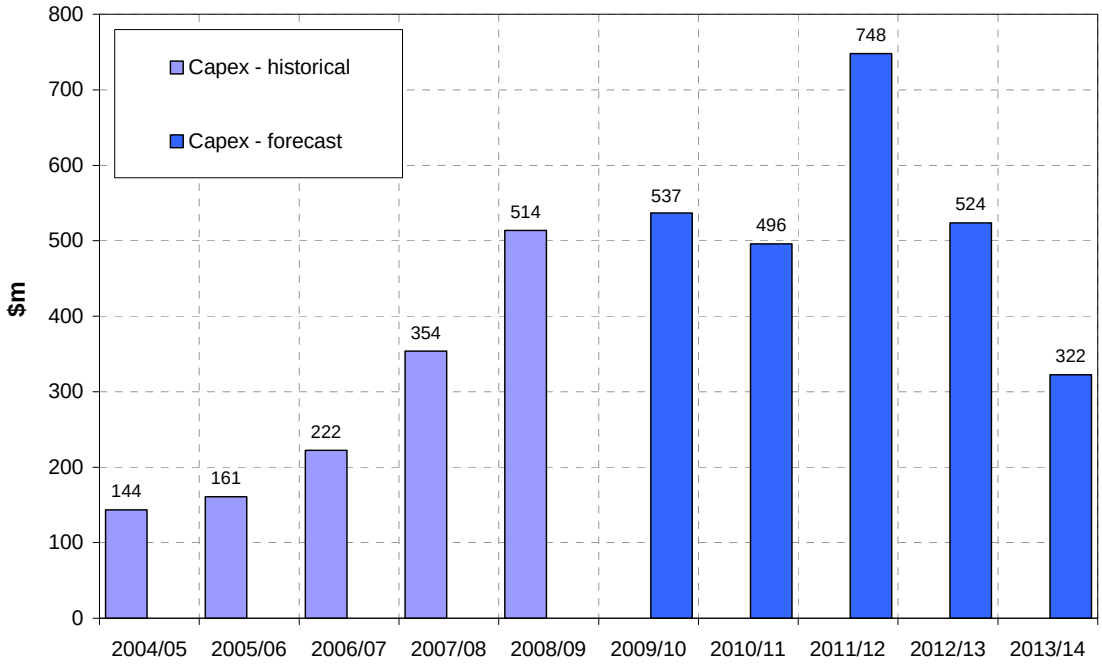
In this section we provide a high-level summary of the historical and forecast expenditure proposals made by TransGrid for the period 2009/10-2013/14 for both opex and capex.

3.1.1 Capex overview

As shown by the trend in Figure 3-1, TransGrid has increased its capital program progressively and considerably since 2004/05. The five-year forecast total is $2,627m (real 2007/08) and this represents an increase in real terms of 88% compared with the current period spend of $1,394m.

The expenditure comprises three major transmission line and cable projects totalling over $1.1b, on ongoing program smaller augmentation projects totalling around $0.9b, replacement capex of $0.49b and non-network related capex of around $0.15b.

Figure 3-1 – TransGrid actual and forecast capital expenditure (real 07/08)

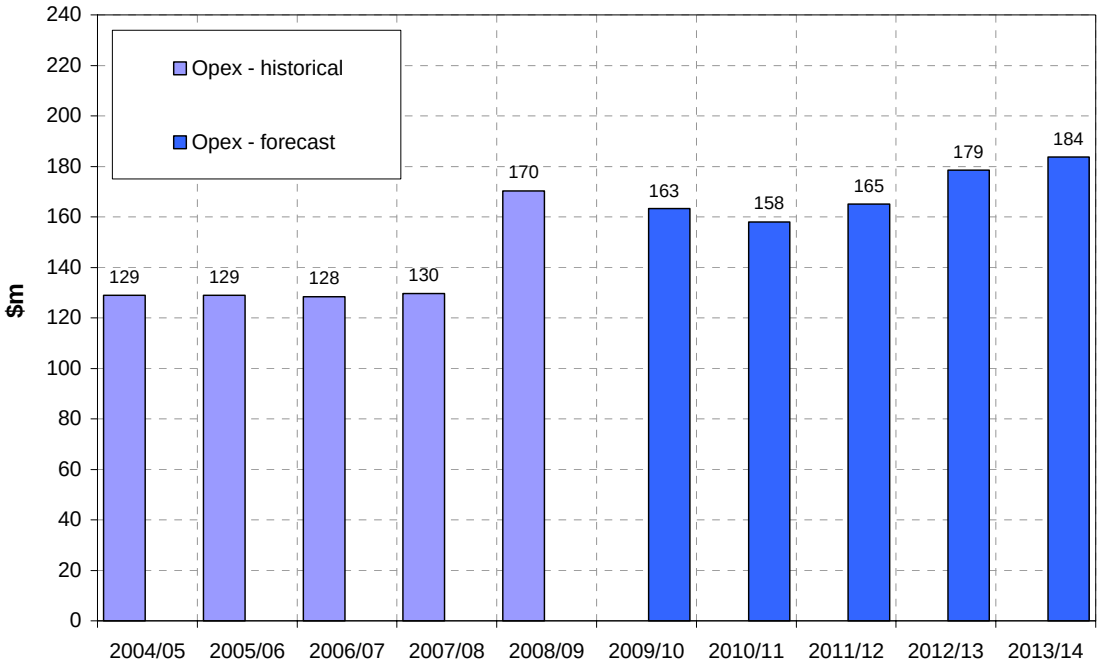


3.1.2 Opex overview

As shown by the trend in Figure 3-2, TransGrid has increased its operating maintenance expenditure program slightly since 2008/09. The five-year forecast total is $849m (real 2007/08) and this represents an increase in real terms of 24% compared with the current period spend of $686m.

The expenditure is comprised of a controllable component that includes around $367m associated with maintenance, $102m for business management, around $289m for operation, grid planning, corporate and regulatory management, etc and another $91m for other non-controllable opex, including network support provisions.

Figure 3-2 – TransGrid actual and forecast operating expenditure (real 07/08)



Source: PB analysis - Note 1: The additional opex spend in the 08/09 period relates to additional network support cost associated with a project in Western Sydney.

3.2 NATIONAL EXPENDITURE COMPARATORS

In this section PB undertakes some high-level comparative analysis of the expenditure proposed by TransGrid against that undertaken by other TNSPs in Australia.

While PB recognises the difficulties in attempting to accurately compare TNSP investment performance due to the inherent differences in businesses associated with matters such as geography, ownership, asset strategies and jurisdictional responsibilities and accountabilities, we consider a high level comparison can provide some valuable insight into the nature of expenditure – especially when the analysis allows further insights into expenditure that varies considerably from the peer group.

It is important to note that the benchmarking included in this report is not intended to represent a comprehensive study but instead aims to provide a high-level 'sense check' on TransGrid's proposal.

Overview of benchmarking

In an attempt to place TransGrid's submission into context, we have undertaken some basic comparative analysis of the present (allowed) and proposed expenditure levels for both opex and capex. The limitations associated with this type of high-level benchmarking are fully

recognised — particularly the difficulties in capturing, and reflecting, a transmission network's unique geographic, environmental and/or demographic characteristics. The development of transmission networks can vary considerably, especially over the typically long lives of the assets, and can be influenced to larger or lesser degrees by the following matters:

- government rules, regulations and incentives
- business structure and roles undertaken
- stakeholder expectations
- environmental factors
- the number, density, load factor and size of customers
- the number, density, type and size of generators
- the extent of interconnection and variations in inter-regional flows
- the mix and age of assets and design philosophies adopted.

In particular, as electricity transmission is essentially a transport activity, geographical distance has a significant influence. Other than this, network expenditure is shaped by major cost drivers such as size and design of the network (generation, demand, energy, voltage levels adopted, etc.), the level of reliability and security provided (planning criteria and network configuration), the environmental and regulatory conditions within which it operates and a businesses appetite for risk. In addition to TransGrid, PB has included the four NEM connected TNSPs within this analysis.

An overview of scale and business conditions of the TNSP's is provided in Table 3-1. These parameters are used to normalise the expenditures as part of the comparative analysis.

Table 3-1 – Overview of Australian TNSPs included in comparative analysis

TNSP	Network length (km)[1]	Number of sub-stations[2]	Peak summer demand forecast (M50, 2007/08) (MW)[3]	6-year summer demand growth forecast (M50, 08/09-14/15) (MW)[3]	Medium growth annual energy forecast (GWh)[3]
Powerlink	12,132	98	9,461	2291	51,058
TransGrid	12,489	82	13,820	2270	75,710
SPA/VENCorp	6,553	44	9,198	1096	47,599
ElectraNet	5,611	76	2,990	376	12,631
Transend	3,654	54	1,381	145	10,221

Note 1 – sourced from TNSP Electricity Regulatory Report for 2006/07 (August 2008, AER).

Note 2 – sourced from TNSP Electricity Regulatory Report for 2005/06 (April 2007, AER).

Note 3 – sourced from Statement of opportunities 2007(October 2007, NEMMCO).

Whilst comparative benchmarking benefits from the use of larger peer groups, PB has excluded other TNSP's within Australia (such as Western Power, MurrayLink, DirectLink and EnergyAustralia), and excluded international businesses for the purposes of simplifying the assessment. Data available for the NEM connected transmission businesses is consistent, as is the efficiency incentive based regulatory framework within which the businesses operate.

3.2.1 Sources of information

With the exception of Transend, for each of the businesses compared to TransGrid, the forecast capex (including the breakdown into growth, non-growth and non-network), opex, and the opening RAB values have been sourced from the most recent AER regulatory

determination. In order to ensure suitability in comparisons, all expenditure values have been adjusted by June 30 CPI (where required) and referenced to real 2007/08 dollars.

For Transend, the forecast capex, opex, and the opening RAB values have been sourced from the businesses proposal for the period 2009/10-2013/14. On this basis, it is important to note that the forecast capex and opex for Transend has not been subject to regulatory review at the time of this analysis.

The separation of the network asset owner (SP AusNet) from the (augmentation) investment decision-maker (VENCorp) within Victoria is unique within the NEM. In other Australian states the transmission business has responsibility for planning and augmentation, as well as for the replacement, refurbishment and maintenance of ageing assets. For the purposes of this assessment, the relevant expenditures for SP AusNet and VENCorp have been summed, based on the six year forecasts submitted by the businesses.

In order to present an indication of the relative sizes of the various Australian TNSP businesses used in PB's assessment, the expenditures and Regulatory Asset Base (RAB) for each business are shown in Table 3-2.

Table 3-2 – RAB, capex and opex of Australian TNSPs included in comparative analysis

TNSP	Opening RAB - July 08[6]	Average annual capex				Average annual opex
		total	growth	non-growth	non-network	
Transend[1]	958	132.1	71.9	52.7	7.6	54.4
ElectraNet[2]	1265	129.9	57.6	64.2	8.1	59.8
SPA/VENCorp[3]	2191	162.0	33.5	119.1	9.4	168.9
Powerlink[4]	3903	546.7	306.9	219.2	20.7	152.1
TransGrid[5]	4113	525.3	390.2	103.9	31.3	169.7
TransGrid (hist)[5]	4113	278.9	172.8	79.4	26.7	137.2

Note 1 – Transend Transmission Revenue Proposal for the Regulatory Control Period 1 July 2009 to 30 June 2014 (May 08, Transend)

Note 2 – Final Decision ElectraNet transmission determination 2008–09 to 2012–13 (April 08, AER)

Note 3 – Final Decision SP AusNet transmission determination 2008-09 to 2013-14 (January 08, AER) and Final Decision Victorian Energy Networks Corporation (VENCorp) transmission determination 2008-09 to 2013-14 (April 08, AER)

Note 4 – Final Decision Powerlink Queensland transmission network revenue cap 2007-08 to 2011-12 (June 07, AER)

Note 5 – TransGrid Revenue Proposal 1 July 2009-30 June 2014 (May 2008, TransGrid)

Note 6 – RAB and expenditures have been escalated by CPI for Transend and Powerlink, while only TransGrid's RAB has been deflated for benchmarking comparisons.

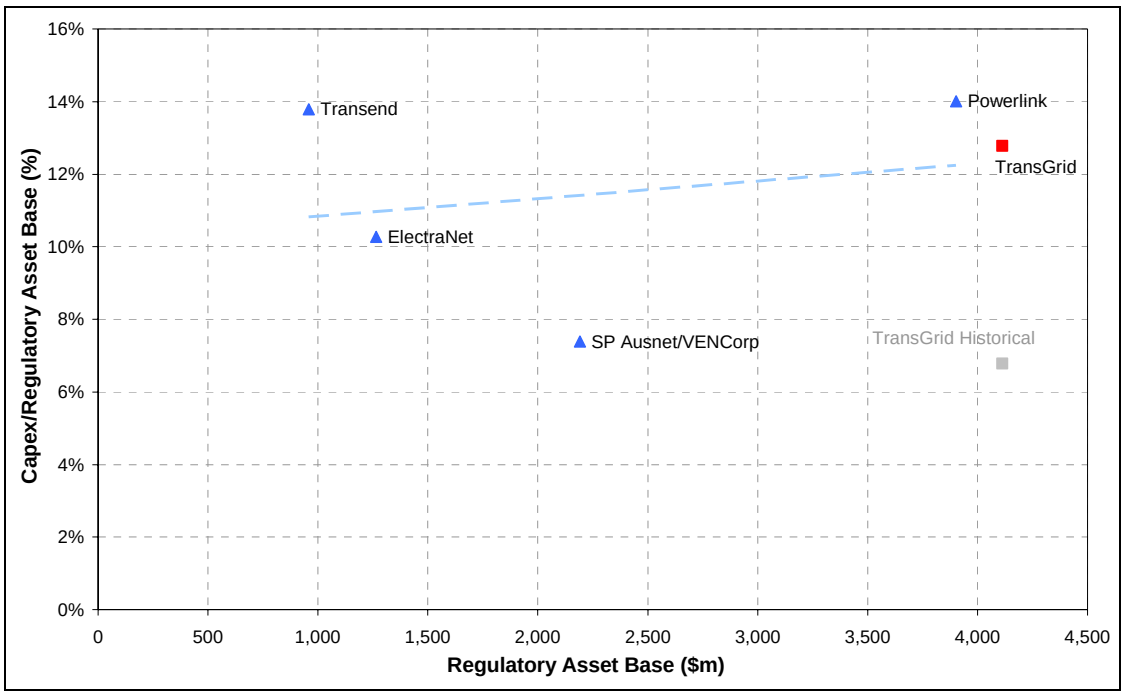
3.2.2 Capex benchmarking

In order to account for differences in size and business conditions, PB has plotted the capital expenditure of TNSPs against the key cost drivers such as size – as expressed by the value of RAB, length of network, the number of substations and the annual energy transmitted.

Indicative linear trend lines (that generally show poor correlation between data points and present very limited statistical basis for assessment) are also shown in each chart.

Figure 3-3 shows the annual average capex at an aggregate level[29] for each business as a proportion of RAB value, plotted against RAB value. It can be seen that typically the businesses invest between 7% and 14% of their RAB on capex per annum. The measure for TransGrid is relatively high within this benchmark group — around 12.8% for a RAB value of $4,113m, however the TransGrid position is not in any way materially different than the other businesses. Figure 3-3 also shows that TransGrid's historical annual capex is around 6.8% of its RAB value, indicating that there has been a considerable increase in capex in the forecast five year period compared with the previous five years.

Figure 3-3 – Average annual capex as a proportion of RAB value

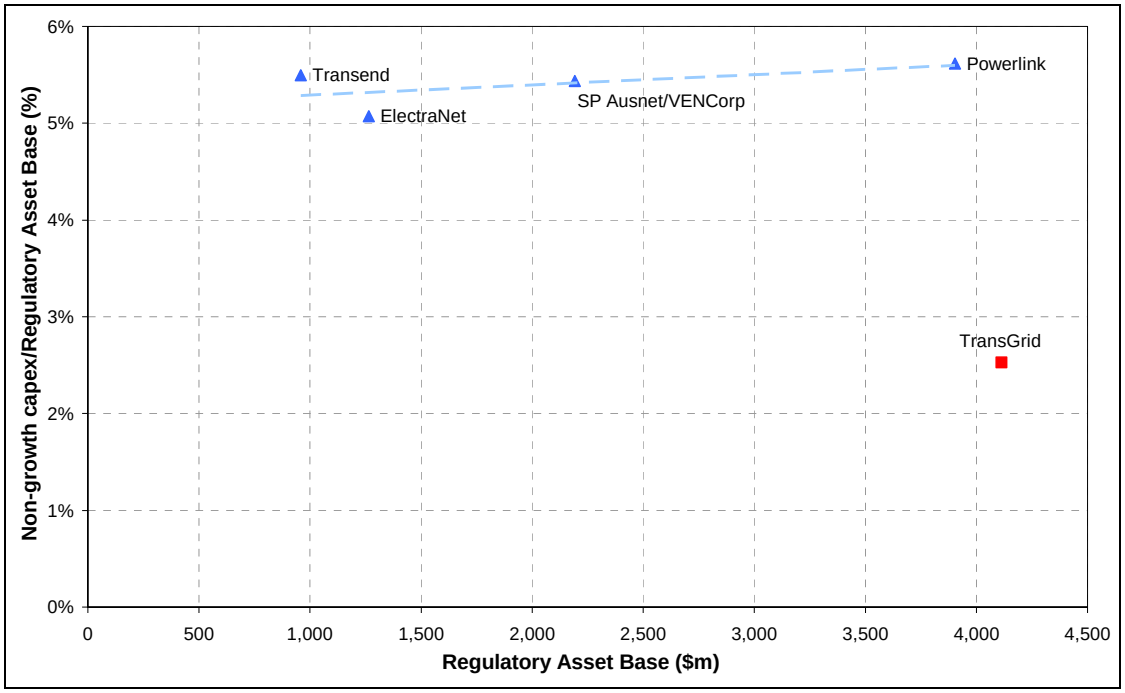


Source: PB analysis.

To provide more insight into TransGrid's forecast capex, in Figure 3-4, we only plot the annual average non-growth capex for each business as a proportion of RAB value, plotted against RAB value. With the exception of TransGrid, it can be seen that typically the businesses invest between 5% and 5.5% of their RAB on non-growth capex per annum. The measure for TransGrid is well below the other points within the benchmark group — around 2.5% for a RAB value of $4,113m. This finding suggests that TransGrid has relatively efficient asset replacement strategies and may be indicative of the age and condition of the plant and equipment it owns. Further assessment of TransGrid's replacement capex is provided in Section 3.3.

29 The total capex includes growth, non-growth (replacement and compliance) and non-network.

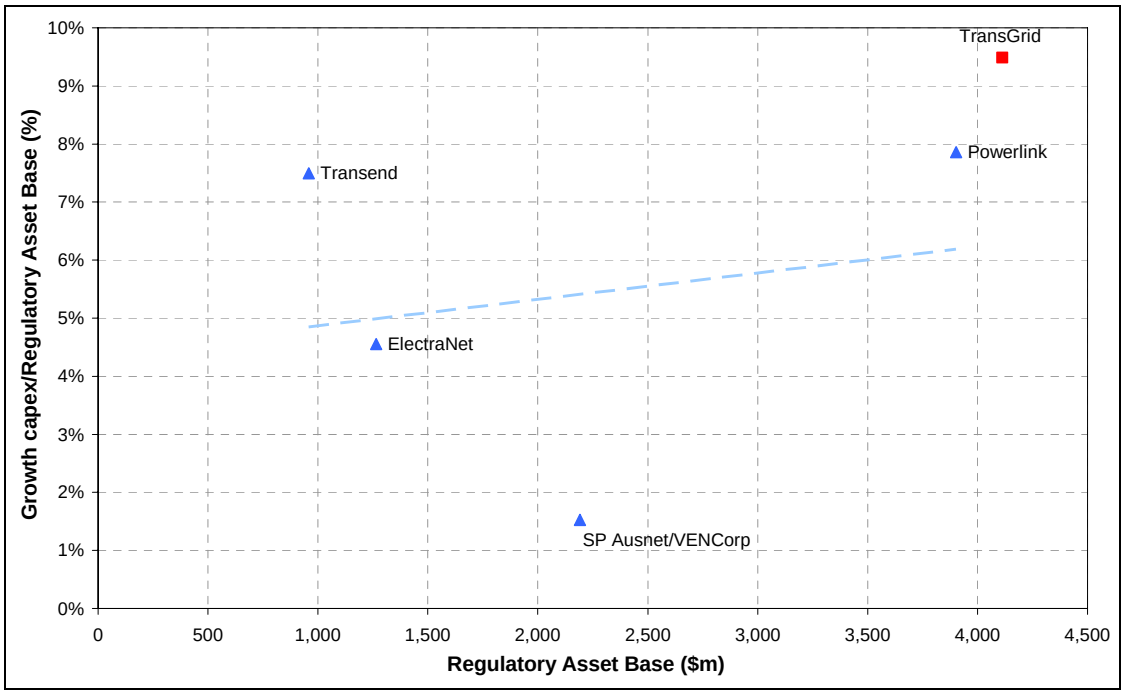
Figure 3-4 – Non-growth capex as a proportion of RAB value



Source: PB analysis.

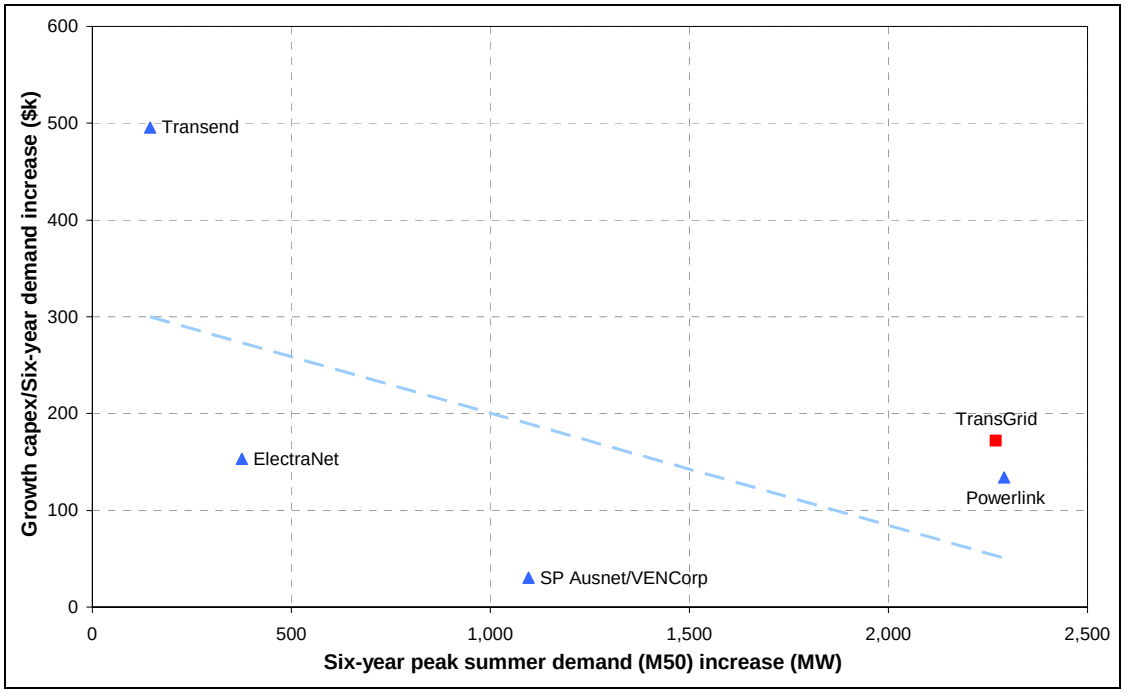
In Figure 3-5, we plot the annual average growth capex for each business as a proportion of RAB value, plotted against RAB value. It can be seen that typically the businesses invest between 1% and 10% of their RAB on growth capex per annum, and this is much more variable compared with the previously discussed non-growth expenditure levels. The measure for TransGrid is the highest within the benchmark group — around 9.5% for a RAB value of $4,113m. To consider this outcome in further detail, Figure 3-6 shows annual growth as a proportion of the six year increase in forecast summer peak demand.

Figure 3-5 – Growth capex as a proportion of RAB value vs RAB



Source: PB analysis.

Figure 3-6 – Growth capex as a proportion of RAB value versus six-year growth

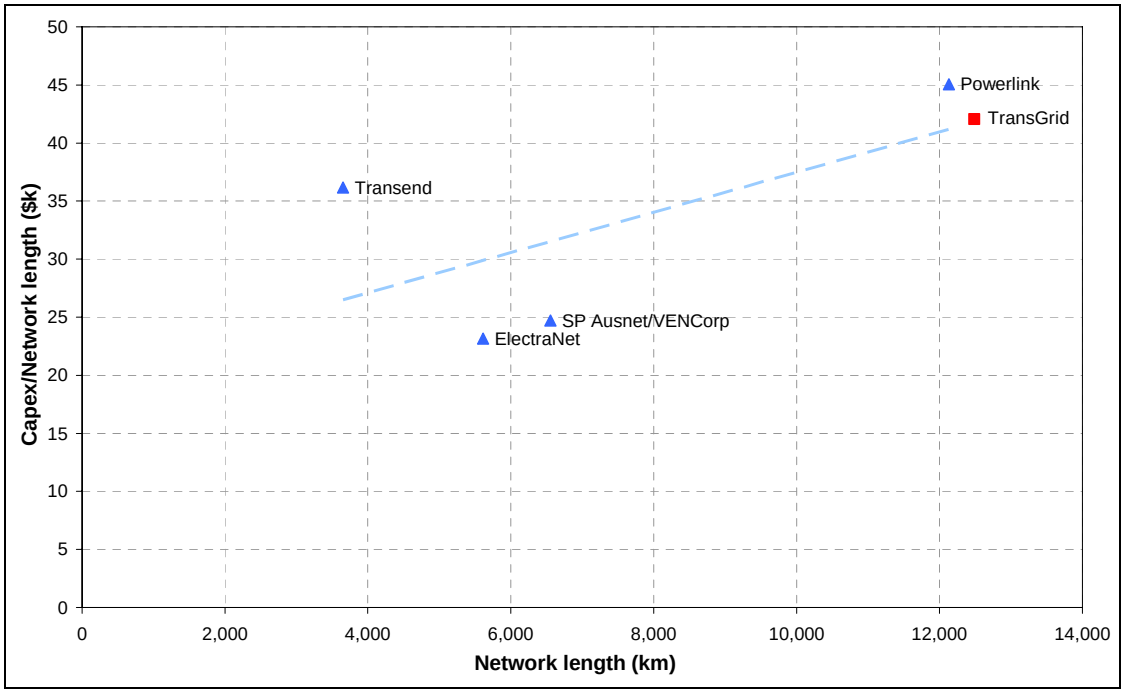


Source: PB analysis.

Figure 3-6 indicates that TransGrid is investing a similar amount of growth related capex per MW increase in peak summer demand compared with its peers, and that along with Queensland, the NSW demand growth is the greatest in the NEM by magnitude.

Figure 3-7 shows capex per kilometre length of circuit (line) as a function of network length (km of line). The proposed capex for TransGrid is seen to be close to that of the other benchmark businesses of similar length, and highlights the considerable differences in network distances.

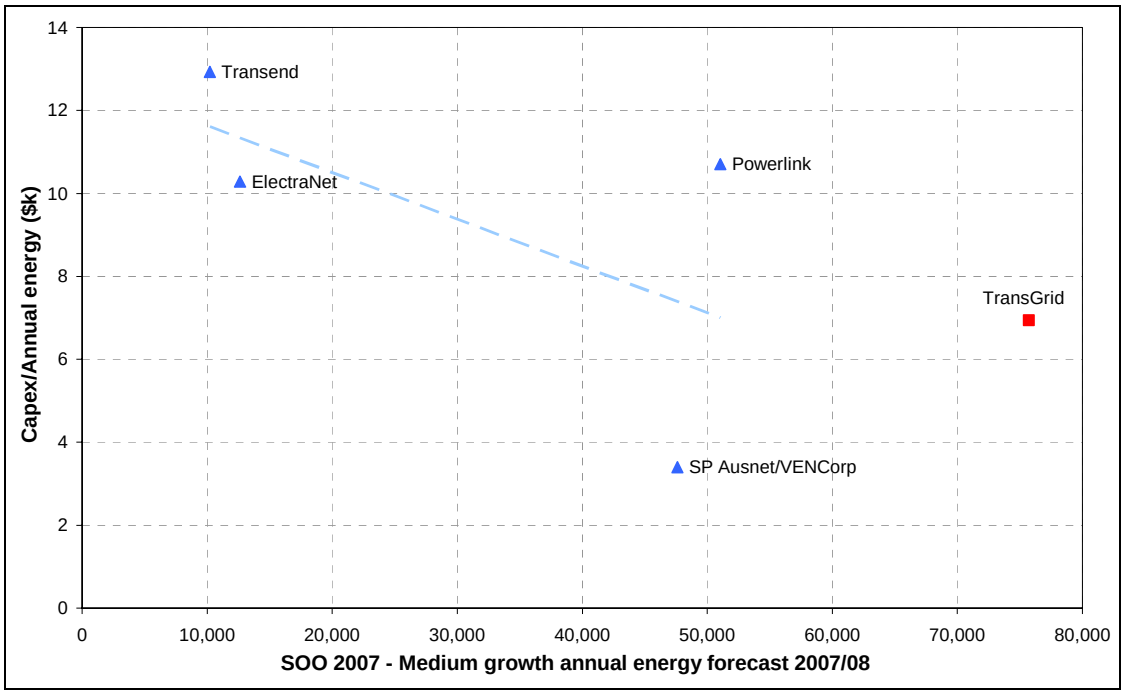
Figure 3-7 – Capex as a function of network length



Source: PB analysis.

Figure 3-8 shows capex per GWh of transmitted energy (as a function of transmitted energy). The proposed capex for TransGrid is shown to be relatively low, indicating some of the economies of scale of the network that transmits the greatest annual energy.

Figure 3-8 – Capital expenditure per GWh of transmitted energy



Source: PB analysis.

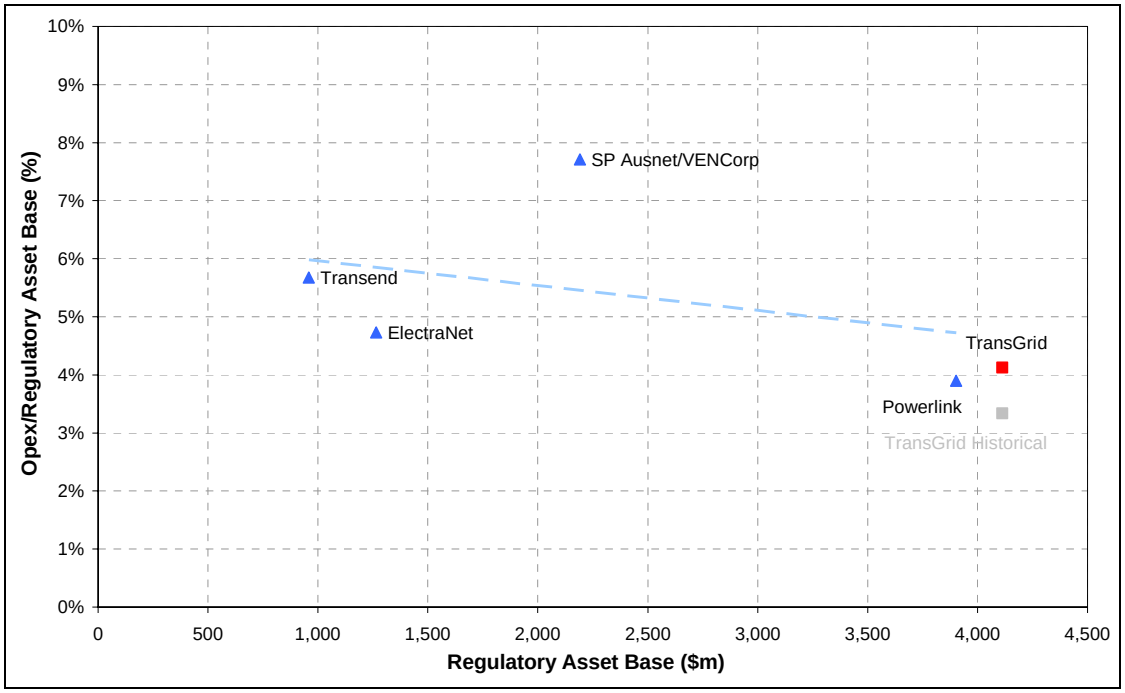
3.2.3 Opex benchmarking

In order to consider differences in both business size and business conditions, we have plotted TransGrid's total annual average opex[30] against the key cost drivers such as size - expressed by RAB value, length of network, and the number of substations.

Figure 3-9 shows opex as a proportion of RAB value plotted against RAB value for each of the sample transmission companies. It can be seen that typically the businesses invest between 4% and 8% of their RAB on opex per annum. As might be expected, the indicative trend is for opex (as a proportion of RAB value) to decrease as the asset base increases. This is likely to reflect the fixed costs of operations and maintenance, and hence the economies of scale available to the larger businesses. As shown on Figure 3-9, the proposed operating expenditure for TransGrid per dollar of RAB value is the second lowest in the benchmark sample group.

30 Including both controllable and other opex, such as network support payments.

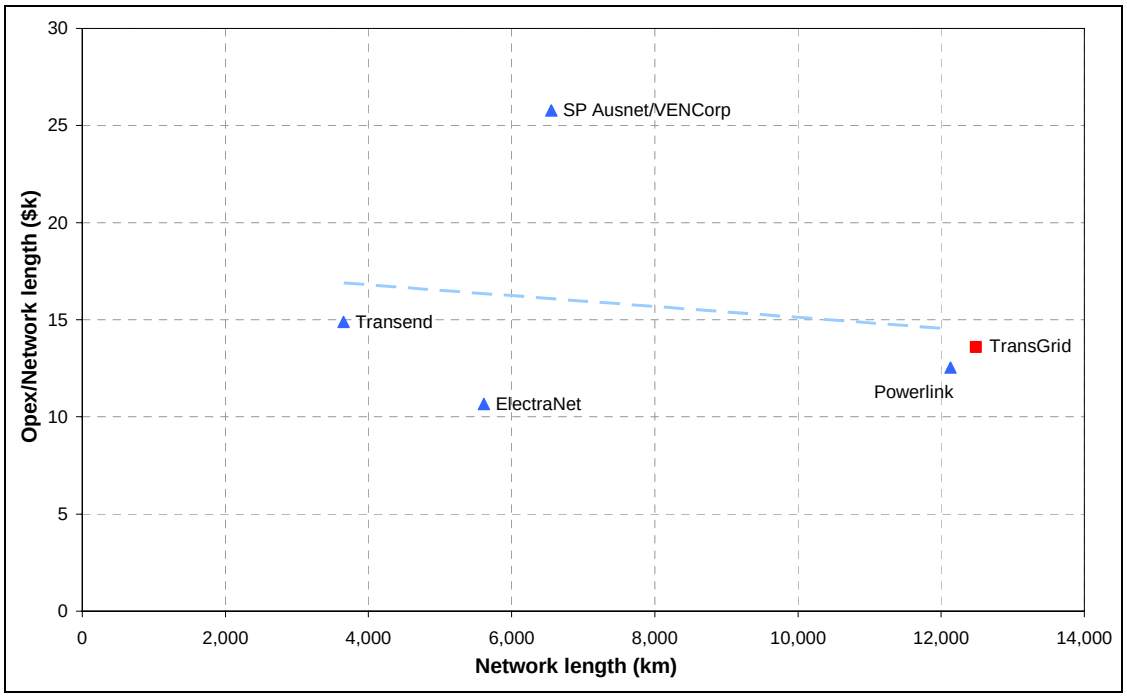
Figure 3-9 – Operating expenditure as a proportion of RAB value



Source: PB analysis – Note: SPAusnet/VenCorp is affected by a higher proportion of land tax applicable to its easements.

Figure 3-10 shows opex per kilometre length of circuit (line) as a function of network length (km of line). This, again, reflects the fixed costs of operations and maintenance, and hence the economies of scale available to the larger businesses. The proposed opex for TransGrid is similar compared to the other businesses.

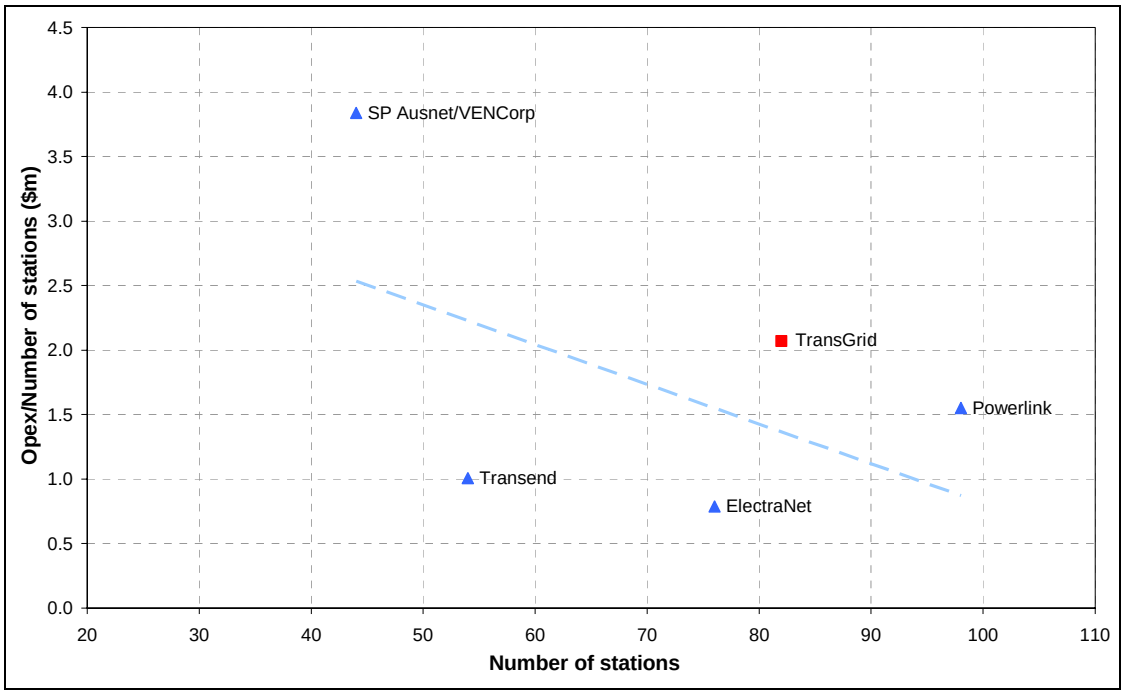
Figure 3-10 – Operating expenditure as a function of network length



Source: PB analysis – Note: SPAusnet/VenCorp is affected by a higher proportion of land tax applicable to its easements.

Figure 3-11 shows opex per transmission substation as a function of number of transmission substations. The proposed opex for TransGrid is seen to be similar compared to the other businesses.

Figure 3-11 – Operating expenditure as a function of number of substations



Source: PB analysis – Note: SPAusnet/VenCorp is affected by a higher proportion of land tax applicable to its easements.

3.2.4 Conclusion

At a high level, and in both capex and opex comparisons, TransGrid's investment in the NSW electricity transmission network compares favourably with TNSPs in other NEM jurisdictions. In particular, TransGrid is seen to be spending considerably less (as a proportion of its RAB) on non-growth related capex. In combination with relatively low opex indicators, this is likely to be indicative of the current condition and age of the plant and equipment TransGrid owns, and the asset management strategies it adopts.

The comparative benchmarking does highlight that TransGrid is spending more than average on augmentation capex driven by demand and energy growth. In PB's view, this is likely to be attributed to the capital intensive inner Sydney 330 kV cable and substation developments, and the strategic 500 kV development options being proposed.

Based on this high-level comparative assessment, PB concludes that TransGrid's proposed capex and opex over the five year period 2009/10-2013/14 appears reasonable.

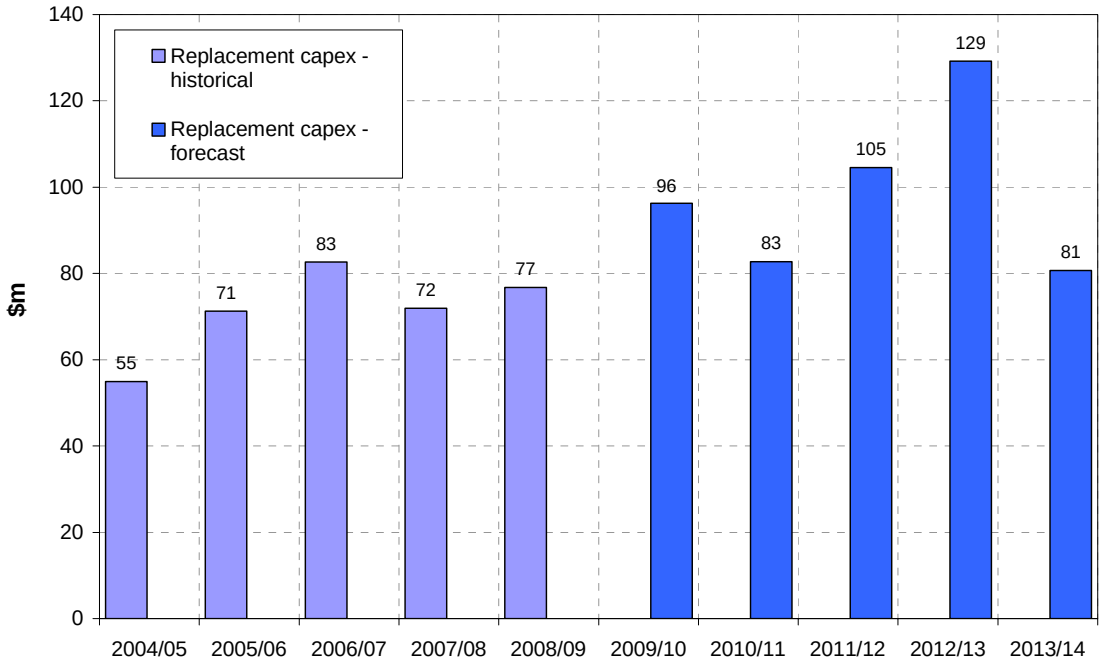
These conclusions are made in the context of, and with regard to, the limitations of, the high level comparative analysis undertaken by PB as described in the introduction to Section 3.2.

3.3 HIGH-LEVEL REPLACEMENT CAPEX ESTIMATES

TransGrid has forecast expenditure of $493.4m (real 2007/08) over the next regulatory period on the replacement of its existing assets, which is 18.8% of the entire forecast allowance. The base estimate proportion of this is $438.3m, and an additional $55.1m (or 12.6%) has been included to comprise of the risk and escalation components applied in the capital accumulation process.

As shown in Figure 3-12, TransGrid's actual and forecast replacement capital expenditure has increased over the 2004/5-2008/09 regulatory period and further increases are predicted to continue over the 2009/10-2013/14 period.

Figure 3-12 – TransGrid actual and forecast replacement capital expenditure (real 07/08)



Source: TransGrid, AER Template sheet 3.1 & 4.1.

The forecast replacement capex expenditure over 2009/10-2013/14 represents a 38% increase over the historical expenditure of $357.4m in the current 2004/05-2008/09 regulatory period and is driven by the inclusion of additional large condition driven replacement projects. The Beaconsfield West 132 kV GIS and Cooma 132 kV Substation replacement projects together comprise $90.9m, or approximately 18%, of the forward replacement capex estimate. Both of these projects are reviewed in detail in Appendix I and H, respectively.

Other significant substation replacement work is proposed for Burrinjuck and Wallerawang 132 kV substations which were commissioned in the period 1950-54. In the case of these projects, the major equipment at the substations will be approaching 60 years of age at the time of replacement.

Standard asset lives

TransGrid's asset replacement works have been determined in accordance with its Asset Management Process detailed in the TransGrid Network 30 Year Asset Management Plan 2009-2039, which for example specifies a technical life of 45 years for transformers.

The asset lives assumed and experienced by TransGrid for primary assets are typically in the range of those used by other TNSPs and industry guidelines. For example, the New Zealand Optimised Deprival Valuation Handbook specifies a standard life 55 years for large power transformers and 45 years for other outdoor substation equipment.

Table 3-3 – Comparison of selected standard asset lives

Asset	TransGrid[31]	NZ ODV Handbook[32]
Power Transformers	45	55
Circuit Breakers	40	45
Steel Towers – inland (coastal)	75 (40)	-
Wood Poles – dry	65	45
Conductor – inland	80	55
Underground Cables	60	45-70
Protection Relays – electromechanical (microprocessor)	40 (20)	40
Communication Equipment	15	15

[a] included with primary asset

Source: as presented in footnotes.

TransGrid assigns protection systems a standard life of 40 years for electromechanical relays and 20 years for microprocessor relays. In comparison, the New Zealand Handbook specifies a standard life of 40 years. Notwithstanding this, PB considers the reduced life for microprocessor based relays is consistent with the asset lives of other computerised electronic equipment.

At a high level, TransGrid states that *"all replacement programs are determined by condition, economic, safety and environmental considerations rather than by age alone".* In PB's view, this is generally supported by the extended asset lives that have been achieved for the major assets that are being considered for replacement.

3.3.1 Development of replacement capex forecast

The replacement capex forecast contained in TransGrid's Revenue Proposal was developed in accordance with its asset management process and supporting strategies outlines in the 30 Year Asset Management Plan. Condition based replacement within TransGrid appears to be a mature asset management process, evidenced by long term records of asset performance. The replacement planning process requires that appropriate evaluation in the form of Asset Replacement Condition Assessments, Planning Evaluation and Options Comparisons (ARCA, ARPE & AROC) documents be produced in order to obtain project approval.

The process identifies the following three triggers for asset replacement[33].

Age

TransGrid states that age is used as a preliminary trigger for identification of the need for a condition assessment and not as the sole justification for replacing an asset. For the purpose of long term planning, age can be used as a predictor (or indicator) of future work, yet replacement options are evaluated based on condition assessment. In PB's view, this is consistent with good electricity industry practice, especially given the relatively fewer volumes

31 TransGrid, Network 30 Year Asset Management Plan 2009-2039, page 24.

32 NZ Commerce Commission, Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Lines Businesses, 2004.

33 Capacity driven replacements are considered to be augmentation projects by TransGrid and are therefore not included in the replacement capex estimate.

and higher degree of speciality associated with extra high voltage electricity transmission plant.

Capability

Capability is expressed as the ability of an asset to carry out its intended function in terms of condition, performance, availability, reliability and supportability. For major replacements of primary systems, condition assessments are prepared which consider factors such as defect history, condition monitoring results, maintenance status, spares availability and risk assessment outcomes. For secondary systems, more emphasis is placed on the level of internal and manufacturer support, spares availability and historical performance and reliability of the asset.

Compliance

This covers regulatory obligations, technical standards and legal issues that may impact on a decision to replace an asset. This may involve the application of environmental legislation, OH&S regulations, chemical control orders, the Electricity Supply Act, industry guidelines or the National Electricity Rules.

3.3.2 Application of the asset replacement process

Within the above three point framework, TransGrid's asset replacement procedure requires a risk analysis to be undertaken in accordance with AS/NZS 4360:2004. This approach assesses the potential consequences if an asset is not replaced using a two dimensional framework.

As shown in Figure 3-13, one dimension is the likelihood of the event occurring, as assessed on a five category scale ranging from "rare" to "almost certain". The second dimension is the consequences of the event, as assessed on a five category scale ranging from "insignificant" to "catastrophic". This risk matrix is applied to each of the following five categories and weighted based on a pre-defined and documented policy[34] to give a final risk score used in the TransGrid's analysis:[35]

- safety
- environment
- reliability
- cost
- operational.

TransGrid notes that its risk assessment process is not exact and while the framework allows project with a similar type to be compared, care should be taken when comparing risk scores across work streams[36].

Asset replacements are prioritised on the basis of the weighted risk score identified for the replacement project. This approach is most useful in situations where the budget is constrained. In this situation, different risks can be assessed relative to one another and the location of the replacement threshold between the two risk score extremes can be determined by the available funds.

34 ibid page 17.

35 TransGrid, Network Asset Replacement Project Evaluation, GM AS G2 025, July 2008 page 14.

36 ibid page 14.

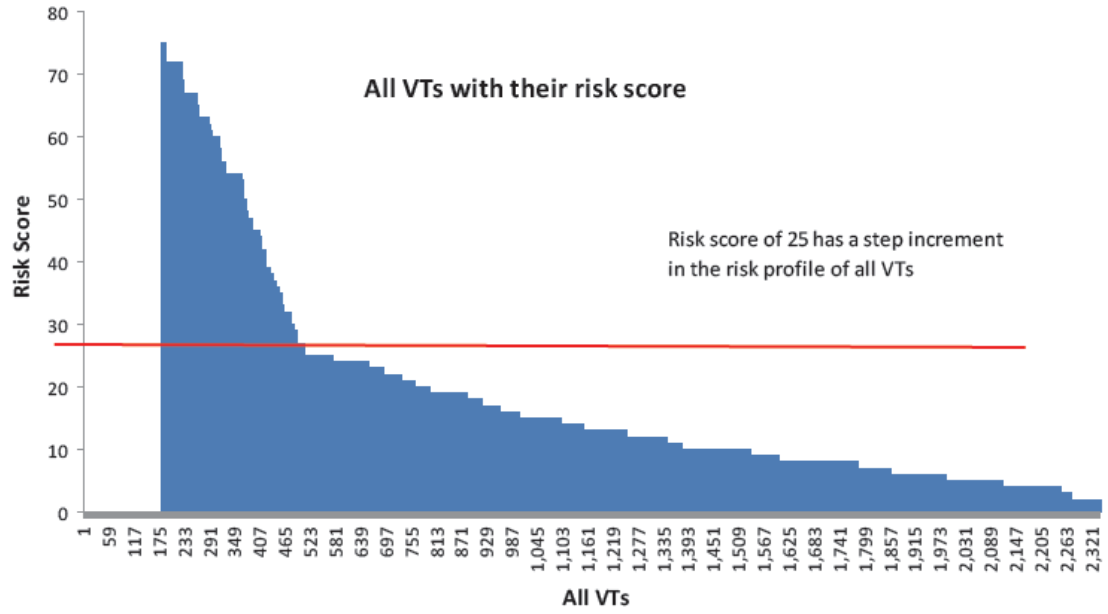
Figure 3-13 – TransGrid risk assessment matrix

Consequence / Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	4	10	17	19	20
Likely	3	8	14	18	19
Possible	2	6	10	14	18
Unlikely	0	2	8	12	17
Rare	0	0	6	10	14

Source: TransGrid GM AS G2 025, July 2008.

TransGrid's policies do not specifically outline where on the matrix an 'unacceptable risk' threshold should be, and TransGrid expressed views that some engineering judgement and expert opinion based on the asset manager's experience is important when making final decisions. PB concurs with this principle in facilitating the risk assessments. PB also understands that in preparing its revenue proposal TransGrid has generally identified assets for replacement on the basis of a significant relative change in the risk score when compared to the population of similar assets. This process is illustrated in Figure 3-14 for a typical asset type.

Figure 3-14 – TransGrid sample need identification – Voltage Transformers



Source: TransGrid Presentation M5_Replacement Capital Expenditure for AER July08v2.

PB notes that this methodology sets the risk score against TransGrid's population of similar assets which, due to the high weighting assigned to reliability, may not be representative of the actual risks in cases where the risk associated with TransGrid's existing assets is low.

Whilst PB acknowledges the value in applying the risk matrix in the project assessment process and recognising that TransGrid has prepared guidelines to assist in assigning consistent risk scores[37], the process of risk determination remains inherently subjective. In PB's view, this is demonstrated by the wide variation in the application of the risk assessment process for replacement projects. Furthermore, our detailed reviews of proposed replacement projects provided little evidence to show that TransGrid had genuinely considered measures other than asset replacement as a strategy for mitigating the identified risks.

37 TransGrid, Network Asset Replacement Project Evaluation, GM AS G2 025, July 2008.

In PB's view, the TransGrid risk assessment process alone provides a relatively weak justification for the selection of an option. Where decisions are based on a combination of NPV and risk reduction, TransGrid has advised that selection is typically informed by the calculation of the risk reduction achieved per dollar NPV, other external factors and engineering judgement[38].

From our detailed reviews of a sample of TransGrid's proposed forward capital works portfolio[39], PB notes the following observations in the application of TransGrid's replacement capex assessment process:

- the use of risk reduction against the 'Do Nothing' benchmark will always exclude the 'Do Nothing' option as it, by definition, provides zero risk reduction
- the risk score evaluation process is relatively arbitrary as it does not capture differences in the risk associated with significantly different options such as the use of replacement concrete poles over replacement wood poles[40]
- the baselines established for the 'Do Nothing' options are in some cases inconsistent with TransGrid's standard practice[41], resulting in an overstatement of the risk reduction provided by other options
- the calculation of the NPV of the project does not appear to include all future costs associated with each option. This results in incompatible NPV comparisons with the conclusions potentially affected by the shortcomings of the analysis
- the options development is not robust and does not identify all reasonable options. For example, on up-rated lines with two distinct installation dates, no assessment has been made of replacing the older structures and newer structures under separate programs
- TransGrid's asset management process includes risk assessment triggers to identify and mitigate the risks associated with asset types. PB is of the view that the use of risk assessment to inform asset refurbishment or replacement is not consistently applied as acceptable risk levels are not well defined. Whilst risk assessment results are considered, asset management decisions are typically made based on 'engineering judgement' which remains a less transparent basis for investment decisions.

PB has provided specific recommendations with respect to detailed project reviews as a result of the application of TransGrid's asset replacement assessment. These matters are discussed in detail in Section 5.4 and Appendices G-J.

3.3.3 High level estimate

PB has adopted a multi-pronged approach to assessing the prudence and efficiency of TransGrid's capex expenditure. An element of this approach involves consideration of the total replacement capex expenditure in light of the age profile of TransGrid's asset base. To achieve this, PB has simplistically modelled the scenario where TransGrid replaces all assets older than the given average economic life of the asset base as a whole, but not already replaced. That is, we answer the question; what would the replacement capex requirements be if all the assets between the average economic life and the greatest maximum standard life (assessed from the end of the next regulatory period) were replaced over the next regulatory period. This is of course a 'broad brush', very high-level age-based estimate, and it is not intended to be a substitute for detailed condition based bottom-up assessment. However it is

38 TransGrid Action 4 5 Cost Risk Reduction Response, 11 August 2008, page 3.

39 Detailed in Appendix C to L.

40 Programs Review Appendix L.

41 For example the stated standard practice of defect replacement of wood poles with concrete poles in the TransGrid 30 Year Network Asset Management Plan 2009-39 page 80.

PB's view that this estimate does provide some indication of the reasonable range replacement capex expected over the extended asset lives of transmission assets, and when combined with other approaches and assessments does serve to inform the overall replacement capex allowance.

Table 3-4 is an extract from TransGrid's Post-tax Revenue Model spreadsheet. This data shows that TransGrid has assumed an economic life of 50 years for transmission lines, 40 or 45 years for other primary assets, and 10 or 15 years for secondary systems. Based on the proportion of each asset type in the asset base, we estimate the average economic life of the asset base as a whole, when weighted by un-depreciated replacement cost, to be approximately 45 years[42]. This is based on the un-depreciated replacement cost of TransGrid's network fixed assets (excluding land and easements) being estimated at approximately $5.7bn (nominal dollars) based on the information in Table 3-4. While the estimate of the average economic life of the asset base may seem high, it needs to be noted that approximately 51% (weighted by replacement value) of the asset base comprises transmission lines with a 50 year life. Hence the average economic life weighted by un-depreciated replacement cost is skewed towards this age.

Table 3-4 – Opening Regulated Asset Base for 2009-10 ($m Nominal)

Category title	Opening asset value ($m)	Remaining life (years)	Economic life (Standard life) years
Transmission lines (pre 2004/05)	1,204.38	23.1	50.0
Underground cables (pre 2004/05)	209.33	35.3	45.0
Substations, incl buildings (pre 2004/05)	793.44	21.5	40.0
SCADA and communications (pre 2004/05)	31.41	6.8	15.0
Non-network assets (pre 2004/05)	41.76	1.7	10.0
SMHEA assets (pre 2004/05)	39.55	8.0	40.0
Accelerated lines (pre 2004/05)	0.04	0.0	n/a
Accelerated substations (pre 2004/05)	0.01	0.0	n/a
Land and easements (pre 2004/05)	510.51	n/a	n/a
Transmission lines (2004-09)	173.33	49.1	50.0
Underground cables (2004-09)	8.94	41.4	45.0
Substations, incl buildings (2004-09)	859.50	38.8	40.0
SCADA and communications (2004-09)	58.06	13.8	15.0
Non-network assets (2004-09)	183.10	8.4	10.0
Land and easements (2004-09)	124.08	n/a	n/a

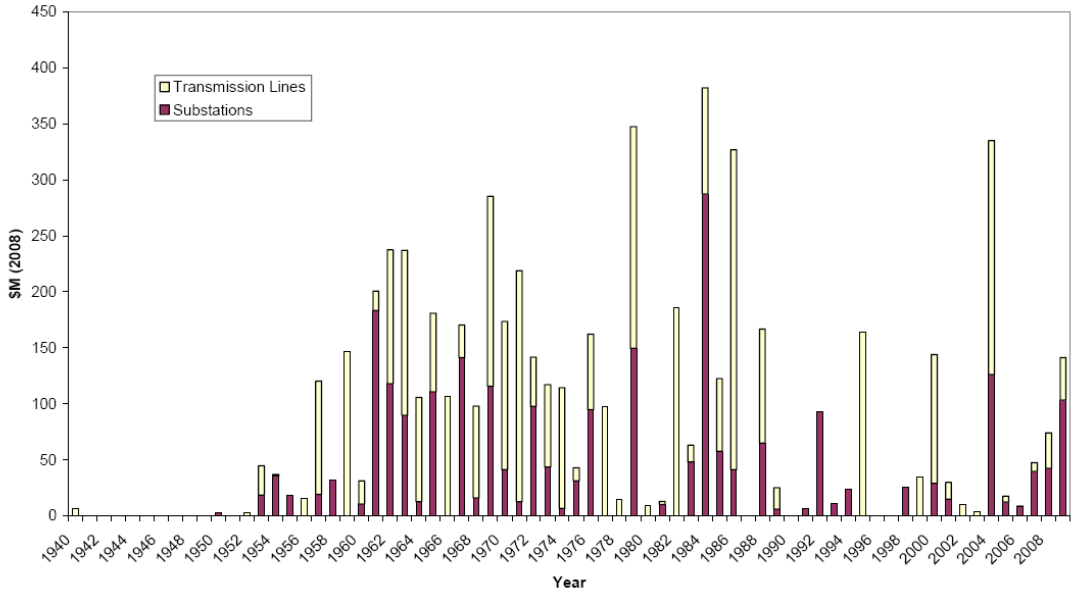
Source: PTRM TransGrid Proposal May08.xls (spreadsheet). TransGrid, 2008.

Figure 3-15 shows the approximate age profile of TransGrid's network assets. Based on the approach outlined above, and the estimated 45 year weighted average economic life with a maximum standard life of 50 years, PB has determined a top-down allowance to permit the replacement (by the end of the next regulatory period) of all assets installed prior to 1969 but after 1963 (i.e. the 5 year period 45 years prior to the end of the next regulatory period). Analysis of the age profile shown in Figure 3-15 indicates that approximately 14% of the current asset base would need to be replaced under this simple model. Hence a conservative estimate of the upper limit of the total replacement cost would be approximately $800m (14% of $5.7 b) over the next regulatory period.

42 This estimate of average economic life has been determined using replacement cost as the basis for the calculation, and uses only those asset categories that are relevant to the network.

It must be stressed that this is a very high-level approximation of network fixed asset replacement costs based on the model outlined above. This method assumes an age-based replacement strategy, which in PB's view is not a sound asset management practice. However, this model provides a broad estimate to inform the overall capex review process.

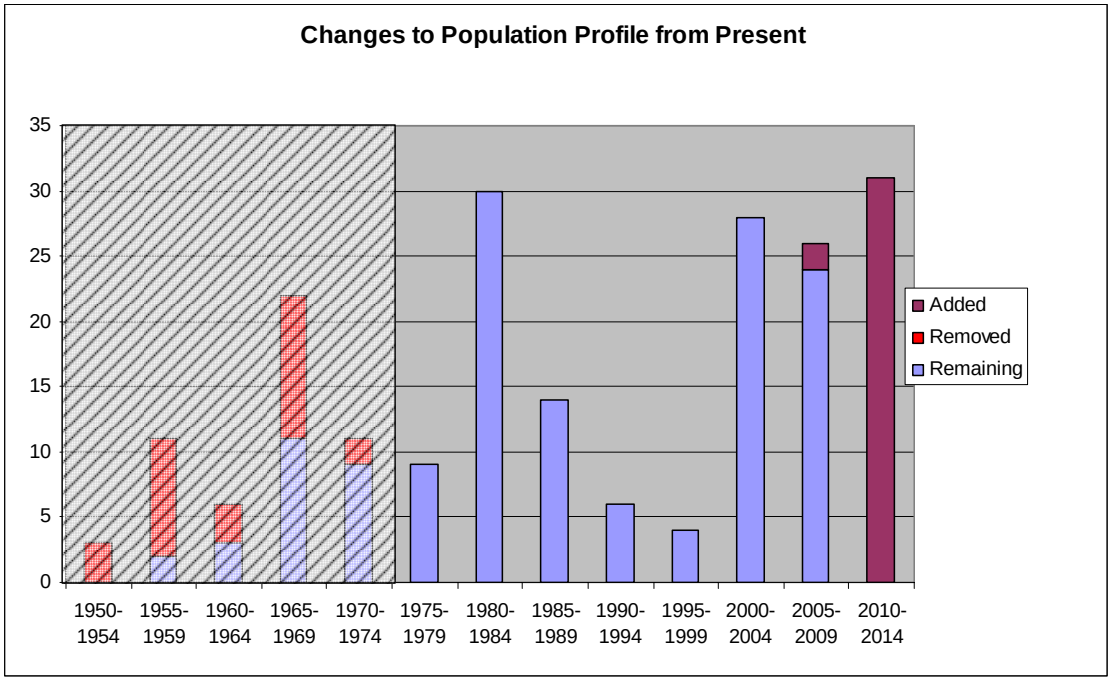
Figure 3-15 – Commissioning of new network assets



Source: TransGrid Action 4 7 Yearly + 5-Year Commissioning Graphs.pdf –supplied in response to PB enquiry.

The approximating nature of this approach is compared to one of TransGrid's individual asset classes (transformers), as shown in Figure 3-16, where it can be seen that based on a bottom-up condition based review and augmentation developments, TransGrid will still have units that were installed between 1955 and 1960 in service at the end of the next regulatory period (i.e. approaching sixty years of age).

Figure 3-16 – Actual replacement of aging transformers based on condition



Source: Transformer Population Changes Graph from Presentation 31 Aug 2008.

Conclusions

PB's high-level indicative approach is based on the scenario where TransGrid replaces all assets older than the weighted average economic life of the asset base as a whole, but is limited to assets less than the maximum standard life. Based on this model, PB would expect that the ex-ante replacement capex proposal would be in the order of $800m. In comparison with expectation, TransGrid has proposed a total network ex-ante replacement capex of $493.4m. While TransGrid's proposed figure is considerably less that the top-down benchmark (approx. 38% below), this is in line with the results discussed in the high level benchmarking section of this report (Section 3.2.2). Further to this, on the basis that TransGrid's asset management approach is condition based and does not involve a significant proportion of brownfield[43] replacement works; this result is not unreasonable or surprising. Notwithstanding the results of PB's detailed project reviews, which target project efficiency from a bottom-up perspective, we have formed the view that the ex-ante capex allowance proposed for replacement of $493.4m is not unreasonable.

3.4 COST ESTIMATING METHODOLOGY

TransGrid maintains a Capex Estimating Database (CED) in accordance with the CED Administration Procedure (EG PG G2 006).

The CED is a key tool used by TransGrid in preparing its cost estimates for major capital works projects and significantly contributes to the project approval, regulatory test and capital budgeting processes. Additionally, the CED is used in the preparation of project cost estimates to support TransGrid's annual capital budget process and the capital expenditure forecast included in TransGrid's revenue submission.

The cost estimates prepared using the CED are based on the respective project scopes as determined during the project investigation phase of each project. The extent of each investigation is dependent on the point in the project cycle at which the investigation is being undertaken and the purpose for which the estimate is being prepared. The results of the project investigation are documented in feasibility study reports and or Project Option Scope and Estimated (POSE) documents.

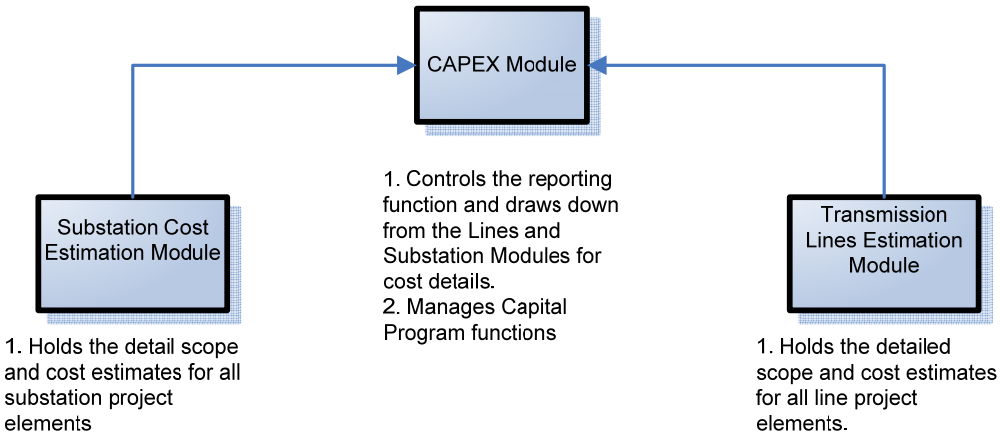
Access to the Project Development Capex Estimating Database is restricted to the CPD/Project Development Team. The system offers the benefits that:

- all cost estimates are prepared in a consistent manner
- all cost estimates are based on a common database of unit prices
- all project definitions are recorded and hence can be verified and modified as required
- a single output file can be generated to enable all costing information to be transferred to the Capital Accumulation Model in a consistent and complete manner.

The system has been developed on the philosophy that all cost estimates are built up from a consistent set of component prices which can be independently verified and reviewed. The key aspect of the CED is that it has a substation design and cost module and a transmission line design and cost module, as shown in Figure 3-17.

[43] Brownfield works are generally defined to involve work at an existing site where work is required in the presence of existing assets.

Figure 3-17 – Diagrammatic overview of CED



Source: D2008/05616, page 6, 24 January 2008.

The information contained in the database falls into the following broad categories:

- unit cost data and escalation factors
- assembly and bay type definitions
- project definitions
- complex definitions
- stored procedures – including algorithms for calculating estimates.

The data is protected by limiting access to the system to members of the Project Development Team within the Capital Program Delivery Group.

Instructions have been issued that:

- data relating to the unit cost data and the assembly and bay type definitions will only be entered into the system by the CED Administrator in accordance with the CED Administration procedure[44]
- data relating to project definitions will only be entered by the person responsible for that specific project
- data relating to the grouping of projects into complex items and complexes will only be entered by the Manager/Project Development and or the Project Development Manager.

TransGrid advises that due to the limited number of people who have access to the system, the procedure has proven to be effective in maintaining the integrity of the system

TransGrid validates the contents of the CED through benchmarking in accordance with the CED administration procedure[45]. The CED benchmarking involves obtaining independent project estimates and comparing these estimates with CED estimates prepared using the same scope inputs.

In PB's view the framework TransGrid has established regarding its cost estimating database is sound and suitable for the purposes intended, however PB highlights the issues associated with the application of generic factors to account for assembly costs in the construction works, costs incurred by TransGrid in the design of the project, the administration of the contracts, the

44 Refer EG PG G2 006.

45 Refer EG PG G2 006.

field supervision, testing and commissioning and ancillary works. This is discussed further in Section 3.5.2 of this report.

3.5 UNIT COST BENCHMARKING

In planning a project, the cost for a given scope of work needs to be established. The accuracy of the estimate will vary depending on the specific application. Ideally, the preferred source of a project cost would be a competitively sourced fixed quote from the work group or contractor completing the work, but to establish this level of accuracy is a time-consuming process and the information required to construct a detailed quote is not typically available at the early stages of a project.

A common process for establishing the cost of a project is to build up an estimate from individual elements and to reach a total cost for the project, commonly known as a building block approach. A reasonable source of these building block costs would be recent historical projects of a similar nature.

At the inception of a project, it is common for the estimation of project costs to have a variance of up to ±25%. As the project progresses and the details are refined, the accuracy of cost estimation will improve, typically to ±5%. Finally work assignment packages or contracts will be released and a price agreed.

PB has examined individual costs that TransGrid has used in its planning process, and compared these to the costs from publicly available information and PB's own internal database of costs.

TransGrid has supplied details and costs on the range of projects included in the detailed project reviews and other information packages provided during the review process. PB has selected key elements from these projects for benchmarking. These elements were selected against three main criteria.

- the first criterion reflects the current replacement strategies for instrument transformers and circuit breakers

  Some instrument transformers are subject to type based replacement programs, whilst other units have been identified for replacement through TransGrid's condition monitoring processes. TransGrid intends to replace 193 instrument transformers[46] at a total cost of $21.8m[47]. Owing to the large number of instrument transformers that TransGrid intends to replace, the cost of each unit is significant

  Similarly, certain circuit breaker types are subject to type based replacement programs, with a total of 129 circuit breakers scheduled for replacement during the 2009/10-2013/14 regulatory period. Owing to the large volume of circuit breakers that TransGrid intends to replace, the cost of each unit is significant
- the second selection criterion relates to the rebuilding of substations and the large number of transformer replacements associated with this work. Transformers are expensive specialist items of equipment that are subject to long procurement lead times. As a single item, transformers are frequently the most expensive procurement item in substation replacement works
- the final selection criterion relates to transmission lines and cables due to the large expenditure associated with transmission line augmentation work proposed for the 2009/10-2013/14 regulatory period.

Additional items were also benchmarked where PB had access to multiple benchmarks either publicly and in its own database. This selection has enabled PB to develop a general perception of the unit costs used by TransGrid.

46 TransGrid ProgramVolumeData.pdf.

47 TransGrid, AER Schedule (for AER).xls – sheet 4.4.

Availability of suitable benchmarks

When benchmarking equipment costs, it is important to recognise that the market for transmission equipment has few suppliers and also few customers. Additionally, the cost of purchasing single units can be high when compared to purchasing multiple units of equipment. This means that the availability of benchmarks in the public domain to which TransGrid's costs can be compared is limited. There are often similar items, but at differing voltages or capacities, and in different locations and business environments.

In establishing benchmark costs, PB has taken into account and adjusted for:

- inflation and monetary exchange rates (all referenced to 2007/08)
- voltage levels
- capacity
- design differences.

In addition to internal reference material, PB utilises publicly available sources of information on project and unit costs as they become available. Examples of publicly available sources include:

- NZ Commerce Commission, 2004, Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Lines Businesses
- CitiPower – Melbourne CBD Enhancement: Regulatory Test Analysis written by NERA dated 5 April 2007
- regulatory determinations
- various TNSP and DNSP Application Notices and Annual Planning Reviews.

Accuracy of the price benchmarks

TransGrid provided its estimated costs for the major items of transmission equipment required to complete the projects under detailed review. The costs and scope has been provided at a summary level for all of the remaining projects included in the forecast capital works program. As the costs have been forecast for a range of projects at various stages of implementation, they contain some uncertainty when compared to actual costs incurred in the past. PB considers that some element of error will be apparent in comparisons between TransGrid's forecast costs, the publicly available information and the information from the PB internal database of costs. Without the option of a detailed audit type review of unit costs, PB considers specialist transmission project type costs within 20% of the benchmark should be considered to be reasonable.

Another element in differences between benchmarks and forecast costs can relate to the location of the project. For instance, the costs associated with building a new 'greenfield' substation on vacant land can be significantly cheaper than retrofitting an existing 'brownfield' substation. The additional cost is usually associated with the need to plan around maintaining existing assets in service and managing the associated electrical hazard during the building process. TransGrid has nominally taken account of these complications by adjusting the DCF (Design Cost Factor), NCF (Network Cost Factor) and AWF (Ancillary Works Factor) factors[48] that are applied to capital cost estimates to cover the design and implementation of the proposed capital works.

Instrument transformers

PB has selected current transformers and voltage transformers at the three main operating voltages of the TransGrid network for benchmarking. The 132 kV, 330 kV and 500 kV voltages

[48] TransGrid, Capex Estimating Database Manual, D2008/05616, January 2008, page 5, as discussed in Section 3.5.2.

cover the majority of the instrument transformer replacement and augmentation works scheduled for the 2009/10-2013/14 regulatory period.

Table 3-5 – Instrument transformer benchmarks (per 3 ph set, installed)

Description	TransGrid unit cost variance compared to PB benchmark
CT 132 kV	-0.7%
CT 330 kV	13.6%
CT 500 kV	-0.4%
VT 132 kV	-9.4%
VT 330 kV	0.1%
VT 500 kV	6.0%

Source: TransGrid; PB Benchmark Database.

Table 3-5 demonstrates that the unit prices applied by TransGrid in its capital expenditure estimation process are generally consistent with the benchmark costs obtained by PB. The benchmark costs are within a range of -9.4% to +13.6% of the PB benchmark. On the basis that this range is within the +/-20% criterion established for this benchmarking process, PB considers that the instrument transformer costs used by TransGrid are reasonable.

Circuit breakers

PB selected circuit breakers at the three main operating voltages of the TransGrid network for benchmarking. The 132 kV, 330 kV and 500 kV voltages cover the majority of the circuit breaker replacement and augmentation works scheduled for the 2009/10-2013/14 regulatory period.

Table 3-6 – Circuit breaker benchmarks (installed)

Description	TransGrid unit cost variance compared to PB benchmark
66 kV	-5.3%
132 kV	-10.2%
330 kV	1.7%
500 kV	-8.4%

Source: TransGrid; PB Benchmark Database.

Table 3-6 demonstrates that the unit prices applied by TransGrid in its capital expenditure estimation process are generally below the benchmark costs obtained by PB. The benchmark costs are within a range of -10.2% to +1.7% of the PB benchmark. On the basis that this range is within the +/-20% criterion established for this benchmarking process, PB considers that the circuit breaker costs used by TransGrid are reasonable.

Transformers

PB selected transformers at the three main operating voltages of the TransGrid network for benchmarking. The 132 kV, 330 kV and 500 kV voltages cover the majority of the transformer replacement and augmentation works scheduled for the 2009/10-2013/14 regulatory period.

Table 3-7 – Transformer benchmarks (3 ph equivalent)

Description	TransGrid unit cost variance compared to PB benchmark
60 MVA 132/66 kV	-7.8%
120 MVA 132/66 kV	-0.8%
375 MVA 330/132 kV	5.5%
500 MVA 500/330 kV	17.5%

Source: TransGrid; PB Benchmark Database.

Table 3-7 demonstrates that the unit prices applied by TransGrid in its capital expenditure estimation process are generally consistent with the benchmark costs obtained by PB. The benchmark costs are within a range of -7.8% to +17.5% of the PB benchmark. PB notes that the larger transformers are significantly over the benchmark figures, whilst the smaller transformers are below the benchmark. PB believe that this may be reflective of the increase in the price of copper and steel in recent years, the effect of which is more evident in the higher capacity transformers as they contain a larger proportion of raw materials. The price history for materials used in transformers is documented in the CEG report[49].

On the basis that this range is within the +/-20% criterion established for the benchmarking process, PB considers that the instrument transformer costs used by TransGrid are reasonable.

Transmission lines

PB selected transmission lines at the three main operating voltages of the TransGrid network for benchmarking. The 132 kV, 330 kV and 500 kV line types selected for benchmarking were selected to be consistent with the construction typically used in the transmission lines projects for the 2009/10-2013/14 regulatory period.

Table 3-8 – Transmission lines benchmarks (excludes easements and clearing)

Description	TransGrid unit cost variance compared to PB benchmark
132 kV D/C concrete pole, 'Mango' conductor	-0.9%
330 kV D/C steel lattice tower 'Olive' conductor	16.2%
330 kV D/C underground per km installed	16.8%
500 kV D/C steel lattice tower 'Orange' conductor	15.8%

Source: TransGrid; PB Benchmark Database.

Table 3-8 demonstrates that the unit prices applied by TransGrid in its capital expenditure estimation process for key unit costs are consistently towards the upper limits of the benchmark costs established by PB. The benchmark costs are within a range of -0.9% to +16.8% of the PB benchmarks, and whilst they are within the broad 20% range of accuracy, the costs used by TransGrid for the higher voltage 330 kV and 500 kV lines are relatively high. This may be attributed to the limited information available due to the lack of transmission line

[49] CEG , Escalation Factors Affecting Expenditure Forecasts – A report for NSW electricity businesses, April 2008, page 12.

development in NSW over recent history, or the increasing adoption of a design and construct approach by TransGrid over recent years in order to deliver its capex program[50].

Buildings and civil works

PB selected typical building and civil works components that were considered to be significant projects for the 2009/10-2013/14 regulatory period.

Table 3-9 – Building and civil works benchmarks

Description	TransGrid unit cost variance compared to PB benchmark
Control building nominal 200m^2	174%
Spill oil tank	-2%

Source: TransGrid; PB Benchmark Database.

Table 3-9 demonstrates that the unit prices applied by TransGrid in its capital expenditure estimation process are consistent with the PB benchmark cost for oil containment work and is significantly above the benchmark costs obtained by PB for building construction. On further investigation, PB determined that TransGrid's control building expenditure, whilst above the benchmark remains within the upper range of the control building costs incurred by other TNSP's.

PB notes that there is understandably a large variation in scope covered by line items described as 'control buildings' in project cost estimates due to site and design influences such as foundation works, services, configuration and architectural differences. Similarly, the extent of security and fire protection systems included in TransGrid's building costs estimates may not be commensurate with the allowances included in the scope of the benchmark building costs.

On examination of the range of building costs incurred by other TNSP's, PB believes that the difference in the benchmark figures, whilst high and quite near the upper limit of control building costs, is not beyond the point where were would consider the costs unreasonable. Therefore, PB is not recommending an adjustment for TransGrid's control building costs.

3.5.1 Conclusions on unit costs

PB's analysis of the plant and equipment costs provided by TransGrid included benchmarking of items to enable PB to form an opinion on whether the costs used by TransGrid were reasonable and efficient. PB found that the following items were lower or about the same as the benchmarks established by PB:

- instrument transformers
- circuit breakers
- transformers up to 120 MVA.

PB also identified that the unit costs for large power transformers and transmission lines were at the upper limit of the expected range, but not unreasonable when compared to the wide range of benchmark costs associated with our relatively high level review of the relevant plant.

Finally, PB identified that control-room building costs were significantly higher than the benchmark (174%) but on detailed analysis of the scope of works, we conclude that the costs are not unreasonable.

[50] PB notes in one instance as part of a detailed project review (Lismore-Dumaresq, refer Appendix E) it appears that the easement cost has been erroneously captured within the overall line development cost.

3.5.2 TransGrid cost estimating factors

PB notes that a significant complication in comparing TransGrid's unit costs to benchmark costs is TransGrid's reliance on 'factors' in the capital works estimating procedures. These factors are identified separately to contingency, which has specifically been removed from TransGrid's capital expenditure estimates, but are included to a varying degree on each project. The standard factors applied in TransGrid's capex estimating database are shown in Table 3-10, below.

Table 3-10 – Standard factors

Scope	Project Type	DCF	NCF	AWF	Total
500 kV Transmission Line	New	5%	10%	10%	25%
500 kV Substation	Augmentation	5%	8%	10%	23%
500 kV Substation	New	5%	5%	10%	20%
500 kV Substation	Transformer	5%	5%	10%	20%
330 kV Cable	Augmentation	2.5%	3%	10%	15.5%
330 kV Transmission Line	Augmentation	12%	12%	15%	39%
330 kV Transmission Line	New	8%	10%	10%	28%
330 kV Substation	Augmentation	10%	15%	15%	40%
330 kV Substation	New	10%	10%	10%	30%
330 kV Substation	Reactive	20%	15%	10%	45%
330 kV Substation	Transformer	13%	5%	10%	28%
132 kV Transmission Line	Augmentation	15%	15%	15%	45%
132 kV Transmission Line	New	12%	12%	10%	34%
132 kV Substation	Augmentation	10%	10%	15%	35%
132 kV Substation	New	10%	10%	10%	30%
132 kV Substation	Reactive	25%	20%	15%	60%
132 kV Substation	Transformer	15%	10%	10%	35%
66 kV Transmission Line	Augmentation	10%	10%	10%	30%

Source: TransGrid, Capex Estimating Database Manual (D2008/05616), January 2008 page 25.

With regard to the materiality of these factors, TransGrid has stated that:

> *"A review of the cost estimates for all of the future projects included in TransGrid's revenue proposal shows that 15.6% of the total cost is accounted for by project cost factors, this includes project delivery costs, brownfield costs*

and early phase estimate costs (DCF- Design Cost Factor, NCF – Network Cost Factor and AWF – Ancillary Works Factor)."[51]

The definitions of the factors identified in the TransGrid Capex Estimating Database Manual (D2008/05616, January 2008) are reproduced below:

- *AWF is the ancillary works factor and is used to account for the minor project costs that are not captured by the high level scoping, using major project components, carried out during the concept phase of a project*

  This includes the costs of integrating the new project into the existing network, changes to control and protection systems, and ancillary/incidental works that occur during the construction period, which are covered by schedule of rates allowances within the construction contract

- *NCF is the Network cost factor and includes all the costs associated with field supervision, site management and commissioning of the project. This cost factor is calculated as a percentage cost of the overall capital cost of the project and is varied according to the type of project being undertaken*

- *DCF is the design cost factor and includes all costs associated with the design, specification preparation, tendering process, the environmental assessment and the project management of the project. It is calculated as a percentage cost of the overall capital cost of the project. The design cost factor is varied according to the type of project being undertaken.*

In addition to the factors documented above, a SCF, or Scoping Cost Factor and Market Factor were also identified in our review of the Lismore-Dumaresq 330 kV line documentation. These factors are not included in TransGrid's Capex Estimating Database Manual and the precise definition of these additional factors has not been identified in the project or policy documents provided.

PB is concerned with the lack of transparency in what these factors represent and the inconsistent manner in which they appear to have been applied. The 'standard' factors[52] are defined on the basis of project type, as shown in Table 3-10. PB notes that these factors would result in uplift of 15.5% to 60% in the base cost for each line item applied to all of the component costs. In this case there is little detailed breakdown to identify the scope of what is covered by the different factors, resulting in a large portion of the project being un-auditable.

Following a review of the additional documentation provided by TransGrid to support these factors, PB is of the opinion that the basis for deriving the standard factors applied by TransGrid is generally well documented in the Capex Estimating Database – Factors document[53]. On the basis of our review PB accept the underlying assumptions and historical alignment of the standard factors demonstrated by TransGrid.

However, PB is of the view that there are two aspects of the application of the factors in the capex estimating database that reduce the transparency of the use of these factors.

Firstly the factors are not necessarily applied to the full base estimate value as different standard factors are applied to each line item in the Capex Estimating Database[54] dependent on its expenditure category. This causes a situation where it is difficult to ascertain the factors that have been applied to each line item from the total of the 'factors' included in the cost estimate documentation. However, as the adjustment of expenditure categories is controlled at

51 TransGrid, Response – PB Advice 6 – F8.

52 TransGrid, Capex Estimating Database Manual (D2008/05616), January 2008 page 25.

53 Refer D2008/09435.

54 TransGrid, Capex Estimating Database – Factors (D2008/09435), January 2008, page 5-6.

a system administrator level, the application of the factors remains consistent throughout the estimating database. Therefore, PB's concern relates to the lack of transparency in the estimating process only. As this relates to the use of standard factors, which have been fully justified, PB does not anticipate material inconsistencies in the application of the factors arising from this issue.

Secondly, TransGrid has stated that the procedure outlined in the Capex Estimating Database Manual allows for the standard factors to be altered if the project investigation identifies that the standard factors are not appropriate[55]. Therefore as the weight of each factor can be adjusted on a discretionary basis for the project, the transparency, consistency and auditability of the capital estimation process can be undermined through the manipulation of the factors.

It is this discretionary adjustment that is of most concern to PB. Where adjustments have occurred there has been very little justification for the magnitude of, or reason for, the adjustment.

This is demonstrated in the Beaconsfield West 132 kV GIS replacement project discussed in Appendix I. PB has concerns regarding the application of the generalised DCF and NCF factors, as well as the 'Ancillary Costs'. It is noted that the DCF and NCF factors have been doubled due to the difficulties of working at an operational site, and due to the one off nature of the work.

While PB accepts these basic reasons, the basis of doubling these costs is not clear and appears arbitrary. The cost of these factors account for some $15.3m (or 37.4%) of the total project estimated cost which has also been escalated for real labour and material cost increases, and adjusted for inclusion of a risk-based allowance.

However as the basis of these factors, their allocation, and their apparent arbitrary scaling is unclear in the project documentation, and given their significant dollar value within the project cost estimate, PB is of the view that the DCF, NCF, and AWF factors should be fully justified and transparently applied.

3.5.3 Cost estimating factors adjustment

PB is of the view that on the basis of the detailed project reviews, unjustified discretionary adjustments to the standard factors used as part of the project cost estimating process are likely to be a systemic issue throughout the TransGrid portfolio. This is supported by the discrepancies that are evident on the factors applied in the detail costing associated with options assessed in the Newcastle - Waratah - Tomago Area Feasibility Study FS PSR 199[56] and the Sydney West – Holroyd – Chullora Overall Feasibility Study FS PSR 12_18_25[57].

We note that we have recommended a factor correction for the Beaconsfield West 132 kV switchyard project and for the Dumaresq-Lismore 330 kV line development project. For a number of the projects subject to detailed review, only high level summary capital cost estimates have been provided, and the estimate line items do not include information regarding the application of the factors. TransGrid has advised that the factors are included in the summary capital cost line items, and not identified as a separate item or explicitly identified in the project documentation[58]. As the factors applied are not explicitly stated and substantiated in the majority of project documentation presented, PB is unable to determine whether appropriate factors have been applied, or whether the applied factors have been subject to discretionary change.

55 TransGrid PB Advice 6 – F8 – TransGrid's use of DCF, NCF and AWF in project estimates.

56 TransGrid Feasibility Study Report FS PSR 199. Revision 0 June 2008, page 58.

57 TransGrid Feasibility Study Report FS PSR 12_18_25 Revision 0 June 2008, page 111.

58 Refer Appendix H Cooma 132 kV Substation Replacement.

The -$8.1m correction recommended for the unjustified increase in DCF and NCF factors in the Beaconsfield West project, represents 0.89% of the value of the $908.7m of reviewed projects. In the instance of the Dumaresq-Lismore 330 kV line development project, the adjustment to the scoping factor proposed by PB amounts to -$4.0m. As we are of the view that the approach adopted by TransGrid in adjusting its factors is likely to be a systemic issue within the cost estimating and options analysis process, we recommend that a high-level adjustment be made to the portion of the ex-ante capex portfolio that has not been subject to detailed review to correct for this systemic inconsistent or in PB's view arbitrary application of the factors[59]. On this basis, PB proposes a conservative downwards adjustment of 0.89% be applied on a pro-rata basis across the $1.56b of the un-reviewed capital works portfolio to correlate to the single worst case example of the Beaconsfield West project. This results in the recommendation of a further adjustment to TransGrid's forecast capex allowance of -$13.9m.

This matter is also discussed in section 5.4.13.

[59] PB's basis for applying this high-level adjustment to the portion of the ex-ante portfolio that has not been subject to detailed review is associated with the fact that PB has made appropriate adjustments to the projects as part of those reviews, where readily applicable and transparent.

4. REVIEW OF HISTORICAL CAPEX

TransGrid's historical capital expenditure provided for investment needs of the business related to the development and augmentation of the electricity transmission network over the current regulatory period. This section of the report will examine two aspects of the historical capital expenditure in turn:

- network capital expenditure
- non-network capital expenditure.

Historical capex in the context of TransGrid's submission includes all expenditure that has been, and is expected to be, incurred between 01 July 2004 and 30 June 2009. This expenditure will be rolled into TransGrid's RAB.

4.1 OVERVIEW

As part of our review, PB has undertaken a high level review of TransGrid's capex and opex over the 2004/05 to 2008/09 regulatory period (the current regulatory period), including estimates of expenditure for 2007/08 and 2008/09. PB has examined the drivers and reasons for any significant variances between capex over the current regulatory period with the forecast expenditures allowed in the April 2005 ACCC revenue cap decision for TransGrid.

PB has also aimed to indicate whether its review of past expenditure raises any issues for consideration of TransGrid's proposed forecast capex for the next regulatory control period. We have considered whether any significant variations or changes in the composition or timing of expenditure indicate management issues within the business. Where issues have been identified we have raised these issues with TransGrid to ascertain how they have dealt with these changes to reinforce the management of their ex ante capex proposal.

4.1.1 Expenditure summary

In 2005, the ACCC determined TransGrid's ex-ante capex allowance for the five year period 01 July 2004 and 30 June 2009 to be $1,187m (real 2003/04) or $1,337m (real 2007/08)[60]. TransGrid has proposed a total of $1,394m (real 2007/08)[61] should be rolled-into its opening RAB on 01 July 2009 to account for its historical capital expenditure. At the aggregate level, TransGrid has marginally overspent its capex allowance by $57m, or 4.3%

TransGrid's historical capital expenditure comprises two major categories:

- network capital expenditure — this includes expenditure on augmentation and replacement of transmission assets directly related to the development, or augmentation, of the transmission network
- non-network capital expenditure – this includes expenditure on Business IT and 'support the business' equipment that is not directly related to the development of the transmission network.

60 ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

61 TransGrid Templates — AER schedules (for AER).xls; worksheet — historic capex — Table 3.1.

Table 4-1 outlines TransGrid's ex-ante allowance.

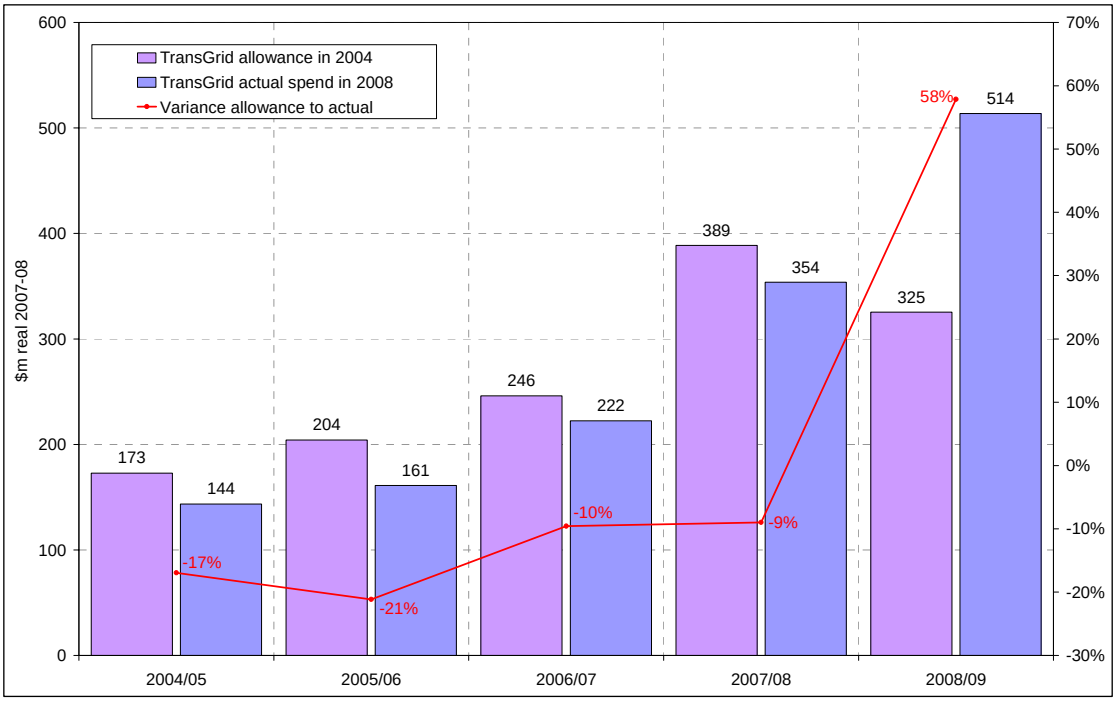
Table 4-1 – Historical capex allowance and actual spend (1 July 2004 to 30 June 2009)

Expenditure $m (real 2008)	04/05	05/06	06/07	07/08[1]	08/09[1]	Total
Network - allowance	154.0	185.2	227.1	369.8	306.5	1,242.60
Non network - allowance	18.9	18.9	18.9	18.9	18.9	94.50
Total - allowance	172.9	204.1	246.0	388.6	325.4	1,337.00
Network - actual	120.35	141.28	192.32	323.62	483.54	1,261.11
Non network - actual	23.23	19.61	30.09	30.11	30.26	133.30
Total - actual	143.59	160.89	222.40	353.73	513.80	1,394.41

Source: *ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.*

Figure 4-1 shows the predicted capex allowance set in 2004 against actual spend across the same period and the year-on-year variance between the allowance and the actual spend in the same period.

Figure 4-1 – 2004 allowance and actual spend on total capex ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

The key observations from Figure 4-1 include:

- the total allowance for the 5 year regulatory period was $1,337m ($m 2008) and TransGrid predict actual expenditure to be $1,394m ($m 2008) by the close of the regulatory period (30 June 2009). This is a total increase of 4.3%

- actual expenditure in the first four years of the current regulatory period was below the allowance. TransGrid are forecasting that actual expenditure in the last year of the period (2008/09) will exceed the allowance by 58%.

4.1.2 Network capex

The expenditure on the network capex category is comprised of two key sub-categories:

- load-driven projects
- non demand-driven projects.

Each of these sub-categories is discussed below.

Load-driven projects

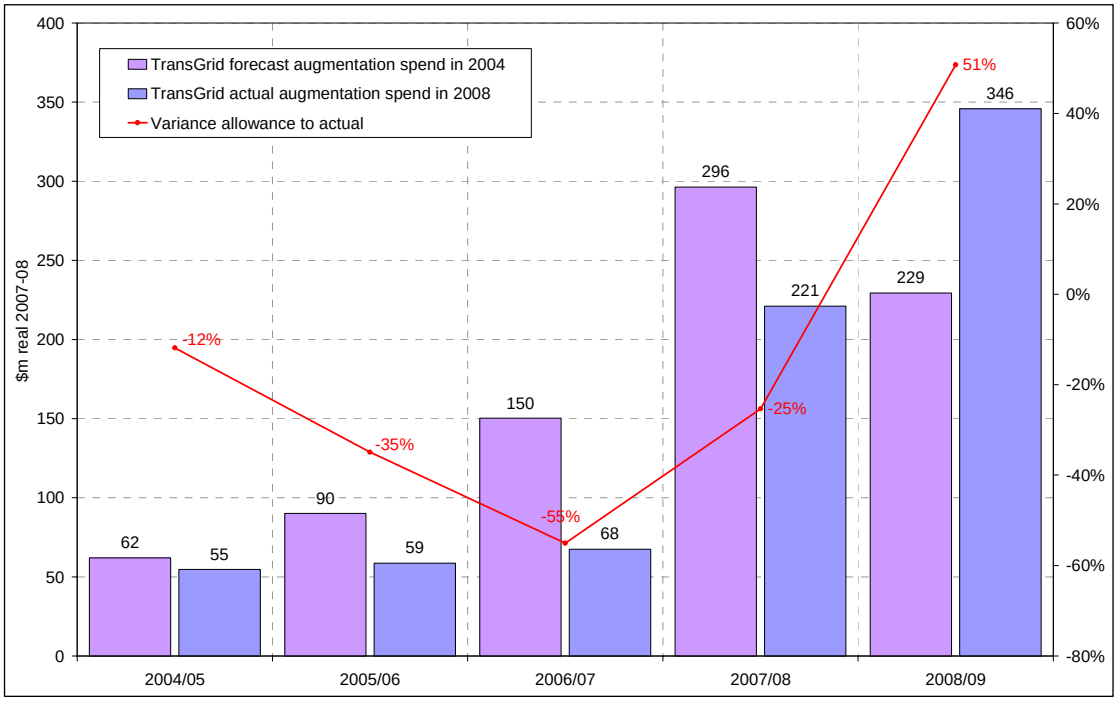
Load-driven projects are required as a consequence of the external influence of general growth in electricity demand and consumption, and the planning criteria adopted by TransGrid. As part of the AER information templates, the expenditure on these types of projects is classified into three groups:

- augmentation
- land and easements
- connection.

In TransGrid's proposal, there is no historical expenditure associated with connection assets.

The augmentation expenditure proposed by TransGrid for inclusion in the RAB for the five year period from 1 July 2004 to 30 June 2009 is approximately $748m. The ACCC allowance for augmentation in 2005 was approximately $828m ($m real 2008). Both the allowance and the expenditure are shown in Figure 4-2 along with the variance.

Figure 4-2 – 2004 allowance and actual spend on augmentation ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

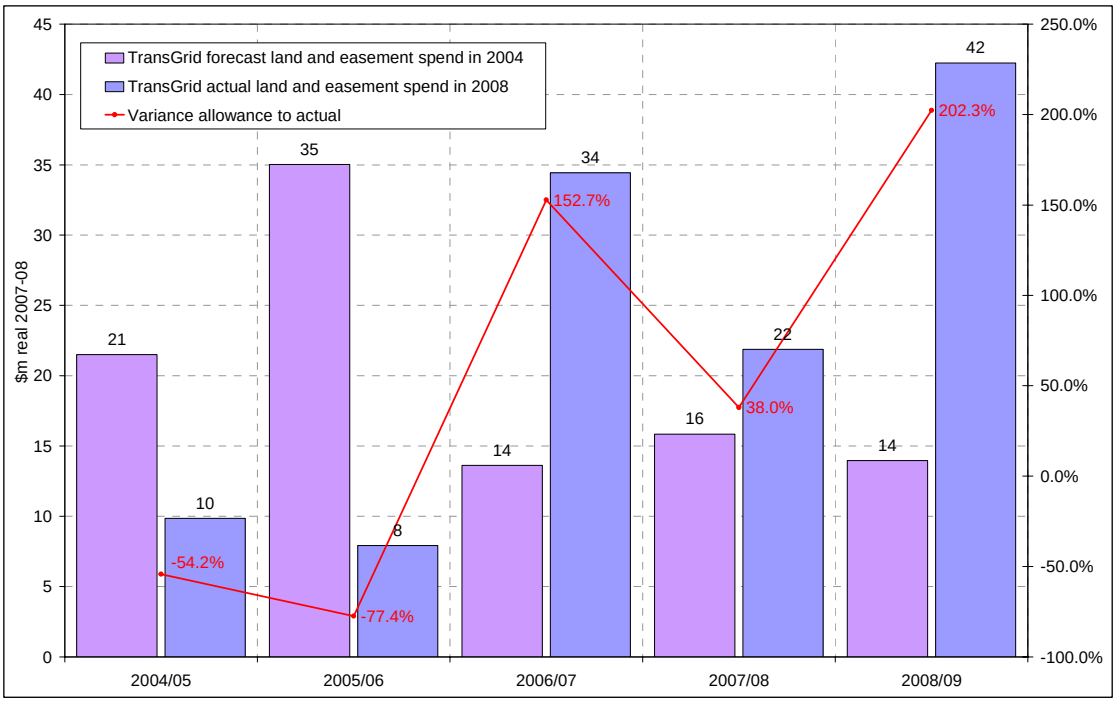
The key observations from Figure 4-2 include:

- the total allowance for the 5 year regulatory period was $828m ($m 2008) and TransGrid predict to expended $748m ($m 2008) by the close of the regulatory period (30 June 2009). This is a increase of approximately 11%
- actual expenditure in the first four years of the current regulatory period was below the allowance. TransGrid are forecasting that actual expenditure in the last year of the period (2008/09) will exceed the allowance by 51%.

With respect to historical capex associated with land and easements, TransGrid has stated that it has had a need to procure land for substations and contract easement rights for transmission lines. TransGrid's equipment traverses a large part of the state and across many types of land usage. Estimates of land purchase costs and easement acquisition costs are based on market rates for land in the immediate area.

The ACCC decision in 2005 for property was set at $100m ($m real 2008). Over the current regulatory period TransGrid has, and intends to invest $116.2m ($m real 2008) in this area. The figures are shown in Figure 4-3 along with the year on year variance.

Figure 4-3 – 2004 allowance[62] and actual spend on land & easements ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

The key observations from Figure 4-3 and include:

- the total allowance for the 5 year regulatory period was $100m ($m 2008) in 2004 and predict to expended $116.2m ($m 2008) by the close of the regulatory period (30 June 2009). This is an increase of 16%
- the program of works was under expended in the first two years followed by two periods of over budgeted expenditure in 2006/07 and 2008/09.

62 The ACCC decision in 2004 equivalent terminology for land and easement is 'property related augmentation'.

Non load driven capex

To ensure that energy can be consistently and reliability transmitted to its customers TransGrid is required to maintain its network. Although maintenance ensures that the equipment remains in a suitable condition, eventually network equipment will require replacement.

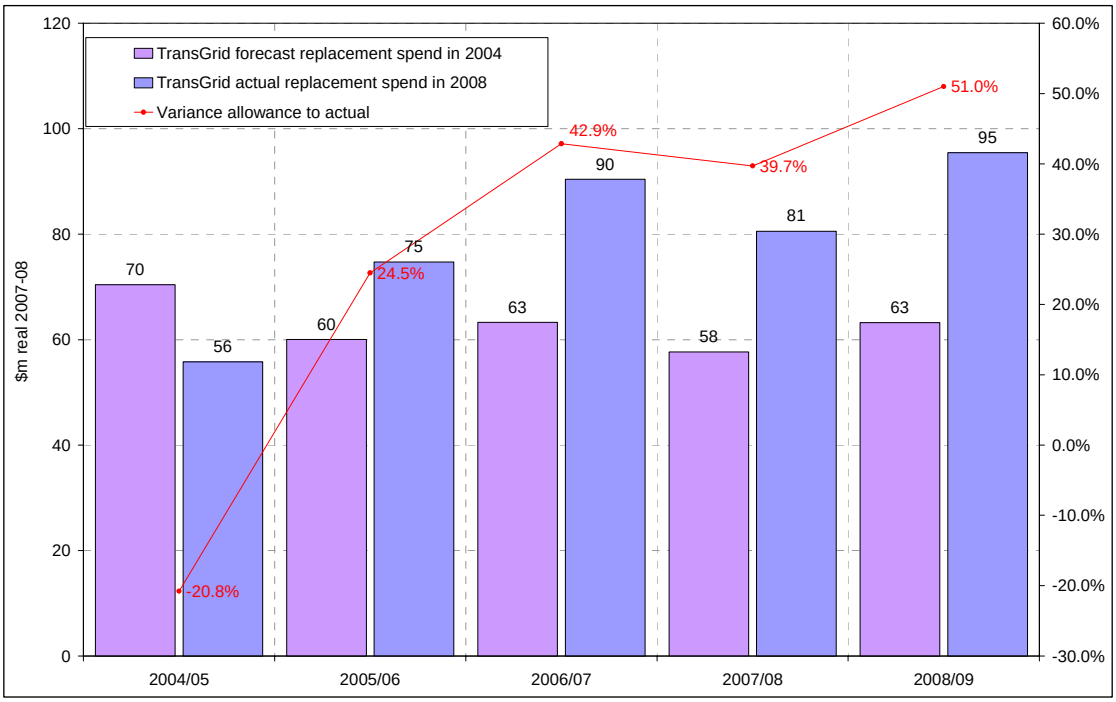
TransGrid also undertakes work to ensure that its equipment is secure and that the business is compliant with any regulatory and statutory requirements. These non load-driven expenditures can be classified into three sections:

- replacement
- security / compliance
- other network.

In TransGrid's proposal, there is no historical expenditure identified in the 'other network' category.

The ACCC decision in 2005 made allowance for replacement capex works set at $315m ($m real 2008). Over the current regulatory period TransGrid has expended, or intends to invest $397m ($m real 2008). The figures are shown in Figure 4-4. Figure 4-4 also shows the year-on-year variance between the 2005 allowance and actual expenditure incurred by TransGrid.

Figure 4-4 – 2004 allowance and actual spend on replacement & security / compliance ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

The key observations from Figure 4-4 include:

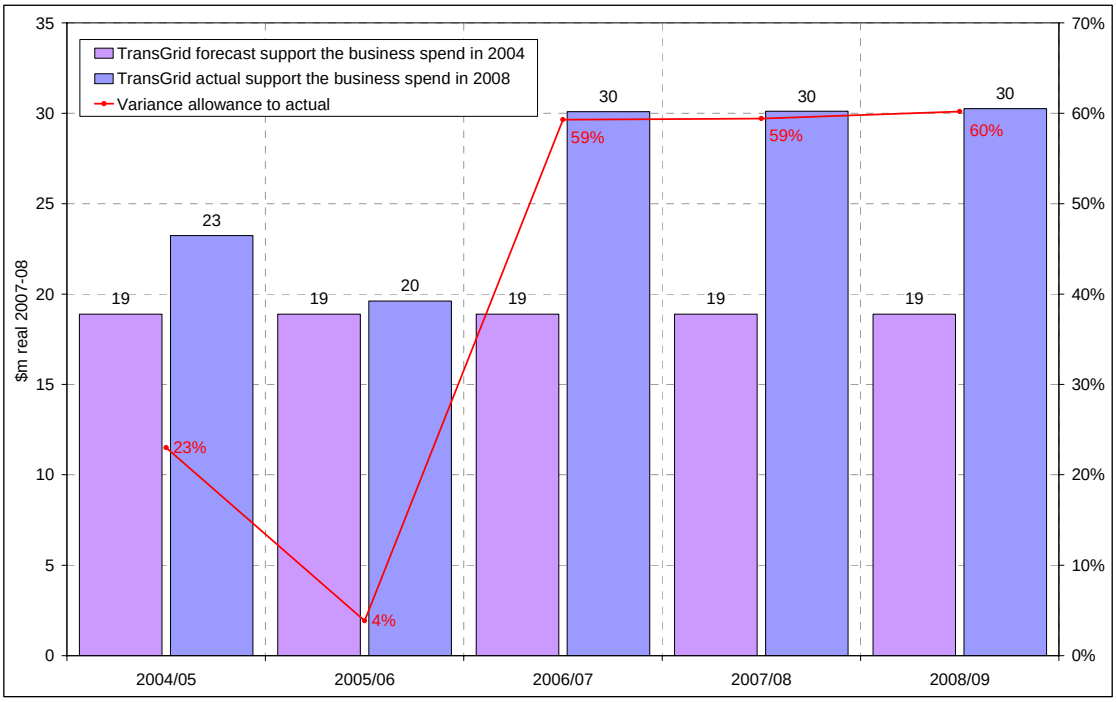
- overall TransGrid's allowance in 2005 was $315m ($m 2008) in 2004 and predict to expended $397m ($m 2008) by the close of the regulatory period (30 June 2009). This is a increase of 26%
- the program of works was under expended in the two years followed an over expenditure in all the following years.

Non network capex

TransGrid's non-network capital expenditure forecast provides for investment costs to be incurred in addressing the needs of the business not directly related to the development and augmentation of the electricity transmission network. An example of capex that falls within this category is the cost of vehicles, building facilities, computers and other IT equipment. In the ACCC's 2005 decision the non network historical capital expenditure was classified as 'support the business' expenditure.

The ACCC allowance in 2005 for 'support the business' was set at $94m ($m real 2008). Over the current regulatory period, TransGrid intends to expend $133.3m ($m real 2008) prior to the end of the current regulatory period. The figures are shown in Figure 4-5 along with the year-on-year variance of allowance and actual spend.

Figure 4-5 – 2004 allowance and actual spend on support the business ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

The key observations from Figure 4-5 include:

- overall TransGrid's proposed to expend $94m ($m 2008) in 2004 and predicted to expend $133m ($m 2008) by the close of the regulatory period (30 June 2009). This represents an increase of 41%.
- the program of works was over expended for the whole period, with the majority of over expenditure in the final three years.

4.2 PB ANALYSIS OF HISTORICAL CAPEX

Consistent with the high level scope associated with the review of a business' historical capex under an ex-ante regulatory framework, PB's approach has focussed on gaining an understanding of any significant variations in expenditure compared to the original allowance forecast, and to determine how the drivers for such variations have been accounted for, or may influence the forecast capex proposed for the 2009/10-2013/14 regulatory period.

PB has reviewed the historical program in two stages:

- stage 1 – where the overall variance of actual expenditure compared with the allowance exceeds ±20%[63]
- stage 2 – for those categories where the total variance exceeds ±20% consideration was given to any trends within the regulatory category where actual expenditure compared with allowance that exceeds ±20%.

In addition to this two stage approach, PB has subjectively examined all the variances and reviewed any significant anomalous results.

Table 4-2 summates TransGrid's original allowances, the actual expenditure and the variance year-by-year by major regulatory category.

Table 4-2 – Summary of the 2005 historical capex allowance and the actual spend

Variance ($m real 2008)		Overall	04/05	05/06	06/07	07/08[1]	08/09[1]
Network							
Augmentation							
	Allowance	828.04	62.08	90.12	150.23	296.25	229.36
	Actual	747.89	54.73	58.63	67.50	221.18	345.85
	Variance	-9.68%	-11.83%	-34.94%	-55.07%	-25.34%	50.79%
Land & easements							
	Allowance	99.97	21.50	35.03	13.62	15.85	13.97
	Actual	116.3	09.84	07.93	34.42	21.88	42.23
	Variance	16.34%	-54.21%	-77.37%	152.73%	38.04%	202.32%
Replacement							
	Allowance	314.59	70.42	60.03	63.27	57.66	63.21
	Actual	396.91	55.78	74.72	90.39	80.56	95.46
	Variance	26.16%	-20.79%	24.48%	42.86%	39.70%	51.01%
Non network							
Support the business							
	Allowance	94.45	18.89	18.89	18.89	18.89	18.89
	Actual	133.3	23.23	19.61	30.09	30.11	30.26
	Variance	41.15%	23.01%	3.85%	59.29%	59.42%	60.20%

Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

From the stage 1 analysis, augmentation and land and easements was, overall, within the ±20%, but replacement and support the business was outside this 20% variance band.

63 PB would expect that this variance is scalar and would therefore apply to the total programme of works. As such PB's initial review is based on a ±20% variance.

Therefore replacement and support the business have been examined in more detail. When looking at annual variations, the land & easements category has two separate years where the expenditure was 158% and 200% higher than the expected allowance. Therefore PB has considered this as a separate case.

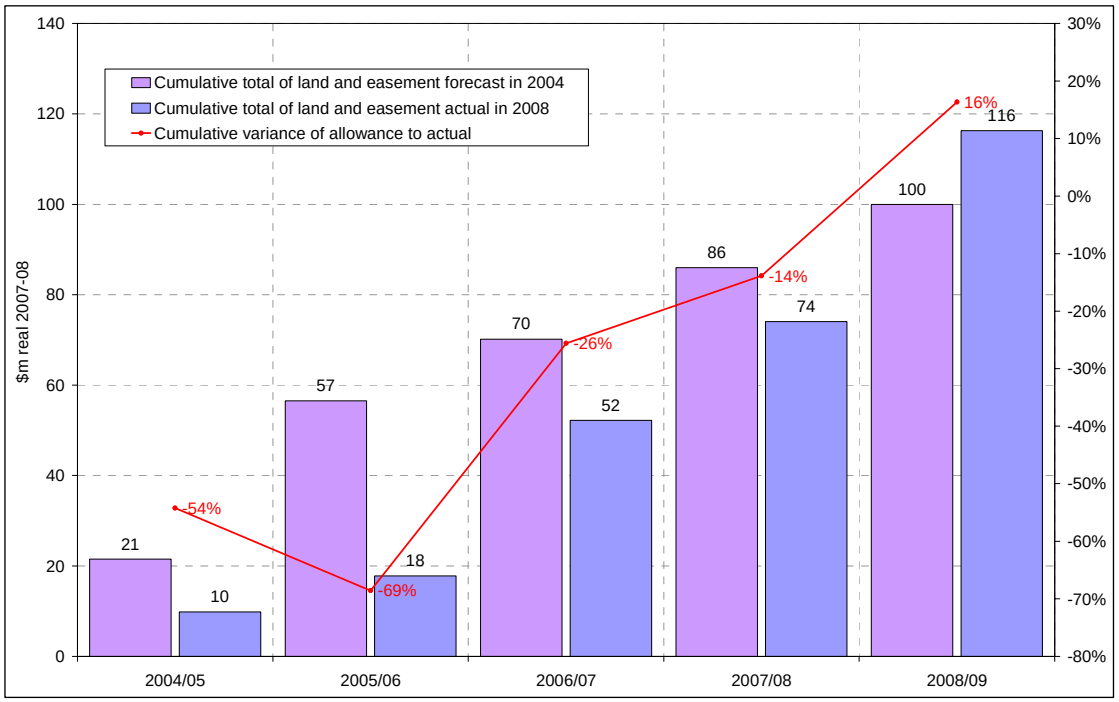
Analysis of historical land & easement capex

TransGrid's 2005 allowance on land & easements was $100m ($m real 2008) across the five year regulatory period. TransGrid intends to incur a total of $116.3m in the period.

TransGrid has advised that this overspend was due to two key factors:

- the forecast expenditure is related to estimated compensation payments as indicated by current market value conditions in the immediate vicinity of the proposed works. The location of the projects are such that there is a significantly larger proportion of the project value in this revenue period that is affecting the more populated areas of NSW. That is areas with higher land values
- the overall increased capital works program and the increased forecast expenditure on transmission lines, in particular over the next regulatory period compared to the current regulatory period.

Figure 4-6 – Cumulative total allowance and actual spend on land & easement ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

From Figure 4-6, it can be seen that over the regulatory period actual expenditure was lower than the forecast allowance where in the final year expenditure is expected to exceed the allowance by 19%.

We note that there are significant annual variations between the allowed and actual capex expenditure. From discussions with TransGrid two drivers for this discrepancy were identified:

- delay in the 2004 decision by the ACCC delayed the progression of some projects

- the location of projects in the current period is in populated areas and as such the cost of land is higher. We note that the price paid of land is set on market rates at the time of procurement.

In PB's view the cost of land can be volatile and in the case of TransGrid land prices in the urban areas of Sydney can be particularly difficult to forecast.

The largest single land and easement expenditure in the 2008/09 period is related to the Holroyd cable and substation easement procurement[64] that is forecast to cost $15m, this accounts for 35% of the total 2008/09 budget in this category. This land procurement has undergone a Regulatory Test assessment.

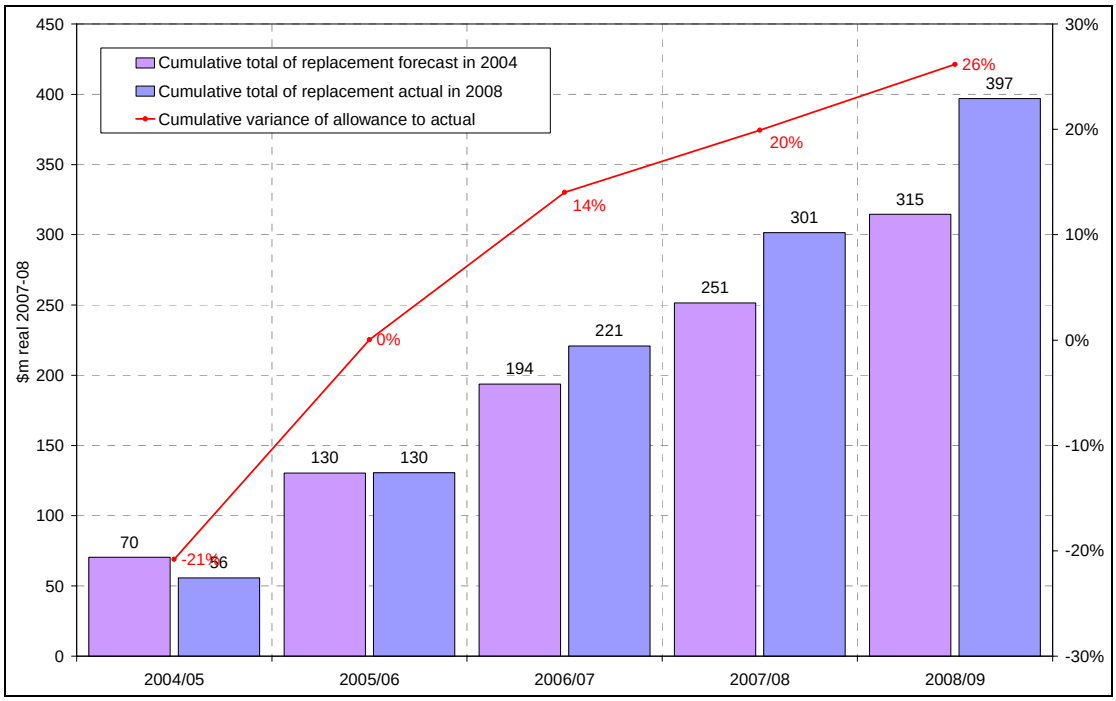
As part of PB's review of this expenditure, we have not identified any expenditure drivers that have not been sufficiently captured already as part of TransGrid's proposed forecast capex for the next regulatory control period.

Analysis of historical replacement capex

The ACCC allowance in 2005 for replacement capex was $315m ($m real 2008) across the current five year regulatory period. TransGrid intends to incur a total of $397m in the period.

In Figure 4-7 we have examined the cumulative totals on a year by year basis. This approach recognises that a small change in timing may cause the actual spend to roll over to the following year, or in some cases an early payment may be included in the prior year.

Figure 4-7 – Cumulative total allowance and actual spend on replacement ($m real 2008)



Source: Template – AER schedules (for AER).xls; ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/287.

From Figure 4-7 it can be seen that TransGrid were tracking very closely in cumulative totals on a year by year basis until the final year. In the 2008/09 year TransGrid expects to over expend by 26% against the total and 51% against the expected yearly allowance for that year.

64 Project ID number 6204a.

TransGrid has identified that annual replacement expenditure increases have been driven by two factors

- delay in the 2004 decision
- a larger number of assets replaced due to poor condition.

The 2005 decision was delayed by approximately one year[65] however, TransGrid has advised that it incurred $56m ($m real 2008) in replacement costs whilst waiting for the decision.

TransGrid has stated that it identified a larger number of assets required replacement due to poor condition. As part of its investigations, TransGrid has identified 6 replacement projects with a total value of $46m that were not foreseen at the last regulatory reset, but which have been incurred in the current regulatory period. The three largest projects are summarised in Table 4-3.

Table 4-3 – Three major replacement projects not foreseen and incurred in the current regulatory period

Project	Reason	Value ($m real 2008))
Wagga 330 kV sub-transformer	PCB contamination	$13.4
Vales Point 330/132 kV transformers	Non compliant equipment	$5.9
NEMMCO PSDCS	Communications upgrade	$23.5
Total		$42.80

Source: presentation – TU10-question A10 historic capex.pdf Vales Pt correction as per TransGrid advice, 10 September 2008.

As part of its review of this expenditure, PB has not identified any expenditure drivers that have not been sufficiently captured already as part of TransGrid's proposed forecast capex for the next regulatory control period.

Analysis of support the business

The ACCC allowance in 2005 for land and easements was set at $94m ($m real 2008). Over the current regulatory period TransGrid intends to expend prior to the end of the current regulatory period $133.3m ($m real 2008).

From a high level examination of TransGrid's' revenue proposal[66] variances have been classified into two main areas:

- price input increase
- scope change.

Of the 19 projects listed under support the business, the cost of 14 projects has varied materially from the original allowance, are shown in Table 4-4.

65 ACCC Final Decision; NSW and ACT Transmission Network Revenue Cap TransGrid 2004-05 to 2008-09; File No: M2003/28 was released on 27 April 2005.

66 TransGrid Templates — AER schedules (for AER).xls; worksheet — historic capex — Table 3.4.

Table 4-4 – Non network projects where the cost variation has been identified as either price input change or scope change ($m real 2008)

Project	Forecast ($m)	Actual ($m)	Variance (%)
Price input change			
Buildings and facilities	20.4	34.5	69
Scope change			
Motor vehicles	16.7	23.4	40
Total	37.1	57.9	56

Source: AER schedules (for AER).xls; worksheet — historic capex — Table 3.4.

This analysis identifies two major sources of cost change from forecast was input price change and scope change.

Price input change

The largest project variance as a result price input changes was associated with facilities and buildings. TransGrid provided further details on the incurred costs of the facilities and buildings expenditure and effectively the cause has been linked to the increase in the number of staff located at certain facilities. The review of the non network capital expenditure identifies the metropolitan facility as being expanded to accommodate relocated staff and this introduced three major changes to the site.

- expansion of existing facilities to accommodate relocated staff
- relocation of Line Training School due to redevelopment of main building
- additional car parking facilities at Wallgrove.

This single event accounts for 33% of the increase in the cost associated with facilities.

As part of its review of this expenditure, PB has not identified any expenditure drivers that have not been sufficiently captured already as part of TransGrid's proposed forecast capex for the next regulatory control period.

Scope change

The second major change to cost was associated with change of scope, while the largest over expenditure was associated with motor vehicles being 40% over budget.

TransGrid identified that a change in the occupational health and safety law required TransGrid to procure elevated work platforms for staff[67]. These vehicles can cost in the region of $250,000 each and TransGrid are procuring these vehicles on a business case basis.

In PB's view the overall value of the variance across the whole capital program is not unreasonable.

67 Response to question G7, received by email dated 22 July 2008.

4.3 RECOMMENDATION

PB has reviewed the historical capital at a high level and makes the following recommendations.

As part of our review, PB has not identified any issues with historical capex that have not been sufficiently addressed by TransGrid as part of the proposed forecast capex for the 200/10-2013/14 regulatory period. In particular our review considered three sub-categories, specifically:

- augmentation
- land & easements
- replacement

PB found that within the support the business category, there were scope changes which caused the actual cost to increase above the ACCC's aggregate allowance in this area.

- the largest of these projects accounted for 33% of the total expenditure. The following three issues were the major cost implications across the support the business category

  In PB's view, the scope change was the result of TransGrid's decision to relocate staff to Wallgrove. This decision led to an increase in expenditure by $14m. Had TransGrid not made the decision to relocate staff then the actual would be in line with the allowance

- the second factor in the change in cost was driven by OH&S requirements. These changes required TransGrid to procure additional vehicles, known as elevated work platforms

Overall, PB has not identified any issues or areas of concern with the control of historical capex that need to be considered as part of TransGrid's proposed forecast capex for the 200/10-2013/14 regulatory control period.

5. REVIEW OF FORECAST CAPEX

In this section, PB provides a high-level overview of TransGrid's proposed forecast (ex-ante) capex. We review a selection of proposed network projects, and we consider and evaluate the need, timing, scope and costs associated with these projects. We then make recommendations on the appropriateness of their inclusion in the ex-ante forecast allowance. PB also extends its analysis and recommendations from the detailed projects reviews through to the remaining program, where appropriate.

5.1 METHODOLOGIES AND ASSUMPTIONS

TransGrid has employed a number of key methodologies and assumptions in developing the proposed ex-ante capex for the 2009/10-2013/14 regulatory period. In TransGrid's revenue proposal the key assumptions used in the development of the capital expenditure forecasts are noted. Specifically, these key assumptions and the section of this report that addresses them are as follows[68]:

- forecast demand as set out in TransGrid's 2007 Annual Planning Report (section 5.1.1)
- scenario analysis that models key themes that will affect likely generation developments and consequently the development of the NSW transmission system (considered in section 5.2 below)
- transmission reliability standards required by the NER and the NSW Electricity Supply Act, as set out in the 2007 Annual Planning Report (considered in section 2.2)
- equipment replacement in accordance with TransGrid's Network Asset Management Plan and related asset management strategies (considered in section 2.3, while our detailed consideration is presented in Appendix L and the key findings of this review are discussed in section 5.4 and 3.3)
- project scopes developed to meet the augmentation and replacement requirements (considered in appendices C to K)
- project cost estimates developed from TransGrid's cost estimating database (considered in section sections 5.3 and in section 3.4, and in appendices C to K)
- cost escalator forecasts for wages growth, construction costs (considered section 5.3)
- cost risk analysis (considered in section 5.3.4).

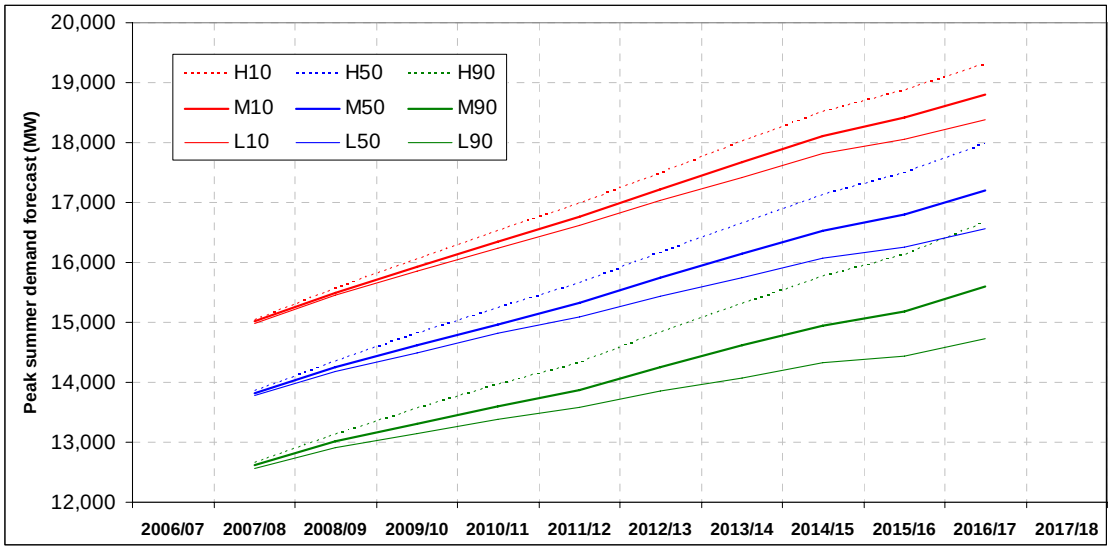
Each of these matters is considered in more detail in the various sections of this report as noted.

5.1.1 Demand forecasts

The demand forecast underpinning TransGrid's network capex allowance is that outlined in its 2007 APR. The forecasts are presented in Figure 5-1, which indicates that summer 2008/09 Medium growth, 50% Probability of Exceedance (PoE) level is 14,260MW and the 10% PoE projection is 1,200 MW higher at 15,500 MW. The 10% PoE level allows for a one in 10 year temperature condition to account for the more extreme weather impacts on electricity usage.

[68] TransGrid 2008, "TransGrid Revenue Proposal 1 July 2009 - 30 June 2014", 31 May 2008, page 51.

Figure 5-1 – NSW summer peak demand forecast – APR 2007



Source: PB, using TransGrid 2007 APR.

PB highlights that TransGrid has updated its demand forecast as part of the 2008 APR, however this has not been accounted for as part this assessment of TransGrid's revenue proposal. The impact of the revised forecast contained in the 2008 APR is considered in the PB supplementary report.

It should also be noted that the scope of PB's review does not provide for a review of TransGrid's demand forecast or the underlying forecast methodology. A review of the demand forecast, addressing these issues, was provided to AER by McLennan Magasanik Associates (MMA)[69]. However, as demand forecasts are a key input into TransGrid's proposed forecast capex, PB must have regard to the MMA report in undertaking this review. From this perspective we note the following key findings of the MMA report[70]:

> *"MMA is required to provide advice to the AER as to whether or not it is satisfied that the methods and processes used by TransGrid to develop the demand forecasts used for its revenue proposal would reasonably reflect a realistic expectation of the demand forecast.*
>
> *While MMA has issues with some areas of TransGrid's forecasting methodology, detailed in the report, overall it considers the methods and processes adopted by TransGrid to be appropriate, well-considered and reasonable. …*
>
> *While MMA does not necessarily consider the TransGrid APR 2007 forecasts unrealistic in light of the information available at the time, MMA considers a reduced growth rate to be more realistic in light of the new information and use of a more appropriate ac index.*
>
> *If the APR 2007 forecasts are to be used for the review of capital expenditure forecasts for the 2009-2014 periods, then MMA's analysis suggests that a conservative approach to capital expenditure requirements is warranted. If the timing of a capital requirement is "on the margin" then MMA would expect that the timing should be assumed to take place later, rather than earlier."*

69 McLennan Magasanik Associates (MMA) 2008, "Final Report to Australian Energy Regulator - Review of TransGrid demand forecasts for the period 1 July 2009 to 30 June 2014", 28 May 2008.

70 Ibid, page 49.

In this regard, PB has (where applicable) accepted the advice of the MMA report.

5.1.2 Forecast capex allowance methodology

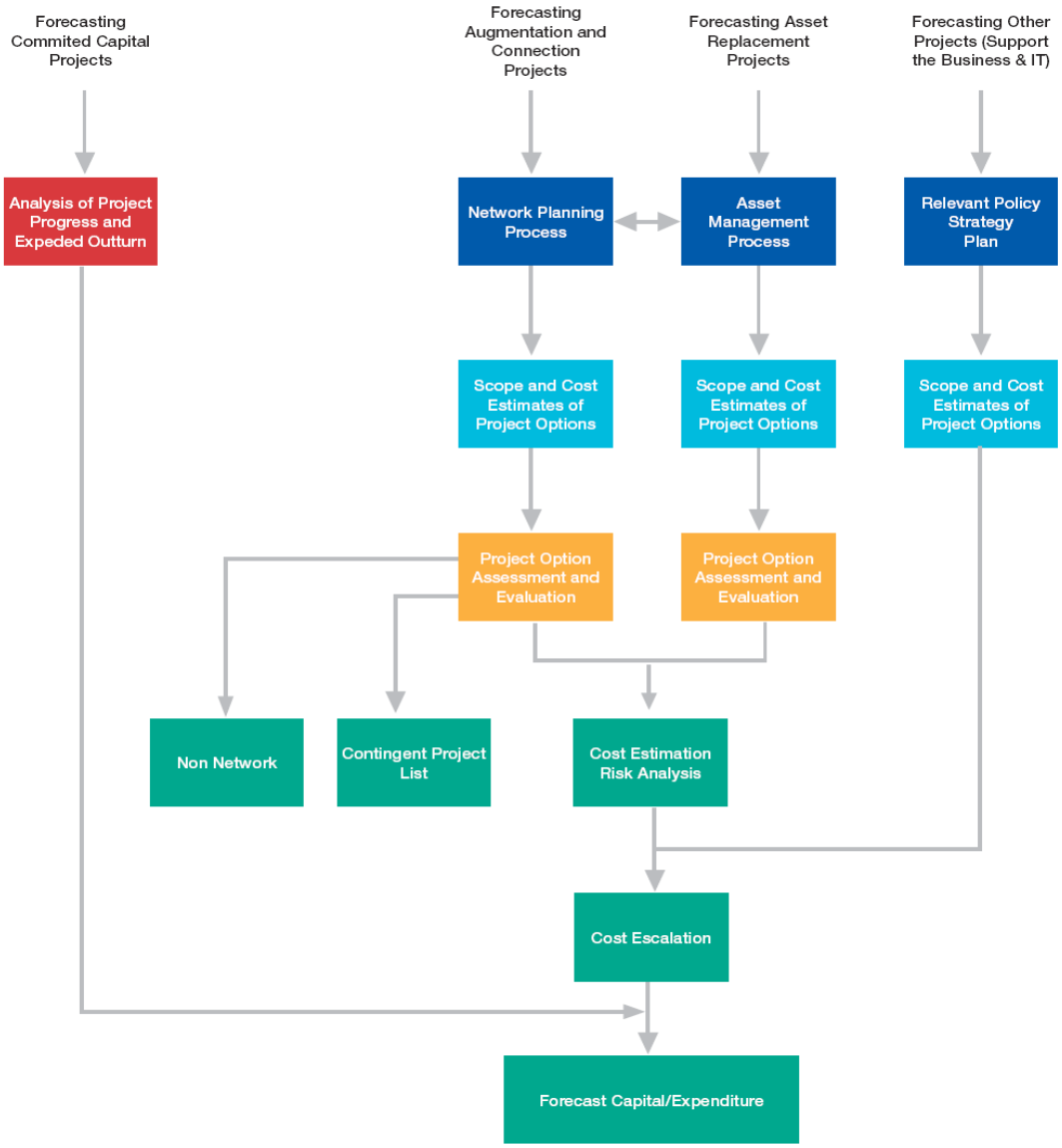
The methodology use by TransGrid in the preparation of the ex-ante capex proposal is shown in Figure 5-2. Essentially this figure shows that TransGrid has categorised four (4) streams of information in order to determine the total forecast capital expenditure, as shown at the bottom of the figure. These four (4) streams of information consist of (from left to right in the figure):

- determination of the progress and expected outturn cost of committed projects
- for network augmentation and connection projects the identification of the preferred option to address the identified need arising from the network planning process, and the scoping and estimating of the options capital cost
- for replacement projects the identification of the preferred option to address the identified need arising from the asset management process, and the scoping and estimating of the options capital cost
- for non-network projects (e.g. business support, IT, etc), the identification of the preferred option to address the identified need arising from the relevant policy/strategy plan, and the scoping and estimating of the options capital cost.

Figure 5-2 also shows how the cost estimates are combined. Firstly contingent projects and non-network projects are identified for separate treatment, and then risk analysis is undertaken based on the proposed project cost estimates. Cost escalation is then applied to produce the forecast capex expenditure proposal.

In PB's view, this is a systematic and appropriate process, and we are of the opinion that TransGrid has applied this process in determining its ex-ante capex proposal.

Figure 5-2 – TransGrid's capital expenditure forecasting methodology



Source: TransGrid 2008, "TransGrid Revenue Proposal – 31 May 2008", page 53.

5.2 PROBABILISTIC METHODOLOGY AND OUTCOMES

In this section we present an overview of the probabilistic methodology used by TransGrid in preparing its ex-ante capex forecast for the 2009/10 to 2013/14 period. PB's views of this methodology and its outcomes are also presented.

5.2.1 Scenario development

In the development of TransGrid's forecast capex, and in conjunction with ROAM Consulting, TransGrid developed 36 scenarios to provide a probability weighted view of the potential generation development (principally within NSW). This process broadly involved an initial study undertaken by ROAM in August 2007, with a subsequent update in February 2008 to account for a number of market developments such as changes in the commitment of some generation developments, potential gas-fired generation and wind farm developments, the Owen inquiry, and the impact of future greenhouse gas abatement legislation. The outcomes of the February 2008 ROAM study were further modified by TransGrid prior to the revenue

submission in order to account for later influences such as the progressive outcomes of the Garnaut reports[71].

In developing the 36 scenarios, consideration was given to four (4) key factors that influence generation development. The key factors considered are[72]:

- economic growth – Low, Medium and High economic growth levels were considered for the 10% POE demand forecast[73]
- inter-regional trade – Business as Usual, Queensland–New South Wales Interconnector (QNI) Upgrade, and Snowy-NSW Upgrade were considered. A potential upgrade of 500 MW was considered realistic for each interconnector respectively[74]
- water availability – Business as Usual and Limited Water Availability scenarios were considered as constraints on wet-cooled thermal station and on the operation of hydro-electric stations
- green house policy - Business as Usual and a CO2 Tax of $35.00/t (nominal).

These four (4) key factors are used to develop 36 possible scenarios and to determine the probability of the scenario's occurrence. The weighting of each scenario is firstly developed based on a top-down assessment of the probability of occurrence of each state of the key factors. This produces a top down scenario weighting. Table 5-1 shows the assessed probabilities as presented in the 2008 ROAM report for each state of the key factors.

Table 5-1 – Initial scenario probabilities

Key factor	Theme[75]	Probability
Load Growth	L10	15%
	M10	70%
	H10	15%
Inter-Regional Trade	BAU	55%
	QNI	35%
	NSW-SNOWY	10%
Water Availability	BAU	35%
	LIMITED	65%
Greenhouse Policy	BAU	40%
	CO2 Tax	60%

Source: ROAM Consulting, 2008, "National Electricity Market Forecasting Scenarios for Revenue Reset Application: 2009-10 to 2013-14", 20 February 2008, page 4.

71 TransGrid 2008, "Revenue Reset 2008 Scenario Probabilities", Revision 0, 4/5/2008, page 2.

72 ROAM Consulting, 2008, "National Electricity Market Forecasting Scenarios for Revenue Reset Application: 2009-10 to 2013-14", 20 February 2008, page 2-3.

73 ROAM has considered only the 10% POE demands as the NEM reliability standards require TNSPs to plant the system in order to meet one in ten year peak demands.

74 ROAM notes that "… 500 MW has been considered as a realistic upgrade path for both alternatives which would support significant changes in power flows and be feasible within the next revenue reset period."

75 L – Low economic growth, M – Medium economic growth, H – High economic growth, BAU – Business as Usual, QNI - Queensland–New South Wales Interconnector, NSW-SNOWY - New South Wales – Snowy Interconnector.

Having identified the possible scenarios, the potential generation developments under each scenario are identified based on publicly available information. A total of 52 potential new generation projects have been identified and assigned both a ranking, and a corresponding weighting, that is used in the analysis. Table 5-2 shows the values assigned to the various weightings used in the analysis.

Table 5-2 – Project rankings and weightings

Ranking	Weighting
Definite	100%
Very High	80%
High	60%
Moderate	30%
Low	10%

Source: ROAM Consulting, 2008, "National Electricity Market Forecasting Scenarios for Revenue Reset Application: 2009-10 to 2013-14", 20 February 2008, page 6.

A bottom-up process is then followed which involves considering the potential new generation developments that could proceed under each scenario. The weighting for each generation development that is assessed to proceed under the scenario is then combined as an average weighting for the scenario. This figure is expressed as a percentage of the average weighting for all scenarios to arrive at a bottom-up scenario weighting.

The top-down scenario weighting and the bottom-up scenario weighting are combined to produce and overall initial assessment of the probability of the occurrence of the scenario. The results of this calculation are further modified to account for the Minimum Reserve Margin conditions that can be tolerated under the operation of the network within the NEM. This reflects the need to ensure that the probability of each scenario reflects the realistic requirements of the operation of the NEM. Table 5-3 shows the weightings applied to further weight each scenario according to how it well it addresses the system reserve margin requirements. That is, the more the scenario addresses the reserve margin requirements, the more likely that scenario is – the assigned weightings reflect this.

Table 5-3 – Minimum reserve margin moderating factor weightings

% difference from minimum reserve margin conditions	Weighting
-1	0
0	1
1	1
2	3
3	5
4	5
5	5
6	5
7	5
8	4
9	3
10	2
11	1
12	1
13	1
14	0

Source: ROAM Consulting, 2008, "National Electricity Market Forecasting Scenarios for Revenue Reset Application: 2009-10 to 2013-14", 20 February 2008, page 14.

This process resulted in a final set of scenario probabilities. As noted above, TransGrid further modified these probabilities[76]. Table 5-4 notes the key considerations made by TransGrid in undertaking this review, while Table 5-5 sets out the results of TransGrid's of the initial scenario probabilities.

[76] TransGrid 2008, "Revenue Reset 2008 Scenario Probabilities", Revision 0, 4/5/2008, page 2.

Table 5-4 – Scenario probability review

Theme Set	Comment
Load growth	A greenhouse abatement policy may reduce the load growth in the short to longer term. Hence it is considered that the low load growth probability needs to be increased. It is considered more unlikely now to have a high load growth. Hence it is considered prudent to modify the probabilities by increasing the low load growth value and decreasing the high load growth value. A breakdown of 20/70/10 is considered reasonable.
Inter-regional trade	The TransGrid – Powerlink work on the QNI upgrade has shown that it has benefits but the optimal timing is deferred to about 2015/16. Hence it is still considered reasonable to assume that a QNI interconnector development will be necessary. Hence the 35% ranking should remain. A relatively low ranking for the NSW – Vic upgrade appears reasonable given the outcome of the ANTS 2007 where upgrades have been shown to have marginal value. Hence it is considered that these probabilities should be unchanged.
Water availability	Whilst there has been some impact on the drought in some areas due to local rain the large long-term storages at Snowy and in Tasmania are still depleted and would take many years of sustained average inflows to restore them. Recent rain has also helped replenished coal-fired power station storages but there is expected to be heightened focus on conserving water. It is considered reasonable to continue with ROAM's probabilities.
Greenhouse policy	A significant incentive for renewables and disincentives for coal generation are likely as a result of the Garnaut review and associated statements by the Federal Government. It is considered that the CO2 tax theme should be increased to 80%.

Source: TransGrid 2008, "Revenue Reset 2008 Scenario Probabilities", Revision 0, 4/5/2008, page 4.

Table 5-5 – TransGrid revised scenario probabilities

Key factor	Theme[77]	Probability
Load Growth	L10	20%
	M10	70%
	H10	10%
Inter-Regional Trade	BAU	55%
	QNI	35%
	NSW-SNOWY	10%
Water Availability	BAU	35%
	LIMITED	65%
Greenhouse Policy	BAU	20%
	CO2 Tax	80%

Source: TransGrid 2008, "Revenue Reset 2008 Scenario Probabilities", Revision 0, 4/5/2008, page 5.

In the preparation of its proposal, TransGrid has also considered the changes in the status of generator connection applications and this is reflected in the final adjustments to the scenario probabilities[78].

[77] L – Low economic growth, M – Medium economic growth, H – High economic growth, BAU – Business as Usual, QNI - Queensland–New South Wales Interconnector, NSW-SNOWY - New South Wales – Snowy Interconnector.

[78] This is further discussed in TransGrid document: "Revenue Reset 2008 Scenario Probabilities", Revision 0, 4/5/2008, page 5-11.

Through this process a final set of scenario probabilities are determined for use in the development of the forecast capex. The final scenario probabilities are shown in Table 5-6 contrasted against the initial ROAM scenario probabilities.

Table 5-6 – Final scenario probabilities

Scenario	Theme combination				ROAM probabilities %	Final probabilities %
	Load	Inter-regional trade	Water availability	Greenhouse policy		
1	L	BAU	BAU	BAU	1.4	1.0
2	L	BAU	BAU	CO2 tax	1.8	3.3
3	L	BAU	Limited	BAU	2.7	1.9
4	L	BAU	Limited	CO2 tax	3.5	6.4
5	L	QNI upgrade	BAU	BAU	0.7	0.5
6	L	QNI upgrade	BAU	CO2 tax	1.0	1.8
7	L	QNI upgrade	Limited	BAU	1.5	1.0
8	L	QNI upgrade	Limited	CO2 tax	2.0	3.7
9	L	NSW–Vic upgrade	BAU	BAU	0.2	0.1
10	L	NSW–Vic upgrade	BAU	CO2 tax	0.3	0.5
11	L	NSW–Vic upgrade	Limited	BAU	0.5	0.3
12	L	NSW–Vic upgrade	Limited	CO2 tax	0.6	1.1
13	M	BAU	BAU	BAU	6.3	3.3
14	M	BAU	BAU	CO2 tax	9.3	12.8
15	M	BAU	Limited	BAU	11.1	5.7
16	M	BAU	Limited	CO2 tax	12.6	17.4
17	M	QNI upgrade	BAU	BAU	3.3	1.7
18	M	QNI upgrade	BAU	CO2 tax	4.0	5.5
19	M	QNI upgrade	Limited	BAU	7.4	3.8
20	M	QNI upgrade	Limited	CO2 tax	8.4	11.6
21	M	NSW–Vic upgrade	BAU	BAU	1.0	0.5
22	M	NSW–Vic upgrade	BAU	CO2 tax	1.2	1.7
23	M	NSW–Vic upgrade	Limited	BAU	2.3	1.2
24	M	NSW–Vic upgrade	Limited	CO2 tax	2.9	4.0
25	H	BAU	BAU	BAU	1.4	0.5
26	H	BAU	BAU	CO2 tax	1.9	1.7
27	H	BAU	Limited	BAU	2.4	0.8
28	H	BAU	Limited	CO2 tax	2.0	1.8
29	H	QNI upgrade	BAU	BAU	0.8	0.3
30	H	QNI upgrade	BAU	CO2 tax	1.0	0.9
31	H	QNI upgrade	Limited	BAU	1.5	0.5
32	H	QNI upgrade	Limited	CO2 tax	1.6	1.5
33	H	NSW–Vic upgrade	BAU	BAU	0.2	0.1
34	H	NSW–Vic upgrade	BAU	CO2 tax	0.3	0.3
35	H	NSW–Vic upgrade	Limited	BAU	0.4	0.1
36	H	NSW–Vic upgrade	Limited	CO2 tax	0.7	0.6

Source: TransGrid 2008, "Revenue Reset 2008 Scenario Probabilities", Revision 0, 4/5/2008, page 13-14.

5.2.2 Scenario planning

For each of the 36 generation scenarios, TransGrid has assessed the performance of the main transmission network under TransGrid's planning criteria. TransGrid's planning criteria is discussed in Section 2.2. The needs arising from these network studies have been identified and solutions determined and evaluated to identify a preferred option. This has is then subject to the development of a cost estimate.

As a consequence of this process, TransGrid has considered capital works projects under each of the 36 possible scenarios. That is, for each scenario, there is a set of costed capital works projects. In total, TransGrid has identified 160 capital works projects under each or 36 scenarios. It should be noted that 140 of these are common to all scenarios, and the project timing varies across the scenarios in only 12.5% of projects. Hence, a large number of projects are not sensitive to the future scenarios. This is essentially due to the large number of projects which are driven by fundamental needs other than generation patterns and state load growth.

TransGrid has developed a Capital Accumulation Model (CAM) spreadsheet to combine the costs of each project identified under each of the 36 scenarios. This model sums the estimated cost of each project proposed under each scenario, and weights the total project costs by the scenario probability to give a probability weighted total capital cost for each scenario. These probability weighted total capital costs are then summed across the 36 scenarios to give the total probability weighted forecast capex.

The CAM also applies a risk factor and cost escalation factors to the capex forecast. These matters are discussed in Section 5.3.

In PB's opinion the scenario planning and probabilistic methodology used by TransGrid is sound, and represents a robust process that is well documented and evidenced. We are also of the view that the development of the scenario probabilities is well considered, with the final scenario probabilities being realistic.

PB has tested the sensitivity of the ex-ante capex portfolio to the scenario probabilities by having TransGrid vary each of the top six scenarios probabilities by +/-10% and redistributing the variance to the lowest twelve scenarios. From this assessment PB is satisfied that the ex-ante capex portfolio is relatively insensitive to reasonable changes in the scenario probabilities. Moreover, this lack of sensitivity is explained largely by the fact that the timing of only 12% (approx.) of the capex projects is sensitive to the scenarios. This, combined with a comparatively small range between the high medium and low demand forecasts, explains the relative insensitivity of TransGrid's ex-ante capex portfolio to the scenario probabilities.

5.3 COST ACCUMULATION METHODOLOGIES AND OUTCOMES

This section describes the general adjustments made to TransGrid's project cost estimates in order to translate them into an annual profile of capital expenditure. This process has been undertaken on a project basis for each of the future and committed projects and programs presented in the TransGrid Revenue Proposal. The process includes matters such as the escalation of costs for labour and material over time, the timing of projects, the determination of expenditure profiles, risk adjustment factors and other related matters.

5.3.1 Cost escalation factors – labour and material

In establishing its annual forecast capex requirement over the review period, TransGrid has applied (real) base escalation rates above CPI, as outlined in the CEG report, to critical input components. This is shown in Table 5-7.

The CEG escalation recommendations are derived from sources available at the time of the report and are typically based on forecasts dated from 2007 to early 2008. The use of these forecasts is considered to be reasonable in the context of the report date. However, significant

changes to economic conditions have occurred since this date. Therefore PB recommends that the impacts on the labour and material cost escalation rates arising from these recent global changes should be considered by the AER in making its determination.

Table 5-7 – TransGrid proposed base cost escalation factors, %

Item	08/09	09/10	10/11	11/12	12/13	13/14	Total (2008 to 2014)
Copper (real)	(3.70)	(6.30)	(4.20)	(2.80)	(3.10)	(3.10)	(21.11)
Aluminium (real)	3.50	(0.50)	(0.20)	0.30	-	-	3.08
Crude oil (real)	12.30	(3.80)	(1.30)	(0.50)	(2.00)	(0.90)	3.04
Steel (real)	0.10	0.30	0.20	0.20	0.20	0.20	1.21
EGW NSW wages (real)*	3.60	3.90	1.90	2.80	3.50	3.70	21.02
Construction costs (real)	2.10	0.90	0.70	1.10	1.90	2.60	9.65
Wages general (real)	1.60	2.40	1.90	1.80	2.00	2.00	12.28
Producer's margin (real)	5.40	6.10	7.60	-	-	-	20.33
Land (real)	4.10	4.10	4.10	4.10	4.10	4.10	27.26
CEG CPI	2.80	2.40	2.40	2.50	2.50	2.40	15.97

Source: CEG April 2008.

The cost escalation factors for each component has been calculated based on the weightings described in Section 5.3.2 and the base escalation rates derived from the CEG report. The weighted escalation factors proposed by TransGrid are reproduced in Table 5-8.

Table 5-8 – TransGrid proposed weighted cost escalation factors, %

Component	Weight	08/09	09/10	10/11	11/12	12/13	13/14	total
EGW Wages	15.65	3.60	3.90	1.90	2.80	3.50	3.70	21.02
Structures and Fabricated Steel	1.34	1.96	0.86	0.67	1.04	1.78	2.43	9.05
Primary Plant	13.28	0.30	0.21	0.48	(0.17)	(0.19)	(0.19)	0.44
Secondary Systems	6.02	0.52	0.59	0.73	-	-	-	1.85
Transformers	9.46	0.65	(0.17)	0.28	(0.28)	(0.37)	(0.33)	(0.22)
Buildings	1.46	2.10	0.90	0.70	1.10	1.90	2.60	9.65
Civil Construction	9.57	2.10	0.90	0.70	1.10	1.90	2.60	9.65
Electrical Construction	1.66	2.10	0.90	0.70	1.10	1.90	2.60	9.65
Transmission Towers	12.99	1.93	0.85	0.66	1.02	1.76	2.40	8.92
Aluminium Conductor	5.67	2.62	0.30	0.62	0.19	0.01	0.01	3.78
Concrete Pole	2.01	0.89	0.38	0.30	0.47	0.80	1.10	4.00
Copper Cable	12.03	1.23	-0.13	0.09	0.31	0.66	1.03	3.23
Wages General	4.75	1.60	2.40	1.90	1.80	2.00	2.00	12.28
Miscellaneous Materials	4.12	-	-	-	-	-	-	-
Weighted Av. Escalation (real)	100.00	1.63	1.02	0.76	0.82	1.17	1.44	7.03
Weighted Av. Escalation (nominal)	100.00	4.43	3.42	3.16	3.32	3.67	3.84	9.05
Property (real)	100.00	4.1	4.1	4.1	4.1	4.1	4.1	27.26
Property (nominal)	100.00	6.90	6.50	6.50	6.60	6.60	6.50	46.74

Source: TransGrid Revenue Proposal (p70) and updates from slides 'W1', Wednesday 09 July 2008.

Escalation has been applied to all future project and program expenditures occurring in the 2009-2014 regulatory period, including the risk component of the estimate.

No escalation above the nominal CPI has been applied to committed projects. PB notes that this is an inherently conservative assumption, but reasonable given committed projects have approved expenditure.

The overall impact of the application of the labour and material escalators is to increase the risk-adjusted base estimates by $228.4m, or 9.8%.[79]

Labour

TransGrid has applied two separate escalators to the wages components of the weighted average escalation. The derivation of these factors is contained in Attachment F to the TransGrid Revenue Proposal. The majority (77%) of the wages component of the escalation

79 PB notes advice from TransGrid that the table included as Figure 7.18 in TransGrid's revenue proposal was based on a spreadsheet that contained formula errors, the correction of which increased the amount of cost escalation by another $7.1m, and enough to increase in the MAR of $1.2m (refer section 5.4.1).

calculation has been escalated at the average of the Macromonitor and Econtech electricity, gas and water (EGW) sector escalation rates resulting in a 21.02% real increase over the 2009-2014 regulatory period. The remaining 23% of wages associated with pole clearing expenditure has been escalated according to the Econtech forecast escalation rates for the general wages resulting in a real escalation of 12.28% over the 2009-2014 regulatory period.

The distinction between EGW and general wages has been included to mitigate the impact of the significantly higher wage growth in the EGW sector when compared to general wage growth. In drawing this distinction PB acknowledges that TransGrid has intended to adopt a conservative approach to the calculation of labour escalation.

As shown in Table 5-9, the cumulative escalation over the 2009-2012 period, that is common to all of the current revenue determinations, demonstrates that the proposed labour escalation rates are in general accordance with those applied in recent revenue determinations. A further comparison of the cumulative escalation over the entire 2009-2014 regulatory period that is common to both TransGrid and SP AusNet, indicates that TransGrid's cumulative escalation at 15.32% remains marginally higher than SP AusNet at 14.81%.

Table 5-9 – Comparison of % real annual labour cost escalators for TNSPs

TNSP	08/09	09/10	10/11	11/12	12/13	13/14	Total (2009 - 2012)	Total (2009 - 2014)
TransGrid (proposed weighted average)[80]	3.13	3.55	1.90	2.57	3.15	3.30	8.23	15.32
SP AusNet[81]	-	2.80	2.80	2.80	2.80	2.80	8.64	14.81
ElectraNet[82]	2.70	3.70	3.40	2.70	2.50	-	10.12	-
Powerlink[83]	4.30	1.50	1.70	3.00	-	-	6.32	-

Source: TransGrid Revenue Proposal and AER Final Determinations.

The proposed base rates are supported by both the Macromonitor and Econtech forecasts referenced in the CEG report, and are also generally consistent with the national outlook provided in the Econtech report[84] prepared for the AER during the SP AusNet revenue review.

PB is of the view that the weighted labour escalation detailed in Table 5-9 is slightly inflated due to the proportion of work subject to the EGW labour escalation and not due to the base rates themselves. Therefore PB is not recommending any specific changes to the base labour escalation rates.

PB is recommending adjustments to correct for the use of non-standard factors in the cost-estimating procedure as discussed in Section 3.5.3. PB is of the view that this adjustment also corrects for part of the increased EGW labour cost component included in the proposed forward capex.

Materials

TransGrid has applied the escalators referenced in the CEG report in calculation of the weighted escalation rates. PB notes that the methodology has been used by CEG in a number

80 Based on the weightings detailed in Table 5-8 and the CEG escalation factors shown in Table 5-7.

81 AER Final decision – SP AusNet transmission determination 2008-09 to 2013-14, January 2008, page 114.

82 AER Final decision – ElectraNet transmission determination 2008-09 to 2012-13, April 2008, page 46.

83 AER Decision – Powerlink Queensland transmission network revenue cap 2007-08 to 2011-12, June 2007, page 110.

84 Econtech, Labour Costs Growth Forecasts, August 2007, (page 12).

of previous revenue reviews. This methodology has been subject to critique by SKM during the ElectraNet review regarding the use and treatment of futures prices in determining long term escalation of commodities.

PB notes that the approach adopted by CEG in determining its copper and aluminium forecast escalators is considered reasonable. PB makes the following observations:

- the assumption that long term (5-10 year) forecasts apply at 10 years reduces the magnitude of the annual escalator in absolute terms, resulting in a net increase in the escalation revenue for negative forecasts, and a net reduction in the escalation revenue for positive forecasts. As the process has been applied consistently, PB is of the view that no change is required
- the use of a 20-day average of the futures prices is considered to be more transparent and should be adopted in the future to reduce the sensitivity to abnormal single day prices.

Table 5-10 – Comparison of % real annual material cost escalators for TNSPs

TNSP	08/09	09/10	10/11	11/12	12/13	13/14
TransGrid (Proposed)[85]						
Copper	(3.70)	(6.30)	(4.20)	(2.80)	(3.10)	(3.10)
Aluminium	3.50	90.50)	(0.20)	0.30	-	-
Steel	0.10	0.30	0.20	0.20	0.20	0.20
Crude Oil	12.30	(3.80)	(1.30)	(0.50)	(2.00)	(0.90)
SP AusNet[86]						
Copper	(3.90)	(3.23)	(0.86)	(0.22)	(0.33)	-
Aluminium	(13.60)	97.06)	(4.11)	(4.68)	(5.04)	-
Steel	(5.70)	(7.42)	(3.21)	(3.43)	(3.55)	-
Crude Oil	(7.77)	(9.90)	(7.21)	(6.66)	(6.99)	-
ElectraNet[87]						
Copper	(8.46)	(5.82)	(7.74)	(8.42)	(9.19)	-
Aluminium	(2.60)	(0.92)	(2.17)	(2.38)	(2.60)	-
Steel	-	-	-	-	-	-
Crude Oil	(8.04)	(5.82)	(7.74)	(8.42)	(9.19)	-

Source: Various.

Table 5-10 provides a comparison of the base materials escalation rates applied in recent revenue determinations. PB notes that the high variation in material escalation applied in each case is associated with the volatility of commodity prices over recent years influencing the consistency of forecasts.

PB notes that TransGrid's oil, aluminium and steel escalators are consistently higher than those applied in either of the SP AusNet and ElectraNet cases. Given the relatively small proportion of the total capital expenditure subject to the material costs escalation factors (0.6% oil, 3.5% aluminium, 4.0% copper and 2.6% steel), small changes to individual materials

85 TransGrid Revenue Proposal and the CEG escalation factors shown in Table 5-7.

86 Calculated from: SKM, Escalation Factors affecting Capital Expenditure Forecasts, February 2007, page 50.

87 AER Final decision – ElectraNet transmission determination 2008-09 to 2012-13, April 2008, page 42.

escalators are not considered to be significant. The increase in oil escalation factors proposed by TransGrid is considered to be consistent with the significant increase in oil prices that occurred in the latter part of 2007.

Therefore, PB is not recommending any changes to the base material escalators.

Producers' margin

TransGrid has applied the escalators referenced in the CEG report in calculation of the producers' margin component of the escalation. PB notes that the methodology used by CEG is based on the forecast increase in EBIT margins for a sample of electrical equipment producers.

PB notes that the forecast company EBIT margins used to determine the escalation of producers margin also includes the effect of increased efficiencies associated with the higher utilisation of facilities, plant and administrative overheads that occur during periods of high manufacturing demand. Therefore the use of the EBIT margin is only applicable for companies that remain at full capacity for a sustained period of time. In all other cases the resulting escalation based on EBIT would be higher than the escalation on the margin charged on contracts.

PB acknowledges that sufficient documented[88] anecdotal evidence supports the implicit assumption that electrical equipment producers are currently near full production capacity, have been for some time, and are likely to remain at or near full capacity for some time to come. Therefore, PB accepts the underlying basis for the CEG forecast. However, the CEG report[89] indicates that the producers margin escalation for 2010 and 2011 is based on forecast Prysmian EBIT results only, as shown in Table 5-11.

Table 5-11 – CEG proposed producers margin escalation (% real, year end June)

Company	2008	2009	2010	2011	2012
ABB Power products (JP Morgan)	3.60	2.90	-	-	-
ABB Power systems (JP Morgan)	7.50	5.80	-	-	-
Prysmian (JP Morgan)	18.80	9.90	6.30	7.60	-
ABB (G. Sachs)	5.10	3.00	-	-	-
Prysmian (G. Sachs)	9.90	5.40	6.00	-	-
Nexans (G. Sachs)	11.80	5.30	-	-	-
Average	9.50	5.40	6.10	7.60	-

Source: CEG Report page 37.

Notably, there is a 99% and 84% variance between the two Prysmian forecasts for 2008 and 2009, respectively. Whilst PB recognises CEG's view with regard to the cause of this variance resulting from a lag in the timing between the two forecasts:

> *"These large differences are primarily differences in the timing of increases – with Goldman Sachs predicting slightly earlier margin growth than JP Morgan followed by lower margin growth in 2008 and 2009. However, when taken across all of the relevant years the average forecast increase in margins is broadly similar (12.0% vs 13.5%)"*[90]

88 CEG, Escalation factors affecting expenditure forecasts, April 2008 page 35.

89 CEG, Escalation factors affecting expenditure forecasts, April 2008 page 37.

90 CEG, PB7 E2 Issue 222 Escalation – Producers Margin.

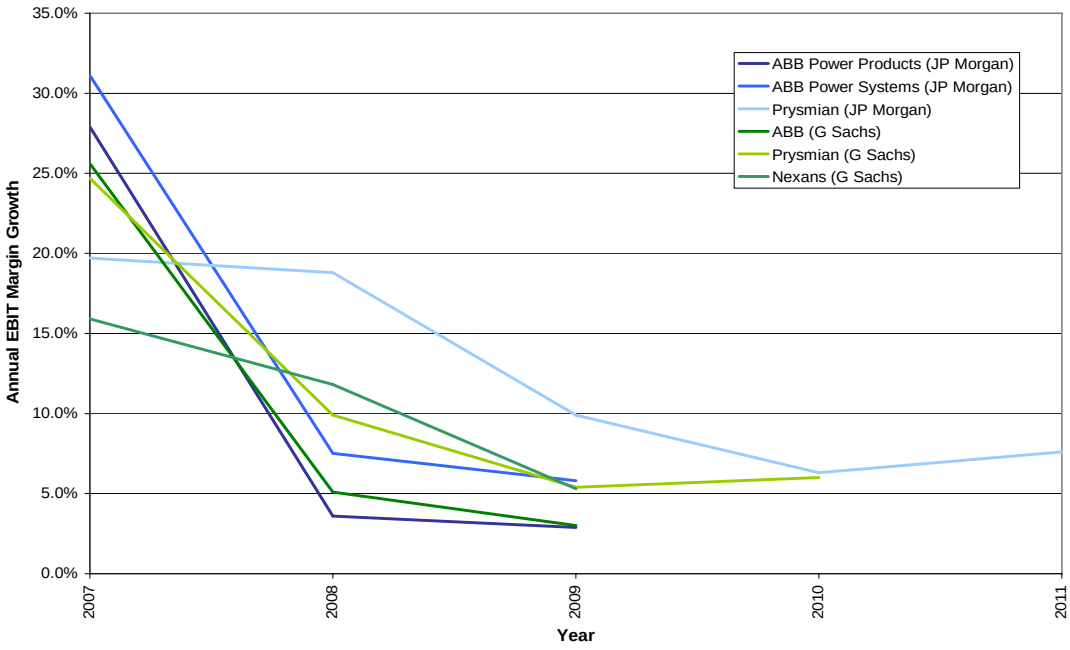
PB notes that, regardless of the timing issues, the JP Morgan forecast for Prysmian, shown in Figure 5-3, is clearly not a reliable indicator of the industry average forecasts over the period from 2007-2009. Nonetheless this forecast forms the majority basis in deriving the escalators proposed beyond 2009 due to a 50% weighting implicit in the CEG averaging process for 2010 and a 100% weighting for 2011. PB considers that the application of this weighting to a single forecast that is shown to be a poor indicator of the average forecast increase in EBIT margin growth over the proceeding years is not a reasonable basis for establishing future margin escalation.

Therefore in the absence of the averaging effect provided by the ABB and Nexans forecast, covering this period, PB is of the view that the forecast based on Prysmian results alone significantly overstates the forecast average industry margin growth.

On this basis, PB remains of the view that a single company forecast for Prysmian is not a reasonable basis for predicting the forecast industry average producer's margin increases over the period 2010-2011.

Therefore, consistent with the approach taken by CEG where no real escalation is applied when insufficient data is available to form a reasonable view, PB recommends that no real increase in margins be applied beyond 2009.

Figure 5-3 – Base forecasts for CEG proposed producer's margin escalation



Source: PB analysis.

Land

TransGrid has escalated all easement acquisition costs by the BIS Shrapnel forecast real escalation of 4.1% p.a.[91] noted in the CEG report. PB notes that this escalation is based on Sydney CBD, non-CBD metropolitan, and B-grade commercial property forecasts. PB notes that the majority of easement acquisitions scheduled for the 2009-2014 regulatory period are located outside the Sydney metropolitan area, and therefore the nominated property escalation factors may not be directly applicable.

For easement escalation in non-metropolitan areas, TransGrid's consultant, Competition Economists Group (CEG), has referenced an independent report prepared for TransGrid by

91 CEG, Escalation factors affecting expenditure forecasts, April 2008 page 40.

Jones Lang Lassalle. This report has been reviewed by PB and indicates that non-metropolitan land value is expected to increase at a rate greater than metropolitan property over the 2009-2014 regulatory period[92]. PB also notes that TransGrid's proposed real escalation of 4.1% per annum is generally consistent with the escalation factors that have been approved in recent revenue reviews for other TNSPs.

Table 5-12 – Land escalation factors (% per annum real)

TNSP	Commercial/ Metropolitan/Urban	Residential	Rural	Weighted average
TransGrid (Proposed)[93]	4.10	-	4.10	4.10
SP AusNet[94]	-	-	-	4.00
ElectraNet[95]	3.80	7.64	4.87	4.73
Powerlink[96]	5.70	-	5.00	-

Source: AER revenue determinations.

Whilst TransGrid has not applied varying land escalation factors across metropolitan, non-metropolitan and rural land acquisitions, the application of the metropolitan escalator to all land acquisitions is considered to be conservative due to the land value recommended in the JLL report and when compared to land escalation applied in recent revenue determinations. This is supported by the 73% weighting of land acquisition costs to the Sydney metropolitan region

Therefore, PB is not recommending an adjustment to TransGrid's proposed real land escalation factor of 4.1% per annum.

Construction Costs

TransGrid has applied the escalators referenced in the CEG report to construction costs proportion of the capital works portfolio. These annual escalation rates are based on the average of Econtech and Macromonitor forecasts for 'Total Engineering' which has been chosen in preference to more industry specific electrical or utilities forecasts.

PB notes that the justification for the selection of the more generic escalation category is considered reasonable on the basis that the industry specific forecasts would double count the higher forecast wage growth in the utilities sector that is already addressed in the escalation of labour costs.

92 Jones Lang LaSalle, Revenue Reset Program – Land growth factors, January 2008, page 9.

93 TransGrid Revenue Proposal and CEG escalation factors shown in Table 5-7.

94 AER Final decision – SP AusNet transmission determination 2008-09 to 2013-14, January 2008, page 123.

95 AER Final decision – ElectraNet transmission determination 2008-09 to 2012-13, April 2008, page 34.

96 AER Draft Decision – Powerlink Queensland transmission network revenue cap 2007-08 to 2011-12, December 2006, page 76.

Table 5-13 – Comparison of % real annual construction cost escalators for TNSPs

TNSP	08/09	09/10	10/11	11/12	12/13	13/14	Total (2009 - 2012)	Total (2009 - 2014)
TransGrid (proposed weighted average)[97]	2.1	0.9	0.7	1.1	1.9	2.6	6.9	9.7
SP AusNet[98]	1.8	1.8	1.8	1.8	1.8	-	9.3	-
ElectraNet[99]	1.9	1.1	0.9	1.2	1.8	-	7.2	-

Source: TransGrid Revenue Proposal and AER Final Determinations.

Table 5-13 presents a comparison of the construction cost escalation factors applied in recent revenue determinations. PB notes that the proposed construction cost escalation rates contained in TransGrid's revenue proposal are generally consistent with the construction escalation rates applied for the common 2008/09 to 2012/13 period. Therefore PB is not recommending an adjustment to TransGrid's proposed construction cost escalation factors.

Escalation adjustments

PB's recommended adjustments to TransGrid's proposed base escalation rates are detailed in Table 5-14 (highlighted in grey shading). Using TransGrid's Capital Accumulation Model[100], PB has calculated the total value associated with these adjustments to be a reduction in the escalation allowance of approximately $9.35m based on the weighted escalators, as presented in Table 5-15.

Table 5-14 – PB recommended base cost escalation factors (%)

Item	08/09	09/10	10/11	11/12	12/13	13/14	Total (2008 - 2014)
Copper (real)	(3.70)	(6.30)	(4.20)	(2.80)	(3.10)	(3.10)	(21.11)
Aluminium (real)	3.50	(0.50)	(0.20)	0.30	-	-	3.08
Crude oil (real)	12.30	(3.80)	(1.30)	(0.50)	(2.00)	(0.90)	3.04
Steel (real)	0.10	0.30	0.20	0.20	0.20	0.20	1.21
EGW NSW wages (real)*	3.60	3.90	1.90	2.80	3.50	3.70	21.02
Construction costs (real)	2.10	0.90	0.70	1.10	1.90	2.60	9.65
Wages general (real)	1.60	2.40	1.90	1.80	2.00	2.00	12.28
Producer's margin (real)	5.40	0.00	0.00	0.00	0.00	0.00	20.33
Land (real)	4.10	4.10	4.10	4.10	4.10	4.10	27.26
CEG CPI	2.80	2.40	2.40	2.50	2.50	2.40	15.97

Source: CEG April 2008 & PB analysis.

97 Based on the weightings detailed in Table 5-8 and the CEG escalation factors shown in Table 5-7.

98 Calculated from: SKM, Escalation Factors affecting Capital Expenditure Forecasts, February 2007, page 36, average of 'Civil' and 'Erection' forecasts, adjusted by SKM's forecast CPI, page 3.

99 AER Final decision – ElectraNet transmission determination 2008-09 to 2012-13, April 2008, page 46.

100 TransGrid Capital Accumulation Model Version 1.8.

Table 5-15 – PB recommended weighted cost escalation factors for base escalation adjustments, %

Component	08/09	09/10	10/11	11/12	12/13	13/14	Total Value ($m)
TransGrid proposed	1.63%	1.02%	0.76%	0.82%	1.17%	1.44%	
PB base escalation adjustments	1.63%	0.78%	0.47%	0.82%	1.17%	1.44%	(9.35)

Source: PB analysis.

5.3.2 Application of escalators to capex forecast components

The methodology adopted by TransGrid to apply its real labour and material escalators as part of the capex allowance forecast involves calculating the proportion of each of the 14 components that have been forecast by CEG, as a percentage of the entire five year works program. This breakdown is shown in Table 5-16 below. Note that land is excluded from the calculation of the weighted escalation due to TransGrid's treatment of land escalation as a separate item in the capital accumulation process.

Table 5-16 – TransGrid proposed component breakdown, %

Component	Weighting	Aluminium	Copper	Steel	Oil	EGW Wages	Wages General	Construction Costs	Producer's Margin	Other
EGW Wages	15.65					100				
Structures & Fabricated Steel	1.34			7				93		
Primary Plant	13.28		6						10	84
Secondary Systems	6.02								10	90
Transformers	9.46		10	9	4				10	67
Buildings	1.46							100		
Civil Construction	9.57							100		
Electrical Construction	1.66							100		
Transmission Towers	12.99			9				91		
Aluminium Conductor	5.67	60		5					10	25
Concrete Poles	2.01							42		58
Copper Cable	12.03	1	19	2	2	9	4	46	4	11
Wages General	4.75						100			
Miscellaneous Materials	4.12									100
Real Escalation 2008-2014		3.1	(21.1)	1.2	3.0	21.0	12.3	9.7	20.3	-
Proportion of Capital Expenditure		3.5	4.0	2.6	0.6	16.7	5.2	32.1	3.9	30.9

Source: TransGrid Report D2008/06328 page 16 & PB analysis.

It can be seen from Table 5-16, that around 31% of the expenditure is not being escalated in real terms, yet approximately 54% of the capital expenditure falls into the wages and construction escalation categories, which is where a comparatively high cumulative escalation is applied. In contrast, the proportion of raw materials subject to lower, or negative, escalation is lower than anticipated for the equipment components. In particular the low proportion (9%) of steel in transmission towers appears is unexpected.

Transformers weighting

The breakdown of the 'transformers' component of the capital works program has been based on the ElectraNet breakdown and adjusted by TransGrid to include a 9.6% 'Producers Margin', in line with the CEG escalation report. TransGrid also states that its analysis revealed "a slightly higher weighting of copper and steel"[101].

PB considers the net effect of these changes could significantly increase the escalation associated with transformers when compared to the approved escalation applied in the ElectraNet case. This is due to the reduction in the weighting given to the raw materials categories, which are subject to low or negative real escalation factors. This increases the weighting assigned to the 'producers margin' category, which is subject to much higher real escalation factors.

PB has reviewed the breakdown of transformers project costs into the component weightings[102] provided by TransGrid. This reveals that TransGrid has assigned a significantly lower proportion of the total cost to the CPI category which is subject to no real escalation. Therefore PB is of the view that the weightings proposed by TransGrid provide no material benefit. On this basis no adjustment to the transformers weightings is recommended compared with the ElectraNet decision.

Steel weighting

PB has highlighted that two components 'Structures & Fabricated Steel' and 'Transmission Towers' appear to have relatively low proportion of raw steel in them. PB recommends that the Rawlinson's breakdown of 11% Steel and 89% Construction Costs noted by TransGrid in its calculation of steel costs be applied for the 'Structures & Fabricated Steel' and 'Transmission Towers' components based on:

- the calculation of the 7% weighting used for steel in the 'Structures & Fabricated Steel' component does not account for all of the raw material cost associated with items such as reinforcing mesh, bolts and anchors[103]
- the exclusion of these items weights the escalation for this component more heavily towards the 'construction costs' category and provides a small increase to the overall weighted escalation rates.

TransGrid has advised that it considers this proposed adjustment to be reasonable[104].

Weighting adjustments

PB's recommended adjustments to TransGrid's proposed weightings are detailed in Table 5-17 (as shown in highlighted cells). PB has requested that TransGrid calculate the adjustment in accordance with its capital accumulation process. TransGrid has advised that the total value associated with these adjustments to be a reduction in the escalation allowance of $0.75m. This change is reflected as an agreed adjustment in section 5.4.1.

101 TransGrid, Forecast Capital Expenditure Cost Escalation D2008/06328, July 2008 page 10.

102 TransGrid, Response PB Advice 7 – E4, page 1.

103 TransGrid, Forecast Capital Expenditure Cost Escalation D2008/06328, July 2008, Appendix C.

104 TransGrid, Response – PB Advice 7 – E1, Escalation Weighting – Steel Component, page 1.

Table 5-17 – PB recommended component breakdown, %

Component	Weighting	Aluminium	Copper	Steel	Oil	EGW Wages	Wages General	Construction Costs	Producer's Margin	Other
EGW Wages	15.65					100				
Structures and Fabricated Steel	1.34			11				89		
Primary Plant	13.28		6						10	84
Secondary Systems	6.02								10	90
Transformers	9.46		10	9	4				10	67
Buildings	1.46							100		
Civil Construction	9.57							100		
Electrical Construction	1.66							100		
Transmission Towers	12.99			11				89		
Aluminium Conductor	5.67	60		5					10	25
Concrete Poles	2.01							42		58
Copper Cable	12.03	1	19	2	2	9	4	46	4	11
Wages General	4.75						100			
Miscellaneous Materials	4.12									100

Source: TransGrid Report D2008/06328 page 15 & PB analysis.

Annual application of escalation factors

In the capital accumulation process, TransGrid has applied its escalation factors on the basis of the aggregate weighting by component of the 5 year capital works program. This does not account for variation in the annual weightings applied to each component of the capital works program arising from variation in the project work being undertaken from year to year – it is only suitable when the components change gradually. For example, in a year where a reduced amount of transmission lines work occurs such as earlier in the forecast period, the weighting of the Transmission Towers and Conductors components should also be reduced.

TransGrid identified that a limitation of the Capital Accumulation Model and Capex Estimating Database does not enable the calculation of escalation weightings annually and therefore TransGrid was unable to demonstrate the effect of annual changes to the component weightings within its normal capital accumulation process. However, TransGrid has undertaken a manual analysis to test the influence of applying escalation on an annual basis to a single scenario developed on the basis of the median commissioning date of the 36 scenarios assessed.

PB has reviewed the TransGrid analysis[105] and notes the finding that the application of annual escalators to its forecast capital works portfolio results in a net reduction of $3.6m to the capital expenditure over the 5 year program. Notwithstanding the net impact being relatively

105 TransGrid, Response – PB Advice 6 – E4 Issues 122 166 Revised 21 August 2008,page 2.

small, PB highlights the inflexibility of the TransGrid CAM model to accommodate this more appropriate representation of critical input assumptions.

PB notes that the CAM model has some ability to apply separate escalators on an annual basis to different expenditure categories. This capability is currently used by TransGrid for the purpose of land escalation but could also be extended to other escalation categories. This would require the derivation of separate s-curves for specific expenditure categories in a similar way that a separate s-curve is applied to land acquisition in the cost estimating database. Given the separate treatment of land escalation and timing in the existing CAM model, PB is of the view that the calculation of annual escalation based on specific cost categories appears within the capability of TransGrid's existing processes. In PB's view, this would represent a more appropriate treatment of annual changes to the escalation weightings.

Therefore PB recommends an adjustment of $3.6m is removed from the TransGrid capex allowance to account for the annual profile of spend in each category being escalated for real labour and material escalators across the outlook period.

Conclusion

PB has undertaken a review of TransGrid's proposed escalation factors and weightings and recommends adjustments to the following items:

- the producers' margin escalator
- the annual application of escalation factors.

The adjustments recommended by PB are summarised in Table 5-18. In addition, the agreed adjustment related to the weightings applied to steelwork has been included in section 5.4.1

Table 5-18 – Adjustment for application of annual escalation weightings

Expenditure $m (real, 07/08)	09/10	10/11	11/12	12/13	13/14	Total Value ($m)
Escalators	(0.42)	(1.64)	(3.33)	(2.62)	(1.34)	(9.35)
Annual component weighting	1.1	1.9	(4.2)	(2.3)	(0.1)	(3.6)
PB recommendation	0.68	0.26	(7.53)	(4.92)	(1.44)	(12.95)

Source: PB analysis.

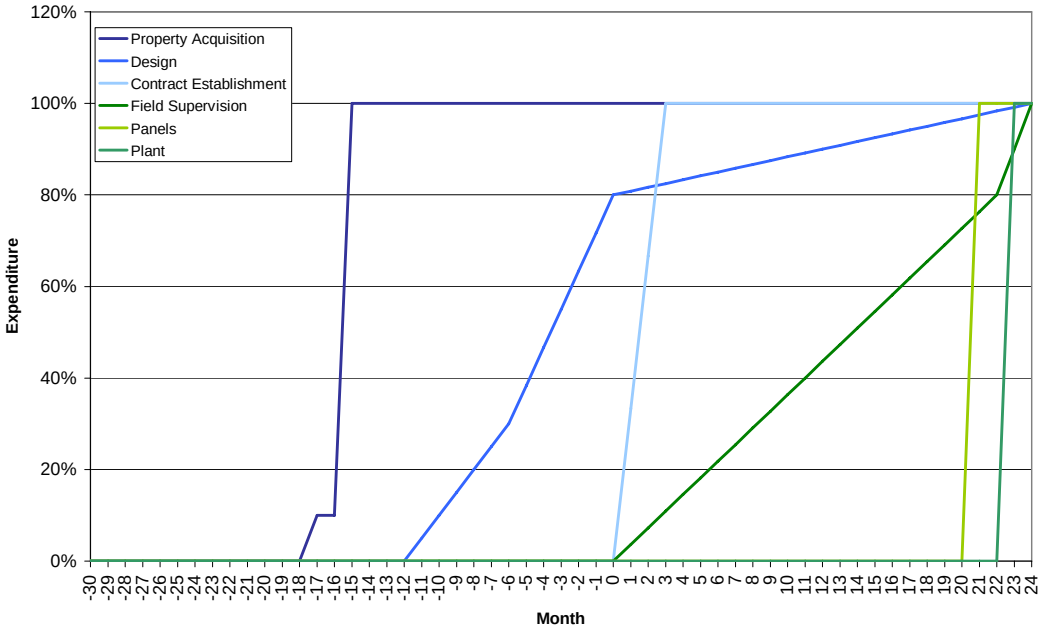
5.3.3 S-curves

To determine the timing of the 'as-incurred' expenditure for each project given an expected commissioning date, standard s-curves are applied in the TransGrid Cost Estimating Database. This provides an annual breakdown of expenditure input to the Capital Accumulation Model. TransGrid's s-curves have been based on a monthly spend profile for each project type, and they have been informed through discussions with senior staff with responsibility for the respective expenditure activity[106]. The s-curves have been externally reviewed as part of an SKM[107] assessment of the TransGrid estimating database. PB's findings are generally consistent with those of SKM. The component s-curves applied to substation and line work components of the typical 24 month program proposed by TransGrid are shown in Figure 5-4 and Figure 5-5.

106 TransGrid report D2008/06031 January 2008.

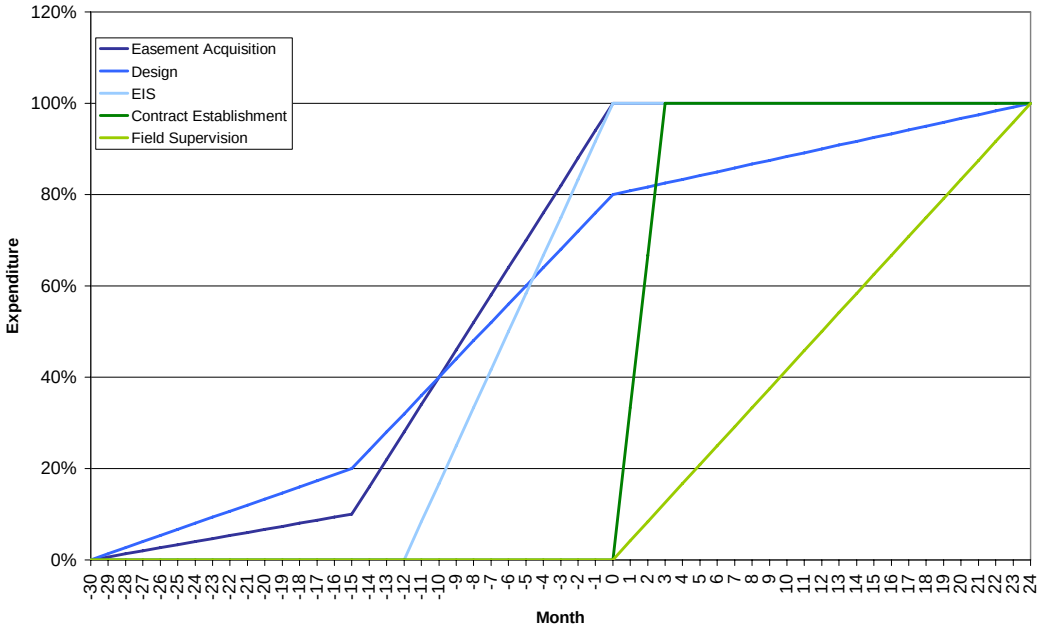
107 SKM Review of TransGrid's Capex Estimating Database, HA01099, July 2008.

Figure 5-4 – TransGrid substation project component s-curves



Source: TransGrid Report D2008/06031 page 5.

Figure 5-5 – TransGrid transmission line project component s-curves



Source: TransGrid Report D2008/06031 page 6.

PB notes that TransGrid has developed its component s-curves through work shopping and experience in lieu of dependence on detailed historical data.

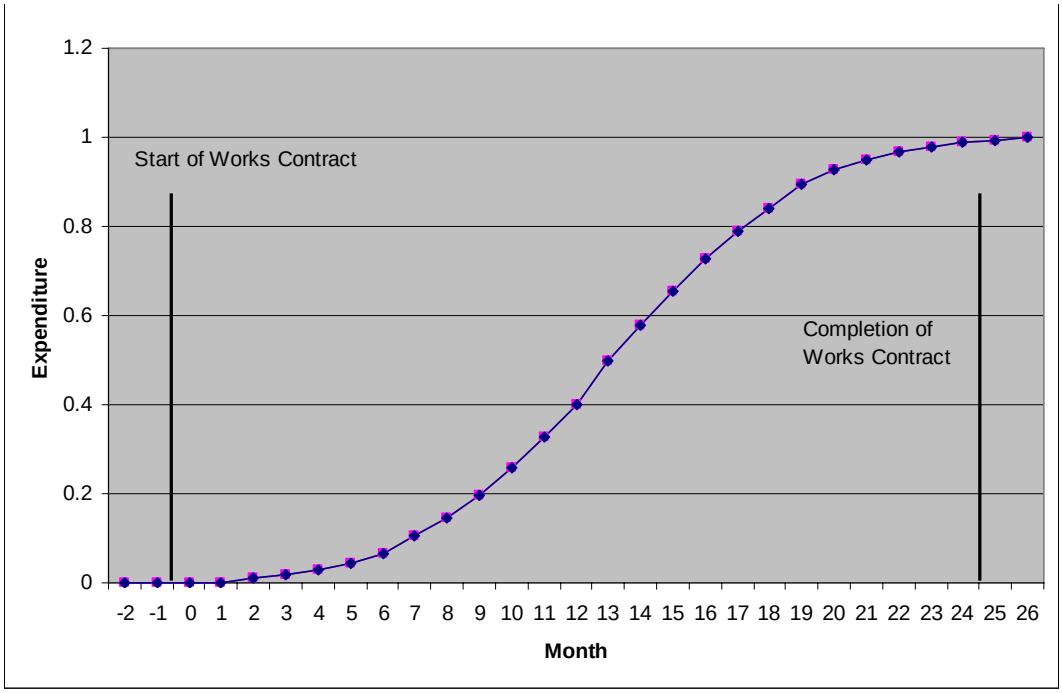
Notwithstanding this observation, PB is of the view that the TransGrid component s-curves applied in the capital expenditure estimation process appear reasonable. The major plant expenditure components are generally weighted towards the later part of the project with design, approvals and supervision activities distributed appropriately between the period prior to contract award and during the execution of the site works.

Project related property acquisition is assumed to occur 16-18 months prior to the commencement of site works for substation projects. Due to the greater level of co-ordination in the acquisition of transmission line easements, acquisitions occur progressively over a period of 30 months prior to contract commencement for transmission lines projects, with the majority occurring in the 15 months prior to contract commencement. In both cases, PB considers the lead times for land acquisition to be reasonable.

Expenditure relating to the main construction contract is assumed to follow the generic expenditure profile shown in Figure 5-6. This expenditure profile is applied to substation building, civil and electrical works, transmission line construction works and HV cable installation works.

PB considers the documented application of TransGrid's historical out-turn project experience would improve the derivation of the expenditure profiles, though PB is still of the opinion that the generic expenditure profile adopted is appropriate and consistent with the expenditure timing associated with typical construction projects.

Figure 5-6 – TransGrid major site activities component s-curves



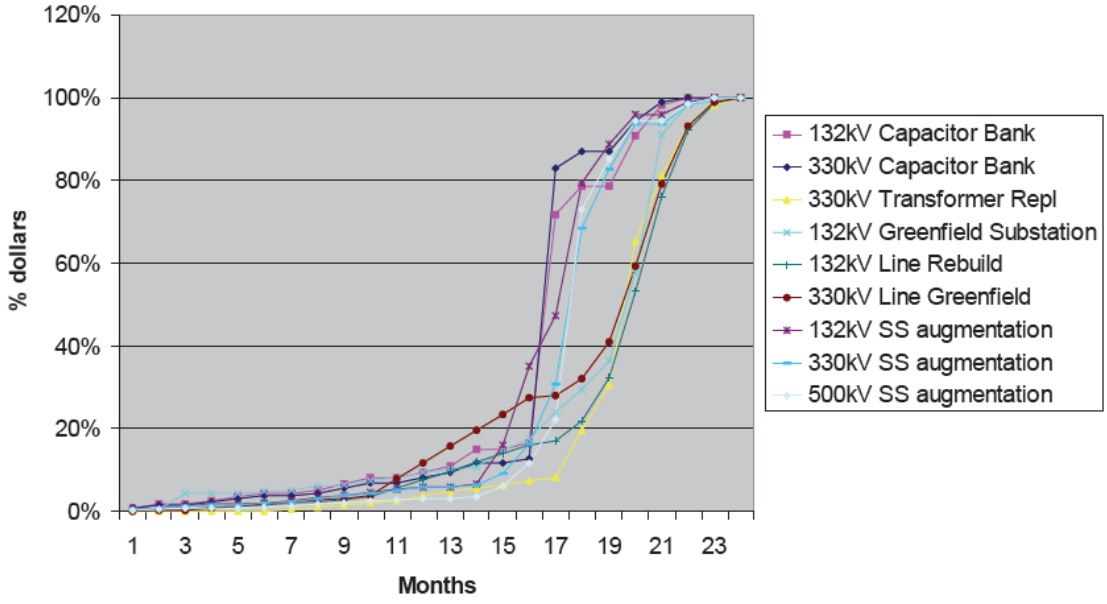
Source: TransGrid Report D2008/06031 page 4.

PB notes that the annual rather than monthly resolution of costs imported from the Cost Estimating Database into the Capital Accumulation Model potentially provides a small benefit where the majority of the expenditure occurs toward the end of each year. PB is of the view that any small benefit arising from assigning expenditure to an earlier year would largely be offset by the loss of the risked escalation allowance that would apply if the expenditure occurred in a later year. Therefore, this matter is not expected to be material.

We note that TransGrid has identified 19 projects where commissioning is expected to occur after the end of the next regulatory period (i.e. beyond 30 June 2014). In these cases, the standard s-curves have been applied in the cost estimating database to determine the portion of the actual project capex that would fall within the 2009-14 regulatory period. PB considers this to be a reasonable approach.

The normalised s-curves for the typical future projects are shown in Figure 5-7, and they demonstrate to PB that the s-curves proposed by TransGrid generally weight expenditure appropriately towards the later stages of construction.

Figure 5-7 – TransGrid 24 month normalised s-curves



Source: TransGrid[108].

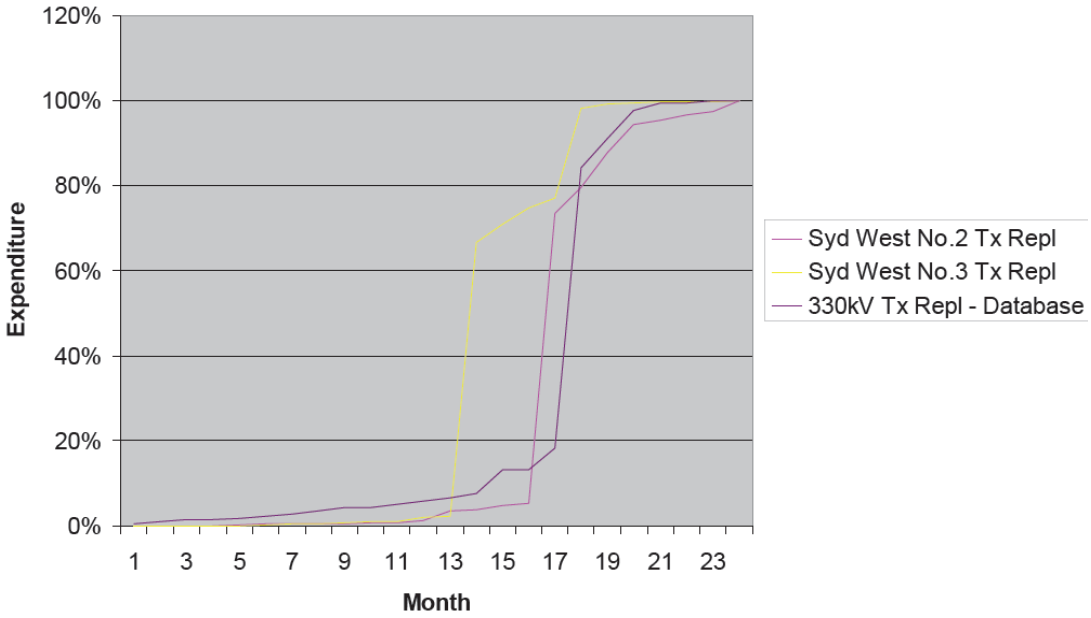
Historical s-curves

To test the suitability of TransGrid's s-curves in a more direct manner, TransGrid has provided a direct comparison of its s-curves for a range of completed projects. The figures show the historical spend against the generic s-curves for the project as applied in the TransGrid capital expenditure estimation database.

Figure 5-8 illustrates the historical project expenditure for two 330 kV transformer replacement projects that have recently been undertaken by TransGrid. In both cases, the cost estimating database s-curve lags the actual expenditure by between 1 and 4 months. During the later stages of the project, the reference s-curve over estimates the cost timing in one instance and underestimates the cost timing in the other. In this case, PB is of the view that the s-curve derived from the database represents a reasonable estimate of the timing of project expenditure.

108 TransGrid presentation, W2 Cost Estimation, 9 July 2009, slide 25-28.

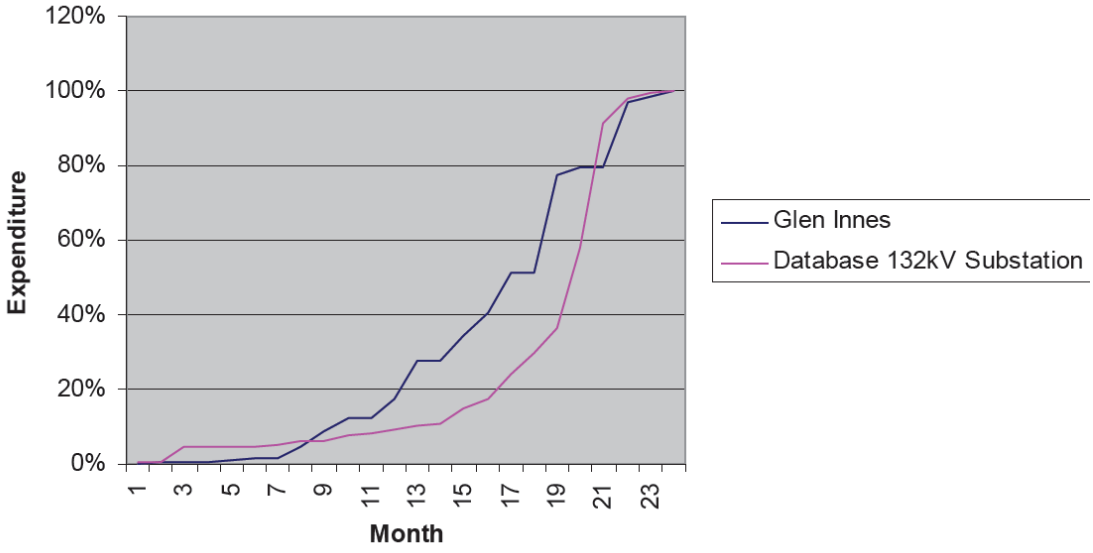
Figure 5-8 – TransGrid historical transformer replacement s-curve (normalised)



Source: TransGrid.

Figure 5-9 illustrates the historical project expenditure for a 132 kV substation project that has recently been undertaken by TransGrid. The reference s-curve overestimates the timing of the expenditure in the early stages of the project but significantly underestimates the timing of project expenditure for the majority project. The underestimation of project expenditure between months 8 to 20 would negate any benefit arising from the small overestimate in the early stages. In this case, PB is of the view that the s-curve derived from the database represents a reasonable estimate of the timing of project expenditure.

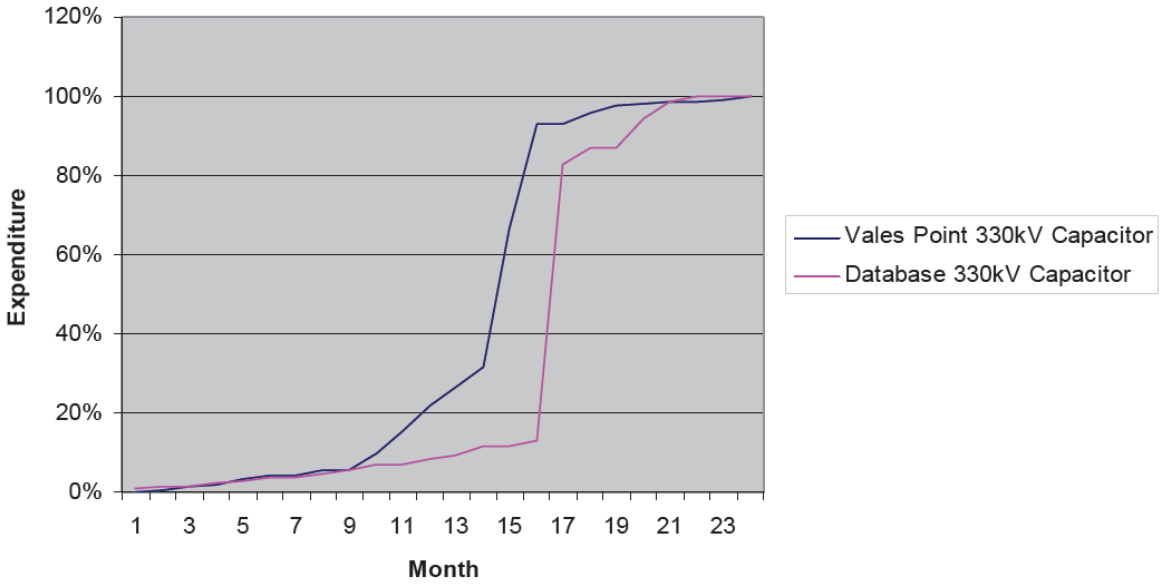
Figure 5-9 – TransGrid historical substation project s-curve (normalised)



Source: TransGrid.

Figure 5-10 illustrates the historical project expenditure for a 330 kV capacitor installation project that has recently been undertaken by TransGrid. The reference s-curve generally underestimates the timing of project expenditure. Once again, PB is of the view that the s-curve derived from the database represents a reasonable estimate of the timing of project expenditure.

Figure 5-10 – TransGrid historical capacitor installation project s-curve



Source: TransGrid.

When compared to the s-curves presented in the Powerlink[109] and ElectraNet[110] submissions, the s-curves proposed by TransGrid weight expenditure further toward the later stages of the project.

As part of PB's review it became apparent that TransGrid process for deriving the s-curves used in the estimation of its forward capital expenditure is largely based on judgement and experience[111], rather than through the use of historical data. This process results in capital expenditure profiles that are less transparent and potentially highly sensitive to the changes in the input parameters derived from opinion. However, a comparison with actual historical expenditure profiles and other businesses demonstrates that the assumed profiles derived through the TransGrid process are generally representative of typical projects and conservative in the context that expenditure is timed to occur at later dates.

On this basis, PB recommends no specific changes to the s-curves proposed by TransGrid.

5.3.4 Risk adjustment

TransGrid, in consultation with Evans & Peck, has undertaken an assessment of the risks associated with TransGrid's capital works program for the five-year regulatory period from 1 July 2009 to 30 June 2014. This involved a framework and process similar to the approach

109 PB Associates, Powerlink Revenue Reset - Review of Capital Expenditure, Operating and Maintenance Expenditure and Service Standards, December 2006, page 128.

110 SKM, Review of ElectraNet Revenue Proposal 2008-2013, November 2007, page 64.

111 TransGrid Report D2008/06031, January 2008, page 4.

adopted by ElectraNet, Powerlink, and SP AusNet[112] as part of their previous revenue reviews.

The impact of the cost estimation risk analysis has been to increase the base estimates of 158 (87% total) network projects by $77.1m[113], through the application of ratios of risk adjusted outturn cost to base estimates of between 1.02 and 1.07, depending on the nature of the project. PB notes that no risk adjustment has been applied to the network programs, however the adjustment represents a global risk adjustment of 3.32% across the total value of all projects and programs.

In general terms, the process to arrive at the risk adjustment factors involves a workshop of the key stakeholders within TransGrid who are directly involved in the estimating and management of network capital works projects. A range of representative projects are selected to focus the expert group on the risks that drive the variation between the concept estimate and the out-turn cost. In undertaking this assessment, Evans & Peck first focused on the variation that can occur in the project costs on a detailed line item basis. TransGrid's expert group identified the cost variance parameters from which a variance model was then developed for each major line item. This information was then used to *"assess the inherent risk and associated risk profiles (usually a Pert distribution) for the project cost components for each of the selected projects"*[114].

As an example of the line item risk assessment, for a new line project (on an existing easement) the cost associated with the tower structures was assigned a minimum bound of 90% of the base case and an upper bound of 160%. The large range clearly demonstrates the significant asymmetry applied to the tower structure input component which would increase the probabilistic costs associated with this project type.

PB notes that some degree of asymmetry is to be expected in input distributions, however we highlight that the strength of the asymmetry applied by TransGrid in this case, with the upper bound six times further from the base case than the lower bound, is higher than expected.

The specific and material risks that inform TransGrid's risk allowance are primarily associated with:

- tower structures because of the uncertainty in route, lack of definition of tower design and configuration and lack of definition of span/tension ratios
- civil works
- plant procurement
- clearing of easements and sites
- cable costs and installation
- property acquisition.

Project cost profiles for each of the representative project types have been developed using Monte Carlo simulation on the multiple line item cost data inputs. This has resulted in the selection and use of a beta general distribution to capture the risk of cost variance at the rolled-up project level. The resulting distributions are incorporated into the CAM model[115] for each project to provide 11 risk profiles representative of the range of projects in the forecast capex portfolio. Through this process a beta general distribution was developed for each of the representative project types, and each future (not committed) project in the proposed forecast capex portfolio was then assigned one of these risk types as shown in Table 5-9.

112 Evans & Peck, 2008, "TransGrid Risk Assessment of TransGrid Capital Works Program for 2009-2014 Regulatory Reset - Abridged Version", 9 May 2008, page 3.

113 Based on the original submission, refer page 72 of the Revenue Proposal.

114 Evans & Peck, 2008, "TransGrid Risk Assessment of TransGrid Capital Works Program for 2009-2014 Regulatory Reset - Abridged Version", 9 May 2008, page 14.

115 See section 5.3 for further details.

Table 5-19 – TransGrid risk profiles

Profile	Project type	Number in forecast	Risk factor
A	500 kV new route[1]	2	1.059
B	330 kV new route	3	1.067
C	330 kV existing route	3	1.045
D	132 kV new route	3	1.024
E	132 kV existing route	6	1.019
F	Greenfield substation	9	1.054
G	Brownfield substation	62	1.064
H	Cable project	1	1.031
I	SCADA and Comms	9	1.037
J	SCADA installation	28	1.038
K	Land and easement	32	1.051
Total		158	

Note 1 – TransGrid advised this was a naming error and should refer to a new line on an existing route.

Source: PB analysis.

Again, using Monte Carlo simulation the global risk adjustment (in dollars) appropriate to TransGrid's portfolio of future projects was determined. This risk adjustment has been applied to the base estimates, including the inherent ACF, DCF and NCF cost estimating factors, prior to the escalation by the material and labour escalation factors. The total risk allowance determined by this approach for the forecast capex, and included by TransGrid in the proposed ex-ante allowance is $77.1 m. It is noted that this figure has been based on the mean value of the estimated risk and not the value at P50 (i.e. the value with equal probability or the outcome being above or below).

It is noted that TransGrid is *"… of the view that where the same or similar tasks are regularly repeated, the risks across a large number of jobs automatically track into the averages used in the estimating process. As a consequence, "Programs" have not been allocated a risk profile"*[116]. Similarly, no risk allowance has been included for projects in the approved or construction phase.

PB has considered the process to determine the risk allowance, and the application of this process by TransGrid to the ex-ante capex portfolio. It is PB's view that there are risks faced by TransGrid in the variation of project costs between the concept estimate and the completion/approval estimate. Furthermore, we agree with Evans & Peck that these variations are likely to be asymmetric in nature with more variation towards higher costs. We are also of the belief that where the cost variation risk can not be reasonably managed by TransGrid, then this risk should be equitably shared between TransGrid and its customers.

However, it is PB's position that the variation in costs that are captured through the risk allowance should not include cost variation that is accounted for through other means. For example, material cost and labour cost variations are captured through the material and labour cost escalators applied to the capex forecast, and hence should not be included in the estimate of the cost variance used in the risk analysis. Similarly, cost allowances that are captured through TransGrid's capital cost estimating process, should also not be included in the estimate of the cost variance used in the risk analysis.

116 Evans & Peck, 2008, "TransGrid Risk Assessment of TransGrid Capital Works Program for 2009-2014 Regulatory Reset - Abridged Version", 9 May 2008, page 15.

While PB supports the application of a risk based approach in the determination of the ex-ante capex allowance, the methodology employed should be evidence-based, transparent, and ultimately auditable. PB is of the view that estimation of cost variation should ideally be based on historical cost records in order to achieve these objectives. Where such historical data is not available, and 'expert judgement' is used to estimate cost variance, then these variance estimates should be tested against supporting data to demonstrate that there is no inherent bias in the estimates, and that the estimates do not include cost variation that is accounted for through other means (e.g. the application of escalators, or estimating allowances). Similarly, only variations in costs that are not reasonably managed by TransGrid should be included in the estimation of cost variance. That is, TransGrid should manage the risk of cost variations that are reasonably under its control.

In addition to the Evans & Peck report, TransGrid has provided additional information in response to PB's enquiries regarding its input assumptions. In particular, PB enquired as to the definition of the cost variance estimates used in the risk calculation, and specifically if these variance estimates included the effects of material and labour cost escalators, project scope creep, and other similar variances that are accounted for through other mechanisms (e.g. cost escalators), or are variations that should be managed by TransGrid and not shared with TransGrid's customers. TransGrid provided documents addressing these issues[117]. This documentation set out further details of the determination of the cost variance estimates, and gave a number of examples of the variation being modelled through the risk assessment process. After reviewing this documentation, PB is concerned that the estimates of variance used by TransGrid include cost variation that is also included in the material and labour cost escalators. For example, under the heading "Risk Contribution to Extra Cost" (i.e. cost variation risk) the following points were noted by TransGrid:

- *"General increases in contractor rates."* - Yass-Wagga 132 kV line rebuild
- *"… the cost of the PAR increased by 25%. Could be a sign of the market forces…"* – Armidale Substation
- *"Property increased from $420k to $1.25M due to market rates…"* – Coffs Harbour 330/132 kV substation
- *"Market forces driving up contract costs."* - Coffs Harbour 330/132 kV substation
- *"… prices increased significantly between the original estimate and the final contract placement due to significant increases in demand."* - Sydney South - Cable 41 Series Reactor.

In PB's opinion, TransGrid has failed to ensure that the estimates of cost variance used in the risk analysis do not include cost variations that are captured through other means. That is, we believe that the estimates of the variance used in the risk calculations include variations in cost due to escalation of labour and materials. As the risk allowance is also escalated by the material and labour escalators, the resulting figures double-count the impact of labour and material escalation on the risk portion of the project costs. Hence PB recommends that an adjustment is made to remove this double-counting.

Determination of an adjustment to remove the double-counted material and labour escalation is however complex, and requires adjustment of the variance estimates for each of the 11 representative project types to remove escalation from each variance estimate. Such an adjustment is not practical without redevelopment of the variance estimates, changes to the CAM model and rerunning the CAM Monte Carlo simulation. However, as an approximation, we can remove the escalation from the risk allowance to determine the un-escalated risk allowance, then reduce the un-escalated risk by an approximation to the escalation included in the variance estimates, and finally re-escalate the risk allowance for inclusion in the overall capital allowance.

117 TransGrid 2008, "TransGrid response to PB Advice Number 6, Issue E1". TransGrid 2008, "TransGrid response to Meeting 14/8 TH1 Action 2, Issue 240".

The total escalation in TransGrid's CAM ver. 14a model is $239.3m[118], of which $10.0m is attributable to the escalation of the risk allowance itself. The total risk allowance is $76.8m. Hence, to determine the un-escalated risk allowance, a reduction of $10.0m is required. That is, the un-escalated risk allowance used for TransGrid's revenue proposal is $66.8m.

However, this allowance still includes the escalation component contained in the variance estimate which must also be corrected. As the overall allowance for escalation of the forecast capex in CAM is approximately 13%, this value can be used as an approximation of the component of the variance estimates attributable to escalation. Removing 13% from the $66.7m un-escalated risk allowance yields a reduction of $8.7m. The resulting $58.1m is approximately the equivalent base CAM input value for the risk adjustment allowance excluding variance due to material and cost escalation.

The $58.1m is then the relevant base level risk amount that should be escalated to provide the correct overall value of the escalated risk adjustment allowance. Again, such an adjustment is not practical without changes to the CAM model and rerunning the CAM Monte Carlo simulation. Hence, using the same approximation of 13% escalation yields an overall risk allowance of $65.7m, which is a reduction of $11.1m (or 14.5%) on the total risk allowance of $76.8m[119].

With regards to the sharing of that risk which is not reasonably manageable by TransGrid, PB is of the view that this requires the application of the P50 value (i.e. the value with equal probability or the outcome being above or below). In TransGrid's response to PB's enquiries, TransGrid stated that[120]:

> *"TransGrid agrees that the P50 value of risk represents a reasonable allocation of risk between a TNSP and its customers. In TransGrid's current revenue proposal the P50 and mean are very close in value. TransGrid used the mean, from a purely pragmatic point of view, as it allows an individual project risk adjustment to be applied to each project in the Capital Accumulation Model."*

PB acknowledges this pragmatic approach and the fact that the P50 and mean vales were very close, being only $0.6m difference. However, while the difference is quite small in this case, in other cases the difference may be more significant depending on the skew in the final risk cost allowance distribution. Consequently, PB recommends that the P50 value is adopted to reflect an equal risk sharing arrangement between TransGrid and its customers of those cost variation risks that are not reasonably manageable by TransGrid.

PB's overall adjustment associated with the risk allowance is the summation of the two separate reductions, which results in a total downwards adjustment of $11.7m, or 15.2%.

Subsequent Update

Subsequent to PB completing its analysis of the risk adjustment and in response to issues raised by PB, TransGrid provided further documentation regarding the methodology used to determine the variance estimates. PB has reviewed this additional information and is of the view that the process used by TransGrid in determining the cost variance estimates could not ensure that the derived estimates were in fact only estimates of the cost variance from uncontrollable risks faced by TransGrid. PB has not been presented with any clear evidence to support TransGrid's variance estimates. Evidence such as analysis of historical data or comparison of TransGrid's variance estimates with other variance estimates of known definition and quality. Consequently PB remains of the view that TransGrid's variance

118 After agreed adjustments within the CAM model, as outlined in section 5.4.1.

119 That is, $76.8m less $10.0m less $8.7m gives a total "input risk allowance of $58.1m". $58.1m escalated by 13% is $65.7m. An overall reduction of $11.1m or 14.5% (approx.) in the proposed risk adjustment allowance.

120 TransGrid 2008, "TransGrid response to PB Advice – Number 6 Issue E8".

estimates include cost variations that are captured through other means, or that are within its control.

5.4 DETAILED REVIEW OF NETWORK PROJECTS

This section summarises the findings of PB's detailed review of nine network projects selected across the range of regulatory categories from TransGrid's proposed capital works program for the 2009/10-2013/14 regulatory period.

5.4.1 Agreed adjustments

In undertaking our review of TransGrid's forward capital works program, PB together with TransGrid identified a number of corrections that resulted in material adjustments to the calculation of the forward capital expenditure. These were advised by TransGrid as part of a formal change management process with PB.

These adjustments typically related to discrepancies between the values entered into the Capital Accumulation Model (CAM) and the values contained in the supporting documentation. The adjustments accounted for a total $9.9m are summarised in Table 5-20 below.

Table 5-20 – Agreed project adjustments

Project	Issue	Initial value ($M)	adjustment ($M)	Final value ($M)
6172 Molong transformer	Double counting	4.2	(4.2)	-
6245 Communication PNX	S-curve adjustment	5.7	(2.9)	2.8
Correction of escalators	Labour and material escalators	228.4	7.1[1]	235.5
5890 Tamworth transformer replacement	Incorrect option included	15.9	(4.3)	11.6
5860 Tarro-Stroud 132 kV line	Incorrect option included	43.0	(4.5)	38.6
6294 Murray transformer replacement	Incorrect option included	21.1	(6.7)	14.4
6001 Waratah West 2nd transformer and 95N line conversion	Inconsistency with PSR 199	16.0	4.9	20.9
6266 Tomago 3rd transformer	Inconsistency with Regulatory Test Final Report	11.5	4.9	16.4
5950 Sydney North No.5 transformer	Inconsistency with PES5950	11.4	(2.4)	9.0
4905 Delle CB Replacement	Double counting	3.1	(1.0)	2.1
Steel Escalation Weighting (refer section 5.3.2)	Agreed Change to Weightings		(0.8)	(0.8)
Total		360.3	(9.9)	350.4

Note 1 – PB has not been advised of the materiality of this adjustment on the capex allowance, but it causes an increase in the MAR of $1.2m. PB has assumed the impact is the same as the reduction caused by adjustments to projects 6172 and 6245.

Source: PB analysis and TransGrid email advice (14 July 2008), and 'Record of change.doc'.

A number of adjustments were also made with regard to the classification of projects to augmentation and replacement expenditure categories. These adjustments are summarised in Table 5-21, below.

Table 5-21 – Agreed project category revisions

Project	Proposal	Revised
6293 Murray - Guthega 132 kV Lines upgrade	Augmentation	Replacement
6155 Protection & Metering - Replacement elecmech uf relays	Augmentation	Replacement
9179 Snowy Assets Rehabilitation - Murray Switching Stn	Augmentation	Replacement
6183 Wallerawang - Orange 132 kV line 944 rebuild	Augmentation	Replacement
5625 Wallerawang No. 1 & 2 Transformer	Augmentation	Replacement
9263 Wellington 330 kV Shunt Reactor	Replacement	Augmentation

Source: PB analysis and TransGrid email advice (20 Aug 2008).

PB highlights the good nature with which TransGrid has approached the review, and the open and transparent identification of errors and their corrections. However, it is also noted that while the net impact has been a reduction in the allowance of $9.9m, the various transposition, consistency and categorisation errors identified in TransGrid's documentation correspond to a range of adjustment from $16.9m to -$26.8m.

In addition to the discrepancies and changes noted, additional errors relating to situations where TransGrid's documentation has been inconsistent with its stated practice were also identified. For example, the double counting of the $22.4m easement cost in the Dumaresq-Lismore project due to the use of a superseded estimating process, or the omission of the most recent circuit breaker cost information[121] from the submitted project evaluation documentation for the Beaconsfield West GIS replacement project. These matters have been identified by PB throughout this report. The impact of, and any associated adjustment associated with these corrections, has been identified on a project by project basis.

5.4.2 Project selection

In co-ordination with the AER, PB selected 9 network projects for detailed review. Table 5-22 lists the projects selected. The basis for this selection included materiality, commissioning date considerations, consideration of the type and range of assets involved in the project, and the projects relationship to other works. These detailed reviews have been undertaken to identify any unique or systemic issues associated with the capital works expenditure proposed in TransGrid's Revenue Proposal.

Through these detailed reviews, PB has examined $908.7m of projects included in TransGrid's proposed total network capex of $2.47b, representing approximately 32.2% of the planned network expenditure on a scenario weighted average basis.

121 Refer Appendix I, Section I.8.

Table 5-22 – Selected network projects

Project ID	Project Name	Commissioning date	Category	Total ($m 2008)	Weighted Average ($m 2008)
5567	Bannaby-South Creek 500 kV lines & sub	2014	Augmentation (easement)	322.5	247.6
6204	Holroyd-Chullora 330 kV cable	2013	Augmentation (easement)	244.5	244.5
9094	Dumaresq-Lismore 330 kV line	2012	Augmentation	165.5	165.5
5607	Communication – South West NSW microwave & satellite	2011	Augmentation	4.8	4.8
5625	Wallerawang No.1&2 transformer	2010	Augmentation	19.0	19
6194	Cooma 132 kV substation replacement and new bay	2014	Replacement (easement)	42.8	42.8
6378	Beaconsfield West 132 kV GIS replacement	2013	Replacement	48.1	48.1
5622	Newcastle 330 kV substation transformer replacement	2013	Replacement	18.9	18.9
5568	Hunter Valley - Central Coast 500 kV lines	2017	Easements (augmentation)	42.6	4.2
			TOTAL ($m, 2008)	908.7	795.4

Source: PB analysis.

The following sections provide and overview of the findings of each of the detailed reviews, while the full details of these reviews can be found in Appendices C to K.

5.4.3 Bannaby – South Creek 500 kV lines and substation

This project involves the construction of a 500 kV transmission line between Bannaby and South Creek and forms part of TransGrid's strategy to reinforce the Transmission network serving the Newcastle-Sydney-Wollongong load corridor. The primary drivers for the project are line rating and voltage control constraints expected to develop on the 330 kV lines that serve the Newcastle-Sydney-Wollongong load corridor from the south.

Over the 2009/10-2013/14 regulatory period, TransGrid is proposing to develop a double circuit 500 kV transmission line between Bannaby (to the west of Bowral) and South Creek in Sydney's west. This proposal essentially involves the rebuilding of the existing 330 kV line from Bannaby (39 line) as a 500 kV circuit. At South Creek, in the Luddenham area to the west of Sydney, the 39 line crosses the existing Eraring to Kemps Creek line. It is also proposed to establish a new 500/330 kV substation in this location, turn in the Eraring to Kemps Creek line, and connect the new 500 kV Bannaby line[122].

PB considers that the drivers, strategic alignment, cost and timing of the project are demonstrated to be both prudent and efficient, and that a reasonable range of alternative options has been identified. However PB is of the view that the options analysis presented in

122 TransGrid 2007, "Feasibility Study – Bannaby–Sydney 500 kV Line Development Feasibility", Document No: FS PSR 131, Rev 01, Dated 14/08/07, page 1.

the project documentation is lacking and PB has a number of concerns with the options analysis as presented:

- while the analysis considered the costs of the various options, no consideration is presented of the comparison between the NPVs of the various options

  The options analysis as presented does not include consideration of the sensitivity of the estimates and hence the impact of this sensitivity to the selection of the preferred option. In this case, given the relatively small cost difference between three primary options and the uncertainties in the cost estimates, scopes of work, land issues, etc. variation in these key input assumptions may be sufficient to alter the choice of the preferred option. In PB's opinion, the impact of variation in the key input assumptions should have been demonstrated in the options analysis However, in the absence of a more complete options analysis from TransGrid, PB is unable to determine whether the most efficient option has been selected.

- while project risk is presented and assessed in the Feasibility Study, the baseline risk assessment (i.e. the 'do nothing' option risk) is very limited, and is implied in the statement of the need rather than being explicitly documented as a clear statement of the 'do nothing' risk. PB also notes that consideration of the do nothing option is also not explicitly presented
- the options analysis qualitatively addresses a number of benefits and costs, however in the limited NPV analysis presented these is no apparent qualitative assessment of the benefits, and some cost elements such operating and maintenance costs (savings) are not presented in the NPV analysis.

In PB's view, as far as is practical, an options analysis should be based on a comparison of the NPV of the various options, and should include the value of all known costs and benefits, as well as unbiased estimates of uncertain costs and benefits. Where there are uncertain costs and benefits, a sensitivity analysis should be used to demonstrate the likelihood that the recommended option is the highest value option[123].

Notwithstanding this, we acknowledge that the qualitative assessment of the costs and benefits presented by TransGrid does demonstrate the relative merits of the preferred option over the alternatives. On the basis of the argument presented, PB is of the option that the most efficient option has been chosen.

From our detailed review of the proposed Bannaby to South Creek 500 kV lines and substation project, PB is of the opinion that the project is prudent, and that it represents efficient investment.

Table 5-23 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the Bannaby to South Creek 500 kV lines and substation project.

Table 5-23 – PB recommendation for Bannaby-South Creek 500 kV lines and substation

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	1.7	9.8	62.6	110.4	63.1	247.6
Proposed variation	-	-	-	-	-	-
PB recommendation	1.7	9.8	62.6	110.4	63.1	247.6

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls and PB analysis.

123 Or, conversely, the lowest cost where benefits are excluded.

5.4.4 Holroyd – Chullora 330 kV cable

This project covers the augmentation of the TransGrid network by installing new 330 kV cable(s) from Hyland Road, Holroyd to a new Chullora 330/132 kV substation.

TransGrid asserts that the reinforcement of supply to the inner metropolitan area is required by the summer of 2012/2013 due to growth in load and ageing assets becoming unserviceable. The Holroyd-Chullora 330 kV cable is proposed, as part of the wider project, to alleviate the constraints to the network to the network by summer 2012/2013[124]. This project is an augmentation project and does not involve replacement of existing assets.

PB considers that the drivers, strategic alignment and timing of the project are demonstrated to be both prudent and efficient, and that a reasonable range of alternative options has been identified.

Based on the original documentation provided by TransGrid, PB is not able to conclude that the scope and cost efficiency of the selected option was adequately demonstrated. Specifically, as there is, in the view of PB, insufficient information to demonstrate the need to install two cables under the project scheduled for the 2009/10-2013/14 regulatory period, and consequently, PB has recommended that the second circuit is not installed with a corresponding reduction in the proposed ex-ante capex allowance of $95.0m to reflect this recommendation.

Subsequently, TransGrid has provided additional information in the form of two revisions to the Project Evaluation Summary document, along with further supporting information. This subsequent information is discussed in Appendix D of this report.

PB has conducted a detailed review of the Holroyd-Chullora 330 kV Cable augmentation project, and considers that the drivers, strategic alignment and timing of the project are demonstrated to be both prudent and efficient. Based on our review of the subsequent information, PB is now of the opinion that the scope and cost efficiency of the selected option have been demonstrated.

Table 5-24 sets out PB's revised recommendation based on our assessment of the prudence and efficiency of the submitted expenditure associated with the Holroyd-Chullora 330 kV Cable augmentation project.

Table 5-24 – PB recommendation for Holroyd-Chullora 330 kV cable

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	-	23.5	187.5	33.5	-	244.5
Proposed variation	-	-	-	-	-	-
PB recommendation	-	23.5	187.5	33.5	-	244.5

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls.and PB analysis.

5.4.5 Dumaresq – Lismore 330 kV line augmentation

This project involves the construction of a 215km 330 kV transmission line between Dumaresq and Lismore to serve the major supply points located on the far north coast of NSW. The project addresses a constraint that arises from the combination of thermal and voltage limits arising as a result of outages of the 137km long Armidale-Coffs Harbour 330 kV line.

124 TransGrid 2008, 'Project Evaluation Summary: Inner Metropolitan 330 kV Supply: Project Number 5995', page 6.

PB considers that the drivers and strategic alignment of the project are demonstrated to be prudent, and that a reasonable, but not exhaustive range, of alternative options has been identified. However, a number of options appear to have been dismissed in the Regulatory Test assessment on the grounds of costs, environmental issues, technical issues, etc, without sufficient rigour and transparency. TransGrid has provided a retrospective technical and economical analysis[125] to support the selected option produced in response to PB's questions regarding this line which indicated a significant change in the NPV of the preferred option. As discussed in Appendix E, in PB's view, this highlights the risk that TransGrid may miss a more efficient project by dismissing options at too early a stage within its assessments.

Similarly, based on data presented by TransGrid on expected network constraints, PB is of the view that the timing for the project completion would ideally be one year earlier, however, long lead times for planning approvals and project construction have lead TransGrid to schedule the project completion for 2011/12.

PB has identified that the project cost estimate for the Dumaresq-Lismore line appears to include the cost for the survey and easement acquisition in error. The easement cost is included in the allowance separately (project ID 9095). PB recommends this amount ($22.4m, un-escalated) be removed from the allowance and TransGrid provide assurances this matter has not occurred elsewhere. In addition PB recommends the following adjustments.

- the substation works at Dumaresq require five new circuit breakers to be installed in a 'breaker-and-a-half' arrangement. In PB's view two of these circuit breakers only provide limited benefits under normal situations (but they do marginally improve operation flexibility and increase the extent of redundancy). Given that TransGrid has not outlined the basis or efficiency of its decision to include this number of circuit breakers, PB recommends a nominal adjustment of 30%[126] be made to the substation works at Dumaresq to remove two circuit breakers resulting in a reduction of $2.6m

- in addition to other factors, a generic 'Scoping Cost Factor on Line Works' of 15% has been applied to the line construction costs. This factor does not appear to be defined in any documentation. On the basis that this development has captured the "longest probable feasible line route", and given that the majority of the line route is based on an existing 132 kV easement, PB recommends that the scoping factor should be reduced to 10% to reflect the relatively well know aspects, and this results in a reduction of $4.0m

- it appears the original cost estimate of $151.4m has been established in 2005/06 dollars, and the CAM entry is 10.1% higher than this at $166.6m. In PB's view this represents the 2-year CPI escalation, which appears high, hence PB recommends using ABS actual CPI (1.062) to escalate the original cost resulting in a further reduction of $7.4m.

The net impact on the cost of the project as a result of PB's recommendations is a reduction of $36.4m. Table 5-25 sets out PB's recommendation on the outcome of our prudence and efficiency review of the submitted expenditure associated with the Dumaresq-Lismore 330 kV Line augmentation project.

125 Supplementary Report, Document number 3979, 15/08/08.

126 Informed by the ratio of 3/5 circuit breakers remaining, and increased by 10% to account for loss of economies of scale.

Table 5-25 – PB recommendation for Dumaresq-Lismore 330 kV line augmentation

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	5.5	80.0	80.0	-	-	165.5
Proposed variation	(1.2)	(17.6)	(17.6)	-	-	(36.4)
PB recommendation	4.3	62.4	62.4	-	-	129.1

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls.and PB analysis.

5.4.6 Communication – SW NSW microwave and satellite

This project involves expenditure on new telecommunications assets at substations in South West NSW. The project will provide SCADA facilities at substations on the Wagga – Darlington Point system in accordance with NEMMCO's request to provide SCADA data from these substations[127].

PB has conducted a detailed review of the proposed Communication - SW NSW Microwave & Satellite augmentation project, and we are of the opinion that the project is prudent given industry standards and NEMMCO requirements, and is efficient investment given that where there has been a choice of technology options available, TransGrid has chosen the least cost option.

Table 5-26 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the SW NSW Microwave & Satellite augmentation project.

Table 5-26 – PB recommendation for communication - SW NSW microwave & satellite

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	0.2	4.6	0.0	0.0	0.0	4.8
Proposed variation	-	-	-	-	-	-
PB recommendation	0.2	4.6	0.0	0.0	0.0	4.8

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls and PB analysis.

5.4.7 Wallerawang No.1 & No.2 transformers

This project involves the replacement of the No.1 and No.2 transformers at Wallerawang substation due to the failure of the No.1 330/132 kV transformer in 2007 due to a severe fault[128]. At the time of the fault, the No.1 and No.2 215 MVA transformers were of the same age, and both were subjected to the same fault conditions that caused the No.1 transformer to fail.

After considering the documentation provided by TransGrid, with regards to the Wallerawang 330/132 kV transformer replacement, we are of the view that while TransGrid has identified and assessed appropriate options for this specific need, TransGrid has not, in its strategic planning, considered the overarching needs of the site as a whole in a cohesive manner. PB is also of the view that TransGrid is attempting to minimise the impacts of this apparent lack of

127 TransGrid 2008, 'PES – Provision of communication services to 132 kV substations in south-western N.S.W.' paragraph 1.2.1.

128 TransGrid has identified the fault as a close-up through fault resulting in the fault current running through the transformer. This fault caused irreparable damage to the No.1 transformer leading to its replacement.

strategic planning for the Wallerawang site by resolving these issues at the detailed design stage, or in the field through works scheduling. It is PB's opinion that this is not an effective and efficient practice.

In PB's opinion, TransGrid's options analysis as presented in its option comparison document is incomplete and consequently the conclusions are potentially affected by shortcomings in the analysis. Furthermore, in our view, the analysis fails to reasonably demonstrate the efficiency and value of the chosen option over the alternatives considered. Consequently, on the basis of the options analysis presented we can not conclude that the most efficient option has been chosen.

However, PB notes the questionable condition of the No.2 transformer and criticality of the equipment in TransGrid's network. Should TransGrid has assessed the risk and cost of failure with consideration of penalty payments and the increased costs associated with emergency replacement, the value of the chosen option would, in PB's opinion, be more clearly demonstrated. TransGrid has not undertaken this analysis, or included these specific costs in its submission documentation but has identified the risk and criticality of the equipment as factors affecting their decision[129].

PB does however recognise that with the inclusion of all appropriate costs and benefits, along with consideration of the other proposed works at the Wallerawang site, in our opinion it is highly likely that the most efficient option to address the indentified need would be to replace both transformers.

From our detailed review of the proposed Wallerawang No. 1 & 2 transformers project, and while PB is of the opinion that the project is prudent, we are not able to conclude that it represents efficient investment due to the lack of planning integration with other works proposed at the Wallerawang substation. Hence, PB's recommendation is for a $300k[130] reduction in the project management costs to account for the duplicated mobilisation/demobilisation and project management inefficiencies across both projects at this site.

Table 5-27 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the Wallerawang No.1 and 2 transformer replacement project.

Table 5-27 – PB recommendation for Wallerawang No.1 and 2 transformer project

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	19.0	-	-	-	-	19.0
Proposed variation	(0.3)	-	-	-	-	(0.3)
PB recommendation	18.7	-	-	-	-	18.7

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls and PB analysis.

5.4.8 Cooma 132 kV substation replacement

This project involves the replacement of the existing Cooma substation due to equipment condition. Notably, much of the primary plant is considered by TransGrid to be in poor condition and approximately 80% of the secondary equipment requires replacement under asset management strategies.

129 TransGrid 2008, 'Asset Replacement Project Evaluation – Wallerawang No.1 and No.2 Transformers' 5625 APRE, Revision 2, 29/05/08, page 14.

130 TransGrid Project Feasibility Study Report, Replacement of Wallerawang Transformers, FS_PSR_202, page 27 –Contractor facilities and mobilisation line item.

TransGrid has proposed that the Cooma 132 kV substation should be rebuilt on a new site during the period 2010/11 to 2013/14. However, PB notes that explicit justification for this timing was not presented in the project documentation provided, however TransGrid states that *"the timing of this project is indicative and may be subject to further refinement"*[131]. Consequently, while PB is of the view that the identified need has been reasonably demonstrated, we can not conclude that the timing represents efficient investment.

The scope of the Cooma 132 kV substation replacement project involves the development of a 132/66 kV substation on a suitable site away from the existing Cooma substation to avoid line congestion in the area and accommodate connection of the second Bega 132 kV line. Additional work at the existing Cooma substation involves the establishment of new 66 kV switchgear and the reconstruction of a section of line as a 132 kV double circuit line to connect the existing Cooma – Munyang tee to Snowy Adit line. This includes additional line works to marshal both the Cooma - Canberra/Williamsdale 132 kV lines at the new substation[132].

Based on the condition review reports, it is PB's opinion that the information presented supports the view that the Cooma 132 kV substation has a range of condition and design related issues. However, PB is of the view that the transformers and regulators, while in an aged condition, are not unserviceable[133]. Notwithstanding this, given the range of issues at the site, the condition of some of the equipment and structures, and the consequences of equipment failure, PB is of the view that it is prudent to address these issues, and that this need has been reasonably demonstrated by TransGrid.

TransGrid's project documentation presents consideration of options to reconstruct the Cooma substation both in-situ and on a new site. TransGrid's preferred option of remote reconstruction has been selected even though it has the greatest cost on the basis that:

> *"This solution has the best improvement in risk score, fully provides for future site expansion, fully overcomes the issues of the existing site and legacies of past design compromises, provides full life for site infrastructure; has the lowest risks associated with implementation and greatest confidence in feasibility; avoids future issues associated with the present busbars and disconnectors."* [134]

In PB's opinion, TransGrid's selection of the most expensive option is not fully justified and fails to reasonably demonstrate the efficiency and value of this option over the alternatives considered. Consequently, we are of the view that the most efficient option has not been chosen. Based on TransGrid's costing and supporting documentation of the advantages and disadvantages, we are of the view that the in-situ refurbishment of the substation is the most efficient option. Therefore we recommend the in-situ refurbishment of the substation as the most efficient option. PB notes that adoption of this recommendation would remove the need for the associated Cooma easement project which has been included in the capex forecast at $0.6m.

We also note that the estimate includes $4.94m for the provision of the 330 kV ultimate substation layout. While PB is of the view that suitable design and space allowances (e.g. land) should be made to meet foreseeable future expansion needs, we are concerned that this cost should be justified where it is significant. PB is of the view that the inclusion of a $4.94m allowance for an unjustified future conversion to 330 kV is not efficient and we recommend it is not included in the allowance (where a decision is made to allow TransGrid's preferred option).

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131 TransGrid 2008, 'Project Option Scope and Estimate - Cooma Area – Cooma North 132/66 kV Substation', Project Number: 6194, Document No. 6194B, Revision 2, 16/04/2008, page 2, 13.

132 TransGrid 16 April 2008, 'Project Option Scope and Estimate - Cooma North 132/66 kV Substation', Document No. 6194b, Revision No. 2, page1.

133 PB is of the view that it is reasonably likely that the transformers and regulators could be refurbished and their life extended.

134 TransGrid 30 April 2008, 'Network Asset Replacement Project Evaluation – Cooma Substation', Document No. 6194 ARPE, Revision No. 2, page 13.

Notwithstanding our views on the efficiency of the chosen option, and the 330 kV provision, PB is of the view that the costs detailed by TransGrid are reasonable given the proposed scope of works.

PB has conducted a detailed review of the proposed Cooma 132 kV substation replacement project, and while we are of the opinion that it is prudent to address the identified need, we are not of the view that the selected option, its timing, or the proposed costs represent an efficient investment.

Table 5-28 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the Cooma 132 kV substation replacement project. PB's recommended adjustment includes risk and escalation calculated using TransGrid's Capital Accumulation Model.

Table 5-28 – PB recommendation for Cooma 132 kV substation replacement

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	-	0.0	1.1	11.5	30.2	42.8
Plus easements	-	0.1	0.5	-	-	0.6
Proposed variation	4.8	4.8	3.8	(6.5)	(25.2)	(18.2)
PB recommendation	4.8	4.9	4.9	5.0	5.0	24.6

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls. and PB analysis.

5.4.9 Beaconsfield West 132 kV GIS replacement

This project involves the replacement of the 132 kV gas insulated switchgear (GIS) at Beaconsfield substation. Whilst the 132 kV switchgear was installed and commissioned in 1979, and although the switchgear is 29 years old, TransGrid has identified a number of condition based issues. Specifically, slow circuit breaker operation due to seal deterioration, a number of SF6 gas leaks and a history of compressor failures. Furthermore, TransGrid has stated that there are limited spare parts available, as well as limited internal expertise and supplier support for this specialist and relatively rare plant.

PB considers that the drivers, strategic alignment and timing of the project are demonstrated to be both prudent and efficient, and that a reasonable range of alternative options have been identified. However, PB notes that it is apparent that not all costs have been included in the analysis of the options. For example, for the refurbishment option the cost to extend the GIS to accommodate the EnergyAustralia 132 kV feeders in 2012 is explicitly stated as not being included in the NPV calculation. For the replacement option at a new site, the NPV analysis did not include the acquisition cost of the additional land required. These issues are discussed further in Appendix I.

In PB's opinion, TransGrid's options analysis as presented in its option comparison document is incomplete and in our view fails to reasonably demonstrate the efficiency and value of the chosen option over the alternatives considered.

Consequently, on the basis of the options analysis presented, we are unable to conclude that the most efficient option has been chosen. We do however note that while the highest cost option has been selected by TransGrid, that this may not have been the highest cost option had the all missing costs and benefits been included in the analysis. We also note that subsequent to issuing our review as a preliminary draft, TransGrid revised its options analysis and related documentation in response to PB's concerns, and addressed many of the issues raised regarding the completeness and quality of the analysis originally presented. However, while TransGrid has been able to undertake further analysis in response to our concerns, PB maintains that TransGrid's analysis as originally presented does not demonstrate that the

most efficient option has been chosen, and does not demonstrate consideration of the broader investment issues at the Beaconsfield site. In our opinion this issue suggests that TransGrid's options analysis process may, in a broader sense, be failing to reasonably demonstrate the relative efficiency of the alternatives being considered as well as identify the most efficient investment package when a suite of interrelated works are being proposed.

PB also has concerns regarding the application of generalised DCF[135] and NCF[136] factors, as well as the 'Ancillary Costs[137,138]. It is noted that the DCF and NCF factors have been doubled due to the difficulties of working at an operational site, and due to the one off nature of the work. While PB accepts these basic reasons, the basis of doubling these costs is not clear and appears arbitrary. The cost of the non standard DCF and NCF factors account for some $13.7m (or 33.5%) of the total project estimated cost which has also been escalated and adjusted for the inclusion of risk. Given the limited transparency in the application of these factors, PB can not conclude that the application of these factors represents an estimate of efficient costs, and consequently PB recommends a 50% reduction in the DCF and NCF values.

Following from our review of the subsequent information provided by TransGrid, we accept the concerns raised regarding the support of the manufacturer in undertaking such a refurbishment, most notably the supplier's uncertainty of obtaining a gastight seal in the refurbishment process. Given this issue (and others raised – refer Appendix I), PB is of the view that replacement of the switchgear may be the only practical alternative and on this basis its replacement is considered prudent.

PB has conducted a detailed review of the proposed Beaconsfield West 132 kV GIS replacement project, including the subsequent information indentified in Appendix I, and while we are of the opinion that the project is prudent, we are not able to conclude that it represents efficient investment.

Table 5-29 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the Beaconsfield West 132 kV GIS Replacement project. PB's recommended adjustment includes risk and escalation calculated using TransGrid's Capital Accumulation Model.

Table 5-29 – PB recommendation for Beaconsfield West 132 kV GIS replacement

Expenditure $m (real, 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	2.4	7.2	10.5	28.1	-	48.1
Proposed variation	(0.4)	(1.2)	(1.8)	(4.7)	-	(8.1)
PB recommendation	2.0	6.0	8.7	23.4	-	40.1

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls and PB analysis.

135 DCF - the Design Cost Factor which includes costs associated with the design, specification preparation, tendering process, the environmental assessment and project management. TransGrid, 'CAPEX Estimation Database Manual', page 5.

136 NCF - the Network Cost Factor which includes costs associated with field supervision, site management and commissioning of the project. TransGrid, 'CAPEX Estimation Database Manual', page 5.

137 AWF - the Ancillary Works Factor which includes costs to account for the minor project costs that are not captured by the high level scoping. It includes the costs of integrating the new project into the existing network, changes to control and protection systems, and ancillary/incidental works that occur during the construction period. TransGrid, 'CAPEX Estimation Database Manual', page 5.

138 TransGrid 2008, 'Project Option Scope and Estimate - 6378 – Beaconsfield West 132 kV GIS Replacement', Document No. 6378, page 7.

5.4.10 Newcastle 330 kV substation transformer replacement

This project involves the replacement of two of the three remaining 330/132 kV single phase transformer sets located at the Newcastle Substation due to condition of the units leading to an increased risk of multiple single phase unit failures at the Newcastle substation[139]. TransGrid do not currently have sufficient single phase system spare transformers to cover this failure scenario resulting in an increased risk of an extended transformer outage at Newcastle while provision is made for the installation of the standard three phase system spare transformer.

The project scope proposed for the 2009/10-2013/14 regulatory period covers the replacement of six of the single phase transformer units with new two new three phase units. The three most serviceable single phase units would be used to extend the life and reliability of the remaining single phase transformer set. Secondary systems replacement and oil containment upgrade work has also been included in the project scope.

PB considers that the drivers, strategic alignment, cost and timing of the project are demonstrated to be both prudent and efficient, and that a reasonable range of alternative options has been identified. However PB is of the opinion that the selection of the two transformers replacement option over the single transformer replacement is largely based on the achieving TransGrid's arbitrary 'acceptable risk score', which we do not consider to be reasonable on the basis that TransGrid's specific acceptable risk criteria and their derivation are not explicitly stated in TransGrid's policy documentation, risk assessment guidelines, or the project documentation itself.

PB has conducted a detailed review of the proposed Newcastle 330/132 kV Transformer Replacement project, and while we are of the opinion that the project is prudent, we are also of the view that the selected option has not been demonstrated to be the most efficient option.

Therefore PB recommends that the scope of the project is reduced to reflect the single transformer replacement option, representing the most efficient option demonstrated in TransGrid's analysis.

Table 5-30 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the Newcastle 330/132 kV Transformer Replacement project. PB's recommended adjustment includes risk and escalation calculated using TransGrid's Capital Accumulation Model.

Table 5-30 – PB recommendation Newcastle 330/132 kV transformer replacement

Expenditure $m (real, 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	-	-	1.3	17.6	-	18.9
Proposed variation	-	-	-	(10.5)	-	(10.5)
PB recommendation	-	-	1.3	7.2	-	8.4

Source: TransGrid, CAM V1.8_Future deliverables 12a.xls and PB analysis.

5.4.11 Hunter Valley – Central Coast 500 kV line easement

This project involves the easement acquisition scheduled to occur in the 2009/10-2013/14 regulatory period associated with the Hunter Valley to Central Coast 500 kV Line Project.

The Hunter Valley to Central Coast 500 kV lines project forms part of the TransGrid strategy to implement a 500 kV ring to enable future development of generation serving the expected load

139 TransGrid Network Asset Replacement Project Evaluation 5622 ARPE, June 2008, page 8.

growth in the Newcastle-Sydney-Wollongong load corridor[140]. The project provides a network solution to line loading issues arising from a potential power station development in the Hunter Valley or Bayswater area and further generation or import from the north of the load corridor[141].

The scope of the project covers the construction of a 500 kV D/C transmission line between Bayswater and Eraring to alleviate the expected line rating and voltage control constraints forecast for the 330 kV lines serving the Newcastle-Sydney-Wollongong load corridor from the North.

PB considers that the drivers, strategic alignment and timing of the project are demonstrated to be both prudent and efficient, and that a reasonable range of alternative options has been identified.

TransGrid has identified, but excluded, a range of 330 kV options on the basis of being unacceptable due to inadequately addressing the voltage control constraints and the requirement to acquire further easements in heavily constrained or environmentally sensitive areas to enable future augmentation once the new 330 kV lines reach their capacity[142]. No assessment of the timing and quantity of additional future transmission line corridors that may be required was provided in the supporting document. As TransGrid has not provided analysis to support the exclusion of the 330 kV options, PB is unable to assess whether the exclusion of the 330 kV options is prudent or represents efficient expenditure.

The specific option selected has little material impact on the expenditure during the 2009/10-2013/14 regulatory period, as the expenditure relates primarily to easement acquisition and preliminary works components which are then adjusted in the capital accumulation model by the small probability (6.8%) of the project requiring expenditure in the period covered by TransGrid's revenue proposal. On this basis PB considers that the materiality adjustment associated with the options assessment process is reflected in our recommendations regarding the project cost efficiency.

A comparison of the easement costs between the similar 330 kV and 500 kV line routes between Eraring and the Hunter Valley reveals a $6.5m disparity in cost, once corrected for easement width, which TransGrid has subsequently identified as primarily the increased compensation associated with the difference in visual impact of a 500 kV line over a 330 kV line. PB also note that the property costs detailed in the Project Feasibility report for a greenfield 500 kV line between the Hunter Valley and Central Coast are a further $4.1m lower again at $36.3m[143].

PB notes that the property estimates included in the TransGrid options documentation are indicative[144] only, and no identification of specific easements or breakdown of how the estimates have been derived has been provided in the project package. On this basis, PB recommends that the externally provided easement cost estimate of $36.3m contained in the feasibility study report is applied.

Therefore PB is of the view that the project expenditure associated with the Hunter Valley to Central Coast 500 kV Line easements project is not sufficiently supported and on this basis does not represent efficient expenditure. Hence PB recommends that the easement expenditure for the project is reduced by a factor of 23.1% to reflect the cost of easements contained in TransGrid's feasibility study presented in the project package.

140 TransGrid Project Feasibility Study Report FS PSR 119, Rev 0, February 2008, page 1.

141 TransGrid Project Evaluation Summary 5567, Rev 2, May 2008, page 77.

142 TransGrid, Project Evaluation Summary 5567 – Reinforcement of supply to the Newcastle-Sydney-Wollongong load corridor, May 2008.

143 TransGrid Project Feasibility Study Report FS PSR 119, February 2008, page 28.

144 Property estimates in the POSE documents note the Property Estimate amount as (TBA).

Table 5-31 sets out PB's recommendation on the prudence and efficiency of the submitted expenditure associated with the Hunter Valley - Central Coast 500 kV Lines easement project. PB notes that all values have been adjusted to reflect the 6.8% probability of this project being required under the 36 scenarios represented in the CAM.

Table 5-31 – PB recommendation for Hunter Valley – Central Coast 500 kV line easement

Expenditure $m (real 07/08)	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Submitted	-	-	0.2	2.1	1.9	4.2
Proposed variation	-	-	-	(0.1)	(0.9)	(1.0)
PB recommendation	-	-	0.2	2.0	1.0	3.2

Source: Template-AER Schedule (for AER).xls – sheet 4.3, and PB analysis.

5.4.12 Project adjustments – replacement programs

In accordance with our review within Appendix L, due to the large number of programs associated with asset replacement works, PB has reviewed a typical component program from each category to assess the prudence and efficiency of the overall capital expenditure. The total value of the reviewed programs is $74m, and accounts for 46% of the total replacement program expenditure.

Based on our assessment, PB recommended the following adjustments to the TransGrid forward replacement capex:

- for the instrument transformers replacement programs 4910, 5085, 5086 and 5087, a reduction of $4.38m is recommended to make allowance for the replaced instrument transformers to be reused
- the capital expenditure for the transmission lines replacement programs for 99T and 99F lines is reduced by $3.57m to cover the reduction in scope associated with the deferral of approximately half of the structure replacements to future regulatory periods.

Based on the subsequent information discussed in Appendix L, PB revised our recommended adjustments in accordance with TransGrid's correction of factual errors in their 4939 TL99F wood poles replacement program supporting documentation.

These adjustments, including the subsequent information, are summarised in Table 5-32.

Table 5-32 – project adjustments – replacement programs

Component	09/10	10/11	11/12	12/13	13/14	Total Value ($k)
Substation adjustments	(689)	(895)	(950)	(919)	(929)	(4,382)
Transmission line adjustments	(102)	(1,136)	-	-	-	(1,238)
Total adjustments	(791)	(2,031)	(950)	(919)	(929)	(5,620)

Source: PB analysis.

5.4.13 Extrapolation of detailed review findings

On a project by project basis, PB's key findings and adjustments to TransGrid's proposed network expenditure have accumulated to $80.1m. The key components of this figure include adjustments of:

- 28% for the inclusion of easements associated the Dumaresq-Lismore 330 kV line augmentation in two areas
- 23% for project substitution (in-situ refurbishment as opposed to replacement) for the Cooma 132 kV substation project
- 13% for project substitution (replacement of one, rather than two) for the Newcastle 330/132 kV transformer project
- 10% for reduced project costs (based on the use of unsubstantiated general estimating factors) associated with the Beaconsfield West 132 kV GIS replacement
- a series of smaller adjustments (summating to the 26% balance of the total adjustment) associated with the matters such as the use of the inappropriate use of generic estimating factors, the use of material escalators, an unjustified scope of work, adjustments to capture efficiencies between projects at the same site, and adjustments to adopt the preferred use of external cost estimates.

Given the very specific nature of the recommendations based on the details of each project review, PB has not indentified a strong basis to extend its findings to the allowance of any other individual project. This position is supported by the open and transparent discussions held with TransGrid during the review process, where a number of agreed adjustments to individual projects were made (11 with material impacts and 6 with definition impacts, refer to section 5.4.1). In the instance of PB's most material adjustment, the Dumaresq-Lismore easement, PB re-iterates its recommendation that the AER should seek TransGrid's assurances concerning the process it has undertaken to ensure this error has not and will not be repeated.

The area with the most significant potential to identify further individual project adjustments would be the options analysis documented by TransGrid as part of its economic NPV assessments. In PB's view, critical omissions (whether this be cost components or other valid options) from these assessments, and a lack of rigour surrounding their development and review have the potential to result in an economically efficient option being overlooked. As part of its project reviews, PB has made appropriate recommendations on this basis.

While PB considers extrapolating its findings to other projects is not warranted or substantiated, in one specific case regarding the use of unsubstantiated generic cost estimating factors, PB has formed a view that limitations associated with the TransGrid's approach can be extrapolated at a high-level to the balance of the capex portfolio. This matter is also discussed in section 3.5.3.

5.5 REPLACEMENT OR RECONFIGURATION OF A CONNECTION ASSET

The AER considers that the appropriate interpretation of clause 11.6.11 of the NER is that any proposed replacement or reconfiguration of an existing connection asset, grandfathered as providing a prescribed transmission service under clause 11.6.11 should be treated as a negotiated transmission asset and therefore excluded from the prescribed forecast capex allowance. The AER's intention is that all connection assets will, over time, provide negotiated transmission services.

In other words, any proposed replacement or reconfiguration of existing connection assets should not be an addition to the TransGrid RAB (and be paid for through use of system tariffs), rather they should be treated separately as a negotiated transmission asset (and paid for by the connection applicant).

Clause 11.6.11 relates to grandfathered prescribed transmission services for connection assets that existed or where committed to prior to 9 February 2006. Under the AER interpretation any replacement of these must be treated as a negotiated asset. Whereas a prescribed service is a transmission network service to which a revenue cap applies.

TransGrid's revenue proposal states that *'To satisfy this requirement it is necessary to identify transmission services that do not form part of the prescribed transmission system. TransGrid has reviewed its capital projects in the current regulatory period and confirmed that all connection projects are appropriately covered by the transitional provisions and that no connection assets have been included that should be classified as negotiated transmission services'*.

For the 2009/10 to 2013/14 regulatory period TransGrid also confirms there are no connection projects that should be treated as negotiated transmission services. TransGrid is stating that all connection assets are, and will be, treated as prescribed (funded through revenue control) and not double-counted as negotiated assets.

TransGrid's revenue proposal sets out what connections it treats as prescribed:

- providing connections with other transmission network service providers in NSW (prescribed TUOS services)
- providing support to the electricity DNSPs by connecting their distribution networks to TransGrid's transmission network (prescribed exit services)
- providing grandfathered connections to generators and directly connected customers to the network (prescribed entry and exit services)
- delivering common transmission services (e.g. maintaining power system security, providing reactive support and assisting in system planning) to ensure the integrity of the network and a high quality of electricity supply to customers.

Intending generation and directly connected load customers receive limited prescribed services through the connection inquiry process. The costs of these services are also factored into the revenue proposal.

The costs to connect new generators and new customers to TransGrid's network are recovered through negotiated and non-regulated transmission services. Revenue and costs derived from these services have not been included in the revenue proposal.

TransGrid presented information on connection assets which set out the procedures TransGrid uses in dealing with connection assets during the current and next revenue periods.

During the current period any replacement capex on connection assets is regulated and the RAB value is increased by the actual expenditure. However any new connection services are funded by the connection applicant, and effectively treated as unregulated/negotiated. They are ring-fenced from regulated expenditure and not added to the RAB value. An exception to this rule is if the new connections are to other Network Service providers – in these cases the capex costs are added to the RAB.

PB confirms that while the current practices are in line with the rules, the practice with regard to replacement assets may need to change under the AER's new interpretation of the rules set out at the start of this paper.

TransGrid states that it has in place relevant procedures to ensure compliance with the rules. These are:

- transmission ring fencing procedure
- capitalisation policies
- procedures for establishing and modifying connections

- transmission pricing procedures.

PB has not audited compliance with these procedures as part of this review.

In terms of TransGrid's submission, it is stated that connection services are treated as 'negotiated transmission services' if they connect a new generator or new end user. TransGrid states that capex on these assets are not included in its revenue cap application.

However, as in the current period, any connection services with another Network Service Provider will be prescribed and included in the RAB. TransGrid states the capex on these services is included in the forecast capex in the revenue application.

TransGrid has not established how it will treat replacement capex on connections in the next period. PB notes that TransGrid will need to confirm that they will be treated as negotiated as per AER interpretation of the NER.

As part of its review, PB can confirm that TransGrid has relevant procedures to deal with future connection asset capex; specifically:

- cost allocation methodology
- negotiating framework (draft)
- transmission pricing methodology (draft).

Again, PB has not audited compliance with these procedures, and throughout our review, we have not identified any connection assets that are clearly inappropriately classified.

5.6 CONTINGENT PROJECTS

PB is required to examine the contingent projects proposed by TransGrid and assess them in accordance with clause 6A.8.1 of the NER. Further to this, PB has examined the reasonableness of the proposed costs of the contingent projects in order to arrive at an independent view on whether the proposed costs relate only to expenditure for prescribed transmission services.

This section summarises PB's detailed reviews (refer to Appendix M for full details) of the suite of 18 network projects that have been proposed by TransGrid as contingent projects. PB's review of the contingent projects has considered the appropriateness of including the projects as part of TransGrid's Revenue Proposal.

5.6.1 Review against the NER requirements

Section 6A.8.1 of the NER defines a set criterion to determine whether a project is a contingent project and can be accepted as part of the revenue determination. In PB's view, there are six key criteria that a project must meet to be classed as a contingent project and these are discussed in the following section.

A project can be included as a contingent project where the proposed contingent capital expenditure:

1. is not otherwise provided for (either in part or in whole) in the total of the forecast capital expenditure allowance

2. reasonably reflects

   a. efficient costs in achieving the objectives

   b. costs that a prudent operator would require to achieve the objectives

c. the realistic expectation of the demand forecast and cost inputs required to achieve the objectives

taking into account the capital expenditure factors, in the context of the proposed contingent project as described in the Revenue Proposal

3. exceeds either $10m or 5% ($33.4m[145]) of the value of the maximum allowed revenue for the first year of the relevant regulatory control period, whichever is the larger amount

and where the trigger event:

4. is reasonably specific and capable of objective verification

5. generates increased costs or categories of costs that relate to a specific location rather than a condition or event that affects the transmission network as a whole

6. is probable during the next regulatory period but is not sufficiently certain that the event will occur in the next regulatory period.

In reviewing the contingent projects, PB has presented the 6 criteria into a tabular format. The format is shown in Table 5-33.

Table 5-33 – Format of the contingent project summary table

Expenditure			Trigger event		
no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain

Source: PB analysis.

The six sections of the summary table are structured to align with six main criterion identified when reviewing the NER requirements. The alignment is defined below:

no provision – is not otherwise provided for (either in part or in whole) in the total of the forecast capital expenditure allowance

reflective – reasonably reflects

a. efficient costs in achieving the objectives

b. costs that a prudent operator would require to achieve the objectives

c. the realistic expectation of the demand forecast and cost inputs required to achieve the objectives

taking into account the capital expenditure factors, in the context of the proposed contingent project as described in the Revenue Proposal

exceeds limit – exceeds either $10m or 5% ($33.4m[146]) of the value of the maximum allowed revenue for the first year of the relevant regulatory control period, whichever is the larger amount

145 In the case of TransGrid – this figure of $33.4m is based on the 2009/10 smoothed revenue of $670.2m, refer page 121 of submission.

specific and verifiable – is reasonably specific and capable of objective verification

generates costs – generates increased costs or categories of costs that relate to a specific location rather than a condition or event that affects the transmission network as a whole

probable but uncertain – probable during the next regulatory period but is not sufficiently certain that the event will occur in the next regulatory period.

In PB's view, where the information provided by TransGrid on a specific project meets the NER requirements, the corresponding entry in the table will be marked with a tick, as shown in Table 5-34. Should PB consider that the information presented by TransGrid on the project does not meet the NER requirements, then a cross will be entered.

Table 5-34 – Identifying criterion for project reviews

Meets criteria	Does not meet criteria
✓	✘

Source: PB analysis.

Importantly, in order for a project to be accepted as a contingent project as part of the revenue proposal, all six criteria must be met.

5.6.2 Review of the contingent projects

TransGrid has identified 18 projects that are foreseeable, but sufficiently unlikely to occur across the 2009/10-2013/14 regularly period, that it has proposed to be treated as contingent projects. These are outlined in Table 5-35.

TransGrid classed these projects as contingents because they have uncertain timing, scope or cost and should the trigger be realised, TransGrid will require the ability to fund the project to meet its customers need.

146 In the case of TransGrid – this figure of $33.4m is based on the 2009/10 smoothed revenue of $670.2m, refer page 121 of submission.

Table 5-35 – List of contingent projects proposed by TransGrid

Project	Capital cost ($m)
Kemps Creek – Liverpool 330 kV line – Undergrounding of all or part of the proposed connection	108
Darlington – Balranald system upgrade 275 kV	51
Development of a second 500 kV link	330
New 500/330 kV substation at Richmond Vale	80
Yass to Wagga 500 kV double circuit transmission line	329
Liddell – Tamworth 330 kV	163
Tamworth – Armidale 330 kV line	130
QNI upgrade – series compensator	120
Interconnection development from Victoria	33
Bannaby – Yass reinforcement	45
CBD supply – cable into the CBD	650
Visy Gadara Mill local area support	54
Williamsdale – Cooma 3rd circuit	40
Orange 330 kV substation	63
330 kV substation at Williamsdale	35
SVC	40
Reactive support at Bayswater	36
System protection scheme	-

Source: PB from Appendix I of submission.

5.6.3 Summary of PB's review of contingent projects

Appendix M outlines the full details and the findings of PB's review. Table 5-36 in this section summates the findings of the review of contingent projects.

Table 5-36 – Review of contingent projects

Project	Capital cost ($m)	expenditure			trigger event		
		no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Kemps Creek – Liverpool 330 kV line – Undergrounding of all or part	108	✓	✓	✓	✓	✓	✓
Darlington – Balranald system upgrade 275 kV	51	✓	✓	✓	✗	✗	✗
Development of a second 500 kV link	330	✗	✓	✓	✗	✗	✗
New 500/330 kV substation at Richmond Vale	80	✓	✓	✓	✓	✓	✓
Yass to Wagga 500 kV double circuit line	329	✓	✓	✓	✗	✗	✗
Liddell – Tamworth 330 kV	163	✓	✓	✓	✗	✗	✗
Tamworth – Armidale 330 kV line	130	✓	✓	✓	✗	✗	✗
QNI upgrade – series compensator	120	✓	✗	✓	✗	✗	✗
Interconnection development from Victoria	33	✓	✓	✗	✗	✗	✗
Bannaby – Yass reinforcement	45	✓	✓	✓	✗	✗	✗
CBD supply – cable into the CBD	650	✓	✓	✓	✗	✗	✓
Visy Gadara Mill local area support	54	✓	✓	✓	✓	✗	✓
Williamsdale – Cooma 3rd circuit	40	✓	✓	✓	✗	✗	✓
Orange 330 kV substation	63	✓	✗	✓	✗	✗	✗
330 kV substation at Williamsdale	35	✗	✓	✓	✓	✓	✓
SVC	40	✗	✓	✓	✗	✗	✓
Reactive support at Bayswater	36	✓	✗	✓	✗	✗	✗
System protection scheme	-	✓	✗	✗	✗	✗	✗

Source: PB analysis.

5.6.4 Contingent project recommendations (superceded)

PB has reviewed the 18 projects proposed by TransGrid as contingent projects. PB has tested the contingent projects against the requirements as defined in schedule 6A.8.1 of the NER. On completion of the assessment, PB recommends that the two projects in Table 5-37 are included in TransGrid's proposal as contingent projects.

Table 5-37 – Proposed contingent projects recommended to be included in TransGrid's revenue proposal

Project	Trigger	Capital cost ($m)
Kemps Creek – Liverpool 330 kV line – Undergrounding of all or part of the proposed connection	1. A determination by the environmental consent authority that inclusion of a specific amount of undergrounding is required for the project to be approved, and 2. The project with undergrounding satisfies the Regulatory Test. The ex –ante capital submission includes the cost of the overhead line. The contingent project cost is the differential cost of the cable over and above the overhead line	108
New 500/330 kV substation at Richmond Vale	1. The environmental consent authority determines that a 500 kV transmission line between the Hunter Valley and Eraring must utilize the route of an existing 330 kV line that supplies the Newcastle area in order to be approved, and 2. The project including the 500/ 330 kV substation satisfies the Regulatory Test.	80

Source: PB analysis.

Of the projects that did not meet the terms of the NER, we identified a common theme throughout the projects, in that the trigger event was rather generalised and not sufficiently or specifically defined outside the bounds of the scenario analysis adopted by TransGrid as part of its determination of the forecast ex-ante capex allowance.

The NER identifies three criterion relating to trigger events. These highlight a trigger must:

1. be reasonably specific and capable of objective verification
2. generate increased costs or categories of costs that relate to a specific location rather than a condition or event that affects the transmission network as a whole
3. be probable during the next regulatory period but not sufficiently certain that the event will occur in the next regulatory period.

Overall, we found that the trigger events proposed by TransGrid were not reasonably specific and consequently PB has not been able to verify that the trigger would generate the cost identified.

5.6.5 Subsequent information on 26 August 2008

On 26 August 2008, TransGrid provided additional information as part of ongoing discussions pertaining to contingent projects, specifically relating to the trigger definitions. The additional information affected 14 of the original contingent projects. These 14 contingent projects are listed in Table 5-38.

Table 5-38 – Projects with subsequent submitted information on 26 August 2008

Project	Capital cost ($m)
Darlington – Balranald system upgrade 275 kV	51
Development of a second 500 kV link	330
Yass to Wagga 500 kV double circuit transmission line	329
Liddell – Tamworth 330 kV	163
Tamworth – Armidale 330 kV line	130
QNI upgrade – series compensator	120
Interconnection development from Victoria	33
Bannaby – Yass reinforcement	45
CBD supply – cable into the CBD	650
Visy Gadara Mill local area support	54
Williamsdale – Cooma 3rd circuit	40
Orange 330 kV substation	63
330 kV substation at Williamsdale	35
Reactive support at Bayswater	36

Source: PB analysis.

5.6.6 Summary of PB's review of additional information – 26 August 2008

Appendix M outlines the full details and the findings of PB's review. Table 5-39 summates the findings of the subsequent review of contingent projects, where it is highlighted that the revised trigger definitions often incorporate more than one component.

Table 5-39 – Review of contingent projects using additional information

Project	revision	capital cost ($m)	expenditure			trigger event		
			no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Darlington – Balranald system upgrade 275 kV	original	51	✓	✓	✓	✗	✗	✗
	trigger 1		✓	✓	✓	✓	✓	✓
	trigger 2		✓	✓	✓	✗	✗	✗
	trigger 3		✓	✓	✓	✗	✗	✗
Development of a second 500 kV link	original	330	✗	✓	✓	✗	✗	✗
	revision		✓	✓	✓	✗	✗	✗
Yass to Wagga 500 kV double circuit line	original	329	✓	✓	✓	✗	✗	✗
	trigger 1		✓	✓	✓	✓	✓	✓
	trigger 2		✓	✓	✓	✗	✗	✗
Liddell – Tamworth 330 kV	original	163	✓	✓	✓	✗	✗	✗
	trigger 1		✓	✓	✓	✓	✓	✓
	trigger 2		✓	✓	✓	✗	✗	✗
	trigger 3		✓	✓	✓	✗	✗	✗
Tamworth – Armidale 330 kV line	original	130	✓	✓	✓	✗	✗	✗
	trigger 1		✓	✓	✓	✓	✓	✓
	trigger 2		✓	✓	✓	✗	✗	✗
	trigger 3		✓	✓	✓	✗	✗	✗
QNI upgrade – series compensator	original	120	✓	✗	✓	✗	✗	✗
	trigger 1		✓	✗	✓	✗	✗	✗
	trigger 2		✓	✗	✓	✗	✗	✗

Project	revision	capital cost ($m)	expenditure			trigger event		
			no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Interconnection development from Victoria	original	33	✓	✓	✗	✗	✗	✗
	trigger 1		✓	✗	✗	✗	✗	✗
	trigger 2		✓	✗	✗	✗	✗	✗
Bannaby – Yass reinforcement	original	45	✓	✓	✓	✗	✗	✗
	trigger 1		✓	✓	✓	✓	✓	✓
	trigger 2		✓	✓	✓	✗	✗	✗
CBD supply – cable into the CBD	original	650	✓	✓	✓	✗	✗	✓
	revised		✓	✗	✓	✗	✗	✓
Visy Gadara Mill local area support	original	54	✓	✓	✓	✓	✗	✓
	revised		✓	✗	✓	✗	✗	✗
Williamsdale – Cooma 3rd circuit	original	40	✓	✓	✓	✗	✗	✓
	revised		✓	✗	✓	✗	✗	✓
Orange 330 kV substation	original	63	✓	✗	✓	✗	✗	✓
	revised		✓	✗	✓	✗	✗	✗
330 kV substation at Williamsdale	original	35	✗	✗	✓	✓	✓	✓
	revised		✗	✗	✓	✓	✓	✓
Reactive support at Bayswater	original	36	✓	✗	✓	✗	✗	✗
	revised		✓	✗	✓	✗	✗	✗

Source: PB analysis.

5.6.7 Subsequent findings on contingent projects – 26 August 2008 (superceded)

PB has reviewed the 18 projects in total and 14 projects where additional information was provided by TransGrid. PB has tested the contingent projects against the requirements as defined in schedule 6A.8.1 of the NER. On completion of the assessment, PB recommends that the following seven projects in are included in TransGrid's proposal as contingent projects with the identified triggers.

Table 5-40 – Revised proposed contingent projects recommended to be included in TransGrid's revenue proposal

Project	Trigger	Capital cost ($m)
Kemps Creek – Liverpool 330 kV line – Undergrounding of all or part of the proposed connection	1. A determination by the environmental consent authority that inclusion of a specific amount of undergrounding is required for the project to be approved, and 2. The project with undergrounding satisfies the Regulatory Test. The ex –ante capital submission includes the cost of the overhead line. The contingent project cost is the differential cost of the cable over and above the overhead line	108
Darlington – Balranald system upgrade 275 kV	1. NSW Government directs TransGrid to upgrade this transmission line to improve their greenhouse gas emissions.	51
Yass to Wagga 500 kV double circuit transmission line	1. A set of coal-fired or gas-fired generators, with a combined output exceeding 200 MW, is committed for connection to the network in the following southern areas of the NSW system south of the Yass / Canberra area: • Wagga; • Jindera; • Buronga / Broken Hill area or 2. The Victorian export capability to Snowy and NSW is increased by 200 MW above the present capability. and The generation development or increased export capability causes a network limitation to arise on the system between Murray and Upper Tumut / Lower Tumut and between Upper Tumut / Lower Tumut and Yass / Canberra.	329

Project	Trigger	Capital cost ($m)
Liddell – Tamworth 330 kV	1. A set of coal-fired or gas-fired generators, with a combined output exceeding 200 MW, is committed for connection to the network in NSW in the Tamworth or Armidale area. or The Queensland export capability to NSW is increased by 200 MW above the present capability. and 2. The generation development or increased export capability causes a network limitation to arise on the system between Liddell and Tamworth.	163
Tamworth – Armidale 330 kV line	1. A set of coal-fired or gas-fired generators, with a combined output exceeding 200 MW, is committed for connection to the network in NSW in the Armidale area. or The Queensland export capability to NSW is increased by 200 MW above the present capability. and 2. The generation development or increased export capability causes a network limitation to arise on the system between Tamworth and Armidale	130
Bannaby – Yass reinforcement	1. A set of coal-fired or gas-fired generators, with combined output exceeding 200 MW, is committed for connection to the network in the following southern areas of the NSW system south of the Bannaby/Marulan area: • Yass • Canberra • Wagga; • Jindera; • Buronga / Broken Hill area or The Victorian export capability to Snowy and NSW is increased by 200 MW above the present capability. and 2. The generation development or increased export capability causes a network limitation to arise on the system between Yass and Bannaby.	45
New 500/330 kV substation at Richmond Vale	1. The environmental consent authority determines that a 500 kV transmission line between the Hunter Valley and Eraring must utilize the route of an existing 330 kV line that supplies the Newcastle area in order to be approved, and 2. The project including the 500/ 330 kV substation satisfies the Regulatory Test.	80

Source: PB analysis.

5.6.8 Subsequent information on 12 September 2008

On 12 September 2008 TransGrid provided additional information as part of ongoing discussions pertaining to contingent projects, specifically relating to the trigger definitions. The additional information affected 14 of the original contingent projects. The 14 contingent projects are listed inTable 5-41.

Table 5-41 – Projects with subsequent submitted information on 12 September 2008

Project	Capital cost ($m)
Development of a second 500 kV link	330
Yass to Wagga 500 kV double circuit transmission line	329
Liddell – Tamworth 330 kV	163
Tamworth – Armidale 330 kV line	130
QNI upgrade – series compensator	60 – 120
Interconnection development from Victoria	33
Bannaby – Yass reinforcement	45
CBD supply – 330 kV cable into the CBD	650
Gadara / Tumut local area support (originally Visy Gadara Mill local area support)	54
Cooma Area (originally Williamsdale – Cooma 3rd circuit)	40
Orange 330 kV substation	63
330 kV supply to Williamsdale	35
SVC	40
Reactive support at Bayswater	36

Source: PB analysis.

5.6.9 Summary of PB's review of additional information – 12 September 2008

Appendix M outlines the full details and the findings of PB's review. Table 5-42 summates the findings of the subsequent review of contingent projects, where it is highlighted that the revised trigger definitions often incorporate more than one component.

Table 5-42 – Review of contingent projects using additional information

Project	revision	capital cost ($m)	expenditure			trigger event		
			no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Development of a second 500 kV link	Original	331	✗	✓	✓	✗	✗	✓
	Revised		✓	✓	✓	✗	✗	✓
400 MW generator in northern or western NSW								
	500 kV DC line	270	✓	✓	✓	✓	✓	✓
Development of a second 500 kV link	Bayswater	31	✓	✗	✓	✓	✗	✓
	Kemps Creek	30	✓	✗	✓	✓	✗	
400 MW import from Queensland to NSW								
	500 kV DC line	270	✓	✓	✓	✓	✓	✓
Development of a second 500 kV link	Bayswater	31	✓	✗	✓	✓	✗	✓
	Kemps Creek	30	✓	✗	✓	✓	✗	✓
200 MW spot load in the Newcastle area								
	500 kV DC line	270	✓	✗	✓	✓	✗	✓
Development of a second 500 kV link	Bayswater	31	✓	✗	✓	✓	✗	✓
	Kemps Creek	30	✓	✗	✓	✓	✗	✓

Project	revision	capital cost ($m)	expenditure			trigger event		
			no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Yass to Wagga 500 kV double circuit line	Original	329	✓	✓	✓	✗	✗	✗
	Trigger 1		✓	✓	✓	✓	✓	✓
	Trigger 2		✓	✓	✓	✓	✓	✓
Liddell – Tamworth 330 kV	Original	163	✓	✓	✓	✗	✗	✗
	Trigger 1		✓	✓	✓	✓	✓	✓
	Trigger 2		✓	✓	✓	✓	✓	✓
	Trigger 3		✓	✓	✓	✓	✓	✓
Tamworth – Armidale 330 kV line	Original	130	✓	✓	✓	✗	✗	✗
	Trigger 1		✓	✓	✓	✓	✓	✓
	Trigger 2		✓	✓	✓	✓	✓	✓
	Trigger 3		✓	✓	✓	✓	✓	✓
QNI upgrade – series compensator	Original	60 – 120	✓	✗	✓	✗	✗	✗
	Trigger 1		✓	✗	✓	✗	✗	✗

Project	revision	capital cost ($m)	expenditure			trigger event		
			no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Interconnection development from Victoria	Trigger 2	33	✓	✗	✓	✗	✗	✗
	Original		✓	✓	✗	✗	✗	✗
	Trigger 1		✓	✗	✗	✗	✗	✗
	Trigger 2		✓	✗	✗	✗	✗	✗
Bannaby – Yass reinforcement	Original	45	✓	✓	✓	✗	✗	✗
	Trigger 1		✓	✓	✓	✓	✓	✓
	Trigger 2		✓	✓	✓	✓	✓	✓
CBD supply – 330 kV cable into the CBD	Original	650	✓	✓	✓	✗	✗	✓
	Revised		✓	✗	✓	✗	✗	✓
Gadara / Tumut local area support (originally Visy Gadara Mill local area support)	Original	54	✓	✓	✓	✓	✗	✓
	Revised		✓	✗	✓	✗	✗	✗
Cooma Area (originally Williamsdale – Cooma 3rd circuit)	Original	40	✓	✓	✓	✗	✗	✓
	Trigger 1		✓	✓	✓	✓	✓	✓

Project	revision	capital cost ($m)	expenditure			trigger event		
			no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
Orange 330 kV substation	Trigger 2	63	✓	✓	✓	✗	✗	✓
	Trigger 3		✓	✓	✓	✗	✗	✓
	Original		✓	✗	✓	✗	✗	✓
	Trigger 1		✓	✗	✓	✗	✗	✗
	Trigger 2		✓	✗	✓	✗	✗	✗
	Trigger 3		✓	✗	✓	✗	✗	✗
330 kV supply to Williamsdale	Original	35	✗	✗	✓	✓	✓	✓
	Revised		✗	✗	✓	✓	✓	✓
SVC	Original	40	✗	✓	✓	✗	✗	✓
	Trigger 1		✗	✗	✓	✓	✗	✓
	Trigger 2		✗	✓	✓	✓	✓	✓
Reactive support at Bayswater	Original	36	✓	✗	✓ ($36 m)	✗	✗	✗
	Revised		✓	✗	✓ ($36 m)	✗	✗	✗

Source: PB analysis.

5.6.10 Subsequent findings on contingent projects - 12 September 2008

PB has reviewed the 18 projects in total and 14 projects where additional information was provided by TransGrid. PB has tested the contingent projects against the requirements as defined in schedule 6A.8.1 of the NER. On completion of the assessment, PB recommends that the following nine projects in Table 5-43 are included in TransGrid's proposal as contingent projects with the identified triggers

Table 5-43 – Revised proposed contingent projects recommended to be included in TransGrid's revenue proposal

Project	Trigger	Capital cost ($m)
Kemps Creek – Liverpool 330 kV line – Undergrounding of all or part of the proposed connection	1. A determination by the environmental consent authority that inclusion of a specific amount of undergrounding is required for the project to be approved, and 2. The project with undergrounding satisfies the Regulatory Test. The ex –ante capital submission includes the cost of the overhead line. The contingent project cost is the differential cost of the cable over and above the overhead line	108
Hunter Valley to coast 500 kV development of A double circuit 500 kV line development	1. A northern or western NSW power station development exceeding 400 MW or 2. A development of the Queensland interconnection enabling an increase in NSW import capability exceeding 400 MW	270
Darlington – Balranald system upgrade 275 kV	1. NSW Government directs TransGrid to upgrade this transmission line to improve its greenhouse gas emissions.	51
Yass to Wagga 500 kV double circuit transmission line	1. A set of coal-fired or gas-fired generators, with a combined output exceeding 200 MW, is committed for connection to the network in the following southern areas of the NSW system south of the Yass / Canberra area: • Wagga; • Jindera; • Buronga / Broken Hill area • Snowy area or 2. The Victorian export capability to Snowy and NSW is increased by 200 MW above the present capability. and The generation development or increased export capability causes a network limitation to arise on the system between Murray and Upper Tumut / Lower Tumut and between Upper Tumut / Lower Tumut and Yass / Canberra.	329

Project	Trigger	Capital cost ($m)
Liddell – Tamworth 330 kV	1. A set of coal-fired or gas-fired generators, with a combined output exceeding 600 MW (or wind farm developments that provide the equivalent output at time of high NSW load), is committed for connection to the network in NSW in the Tamworth or Armidale area or 2. The NSW import capability from Queensland is increased by 600 MW above the present capability or 3. The NSW export capability to Queensland is increased by 200 MW above the present capability. and The generation development or increased interconnection capability causes a network limitation to arise on the system between Liddell and Tamworth.	163
Tamworth – Armidale 330 kV line	1. A set of coal-fired or gas-fired generators, with a combined output exceeding 300 MW (or wind farm developments that provide the equivalent output at time of high NSW load), is committed for connection to the network in NSW in the Armidale to north coast area or 2. The NSW import capability from Queensland is increased by 300 MW above the present capability or 3. The NSW export capability to Queensland is increased by 200 MW above the present capability. and The generation development or increased export capability causes a network limitation to arise on the system between Tamworth and Armidale	130

Project	Trigger	Capital cost ($m)
Bannaby – Yass reinforcement	1. A set of coal-fired or gas-fired generators, with combined output exceeding 200 MW, is committed for connection to the network in the following southern areas of the NSW system south of the Bannaby/Marulan area: • Yass • Canberra • Wagga; • Jindera; • Buronga / Broken Hill area • Snowy area or 2. The Victorian export capability to Snowy and NSW is increased by 200 MW above the present capability. and The generation development or increased export capability causes a network limitation to arise on the system between Yass and Bannaby.	45
Cooma area	The emergence of one or more generators totalling 225 MW[147] (or more) to be connected to the transmission network which services the Cooma Area	40
New 500/330 kV substation at Richmond Vale	1. The environmental consent authority determines that a 500 kV transmission line between the Hunter Valley and Eraring must utilize the route of an existing 330 kV line that supplies the Newcastle area in order to be approved, and 2. The project including the 500/ 330 kV substation satisfies the Regulatory Test.	80

Source: PB analysis.

Of the projects that did not meet the terms of the NER, we identified a common theme throughout the projects, in that the trigger event was rather generalised and not sufficiently or specifically defined outside the bounds of the scenario analysis adopted by TransGrid as part of its determination of the forecast ex-ante capex allowance.

The NER identifies three criterion relating to trigger events. These highlight a trigger must:

1. be reasonably specific and capable of objective verification

2. generate increased costs or categories of costs that relate to a specific location rather than a condition or event that affects the transmission network as a whole

3. be probable during the next regulatory period but not sufficiently certain that the event will occur in the next regulatory period.

147 In TransGrid's response the actual value was 225 MVA. PB has assumed that this is a typographic error as generation output is measured in MW. Therefore it is assumed to be 225 MW.

Overall, we found that the trigger events proposed by TransGrid were not reasonably specific and consequently PB has not been able to verify that the trigger would generate the cost identified.

5.7 DELIVERABILITY

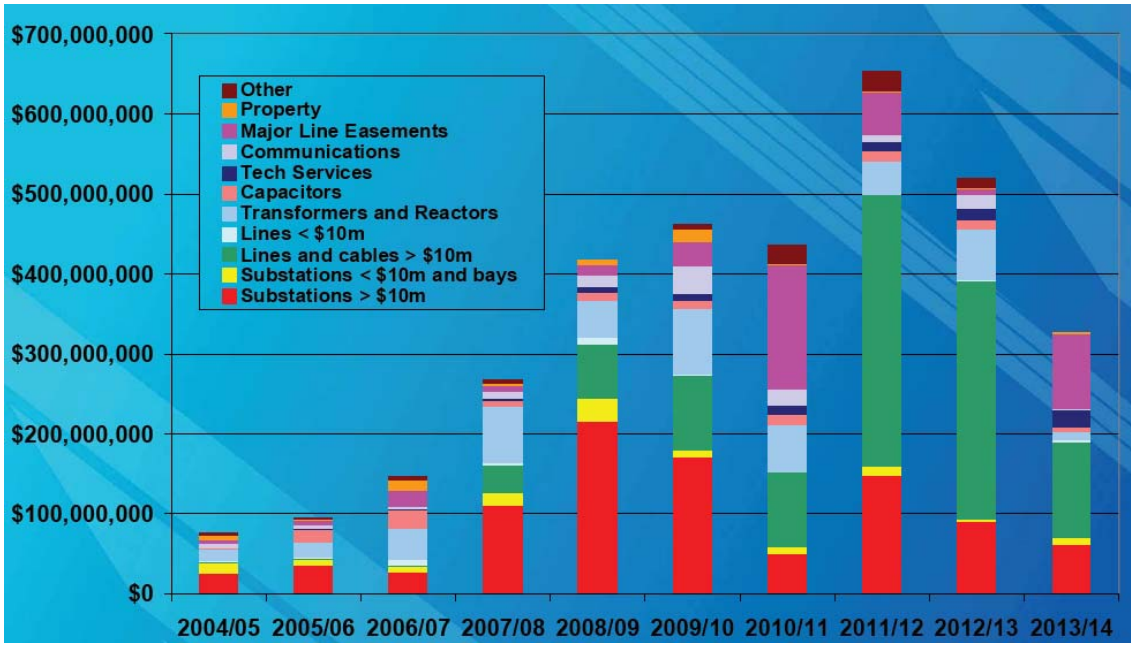
In this section we discuss the capacity of TransGrid to deliver the works program for the next regulatory control period.

5.7.1 TransGrid's capital program

The capital works program proposed by TransGrid over the five year 2009/10-2013/14 period is approximately 90% greater than the value of the capital works program in the current 2004/05-2009/10 regulatory control period. However, as shown in Figure 5-11, the program in the current regulatory period is not evenly distributed over the 5 year period and is heavily weighted towards the last two years of the period. The forecast expenditure for 2007/08 is approximately two-thirds of the average expenditure for the next regulatory period and the forecast for 2008/09 is approximately the same as that proposed for the next regulatory control period.

PB therefore considers that the delivery of the capital program in the current year (2007/08) and the next year (2008/09) will provide a very good indication of the capacity to deliver the proposed works program in the next regulatory control period.

Figure 5-11 – Capital expenditure profile – by project types



Source: presentation – TransGrid.

The major categories of capital expenditure in the next regulatory period are:

- substations – augmentation ($930m)
- transmission Lines & Cables – augmentation ($853m)
- land & easement ($288m)
- substations – replacement ($160m).

These four categories account for approximately 85% of total proposed expenditure.

The level of expenditure proposed for Substations – Augmentation is very similar to the level of expenditure in the last two years of the current period (2007/08 and 2008/09). The level of expenditure proposed for Transmission Lines & Cables – Augmentation and Land & Easements is a significant increase over the current level of expenditure. The level of expenditure proposed for Substations – Replacement is less than the current level.

The proposed expenditure on Transmission Lines & Cables is dominated by three large projects:

- Bannaby-South Creek 500 kV Lines and Sub ($323m)
- Holroyd-Chullora 330 kV Cable ($245m)
- Dumaresq-Lismore 330 kV Line ($166m).

5.7.2 Delivery of historical capital program

TransGrid has made significant changes to the way that capital works are delivered over the past few years. These changes include the formation of a Capital Program Delivery Business Unit in late 2005 and the introduction of new project delivery models such as Design and Construct contracting. On this basis, PB does not consider that a detailed analysis of TransGrid's capital program delivery in early years of the current regulatory period will provide insight into the capacity of TransGrid to deliver the program in the forthcoming regulatory control period.

Compared to its forecast capex as part of its revenue cap decision in April 2005, and except for 2008/09, during the current regulatory period TransGrid has spent less in each year of the period than was planned. In 2006-07 and 2007-08 this under-expenditure was less than 10% of total planned expenditure. However, for 2008-09 TransGrid is planning expenditure significantly in excess (57%) of that planned at the time of the last Network Revenue Cap Decision.

TransGrid has explained that the commencement of the capital program for the current regulatory period was delayed due to the late Revenue Cap Decision and this delayed start caused under-expenditure in the early years of the current regulatory control period. In the most recent year on the current regulatory control period, 2007-08, TransGrid has undertaken an analysis of the reasons why expenditure is below budget. These reasons include delays in plant delivery, adverse weather and the forecasting process.

5.7.3 Relationship between capital and operational programs

With an increase in the size of the capital works program, there is the potential for labour to be redirected from maintenance works to capital works and therefore the potential for some undesirable impact on the maintenance program. In many areas the skills required to deliver a capital works program are similar to those used to deliver a maintenance program. For example, it is common for utilities to use the same staff to maintain and commission secondary systems at substations. There is, therefore, a risk that an increased capital works program may result in resources that are ordinarily used for maintenance being diverted to capital works and this, in turn, may have an impact on maintenance.

As part of its review, PB questioned TransGrid over the extent of any trade-off between maintenance works and capital projects. TransGrid has advised that it manages its business to ensure that maintenance work is completed on schedule and therefore there has been little, or no, impact on the delivery of the maintenance program as a result of the increased capital program. As evidence of this, TransGrid provided the results of routine maintenance delivery. In each of the past four years (2004-05 to 2007-08), TransGrid has delivered over 97% of routine maintenance in the planned year. This indicates that TransGrid does ensure that routine maintenance is given priority over capital works and therefore in PB's view there is little risk that an increased capital program will affect planned maintenance works.

5.7.4 Forecast expenditure for 2008/09

TransGrid is proposing network expenditure for 2008/09 of $483m. The average network expenditure proposed by TransGrid for the next regulatory period ($494m) is only slightly larger than that proposed for 2008/09.

The major projects planned for 2008/09 and the expenditure in the year are:

- Western 500 kV Development $135m
- Wollar-Wellington 300 kV development $42m
- Macarthur 330/132 kV Substation Establishment $34m
- Yass-Wagga 132 kV (990) Reconstruction $19m
- Holroyd Line, Cable & Substation $16m
- Wagga North 132 kV Substation $16m
- Armidale 132 kV Phase Shifting Transformer $14m

TransGrid is well advanced with preparation and delivery of these projects. TransGrid has provided PB with a schedule of committed expenditure for 2008/09 along with details of contracts awarded including the contractor and value of the contracts. For each of the major project expenditures planned for 2008-09 that require construction or delivery of equipment, TransGrid has entered into contracts with contractors and suppliers to deliver the required projects.

In addition to the major projects detailed above, there are a large number of smaller projects planned for 2008/09. TransGrid produces a report that tracks project commitment for all major capital program projects. This tracking progress involves an assessment of the projects that are planned for the year and presentation of the results in a form that shows the proportion of the program that is already committed and a forecast of the dates that the remaining program is to be committed over the year. This process provides management with high visibility of the progress of the capital plan for the current and forthcoming years. At the commencement of the financial year (June 2008) TransGrid had committed over 80% of the major capital program expenditure planned for the financial year. This is a high level of program commitment that provides a level of assurance that the program for the current year will be delivered.

5.7.5 TransGrid's strategies to deliver the capital program

TransGrid has implemented a number of strategies to deliver an increasing capital program. Some of these strategies are well established and others are developing as the capital program grows.

Increase in internal resources

TransGrid has increased internal resources in a number of key areas. The area with the most significant increase has been the Capital Program Delivery Unit. This business unit was established in late 2005 to ensure that dedicated resources are available to deliver the growing program of capital works. This unit effectively takes responsibility for delivery of the capital program. TransGrid has provided PB with information on the size of the Capital Program Delivery unit and the target for additional resources for 2009. TransGrid is meeting its target for recruitment of additional resources.

In addition to the Capital Program Delivery Unit, TransGrid has established a group specifically responsible for undertaking the extensive feasibility studies that are required to appropriately assess proposed large capital projects; a specialist project management group to deliver "design and construct" projects; and a specialist engineering group to design secondary systems in substations.

TransGrid has not specifically undertaken any resource modelling by skill type to ensure that adequate skills of the right type are available to meet the mix of projects in the next regulatory period. However, TransGrid has undertaken an analysis of the type of project to be delivered in the next regulatory period and considers that the delivery model currently used and expected to be applied will deliver the required program.

In general, PB believes that TransGrid has not identified any labour issues that currently affect many electricity industry participants such as skill shortages and an ageing workforce. There is no evidence that TransGrid is immune from these issues, nor is there any evidence that the issues are affecting the capacity of TransGrid to deliver the capital program. In fact, TransGrid has successfully recruited additional staff in the Capital Program Delivery Unit and is confident that the additional staff forecast can be recruited in an appropriate timeframe.

Design & construct

TransGrid has, in the current regulatory control period, implemented a model of "design and construct" to deliver substation projects. This model utilises the resources employed by contractors to both construct the substation and to undertake design, testing and commissioning. The technique requires some additional up-front effort by TransGrid to ensure that standards are clearly defined and understood by the contractor and to ensure that project specifications are clear. This additional effort is offset by the use of the contractor's resources to undertake detailed design and to reduce the interaction between TransGrid and the contractor during project delivery.

The design and construct technique has been successfully used to deliver a number of substation projects. In the current regulatory period the design and construct technique has been primarily applied to "greenfield" substations. In the forthcoming period, TransGrid intends to expand the use of design and construct to substation expansion and refurbishment projects and also to projects such as transmission line and cable projects.

Design and construct contracting relies on the contractors employing or finding the resources necessary to undertake the projects. PB is aware that other contractors compete for the same pool of employees as transmission and distribution businesses and are therefore also constrained by workforce issues such as skill shortages and an ageing workforce. Contractor skill shortages become evident when there are few competitive bids for large projects; the projects are not completed on time, or are of poor quality. TransGrid has not reported any significant issues with the use of contractors to deliver its design and construct projects. There is no evidence of any design and construct projects falling behind schedule and TransGrid is successfully tendering design and construct works on a competitive basis.

External design

External design resources are employed by TransGrid to undertake a number of design roles such as civil design and transmission line design. TransGrid adopts the use of period contracts and has placed significant volumes of work with design contractors and intends to grow the amount of work.

The approach taken by TransGrid involves entering into long-term relationships with providers. This approach involves making TransGrid an attractive customer for the service provider as it gives the service provider with some assurance that future work is available and enables the service provider to commit the resources required to perform TransGrid work. This is a commonly used strategy in an area where resources are limited and it appears to be working effectively for TransGrid.

Alliances

TransGrid has recognised that in the forthcoming regulatory period there are a number of telecommunications projects that do not have a large capital value (at least in comparison to line, cable and substation projects), yet they require very specialist skills. It is planned to deliver these projects using an alliance with a specialist service provider.

Alliance contracting is generally used where a single organisation does not have the resources or breadth of resources necessary to deliver a large project or where the project is technically complex and a number of uncertainties are apparent at the project formation stage. The use of alliance contracting to deliver projects, in a technically complex area such as telecommunications, is a valid delivery strategy that should enable TransGrid to delivery complex projects that would otherwise be difficult to deliver.

Procurement

TransGrid is using long-term contracts with key suppliers to deliver major items of plant. This involves TransGrid selecting and using multiple suppliers for each key item of plant and ensuring that strong relationships are developed with these key suppliers. TransGrid has provided PB with a list of the period contracts for equipment. The period contracts typically run for three years and include equipment items such as circuit breakers and current transformers. For long lead-time items such as power transformers, TransGrid is reserving production slots in anticipation that equipment will be required at that time. This approach is used by other industry participants and appears to be effective in ensuring that materials are available when needed (provided that sufficient notice is provided to the equipment supplier).

TransGrid is a member of APUG, a group of international electricity utilities who collaborate on supply chain management activities in the Asia Pacific region. This group promotes sharing of information on supply chain processes and procurement activities such as supplier registration and prequalification.

TransGrid is, by Australian standards, a large customer for equipment suppliers and is should therefore be able to ensure that necessary plant and equipment is procured for projects planned in the forthcoming regulatory control period.

Capital Program Smoothing

Capital program smoothing involves adjusting the timing of projects within the capital program so that projects that require scarce resources are spread more evenly over the outlook period. TransGrid has deferred some projects from its ideal commissioning date and have advanced a small number of projects to smooth the workload over the next regulatory control period[148]. An example of this smoothing is the replacement of transformers where the ideal replacement program is defined and then this replacement program is smoothed based on compliance and work balancing. The approach taken by TransGrid is typical of capital program smoothing undertaken by utilities where high-value critical projects are delivered at the optimum time and replacement and/or low-value projects are adjusted slightly to smooth the workload.

5.7.6 PB assessment of TransGrid's capacity to deliver

TransGrid is planning a significant program of expenditure in the forecast regulatory control period. However, on an annual basis, this program is similar in size to that planned for 2008/09. The only categories of expenditure that are significantly larger in the forecast regulatory period compared with 2008/09 are 'Transmission Lines & Cables – Augmentation' and 'Land & Easement'. Other categories of expenditure are of a similar size or smaller than the 2008/09 program.

TransGrid has already implemented a number of strategies to deliver an increased capital works program. These strategies appear to be well implemented and have allowed TransGrid to have a high degree of confidence in the delivery of the 2008/09 capital program. This is evidenced by the high percentage of major projects (and their value) with contracts executed. The strategies adopted are not unique to TransGrid and have been successfully utilised by other utilities. TransGrid is relying on an extension of these strategies to deliver the program in the forecast regulatory control period.

148 For example the Coffs Harbour 2nd 330/132 kV transformer has been advanced by 1 year.

In the Transmission Lines and Cables – Augmentation category, TransGrid is relying on a Design and Construct approach to deliver the three large projects that dominate the forecast program. This approach is not without risk as TransGrid has not delivered large projects of this type using Design and Construct techniques. However, TransGrid has successfully implemented Design and Construct for large substation projects and the approach should not be significantly different for Transmission Lines and Cables. The Design and Construct approach also relies on contractors having sufficient skilled resources to deliver these large projects. TransGrid cannot be totally confident that contractors will have the level of resources available to deliver these projects however the projects are very large and are likely to be highly attractive to contractors. It is therefore likely that contractors will be able to provide the resources necessary to deliver the large projects (even though this may have an effect on the contractors' ability to deliver projects for other customers). We therefore consider that TransGrid will be able to leverage off its previous experience in this area and successfully extend the Design and Construct approach to the large projects planned for the forecast regulatory control period.

Most of the expenditure in the Land & Easements category, which is also forecast to have a significant increase in the next regulatory control period, relates to the purchase of land or payments to landowners for easements over their land. While some effort is involved in planning this expenditure and negotiating payments, the proportion of the expenditure that involves labour or procurement of materials and equipment is very low. PB does not consider that the size of the planned expenditure on Land & Easements will be a constraint in delivery of the capital program.

In general, TransGrid has implemented a number of successful strategies such as the recruitment of additional staff, the establishment of new business units, the use of external design resources and long-term procurement contracts to increase its capacity to deliver the capital program. PB considers that the strategies implemented are appropriate to the capital program and TransGrid can demonstrate some success with a number of the strategies. Further, TransGrid has, through the establishment of the Capital Program Delivery business unit and through the Capital Works Program Steering Committee ensured that the delivery of the capital program has a high profile within the organisation.

TransGrid has successfully recruited additional staff and has been successful in identifying contractors to supplement internal resources. However, TransGrid has not demonstrated that a detailed skills analysis has been performed and matched against the proposed capital program. PB considers that this might improve confidence that the capital program will not be constrained by skills in any key area.

Overall, PB considers that TransGrid has demonstrated a high probability of delivering the capital works program in 2008/09 and, as the program for the next regulatory period is of a similar size, should be able to deliver the planned program across the five years to 2013/14. While there are some areas, such as a detailed skills analysis that might improve confidence in TransGrid's capacity to deliver the proposed capital program, we consider that TransGrid has adopted a number of appropriate strategies that will contribute to the successful delivery of a capital program of the size proposed.

As an observation, and notwithstanding the highly unlikely situation, PB notes that should any of the contingent project triggers be realised and require significant additional capital investment, TransGrid may not be in a position to deliver. While PB is of the view that the likelihood of a contingent project being triggered is quite small, and as there is range of capital investment associated with the various proposed contingent projects, we are of the view that the AER should revisit the issue of deliverability should a contingent project be triggered.

5.8 PB RECOMMENDATIONS AND CONCLUSIONS – FORECAST CAPEX

PB has undertaken a detailed review of nine network projects selected from TransGrid's proposed capital works program for the 2009/10-2013/14 regulatory period, as well as TransGrid's replacement programs. This review has been used, in conjunction with assessments of TransGrid processes, plus national comparative benchmarking analysis to inform PB's view on the prudence and efficiency of TransGrid's ex-ante capex proposal.

In total, through the detailed project review, PB has examined $908.7m of projects included in TransGrid's proposed total network capex of $2.47b, or approximately 32.2% of the planned network expenditure on a scenario weighted average basis. As a result of this review, PB recommends a net downward adjustment of $128.6m (4.9%) of the ex-ante capex allowance. This is based on the findings of our review of the revenue proposal and its attachment, and the supporting information delivered by TransGrid. These adjustments are summarised in Table 5-44.

Table 5-44 – Summary of PB's recommended adjustments to forecast capex allowance

Expenditure $m (real 2007/08)	Ref.	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Bannaby - South Creek 500 kV lines and substation	5.4.3	-	-	-	-	-	-
Holroyd - Chullora 330 kV cable	5.4.4	-	-	-	-	-	-
Dumaresq - Lismore 330 kV line	5.4.5	(1.2)	(17.6)	(17.6)	-	-	(36.4)
SW NSW microwave & satellite	5.4.6	-	-	-	-	-	-
Wallerawang No.1 &No.2 transformer	5.4.7	(0.3)	-	-	-	-	(0.3)
Cooma 132 kV substation replacement	5.4.8	4.8	4.8	3.8	(6.5)	(25.2)	(18.2)
Beaconsfield West 132 kV GIS replacement	5.4.9	(0.4)	(1.2)	(1.8)	(4.7)	-	(8.1)
Newcastle 330 kV substation transformer replacement	5.4.10	-	-	-	(10.5)	-	(10.5)
Hunter Valley - Central Coast 500 kV line easements	5.4.11	-	-	-	(0.1)	(0.9)	(1.0)
Replacement programs	5.4.12	(0.8)	(2.0)	(1.0)	(0.9)	(0.9)	(5.6)
Escalation adjustments (factors)	5.3.1	(0.4)	(1.6)	(3.3)	(2.6)	(1.3)	(9.4)
Yearly weightings	5.3.2	1.1	1.9	(4.2)	(2.3)	(0.1)	(3.6)
Agreed CAM adjustments	5.4.1	(2.0)	(1.8)	(2.9)	(2.0)	(1.2)	(9.9)
Risk allowance adjustments	5.3.4	(2.4)	(2.2)	(3.4)	(2.4)	(1.4)	(11.7)
Cost estimating factors adjustment	3.5.3	(2.8)	(2.6)	(4.0)	(2.8)	(1.7)	(13.9)
PB total adjustment		(4.4)	(22.3)	(34.3)	(34.8)	(32.6)	(128.6)
TransGrid submitted total ex-ante capex		536.8	495.9	748.0	523.8	322.3	2,626.8
PB total adjustment - %		(0.8%)	(4.5%)	(4.6%)	(6.7%)	(10.1%)	(4.9%)

Source: PB analysis.

In undertaking our review of TransGrid's ex-ante capex proposal, PB's methodology has relied upon a number of investigative approaches that assist to inform the overall prudency and efficiency of the forecast capex allowance. These areas of investigation include:

- the businesses internal governance and capex approval processes
- the businesses augmentation planning and asset management processes, and how this is co-ordinated with other partiers and major stakeholders
- comparisons of high-level streams of expenditure against similar national businesses, including non-network capex
- cost estimating processes and benchmarking of unit costs
- a historical review of the businesses capex investment
- a detailed review of the methodologies, cost accumulation model and outcomes associated with the forecast capex allowance
- a detailed bottom-up project review, (including need, alternatives, timing, strategic alignment, scope efficiency and cost efficiency)
- a review of the deliverability of the allowance and contingent projects proposed
- a historical and forecast review of the businesses opex, in particular controllable opex and forecast methodology adopted
- the service standards proposed, as relating to plant availability, outages and loss of supply.

Further to the specific recommendations included as part of Table 5-47, PB has not substantiated any adjustments to TransGrid's forecast capex allowance based on the insights it has gained from its wider review, which has included matters such as national benchmarking, historical capex, the deliverability of the allowance, the opex approach of the business, and the service standards proposed.

PB has formed the following opinions and views:

The ex-ante capex development process is sound

In PB's view, the methodology used by TransGrid in determining the ex-ante capex proposal is a systematic and appropriate process. This is discussed further in Section 5.1.

TransGrid's scenario planning and probabilistic methodology is robust and well supported

In PB's opinion, the scenario planning and probabilistic methodology used by TransGrid is sound, and represents a robust process that is well documented and evidenced. We are also of the view that the development of the scenario probabilities is well considered, with the final scenario probabilities being realistic. This is discussed further in Section 5.2.

TransGrid's proposed producers' margin escalator has not been reasonably determined

In PB's opinion, the escalation factors proposed by TransGrid for producer's margin escalation are not reasonable over the period 2010 and 2011 on the basis that they are based on a single company forecast that may not be representative of the industry as a whole. PB has recommended that no real escalation or producers' margin is applied beyond 2010, which results in a recommended reduction of $9.35m in the overall ex-ante capex proposal.

PB is of the opinion that the remainder of the material escalators are reasonable.

TransGrid's proposed steelwork escalation weightings unreasonably weight toward higher escalated components

In PB's opinion, the escalation weightings proposed for steelwork are unreasonably weighted towards higher escalating labour components. PB has recommended weighting adjustments to correct the disparity which TransGrid considers to be reasonable. This results in an agreed reduction of $0.75m in the overall ex-ante capex proposal.

The 5 year aggregate weighting of escalator components is unreasonable

In PB's opinion, the application on the basis of the aggregate weighting by component across the 5 year capital works program does not account for variation in the annual weightings applied to each component of the capital works program arising from variation in the project work being undertaken from year to year. PB has recommended that the $3.6m variance identified in TransGrid's analysis of this issue is subtracted from the total ex-ante capex allowance.

TransGrid's proposed s-curves are reasonable

In PB's opinion the process used to derive the s-curves is based on judgement and experience rather than TransGrid's historical experience, and on this basis the process is not considered to be transparent. In addition we are of the view that the output is highly sensitive to changes in the input parameters derived from individual opinion. However, PB has examined the s-curves used to calculate the timing of the expenditure over the regulatory period and we are of the view that they are generally conservative when compared to TransGrid's historical experience. The s-curves proposed by TransGrid were found to generally distribute expenditure later into a project when compared to historical experience and other TNSP's. On this basis PB does not recommend any specific changes to the s-curves proposed by TransGrid.

TransGrid's application of non-standard DCF, NCF and AWF factors in its capital expenditure estimating process is considered to be unreasonable

PB is of the opinion that the discretionary application of unjustified non-standard factors in the TransGrid capex estimating process undermines the derivation of the standard factors by TransGrid. On this basis, the use of non-standard factors is considered to be unreasonable.

As the basis of the non-standard factors, their allocation, and their apparent arbitrary scaling is discretionary, and given their significant dollar value within the project cost estimate, PB is of the view that the DCF, NCF, and AWF factors should be fully justified and transparently applied. PB is also of the view that, unjustified discretionary adjustments to the standard factors are likely to be a systemic issue throughout the TransGrid portfolio. PB has recommended that the adjustments associated with the findings of its detailed project reviews be applied across the remainder of the capital projects. These adjustments result in a reduction of $13.9m in the total ex-ante capex.

The application of a risk allowance is appropriate, but overstated

In PB's opinion there are risks faced by TransGrid in the variation from estimated project costs, and these variations are likely to be asymmetric in nature. Furthermore we are of the view that where the risk of cost variation can not be reasonably managed by TransGrid, then this risk should be equitably shared between TransGrid and its customers. Hence PB supports the application of a risk based approach in the determination of the ex-ante capex allowance.

PB is of the opinion that the estimation of cost variance includes cost variations that are captured through other allowances, resulting in the double counting of these variations. Therefore we recommend a reduction of $11.7m in the proposed risk allowance.

TransGrid's options analysis is limited and simplistic

PB is of the view that TransGrid's options analysis is overly simplistic, and somewhat limited. We believe that TransGrid fails to include all relevant information into the options analysis, and sensitivity analysis is not used to inform the options choice. Furthermore, in our opinion, TransGrid does not rely on the results of the options analysis, but rather tends to rely on qualitative arguments to dismiss the findings of the economic options analysis to justify the preferred option. On this basis, PB has recommend reductions in the proposed capex for the Cooma 132 kV Substation Replacement projects

TransGrid has only defined a number of its contingent project triggers in a specific manner that can be objectively verified

PB determined that 9 of the 18 projects identified as contingent project by TransGrid did not meet the terms of the NER. PB identified a common theme throughout the projects, in that the trigger event was rather generalised and not sufficiently or specifically defined outside the bounds of the scenario analysis adopted by TransGrid as part of its determination of the forecast ex-ante capex allowance.

TransGrid has a high probability of being able to deliver its forecast capex program

TransGrid has implemented a number of strategies to improve deliverability of the capital program. PB considers that TransGrid has a high probability of delivering the program in 2008/09 and, as the program for the next regulatory period is of a similar size, should be able to deliver the planned program across the five years to 2013/14. While there are some areas, such as a detailed skills analysis that might improve confidence in TransGrid's capacity to deliver the proposed capital program, we consider that TransGrid has adopted a number of appropriate strategies that will contribute to the successful delivery of a capital program of the size proposed.

As an observation, and notwithstanding the highly unlikely situation, PB notes that should any of the contingent project triggers be realised and require significant additional capital investment, TransGrid may not be in a position to deliver. While PB is of the view that the likelihood of a contingent project being triggered is quite small, and as there is range of capital investment associated with the various proposed contingent projects, we are of the view that the AER should revisit the issue of deliverability should a contingent project be triggered.

6. NON-NETWORK CAPEX

TransGrid's non-network capital expenditure forecast provides for investment costs to be incurred in addressing the needs of the business not directly related to the development and augmentation of the electricity transmission network. An example of capex that falls within this category is the cost of vehicles, building facilities, computers and other IT equipment.

This section of the report will examine the historical non-network capex that TransGrid has requested to be included into the Regulatory Asset Base (RAB) for the period up until 30 June 2009 — its historical expenditure. It also reviews the forecast expenditure that TransGrid has identified in its revenue proposal and provides an independent view on the reasonableness of this forecast. Both the ex-post and ex-ante expenditure proposals form a part of the TransGrid Electricity Transmission Revenue Proposal.

6.1 OVERVIEW

As part of our review, PB has examined the non-network capex over the ten year period 01 July 2004 to 30 June 2014. This assessment has included a high-level review of the business drivers supporting the forecast; comparative (benchmark) assessments of the expenditure proposed by TransGrid with that of other transmission network service providers in Australia; and a detailed bottom-up project review of two main areas, IT and vehicles. In particular, the detailed reviews have enabled PB to understand the implications of non-network cost drivers, and informed the review of how TransGrid applies its policies and procedures.

6.1.1 Expenditure summary

TransGrid has proposed a total of $133.3m (real 2008)[149] to be rolled-into the opening RAB on 01 July 2009 to account for its historical non-network expenditure between 01 July 2004 and 30 June 2009.

TransGrid has also forecast its non-network capex for the period 01 July 2009 to 30 June 2014 is expected to be $156.3m ('as incurred', real 2008)[150].

TransGrid's non-network capital expenditure comprises two major categories:

- Information Technology (IT) — this includes expenditure on IT-related items that are not directly related to the development, or augmentation, of the transmission network
- Support the Business — this provides for expenditure required for TransGrid to undertake business activities to support the development of its transmission network.

Table 6-1 shows the categorised historical non-network capex that TransGrid has incurred up to the end of the current regulatory period.

149 TransGrid Templates — AER schedules (for AER).xls; worksheet — historic capex — non-network — Table 3.1.

150 ibid; worksheet — forecast capex — non-network Table 4.1.

Table 6-1 – Historical non-network capex (1 July 2004 to 30 June 2009)

Expenditure $m (real 2008)	04/05	05/06	06/07	07/08[1]	08/09[1]	Total
Business IT	11.67	14.92	10.17	13.12	14.27	64.15
Support the Business	11.56	4.70	19.91	16.99	15.99	69.15
Total	23.23	19.62	30.08.0	30.11	30.26	133.3

Note 1 – these are forecasts

Source: Template – AER schedules (for AER).xls, Table 3.1.

Table 6-2 shows the categorised forecast non-network capital expenditure forecast by TransGrid over the 2009/10 to 2013/14 regulatory period.

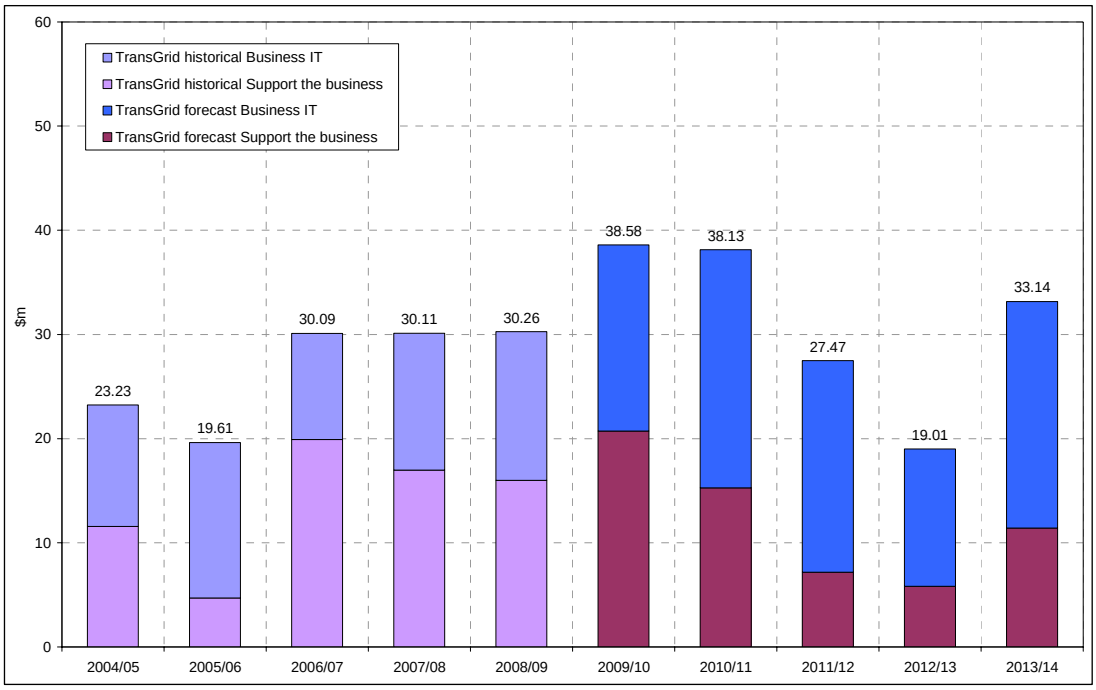
Table 6-2 – Forecast non-network capex (1 July 2009 to 30 June 2014)

Expenditure $m (real 2008)	09/10	10/11	11/12	12/13	13/14	Total
Business IT	17.86	22.85	20.29	13.19	21.72	95.91
Support the Business	20.72	15.27	7.18	5.82	11.42	60.41
Total	38.58	38.12	27.47	19.01	33.14	156.32

Source: Template – AER schedules (for AER).xls, Table 4.1.

Figure 6-1 shows the ten year categorised trend of non-network capex proposed by TransGrid.

Figure 6-1 – Historical and forecast non-network capex proposals ($ real 2008)



Source: Template – AER schedules (for AER).xls

The key observations from Figure 6-1 include:

- a steady increase on non-network capex from a yearly average in this regulatory period of approximately $27m to $31m in the next regulatory period. This is driven by an increase in the IT component of non-network
- support the business costs increase at the beginning of the next regulatory period and dropping off towards the end.

6.1.2 Support the business capex

The expenditure on the Support the Business category is a comprised of three sub-categories, including:

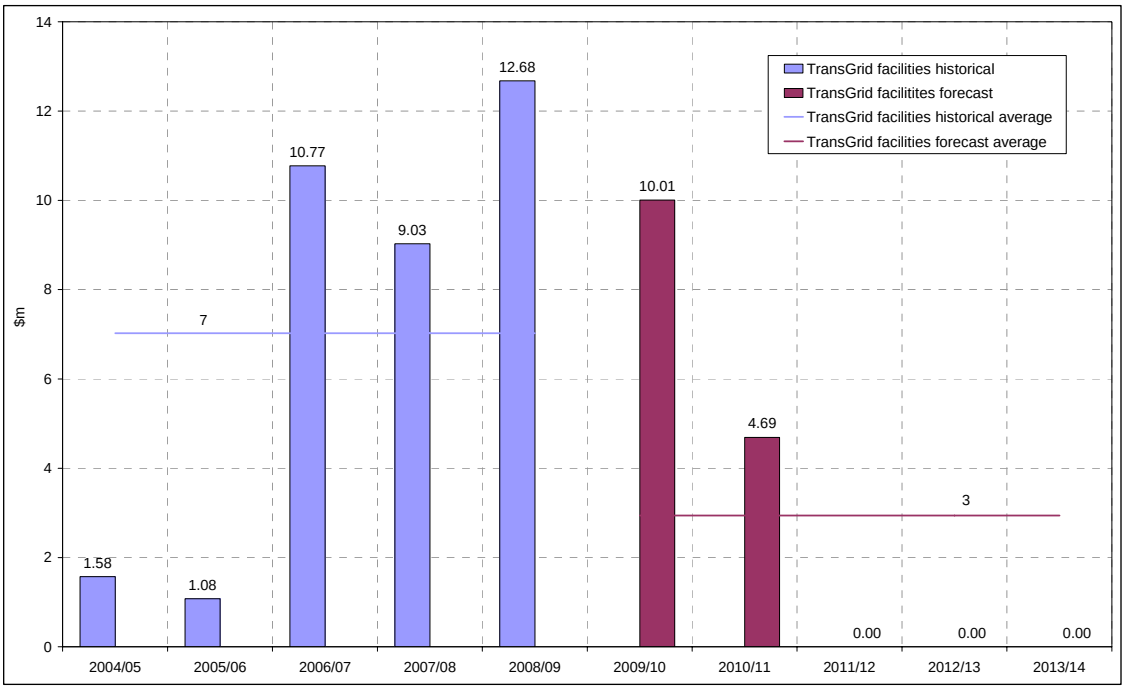
- facilities
- motor vehicles
- other.

Each of these sub-categories is discussed below.

Facilities

TransGrid owns and operates various premises throughout New South Wales. These premises include a large number of operational substations and also a number of offices and operational sites. As these premises are owned and operated by TransGrid, there is a requirement for maintenance to be carried out. Figure 6-2 displays the historical and forecast expenditure proposed by TransGrid for facilities.

Figure 6-2 – Historical and forecast expenditure for 'facilities' ($m real 2008)



Source: Template – AER schedules (for AER).xls.

From the current regulatory period (2004/05 to 2008/09) to the next regulatory period (2009/10 to 2013/14) TransGrid estimates that its average yearly expenditure on premises will reduce by approximately 59% from $7.0m to $2.9m, real 2008, with no expenditure on facilities from 2011 to 2014.

The major cost components in the 2007 to 2010 period are shown in Table 6-3.

Table 6-3 – Major cost component of the facilities expenditure ($m real 2008)

Location	Cost ($m)
NRC	12.19
Metropolitan	10.56
Orange	5.50
Tamworth	3.07
Newcastle	2.89
Yass	2.86
Wagga	0.40
Total	**37.47**

Source: Template – AER schedules (for AER).xls; facilities 2009-2014.xls; regional depots budget and variance summary.xls.

TransGrid has noted that there has been a variance in the original costs than that has been incurred, or is going to be incurred, on facilitates that are currently being refurbished. The variance in cost has been recognised as mainly due to a change in scope of the project. The driver of the change is shown in Table 6-4.

Table 6-4: Facilities forecast project costs and actual project costs ($m real 2008)

Location	Forecast cost	Actual cost	Variance	Reason
Metropolitan	5.74	10.56	4.82	Additional staff
Orange	3.34	5.50	2.16	Scope change
Yass	1.21	2.86	1.65	Scope change
Total	**10.29**	**18.92**	**8.63**	

Source: Regional depots budget and variance summary.xls.

TransGrid has identified the scope change was a change initiated by TransGrid due to a change in the requirements at the sites. This has predominately been driven by staffing needs.

The lack of facilitates investment in the latter part of the forecast period appears unusual, PB would expect there to be some expenditure through the whole period.

Vehicles

In order to undertake its required operation and maintenance of the NSW transmission system, TransGrid project and field staff are required to travel widely, and to geographically diverse sites. In order to carry out this work effectively TransGrid procures suitable, and often specialist vehicles.

Towards the end of the current regulatory period, TransGrid has a total of 943 vehicles and trailers listed in their ownership. In 2006 TransGrid introduced a new policy that allows for all business use vehicles to be replaced on a whole of life cost analysis rather than a set age or mileage. The exception to this rule is Senior Contract Officer vehicles, as they are still

replaced on either a 2 year cycle or 40,000 km event, dependent on which occurs first. Table 6-5 shows a breakdown of the current vehicles owned by TransGrid

Table 6-5 – Number of vehicles owned by TransGrid (as of 27 Nov 2007)

Vehicle type	Number
Business / private use vehicle	57
Business use vehicle	442
Mobile plant	83
Trucks	250
Trailers	111
Total	943

Source: TransGrid spreadsheet – AER capex 27-11-07 KC present.xls.

The allocation of vehicles within TransGrid is controlled by a procedure named 'Control of Motor Vehicles and Mobile Plant'[151], and it describes the way in which motor vehicles and mobile plant are controlled from acquisition through to disposal.

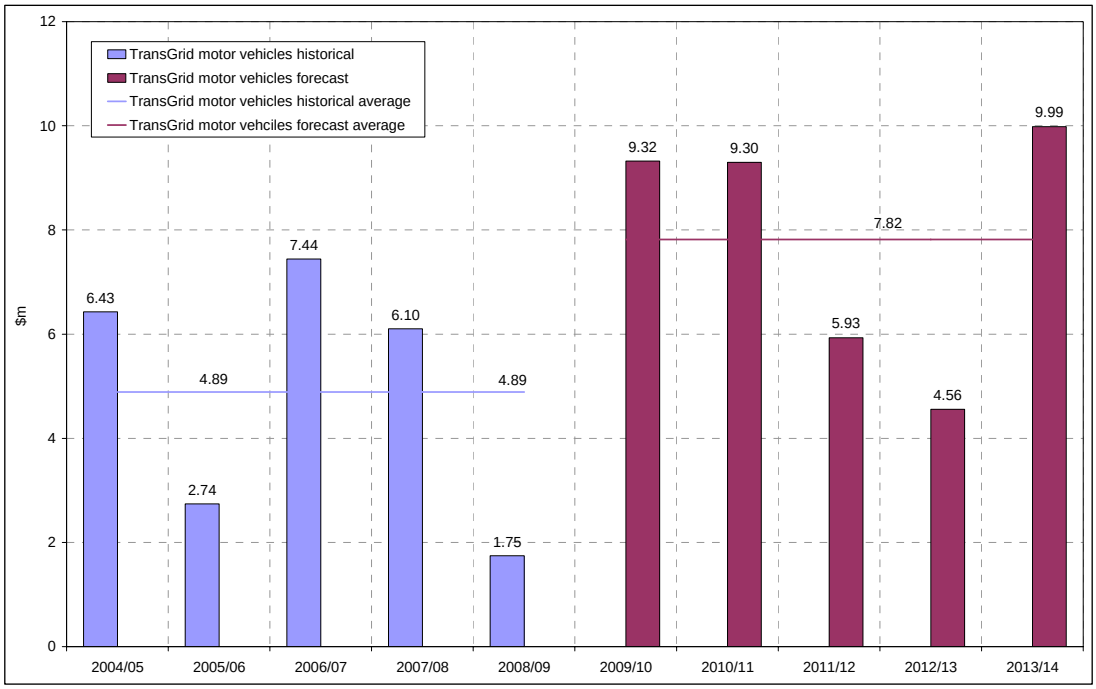
As stated in the TransGrid policy, the provision and selection of all motor vehicles is based on meeting business requirements, and the following five criteria are assessed when determining the types of vehicles procured:

- suitability
- safety
- environment
- economics
- standardisation.

Figure 6-3 shows the expenditure that TransGrid has incurred on motor vehicles in the current regulatory period, together with the forecast of expenditure in the next regulatory period.

151 Control of motor vehicles and mobile plant; document reference GD TR G2 001.

Figure 6-3 – Historical and forecast expenditure for motor vehicles ($m real 2008)



Source: Template – AER schedules (for AER).xls.

From the current regulatory period (2004/05 to 2008/09) to the next regulatory period (2009/10 to 2014/15) TransGrid estimates that its average yearly expenditure on vehicles will increase by approximately 59% from $4.9m to $7.8m, real 2008. Motor vehicles are reviewed in detail in Section 6.3.3 of this report.

Other

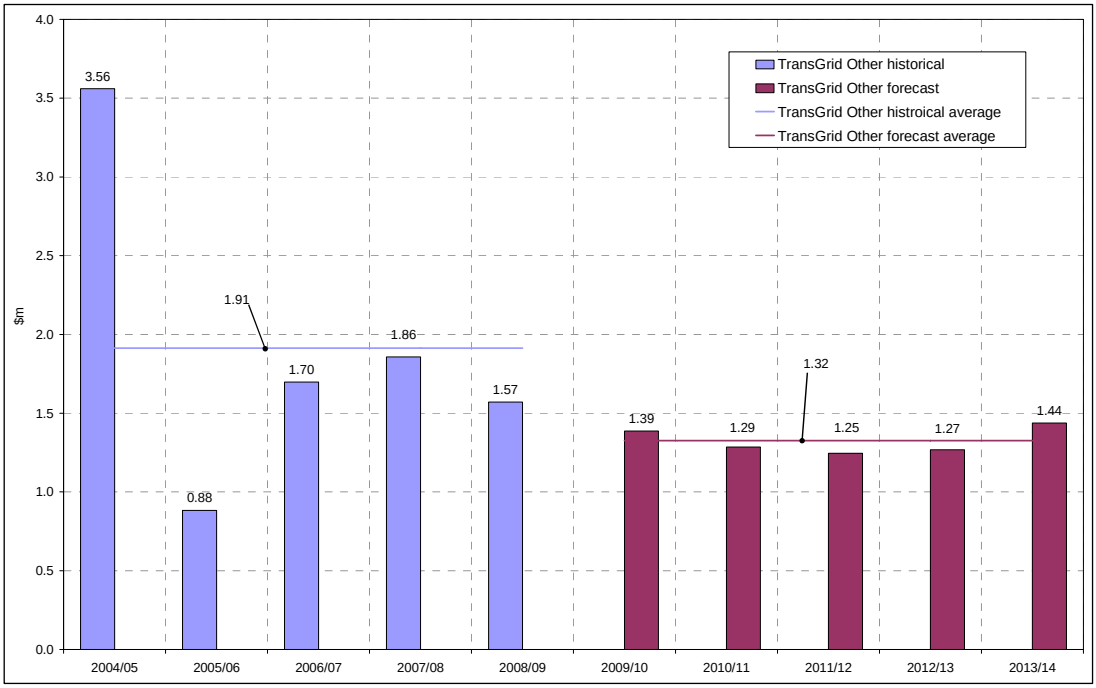
As part of its ongoing operation, TransGrid procures a number of one-off items which are grouped under a single category labelled as 'Other'. This expenditure category includes, amongst other things, the following items:

- office machines
- health and safety equipment
- miscellaneous plant

Figure 6-4 shows the expenditure on 'Other' items over the current regulatory period and also the expenditure forecast for the next regulatory period. Period averages are also provided.

There is no common driver for expenditures under the 'Other' section. Each item that is procured and allocated to this category uses the internal approval process to justify the procurement.

Figure 6-4 – Historical and forecast expenditure in the 'Other' category ($m real 2008)



Source: Template – AER schedules (for AER).xls.

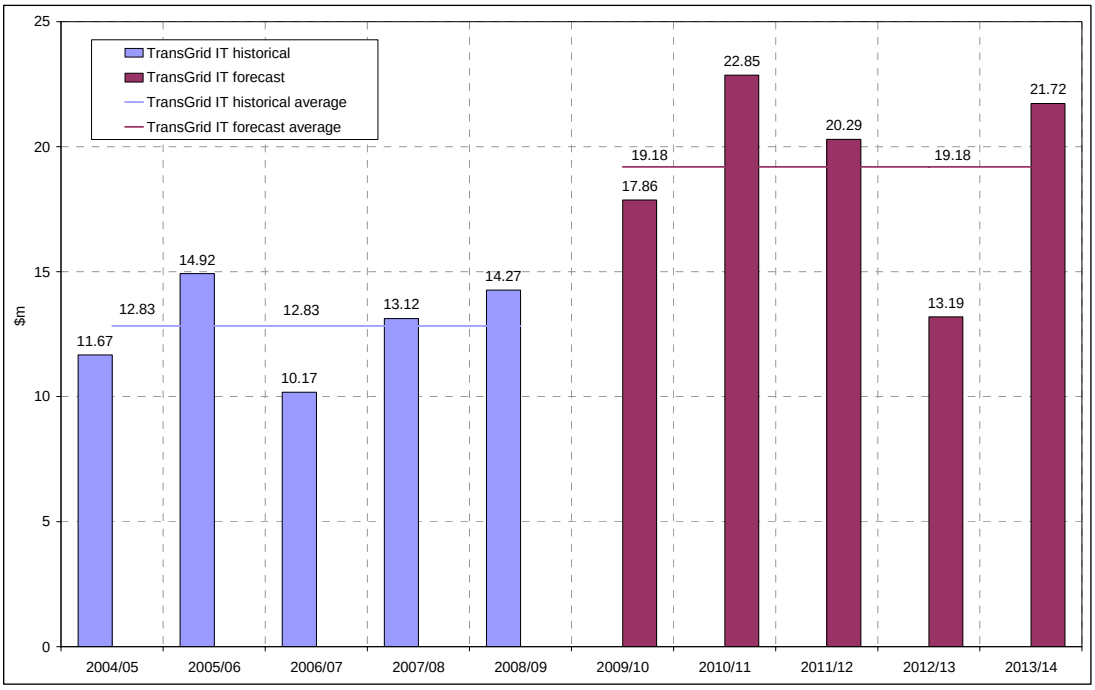
From the current regulatory period (2004/05 to 2008/09) to the next regulatory period (2009/10 to 2014/15) TransGrid estimates that its average yearly expenditure on 'Other' will decrease by approximately 32% from $1.9m to $1.3m, real 2008.

PB notes that the 2004/05 year has a significant affect on the current regulatory period average and when the 2004/05 year is excluded, the average yearly expenditure from 2005/06 to 2008/09 is $1.5m. This is a decrease of 12%, and in PB's view shows a reasonable ongoing cost.

6.1.3 Information technology

Like other infrastructure businesses, TransGrid as an electricity transmission network owner and operator is critically dependent on Information Technology (IT) for its general business operation. Figure 6-5 shows the historical and forecast expenditure that TransGrid has requested in its proposal.

Figure 6-5 – Historical and forecast expenditure for IT ($m real 2007/08)



Source: Template – AER schedules (for AER).xls.

From the current regulatory period (2004/05 to 2008/09) to the next regulatory period (2009/10 to 2014/15) TransGrid estimates that its average yearly expenditure on IT will increase by approximately 50% from $12.8m to $19.2m. For further comments on IT, reference should be made to Section 6.3.2 for PB's detailed review.

6.2 COMPARATIVE BENCHMARKING

PB has compared the forecast non-network capex proposed by TransGrid with other Australian electricity transmission network businesses.

6.2.1 Background

In order to develop an independent view on the prudence of TransGrid's historical and proposed non-network expenditure, PB has benchmarked the TransGrid proposal against other transmission businesses in Australia. Our analysis has been undertaken using publicly available information for five other transmission businesses, including:

- Powerlink in Queensland[152] decision 2007
- Transend in Tasmania[153] proposed 2008
- ElectraNet SA in South Australia[154] decision 2008
- SP AusNet[155]/VENCorp[156] in Victoria. decision 2007.

152 Powerlink annual report 2006/07.

153 Transend annual report 2007.

154 ElectraNet SA annual report 2007.

155 SP AusNet statutory annual report 2008.

156 VENCorp annual report 2006/07.

Data sources, information and the limitations recognised with this sort of assessment can be found in section 3.2.

6.2.2 PB analysis

PB has benchmarked TransGrid's total non-network capex and each of the sub-categories — 'Support the Business' and IT.

In order to capture the Victorian TNSP arrangements, we have included a benchmark based on TransGrid and VENCorp combined to represent the regional role to more appropriately compare it to TransGrid in New South Wales. The Australian transmission businesses identified above have all been subject to regulatory price reviews in the last 5 years. The results of which have been published[157].

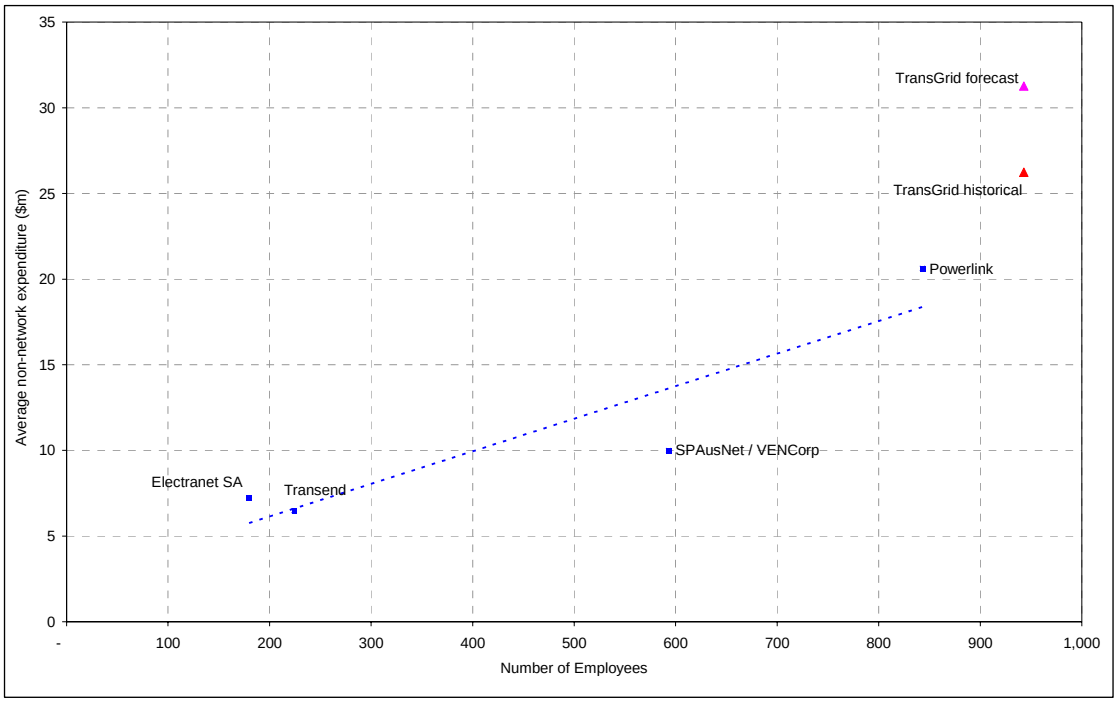
PB has extracted and reviewed the regulatory determinations for the businesses and to ensure a common baseline for reference, all non-network capex has been adjusted to 2007/08 equivalent dollars and annual average figures have been used. PB considers this approach facilitates more meaningful comparisons as it better reflects long-term trends in business expenditure. The TransGrid data has also been averaged over the review period in question.

To aid in our benchmarking analysis, we have extracted and compared data using company employee numbers available in relevant annual reports.

6.2.3 Overall non-network

Figure 6-6 represents the annual expenditure on non-network capex as identified in various regulatory decisions and using the total number of employees in each transmission business.

Figure 6-6 – Non-network capex as a function of employee numbers ($m real 2007/08)



Source: PB analysis; regulatory decisions.

Figure 6-6 shows that TransGrid has been expending an average of approximately $28,000 per employee per year on non-network capex in the current regulatory period. This will

157 AER website.

increase to approximately $33,000 in the next regulatory period. As the expenditure on Support the Business is the dominant cost in non-network, this implies that 'number of employees' is a more appropriate reflection of the cost driver rather than 'size of the network' or the serviced area of the business.

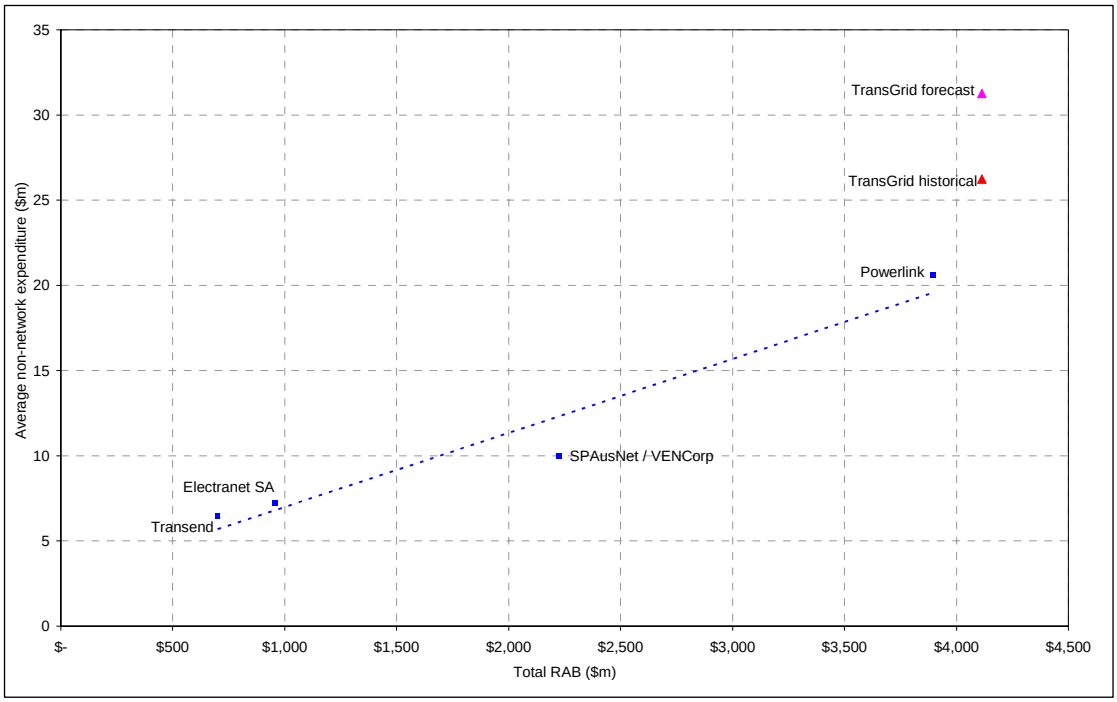
From the information attained via the regulatory decisions, the average for the transmission industry is approximately $24,000 per employee. In the current regulatory period TransGrid are slightly higher than the industry average, but this will drop in the next regulatory period to below the industry average.

PB also compared the non-network expenditure against three established transmission industry quantities:

- size (value) of the regulatory asset base at the last review
- forecast opex
- forecast capex.

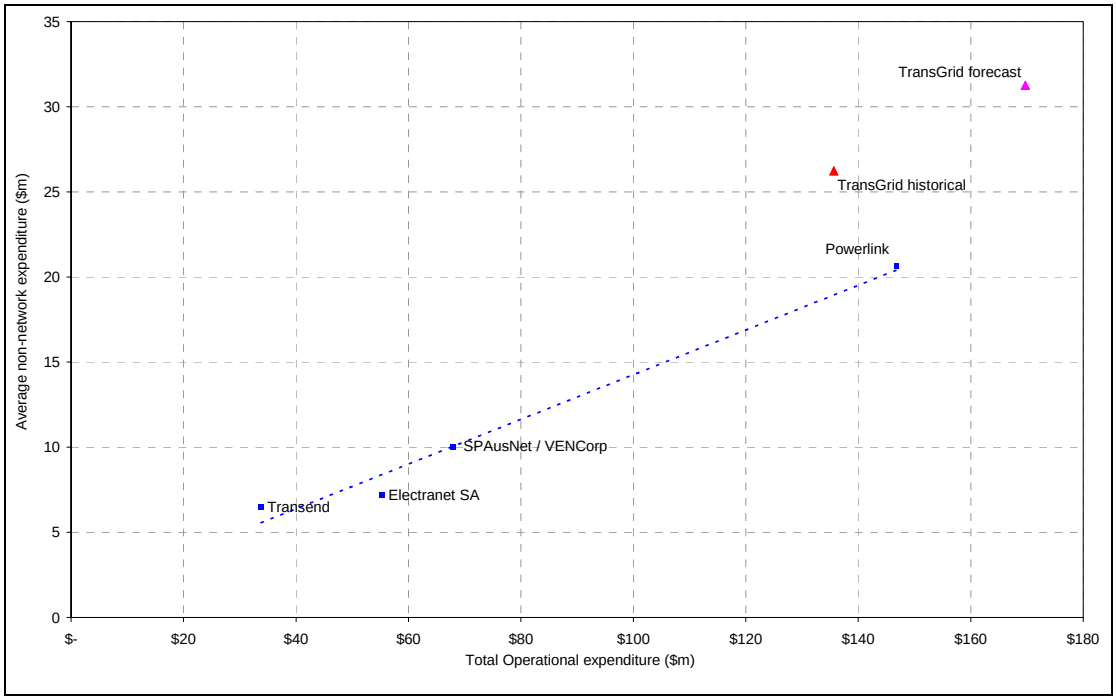
The results are shown in Figure 6-7, Figure 6-8 and Figure 6-9.

Figure 6-7 – Non-network capex as a function of RAB ($m real 2007/08)



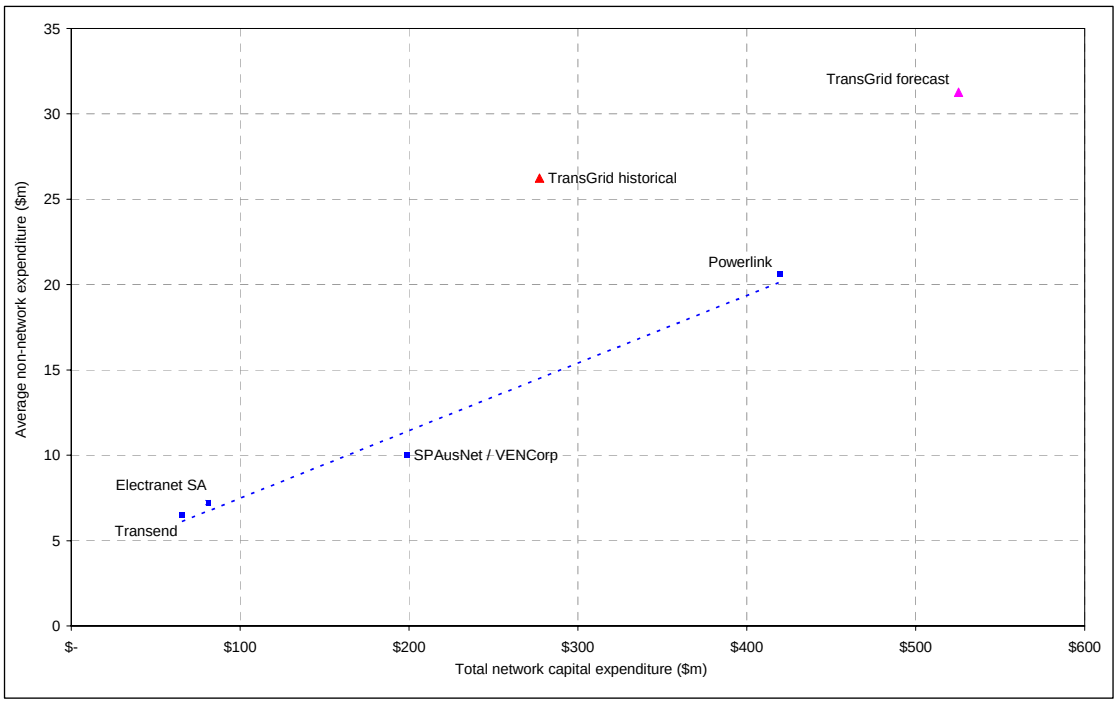
Source: PB analysis; regulatory decisions.

Figure 6-8 – Non-network capex as a function of opex ($m real 2007/08)



Source: PB analysis; regulatory decisions.

Figure 6-9 – Non-network capex as a function of total capex ($m real 2007/08)



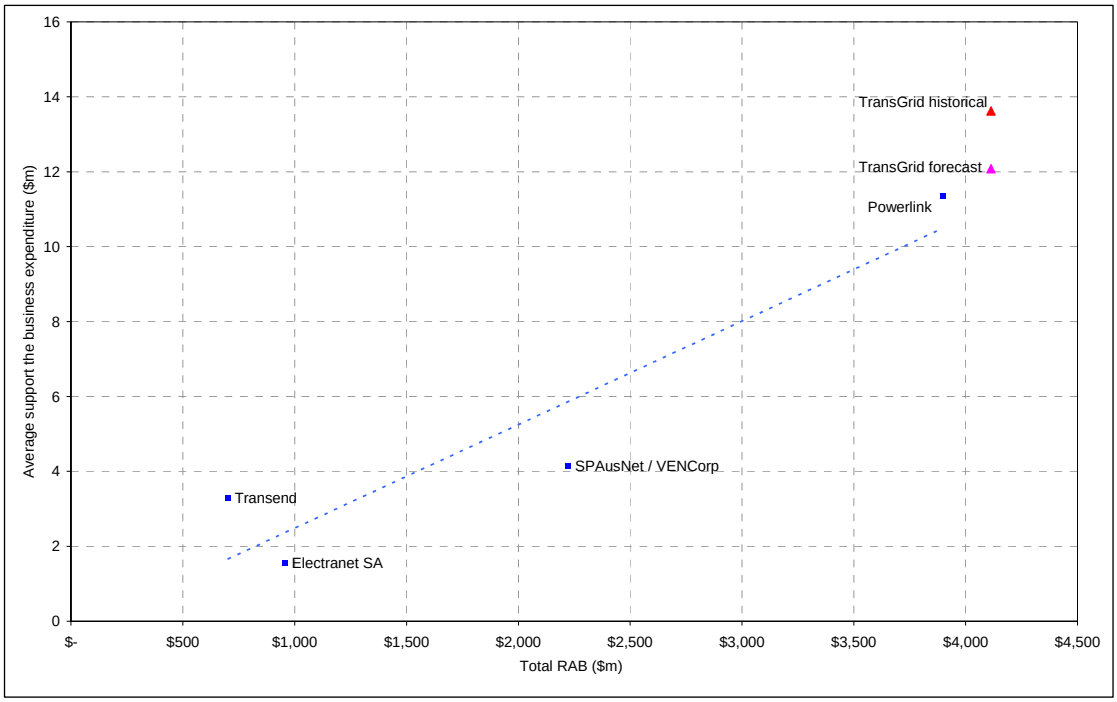
Source: PB analysis; regulatory decisions.

From Figure 6-7, Figure 6-8 and Figure 6-9 it can be seen that TransGrid will be above the industry average in the next regulatory period.

6.2.4 Support the business

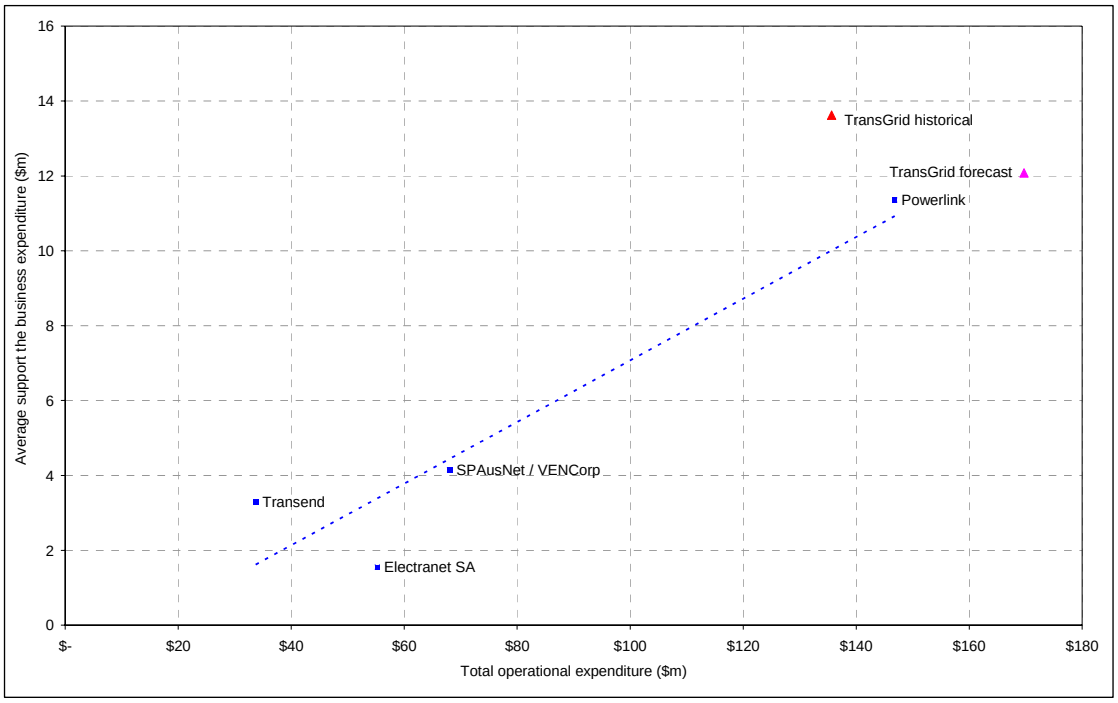
PB has examined the individual non-network categories as a function of the total RAB. We would expect that economies of scale would be captured for businesses that own or manage larger transmission networks (represented by the value of the businesses RAB). This efficiency would then be reflected in the number of staff needed to manage the network, and ultimately in the support to the staff (a function of non-network). PB's assessment is shown in Figure 6-10, Figure 6-11 and Figure 6-12.

Figure 6-10 – Support the business capex as a function of the RAB ($m 2007/08)



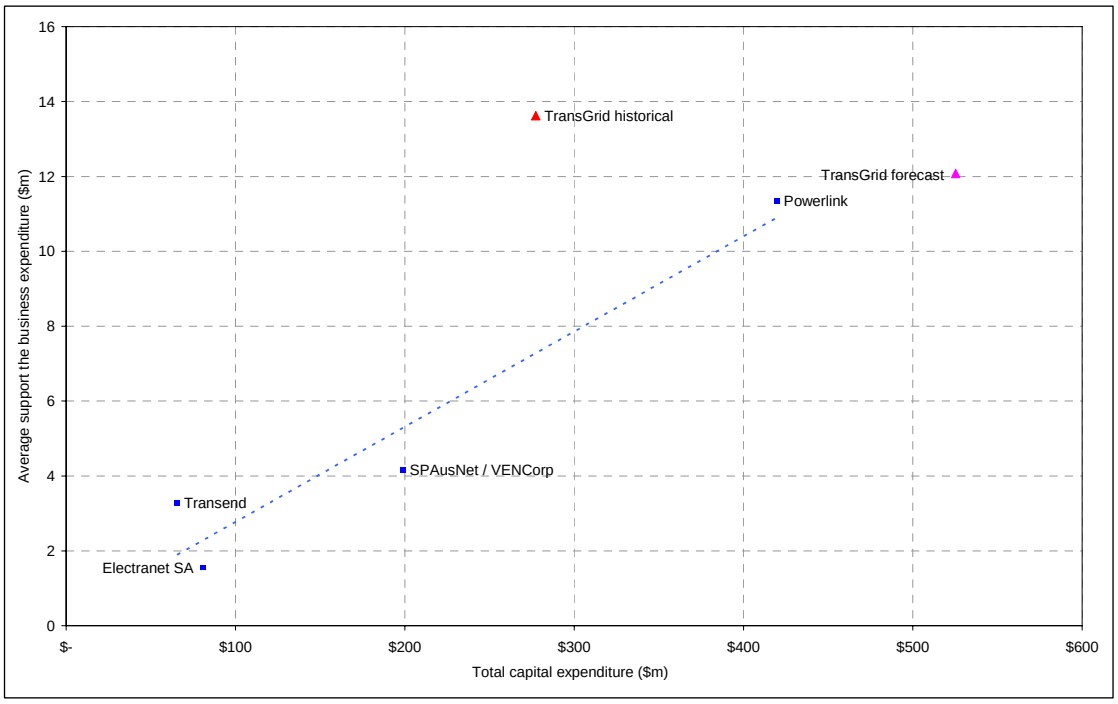
Source: PB analysis; SP AusNet Revenue proposal.

Figure 6-11 – Support the business capex as a function of opex ($m 2007/08)



Source: PB analysis; SP AusNet Revenue proposal.

Figure 6-12 – Support the business capex as a function of capex ($m 2007/08)



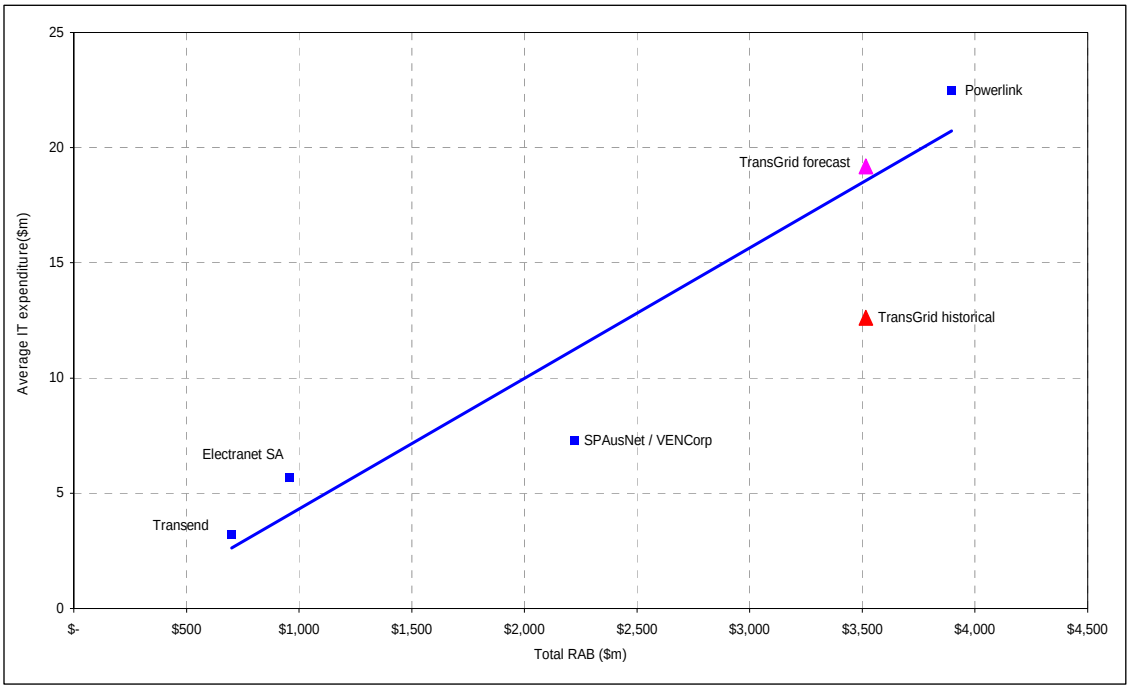
Source: PB analysis; SP AusNet Revenue proposal.

From this analysis, historically, TransGrid has been expending comparatively more than similar businesses on Support the Business. In examining the forecast expenditure on support the business, TransGrid are planning to expend similar to other businesses.

6.2.5 Information technology (IT)

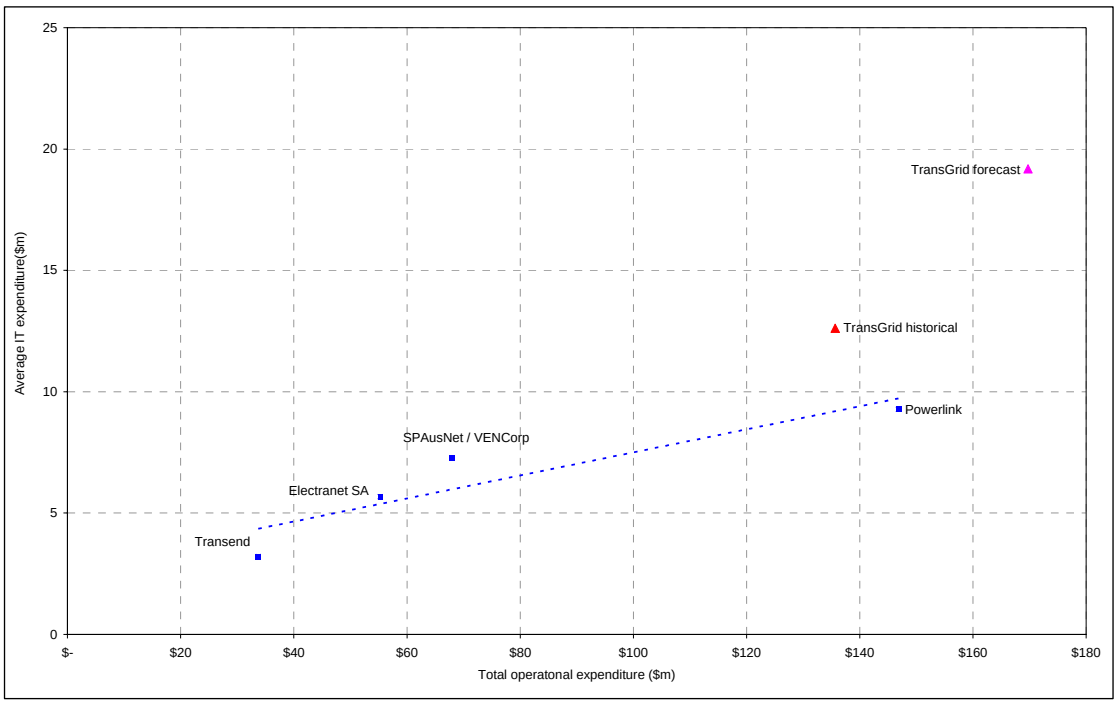
PB has examined the individual IT category as a function of the total RAB. We would expect that economies of scale would be captured for businesses that own or manage larger transmission networks (a function of the RAB). This efficiency would then be reflected in the number of staff needed to manage the network, and ultimately in the support to the staff (a function of non-network). This is shown in Figure 6-13, Figure 6-14 and Figure 6-15.

Figure 6-13 – IT capex as a function of the RAB ($m 2007/08)



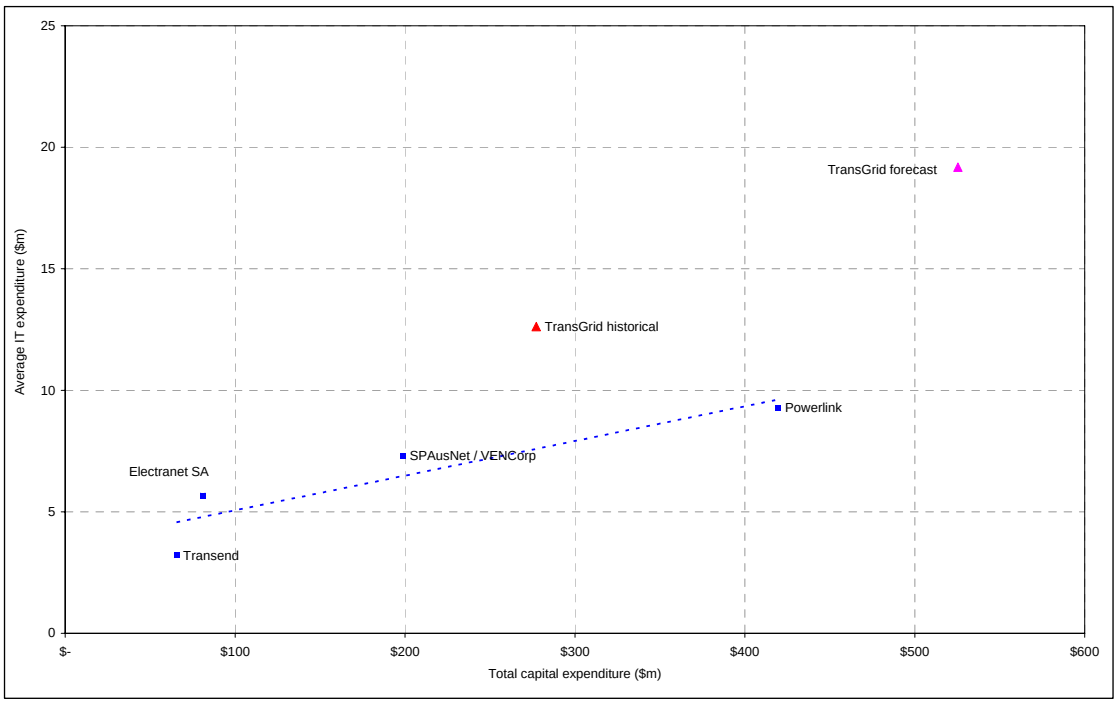
Source: PB analysis; SP AusNet Revenue proposal.

Figure 6-14 – IT capex as a function of opex ($m 2007/08)



Source: PB analysis; SP AusNet Revenue proposal.

Figure 6-15 – IT capex as a function of capex ($m 2007/08)



Source: PB analysis; SP AusNet Revenue proposal.

TransGrid's historical expenditure is above similar businesses on IT and PB concludes that the comparative forecast expenditure of the business is higher than the trend.

6.3 DETAILED EXPENDITURE REVIEWS

As part of our assessment of non-network expenditure, PB has reviewed two areas of expenditure in detail. This review has focused on IT and vehicles.

6.3.1 Summary and selection

In selecting the areas of expenditure for detailed review, PB has considered a number of factors (such as materiality and timing), and in general these areas were chosen to provide as wide coverage as possible across the entire non-network expenditure program.

PB has examined the forecast expenditure associated with each specific item and has reviewed the proportion of the total allowance it comprises. The largest single expenditure in the non-network capital expenditure relates to Business IT. PB has therefore selected Business IT to review in detail. The second expenditure item, motor vehicles, was selected as it is the second largest proportion of expenditure made by TransGrid.

Table 6-6 shows the 5-year value of each of these expenditure items and the percentage of the non-network regulatory expenditure proposed that they represent.

Table 6-6 – Expenditure associated with the three items selected for detailed review

Expenditure $m (real 2007/08)	Forecast non-network expenditure	
	Value ($m)	% of total
Business IT	95.92	45.65
Vehicles	39.10	18.60

Source: TransGrid Proposal; PB analysis.

6.3.2 Business IT

Business IT is the largest expenditure category within the total non-network capex. TransGrid has proposed an allowance of $95.92m ($ real 2007/08) of expenditure over the next regulatory period. This accounts for 46% of the total proposed non-network capital expenditure.

Company policy

TransGrid has three documents that control IT and its related expenditure. The documents are:

- Technology Strategy 2008[158]
- IT Asset Management Plan[159]
- IT Management Framework[160].

Each of the documents is discussed in detail below.

158 TransGrid document reference Information Technology Strategy 2008; Version 1; dated 22/02/08.

159 TransGrid document reference IT Asset Management Plan; Draft; no revision; dated 21/01/08.

160 TransGrid document reference GD IS G2 021; IT Management Framework; Revision 2; dated 15/08/07.

Technology Strategy 2008

TransGrid has developed an Information Technology Strategy 2008 that covers a 5-year period (2009/10 to 2013/14) and identifies the large-scale Business IT expenditure it has been proposed, outlining the overall business strategy.

The purpose of the Technology Strategy 2008 is to articulate the information technology objectives that support the TransGrid corporate coals and associated business unit objectives.

TransGrid's Business IT Strategy comprises the following strategic initiatives for the 2008 period:

- leverage off ongoing enhancements
- integrate and augment capital projects information systems
- improve the flow of asset related information
- optimise the investment in, and delivery of IT infrastructure and services
- implement IT solutions that help TransGrid reduce its carbon footprint.

IT Asset Management Plan

The purpose of the IT Asset Management Plan is to establish the policy and overall plan for the management of IT assets with TransGrid. The scope of the plan is defined in the IT Management Framework [161].

The Asset Management Plan identifies the businesses philosophy, with key elements being:

- procurement of IT is primarily managed through standardised hardware lists
- IT assets are required to achieve a standard to meet reliability and availability requirements
- TransGrid balances the reliability and availability of IT with the cost to procure and support
- a useful life is established for all asset and replacement according to the timeframe established
- maintenance and support is expected to reflect the potential impact of device failure.

The IT Asset Management Plan sets out the specific strategies for IT equipment. For example, the cyclic replacement of IT asset classes is identified. A summary of TransGrid's policy on useful lives for IT assets is shown in Table 6-7.

[161] TransGrid document reference GD IS G2 021; IT Management Framework; Revision 2; dated 15/08/07.

Table 6-7 – Summary of IT assets useful lives

Asset class	Useful life	Australian Government Taxation Ruling
Corporate servers	4 years	4 years
Network equipment	5 years	not documented
Desktop computers	4 years	4 years
Laptops / personal digital assistants	3 years	3 years
Printers / multi-function devices	4 years	5 years
Corporate applications	5 years	not documented

Source: IT Asset Management Plan; table 1 – Summary of IT assets useful lives; Australian Government taxation ruling TR2000/18.

When comparing the asset lives of TransGrid's IT equipment, PB has referred to the asset lives as defined by the Australian Government under taxation ruling [162]. From this analysis PB is of the opinion that TransGrid's policy on replacement of assets is reasonable and appropriate.

Within the IT Asset Management Plan, each separate project is prepared, assessed and approved through a defined business case. Typically, business cases include the identification of alternative options (including a 'do nothing' option), followed by a cost–benefit analysis. Projects are then approved in accordance with the TransGrid business case approval process.

IT Management Framework

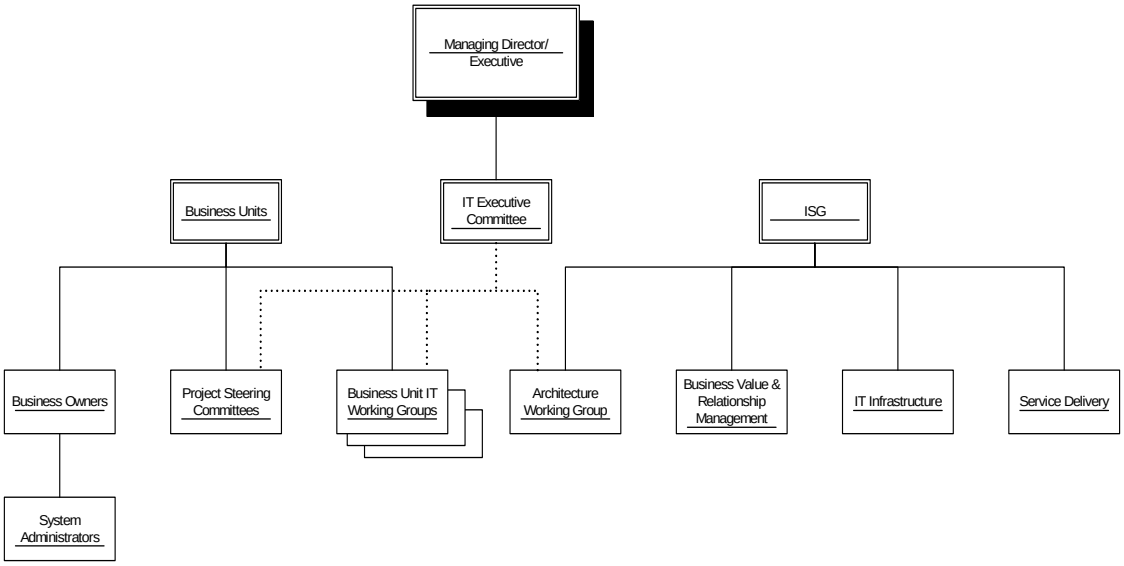
TransGrid produce an IT Management Framework[163], which describes the framework to manage (IT) within TransGrid. The framework describes the roles, responsibilities and mechanisms in place to effectively manage and deliver IT service to support TransGrid's business objectives.

The framework document depicts the roles and responsibilities under the IT management framework. The roles and responsibilities are shown below in Figure 6-16.

162 Australian Government; Australian Taxation Office; Taxation ruling TR 2000/18.

163 TransGrid – IT Management Framework; GD IS G2 021.

Figure 6-16 – Role and responsibilities for IT management in TransGrid



Source: TransGrid – IT Management Framework; GD IS G2 021.

The structure identified above is further supported with a list of delegations in the report. The main group with a charter to control IT expenditure is the Information Technology Executive Committee (ITEC). The ITEC group is the governing body for IT related service and investments within TransGrid. The ITEC sets TransGrid's strategic direction for IT investment.

The ITEC's key role is ensuring that IT investment aligns with business priorities and delivers value to enhance business performance. ITEC consists of 9 members who review and endorse projects throughout TransGrid with a focus on projects with a value of over $250,000.

PB analysis

PB reviewed three specific IT projects:

- single sign on system — Project number 6433
- ProTrack record keeping system — Oracle number 5632A
- SCADA / EMS upgrade — Project code, P5651

Single sign on system

TransGrid had identified a need within the business relating to logging on to computer systems. The solution was a sign on management software.

The initial scope of December 2006 identified 3 options where the Oracle eSSO package was identified as the preferred option. This was then further expanded upon with a signed business case dated April 2008 identifying 5 options, including a 'do nothing' option.

Two options were identified as being suitable for the task (Oracle eSSO and Citrix Password Manager) and a cost benefit analysis was conducted on both options. The capital cost for the two systems was the same at $350,000, but the annual maintenance cost of the Citrix option was moderately lower. TransGrid has taken both options forward for further cost benefit analysis. After further analysis of the two options, the Oracle eSSO option became the preferred option in cost as well as scope.

TransGrid supplied the signed signatories sheet that approved Oracle eSSO option of this project. In this case two groups were required to sign off – ITEC members and IT Working Group. The sign off was conducted via electronic acknowledgement with the results below.

Table 6-8 – Members of the IT working groups and responses to single sign on system

Group	Number of members	Number of responses
ITEC	8	6
Commercial and IT Working Group	15	10

Source: TransGrid SSO and business case and PIR.pdf.

From a governance perspective, PB has identified two areas of note with the approval of this project. Not all members if the ITEC received the 'request for endorsement of the project' email. According to the business case the request was sent to 7 members of ITEC[164]. From the minutes of the ITEC meeting there are 8 members[165],[166].It appears that not all members of the ITEC were consulted. The members of the Commercial and IT working groups were also polled for endorsement. In total 10 out of 15 people responded. PB acknowledges that at times it can be difficult for all members of working groups to respond to requests, however TransGrid's IT policy indicates that projects have to be endorsed by the group.

Overall, PB is satisfied of the need and reasonableness for the expenditure, and we are of the view that for this project there was sufficient TransGrid endorsement from the relevant group members and that there is minimal risk of a project being accepted without appropriate review.

ProTrack record keeping system

ProTrack is an IT solution that should improve the way that TransGrid ensures it is compliant with legislative and industry requirements. The system is used for recording and management of inspection, testing and tagging equipment across the business.

The business brief[167] describes ProTrack as a data capture and management system for the tracking of items and plant. The system utilises a portable hand held device for directing, recording and validating set inspection and testing of identified plant and equipment on site.

A range of reports can be generated at any time, some examples are:

- equipment details
- inspections due
- inspections completed
- person/s who completed the inspections
- current status of plant/equipment.

The system can be easily installed onto a SQL server based system, making it suitable for use across the business. The business case[168] has a footnote statement as follows:

> *"The business case will present the various alternative solutions for completeness, however the evaluation & selection of the software (ProTrack) has already been made prior to this project by OH&S team "*

164 TransGrid SSO and business case and PIR.pdf.

165 ITEC minutes 071203.doc.

166 These numbers exclude the Secretariat of ITEC as we have assumed that the Secretariat does not have voting rights.

167 Project brief No HBS01-06-07.doc.

168 Business Case; ProTrack; Oracle Project Code 5632A.

In PB's view, the selection of the preferred option prior to the business case does not meet with TransGrid's IT Management Framework, however it is noted the retrospective business case does evaluate 4 options where the chosen option is the substantiated as the preferred option.

Overall, PB is satisfied of the need and reasonableness for the expenditure on ProTrack, however PB has identified that TransGrid is exposed to risks of investing in inefficient capex as a result of the retrospective business case assessment. In this case, PB does not recommend any adjustment to the proposed capital expenditure.

SCADA / EMS upgrade

The supervisory control and data acquisition (SCADA) system provides a critical link between system operations and the primary system assets. It includes the communications systems that carry SCADA information; tele-protection signalling information; voice communications and ancillary communications to operational sites.

Relevant measures such as voltages, currents and plant status/condition are displayed to operational personnel in the control centres. The functionality of this system is integral to the real-time operation of the network and there are significant legal and consequential implications associated with failure of the system to the extent that its design warrants duplicated, fully redundant systems across multiple sites.

TransGrid identified a need to upgrade its SCADA / EMS system in February 2007 and a project brief[169] was written that detailed the condition and the necessity to upgrade the SCADA / EMS to allow for further enhancements to be added to the system. The project brief estimate was $4m ±20%. This project was initiated through the Network Performance and Operations working group (NP&O).

The business case[170] was signed off on behalf of the NP&O working group on 16 November 2007 and presented to ITEC on 03 December 2007 and approved by ITEC. The business case discusses three options that were considered. There was a do nothing option, a full replacement options and an upgrade option. The upgrade option was chosen as the preferred alternative and was also identified as the lower cost of the 2 action items. The business case value is for a total of $5.9m ±10% ($5.3m to $6.5m). No clarity is given on the change in cost.

PB is of the view that this project is needed, but when the cost increased, the project scope does not appear to have been re-evaluated. For projects where the business case cost exceeds the project brief boundaries (in this case the maximum project brief estimate would be $4.8m and the business case is $5.9m) the project should be re-evaluated against the original options to ensure that the most appropriate project is selected.

Conclusion

PB has found that TransGrid has a strong governance structure for IT policy and Management, however in some areas policies have not being prescriptively followed. Of the three projects that PB has reviewed in detail, PB is of the opinion that the process for establishing the cost of these projects is sound, the need for investment is reasonable and that the proposed expenditure is efficient given the degree and nature of the approvals processes. On this basis, we do not recommend any adjustment to the TransGrid's IT expenditure.

169 Project brief no NP&O – 01; dated 19 August 2007.

170 Business case; SCADA/ EMS Upgrade; Project Code P5651.

Table 6-9 – Recommendation for business IT capex from 01 July 2009 to 30 June 2014

Expenditure $m (real 2008)	09/10	10/11	11/12	12/13	13/14	Total
Proposed Business IT	17.86	22.85	20.29	13.19	21.72	95.91
Recommended Business IT	17.86	22.85	20.29	13.19	21.72	95.91
Adjustment	-	-	-	-	-	

Source: PB analysis.

6.3.3 Vehicles

TransGrid procures vehicles on a regular basis and this section outlines the results of PB's review of the proposed vehicles capex within the non-network category.

TransGrid maintains a fleet of motor vehicles and specialist mobile plant to primarily support the maintenance and project activities of the organisation.

There are three categories of motor vehicles:

- ***100% private use*** motor vehicles that are allocated to employees appointed under an individual employment contract, and that are used exclusively for private purposes
- ***Business / Private use*** motor vehicles that are allocated to employees appointed under an individual employment contract used primarily for business purposes but also with a private use component
- ***Business Use vehicles*** Motor vehicles that are used exclusively for business purposes in support of organisational functions.

PB's review, and the forecast vehicle capex proposed by TransGrid, excludes 100% private use vehicles as all costs are recovered from employees.

Company policy

Motor vehicles and mobile plant are procured in accordance with procedure "Control of Motor Vehicles and Mobile Plant – GD TR G2 001". The following is a summary of the procedure:

Business / private use

Business/private use vehicles with associated accessories and options are only selected from the NSW Government State Contract list of vehicles. Business/private vehicles with associated accessories and options are selected on the basis of fitness for purpose. Further conditions are identified in the guideline GD ST G2 009 "Senior Officer Guidelines".

Business use vehicles

Business use vehicle requirements are generally met from those vehicles available under State Contract and these vehicles are evaluated on a first preference basis when considering requirements. Passenger and light commercial vehicles available under state contract are purchased in accordance with standard procedures and vehicles are selected on the following basis:

- suitability – selection on the basis of the vehicle's ability to perform the intended duties

- safety – selection on the relative safety characteristics for comparable suitable vehicles
- economics – selection of the least whole of life cost vehicle with comparable suitability and safety weighted equally with environmental impact
- environment – selection of the vehicle with least environmental impact with comparable suitability and safety, weighted equally with economics
- standardisation – selection of a vehicle which is in keeping with others used for similar tasks.

Mobile plant, large specialised motor vehicles and motor vehicles not covered by State Contract are purchased in accordance with TransGrid's purchasing business rules, which includes competitive tendering.

Replacement of vehicles

TransGrid has two separate strategies for replacing vehicles dependent on the class of vehicle. Procedure GD TR G2 001 – Control of Motor Vehicles and Mobile Plant outlines that:

- business / private vehicles allocated to Senior Contracted Officers will generally be replaced at the earlier of two years from date of purchase or 40,000 kilometres travelled. The Transport Manager may extend or reduce the replacement period in special circumstances and in consultation with the Manager/Logistics and Quality
- the replacement criteria for business use vehicles will be aimed at achieving long-term return on investment for each type based on whole of life analyses carried out by Transport. Replacement parameters may be extended or reduced depending on these analyses during the life of the vehicle
- business use commercial vehicles of five tonne or greater capacity and mobile plant will be retained until the end of their economic life taking consideration of the current and expected utilisation. The condition, running costs, and acceptable downtime of such vehicles or mobile plant is to be reviewed periodically by controlling officers and replacement forecast and budgeted accordingly.

PB analysis

TransGrid provided data on the age and odometer reading of their 943 vehicles, trucks, trailers and mobile plant as of 01 August 2008. The spreadsheet listed vehicles under the following headings:

- business / private vehicles
- business vehicles
- trucks central
- trucks northern
- trucks southern.

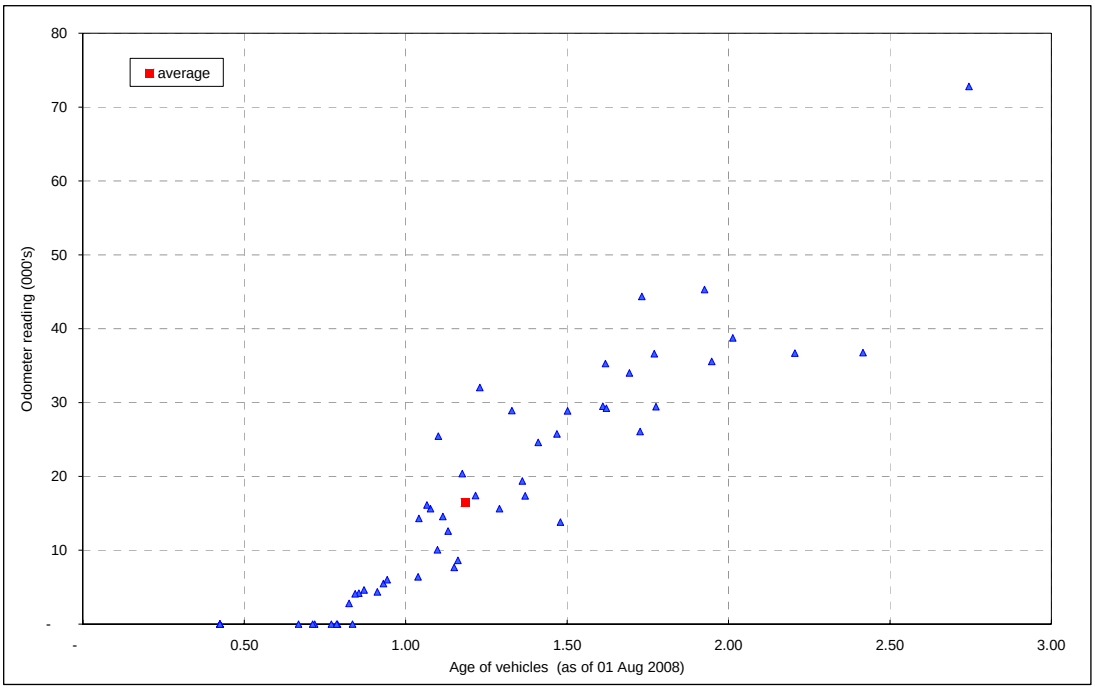
The trucks section included all trucks, trailers, motorbikes and mobile plant.

Business / private vehicles

TransGrid's company policy for business / private vehicles is to replace the vehicle at either 2 years of age or 40,000 km. Figure 6-17 represents the age and the odometer reading of the total number of vehicles classified as business / private use by TransGrid.

TransGrid has a total of 57 vehicles classified as business / private use.

Figure 6-17 – age and odometer reading of all business / private vehicles



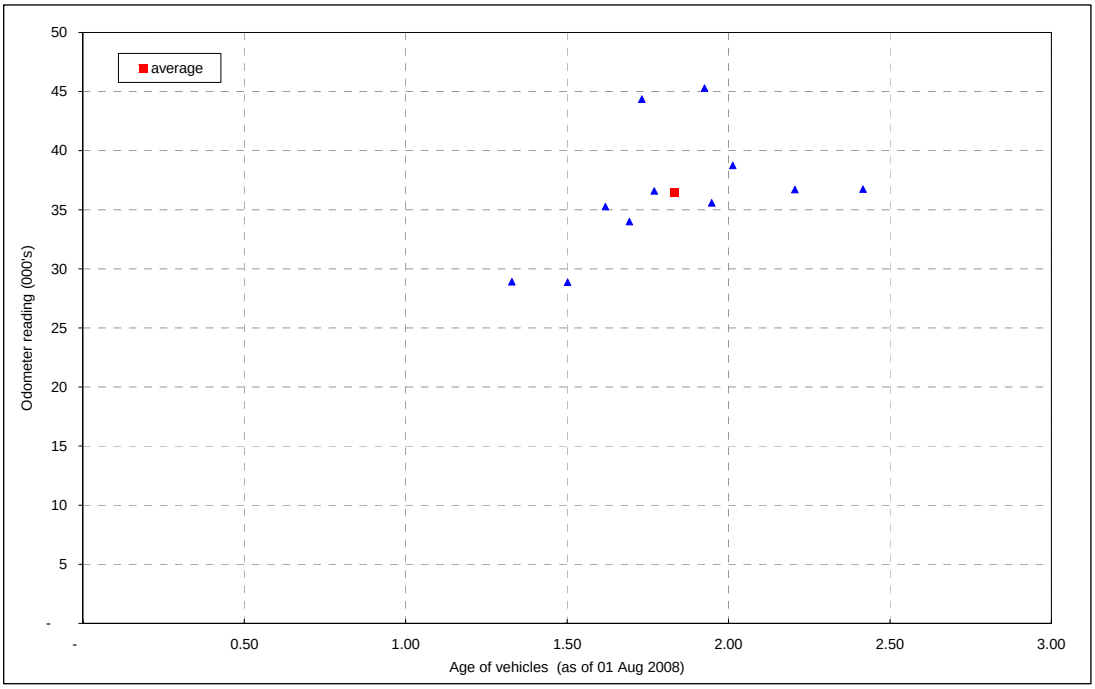
Source: TransGrid – AER capex 27-11-07 total KC present.xls.

Figure 6-17 also includes the average of the total number of vehicles. It can be seen that the average age of the vehicles is approximately 1 ¼ years and the average odometer reading is approximately 16,500 kilometres.

TransGrid has identified within the spreadsheet that a total of 11 vehicles are scheduled for replacement and Figure 6-18 represents these vehicles with the red square representing the average of the age and average of the odometer reading.

PB notes that Figure 6-18 represents the vehicles scheduled to be replaced in the next year, not the vehicles actually replaced. This allows TransGrid to plan their replacements over the following year.

Figure 6-18 – Age and odometer reading of business / private vehicles scheduled for replacement



Source: TransGrid – AER capex 27-11-07 total KC present.xls.

Business / private vehicles are expected to be replaced at the earlier of either 2 years or 40,000 kilometres and this is supported in Figure 6-18 where the average age of the scheduled replacement vehicles is approximately 1¾ years with an approximate average odometer reading of 36,000 km.

However, as the spreadsheet represents vehicles that are scheduled for replacement, not vehicles that have been replaced and PB would expect to see a moderately earlier date and odometer reading for the forecast.

Business use vehicles

TransGrid has advised that business vehicles are replaced on a whole of life cost. This new system was introduced in 2006 and establishes the cost for replacement and repair in a uniform manner. Equation 6-1 establishes the criteria to determine the best replacement option for each vehicle.

Equation 6-1 – Formula used by TransGrid to establish whole of life cycle costs

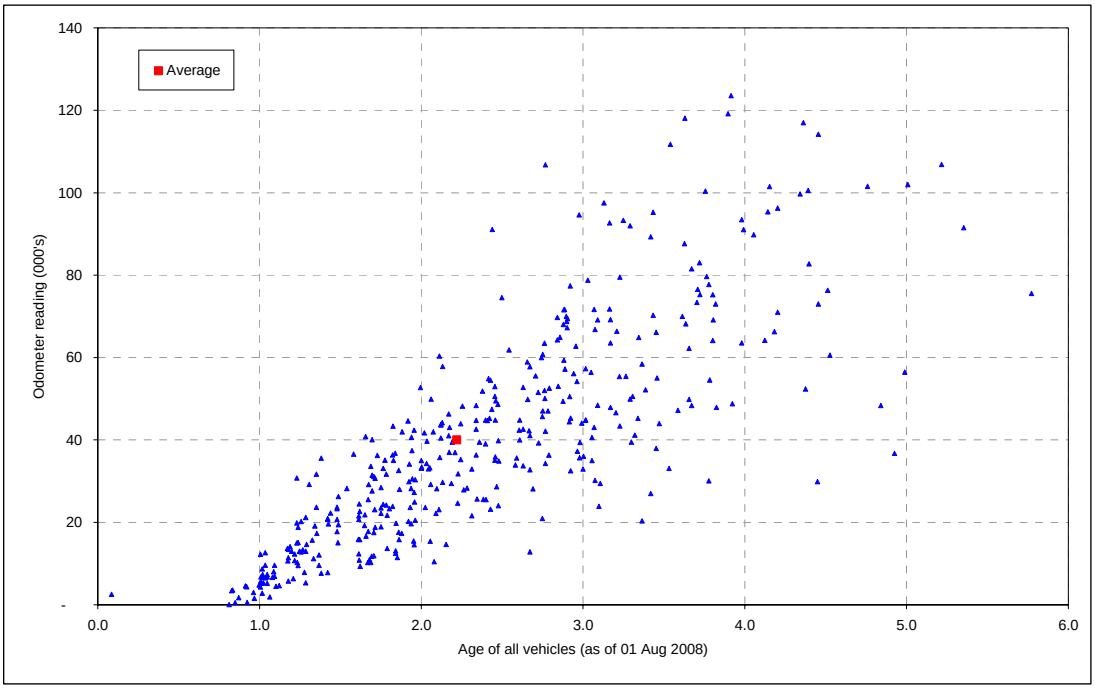
Whole of life cycle cost = Purchase cost + Ownership cost + running cost – Sales return

Source: category 1 2WD sedans & sw.xls.

TransGrid establish a cost of running each vehicle over a 5 year period. This is then used to establish the appropriate time to replace a vehicle. The current age of all business use vehicles is shown in Figure 6-19.

TransGrid has 442 vehicles classed as business use vehicles.

Figure 6-19 – Age and odometer reading of all business use vehicles



Source: TransGrid – AER capex 27-11-07 total KC present.xls.

From Figure 6-19, the average age of the vehicles owned by TransGrid is just over 2 years. The odometer reading is approximately 40,000 km.

The whole life cycle policy was introduced in 2006, which means that only two years of business vehicles have been replaced under this policy. Therefore, in PB's view there is not enough data to establish if the overall affect of a condition based replacement strategy is more reflective of the true costs borne by the business. However, in PB's condition based replacement strategy appears to be an appropriate base for a replacement strategy.

Trucks and mobile plant

TransGrid separates out vehicles with a specialist use. These include trucks, trailers and mobile plant. These vehicles are assigned by location:

- central
- northern
- southern.

Table 6-10 displays the vehicle type and the associated location designated by TransGrid.

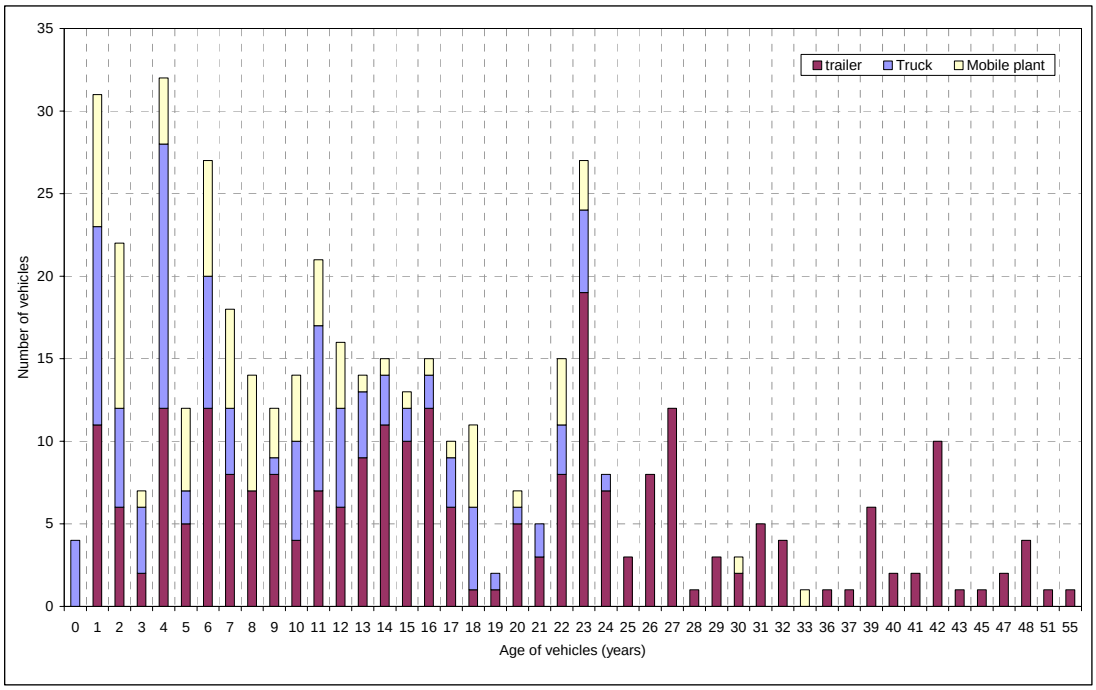
Table 6-10 – Number of trucks, trailers and mobile plant owned by TransGrid

	District			Total
	Central	Northern	Southern	
Truck	39	37	35	111
Trailer	80	81	89	250
Mobile plant	36	10	37	83
Total	155	128	161	444

Source: TransGrid – AER capex 27-11-07 total KC present.xls.

Figure 6-20 displays the age of all the trucks, trailers and mobile plant in TransGrid.

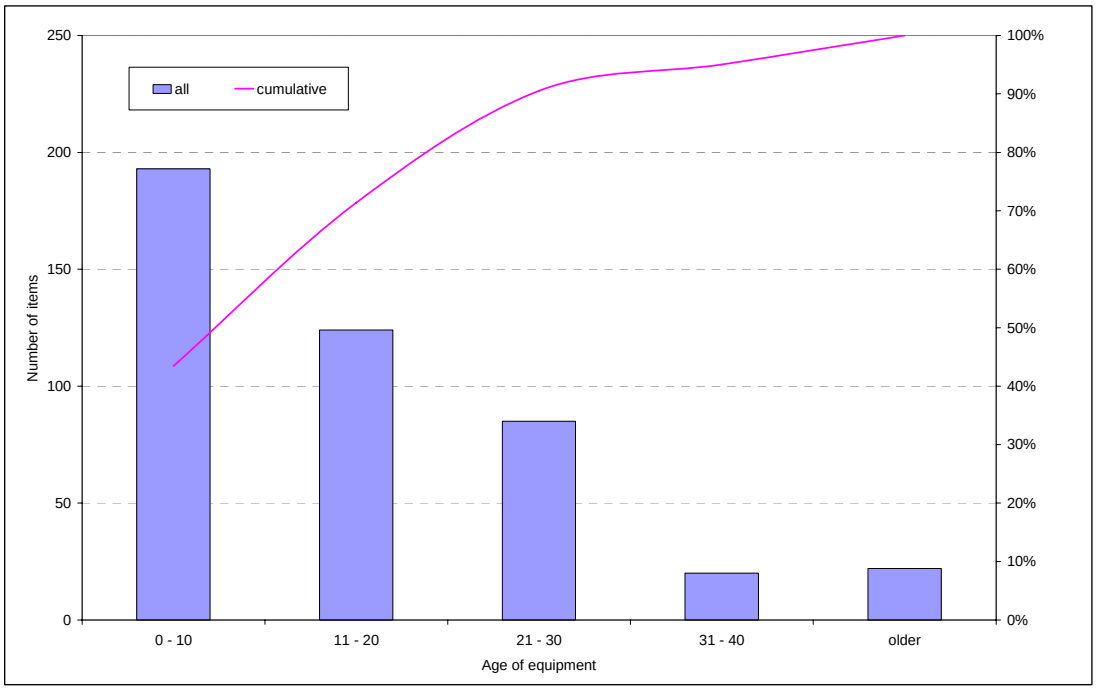
Figure 6-20 – Age, type and number of vehicles used in the transmission business



Source: TransGrid – AER capex 27-11-07 total KC present.xls.

Figure 6-21 shows the concatenation of all trucks, mobile plant and trailers and the cumulative ages.

Figure 6-21 – Cumulative ages of all trucks, mobile plant and trailers



Source: TransGrid – AER capex 27-11-07 total KC present.xls.

From Figure 6-20 and Figure 6-21 it is possible to determine that 50% of TransGrid's trucks, mobile plant and trailers are less than 10 years old, but trucks and trailers have a longer life than mobile plant.

As with business vehicles, trucks, trailers and mobile plant are assessed on a whole of life cycle policy that was introduced in 2006, which means that only two years of business vehicles have been replaced under this policy. Therefore it is not possible to establish if the overall affect of a condition based replacement strategy is reflecting the true cost of vehicles against a time and distance based policy. However, in PB's view a condition-based replacement strategy appears to be an appropriate base for a replacement strategy.

Conclusion

TransGrid replaces vehicles under two separate structures:

- business / private vehicles are replaced on a age / odometer basis
- business vehicles are replaced on a whole life cycle cost basis.

However, the contemporary whole life cycle policy was introduced in 2006, which means that business vehicles have been replaced under this policy for only two years. Therefore, it is difficult to establish if the overall affect of a condition-based replacement strategy is reducing costs.

PB has reviewed the policy and strategy behind the allocation of vehicles and has found that the process appears robust, with all new or replacement vehicle procurements requiring the preparation of a business case. We found that vehicle allocation was as described in the policy.

PB is of the opinion that the process used by TransGrid for establishing the cost of vehicle expenditure forecasts is sound, the need for investment is reasonable and that the proposed expenditure is efficient given the degree and nature of the approvals processes. On this basis, we do not recommend any adjustment to the TransGrid's vehicle expenditure.

Table 6-11 – PB recommendation on TransGrid's forecast proposal for vehicles

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Proposed vehicles	9.32	9.30	5.93	4.56	9.99	39.10
Recommended vehicles	9.32	9.30	5.93	4.56	9.99	39.10
Adjustment	-	-	-	-	-	-

Source: Template – AER schedules (for AER).xls.

6.4 RECOMMENDATIONS

PB has reviewed in detail the two major categories of non-network capex and makes the following recommendations.

Using top-down benchmarking measures, PB found that the total non-network capex proposal made by TransGrid was in line with similar businesses. We reviewed the non-network expenditure against the number of staff, the RAB at the last review, average opex and average capex and determined that TransGrid was typically below the industry average. At a high level, PB is of the opinion that TransGrid's non-network capex is reasonable.

Following this high-level review we looked at each category of the non-network capex. The conclusion of each section is below

6.4.1 Business IT

PB carried out benchmarking analysis by using measures informed by the value of the RAB, and opex and capex levels and identified overall TransGrid was expending an equivalent amount to other businesses.

During the review of business IT related capex, we noted that the process and procedures adopted was not being prescriptively followed, however in the cases examined this has no material impact on the investment decision. Of the three projects that PB has reviewed in detail, PB is of the opinion that the process for establishing the cost of these projects is sound and concludes that the expenditure is efficient, on this basis we do not recommend any adjustments to TransGrid's proposed IT expenditure.

6.4.2 Vehicles

TransGrid uses vehicles as part of its regulated transmission business. TransGrid has two policies for vehicle replacement.

The first policy applies to vehicles classified as business / private and these are replaced on an age / odometer basis. The second policy that applies to all business vehicles is a whole of life cycle policy. This means that the vehicle is replaced when the cost of ownership exceeds the cost of replacement.

The contemporary whole of life cycle policy was introduced in 2006 and in principle appears to be a more cost effective and appropriate method for vehicle replacement more aligned to condition based replacement. However, the policy is in its infancy and will take some time to affect the longer aged trends used in benchmarking.

6.5 CONCLUSION ON NON-NETWORK CAPEX

In PB's opinion, TransGrid's IT expenditure is reasonable and efficient and PB recommends the values shown in Table 6-12 are allowed. PB recommends that there are no adjustments made to the TransGrid's proposal.

Table 6-12 – Summary of forecast non-network capital expenditure from 01 July 2009 through to 30 June 2014

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Proposed expenditure						
Business IT	17.86	22.85	20.29	13.19	21.72	95.91
Support the Business	20.72	15.27	7.18	5.82	11.42	60.41
Total	38.58	38.12	27.47	19.01	33.14	156.32
Detailed breakdown of support the business						
Facilities	10.01	4.69	-	-	-	14.70
Vehicles	9.32	9.30	5.93	4.56	9.99	39.10
Other	1.39	1.29	1.25	1.27	1.44	6.64
Total	20.72	15.28	7.18	5.83	11.43	60.44
Recommended expenditure						
Business IT	17.86	22.85	20.29	13.19	21.72	95.91
Support the Business	20.72	15.28	7.18	5.83	11.43	60.44
Total	38.58	38.13	27.47	19.02	33.15	156.35
Adjustments	-	-	-	-	-	-

Source: PB analysis.

7. OPERATIONAL EXPENDITURE

In this section of the report we review TransGrid's historical and forecast operational expenditures and provide commentary on the prudence and cost efficiency of these expenditure. We also present our recommended efficient annual operational expenditure for the regulatory period 2009/10 to 2013/14. The methodology adopted to carry out this review is explained in the following section.

7.1 REVIEW METHODOLOGY

The methodology adopted by PB in reviewing TransGrid's forecast operating expenditure has involved a critical review of TransGrid's submission, associated documentation including, in particular, the TransGrid opex model and the underlying assumptions and forecasting methodologies used to determine operating expenditure for the next regulatory period.

During the initial stages of the PB review, several issues were identified which had an impact on forecast operating expenditures and which TransGrid and PB agreed should be incorporated into the opex modelling.

The forecast operating expenditure incorporated in the TransGrid submission is based on version 4 of the TransGrid opex model. In total, 4 separate issues have been identified during the period of the PB review, each of which has been incorporated into a new version of the TransGrid opex model. The impact of each issue has been modelled cumulatively in opex model versions 4.2, 4.4, 4.5 and 4.5a. An explanation of each issue identified and the cumulative impact of these issues on the forecast operating expenditure is detailed in section 7.3 of this report.

As TransGrid has agreed to the impact of these 4 issues being incorporated into the opex modelling, PB has assumed that for the remainder of its opex review that the base forecast operating costs are those forecast in the opex model version 4.5a and our recommendations are based on these forecasts and any comparisons refer to these revised forecasts.

In addition PB also reviewed the methodology used by TransGrid to allocate costs between opex and capital works. TransGrid was required to submit its cost allocation methodology to the AER for approval before March 28, 2008 in accordance with clause 6A.19.4(a) (1) of the National Electricity Rules. This cost allocation methodology was subsequently approved by the AER.

Essentially, all direct labour and non labour costs are allocated to the appropriate category by coding costs to the specific project/task or cost centre. Direct labour is allocated using time sheets and materials and contractor costs (including contractor overheads) are charged directly to the appropriate cost code. Field support costs that are not able to be directly allocated to a specific cost code are allocated in proportion to the direct labour costs charged to each cost code. Corporate support costs are maintained independently recognising its different nature to field support costs and are not allocated to specific jobs.

PB considers this cost allocation methodology to be reasonable because wherever possible costs are directly allocated to either opex or capital works using the Oracle financial system. In addition we consider the use of direct labour cost as the cost driver for the allocation of field support costs to be appropriate

7.2 HISTORICAL CONTROLLABLE OPERATING PERFORMANCE

The ACCC in its 2005 revenue decision incorporated an annual 2% efficiency adjustment to TransGrid's revenue cap allowance. Table 7-1 details the ACCC annual regulatory allowance (07/08 dollars) and TransGrid's actual and forecast controllable operating and maintenance

expenditure for the current regulatory period. TransGrid developed an opex model to forecast controllable operating costs and this model is discussed further in section 7.4.

Table 7-1 shows that TransGrid has achieved operating efficiency gains in excess of those incorporated into the ACCC annual regulatory allowances and predicts this trend to continue through to the end of the current regulatory period 2004/05 TO 2008/09. The expenditures included in Table 7-1 do not include any network support costs. TransGrid's 2004/05, 2005/06 and 2006/07 are actual expenditures.

During the current regulatory period TransGrid predicts operating expenditures to be in total approximately $20m below the total ACCC regulatory allowances. The expected total expenditure over the current regulatory period, combined with the network performance and the benchmarking results achieved suggest that TransGrid is an efficient and prudent provider of transmission services. The benchmarking results are discussed in more detail in section 7.4.4 of this report.

Table 7-1 – Comparison of TransGrid's actual and forecast controllable opex expenditures to the revenue cap allowances.

Expenditure $m (real 2007/08)	04/05	05/06	06/07	07/08	08/09	Total
TransGrid actual and forecast expenditure	127.04	125.53	124.67	121.56	122.21	621.01
Revenue cap allowance	129.15	128.63	128.17	127.79	127.46	641.20
Variation	(2.11)	(3.10)	(3.50)	(6.23)	(5.25)	(20.19)

Source: PB and TransGrid Opex Model 4.5a.

7.3 AGREED VARIATIONS

As discussed in section 7.1, during the initial consultations held between TransGrid representatives, AER staff and PB, four issues were identified that TransGrid agreed impacted on operating expenditure forecasts and which should be incorporated into the opex modelling. Each of these issues is discussed in the following sections and the revised base forecasts detailed in section 7.3.5.

7.3.1 Opex model version 4.2

TransGrid based the annual forecast operating expenditures in it's submission on version 4 of the opex model, which was labelled the "AER version".

Version 4 of the TransGrid opex model was based on a forecast CPI for 2008 of 3.25% but a revised forecast was provided by Competition Economists Group (CEG) based on actual CPI results for the period March 2007 to March 2008. The revised forecast is 4.24%. This CPI is used to convert nominal dollars to $07/08 and to convert the base year dollars (06/07) to $07/08. Version 4.2 was produced to incorporate the actual CPI for 2008.

Furthermore, TransGrid adopted a methodology to escalate opex categories in accordance with asset growth. This methodology was correctly applied to maintenance categories but was incorrectly applied to non-maintenance opex categories. This issue was also corrected in version 4.2 and the combined impact of these issues is displayed in Table 7-2.

The combined effect is an increase in total forecast operational expenditure over the five year regulatory period of $1.92m (07/08).

Table 7-2 – Comparison of TransGrid's opex model version 4.2 annual opex expenditure forecasts to opex model version 4 annual opex forecasts.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.2 forecast expenditures	135.40	145.22	149.96	161.93	167.01	759.52
Opex model version 4 forecast expenditures	135.23	144.39	149.73	161.76	166.49	757.6
Variation	0.17	0.83	0.23	0.17	0.52	1.92

Source: PB and TransGrid.

7.3.2 Opex model version 4.4

TransGrid engaged Willis Risk Practice Australia (WRP) to conduct an independent review of its insurance arrangements for the purposes of preparing a report to be submitted to the AER for its revenue reset process. The report forecasts both future premium costs and future risk management cost for the period 2010 to 2014.

PB has reviewed this report and considers both the methodology used and the recommended forecast insurance costs, to be reasonable. Our comments and recommendations in relation to insurance costs, including self insurance premiums are detailed further on in this report.

However, in reviewing version 4.2 of the TransGrid opex model PB has been unable to align the recommendations of the WRP report with the insurance forecasts incorporated in the model. This issue was rectified by TransGrid and version 4.4 of the TransGrid model was produced to incorporate these changes.

In addition, TransGrid updated an earlier approximation of the 06/07 replacement value of the system, primarily relating to the replacement cost of secondary systems. The approximation had been carried over from earlier versions of the opex model. The value of secondary systems was increased by 19%, substations by 0.7% and land and easements was decreased by 0.7%. These changes have an impact on the escalation factors in the opex model that relate to asset growth resulting from proposed capital expenditures.

Version 4.4 of the TransGrid opex model includes the alterations detailed in Section 7.3.1 of this report as well as the alignment of the WRP insurance recommendations with the forecasts incorporated in the opex model. In addition it incorporates the adjustments to asset base replacement costs.

The combined impacts of these issues on forecast annual operational expenditures are detailed in Table 7-3. Table 7-3 also contains the original annual operational forecasts calculated using version 4 of the TransGrid opex model for comparison.

Table 7-3 – TransGrid's opex model version 4.4 annual opex expenditure forecasts and opex model version 4 annual opex forecasts.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.4 forecast expenditures	135.35	145.04	149.72	161.63	166.68	758.42
Opex model version 4 forecast expenditures	135.23	144.39	149.73	161.76	166.49	757.60
Variation	0.12	0.65	(0.01)	(0.13)	0.19	0.82

Source: PB and TransGrid.

7.3.3 Opex model version 4.5

TransGrid has advised that:

> *"In its Revenue Proposal for the 2004-09 regulatory control period, TransGrid requested an allowance for self insurance consisting of two elements:*
>
> - *An allowance of $755,000 per year for "Towers and Wires" risks;*
> - *An allowance of $800,000 per year for "Losses within insurance deductibles"*
>
> *In its decision, the ACCC included the $755,000 per year for "Towers and Wires" risks, but excluded the allowance for "Losses within insurance deductibles".*
>
> *For the period 2004/05 to 2007/08, TransGrid has incurred a total of $10.75 M in opex relating to insurance events. Over this same period, TransGrid has recovered $2.39 M from its external insurance cover, with over $3 M in outstanding claims yet to be settled. The resultant shortfall that is required to be funded from the self insurance provision is expected to be significantly in excess of the $755,000 allowance from the last decision.*
>
> *TransGrid has included all opex costs in the opex model, including costs associated with insurance events. Total opex in 2006/07 applying to these insurance events is $3.49 M. These costs have been included in the relevant Defect Maintenance category within the Opex Model.*
>
> *For the period 2010-14, it is expected that any costs arising from insurance events would be met either through claims on insurance policies or through the self insurance allowance. It is therefore expected that, provided sufficient provision is made in the self insurance allowance, these opex costs relating to insurance events can be removed from the base year data used in the opex model."*
>
> *The impact of removing the opex costs relating to insurance events from the base year has a consequential impact on the defect ratio used in the opex* model for Substations (a reduction from 120% to 115%)."

The base year costs used in previous versions of the TransGrid opex model included costs associated with the rectification and repair of insurance events. These opex costs have been removed form the base year costs in version 4.5 of the opex model as in the next regulatory they will be met from either insurance policies or through the self insurance allowance.

Forecast insurance costs including self insurance premiums in the opex modelling have been forecast from a zero base.

PB notes that the defect ratio is an integral component of the TransGrid opex model as it correlates the routine inspection and testing operations to the number of equipment defects identified as a result of these routine inspections and tests. The removal of defects associated with events, which during the future regulatory period will be covered by self insurance premiums, results in a lower defect ratio and TransGrid has incorporated this impact on defects in all future versions of the opex model.

TransGrid has produced version 4.5 of the opex model to determine the impact the removal of these costs from the base year costs. In addition TransGrid has also taken this opportunity to rectify two minor inconsistencies in the model. These are as follows:

- correction to the calculation of the unit rates for Major Operating Projects on sheet P - MTCE Unit Rates (cells S43:AR47). This has no material impact on the opex forecast; and
- the use of actual CPI to convert 2008 dollars to 2007 dollars for calculation of effective asset growth. The use of actual CPI reduces total opex over the period by less than $0.5m.

The impact of these issues on forecast operational expenditures is shown in Table 7-4 which also includes the impacts of the issues described in Sections 7.3.1 and 7.3.2. Table 7-4 also includes the original annual operational expenditure forecasts determined in version 4 of the TransGrid opex model for comparison.

Table 7-4 – Comparison of TransGrid's opex model version 4.5 opex expenditure forecasts to the opex model version 4 opex forecasts.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5 forecast expenditures	131.54	140.63	144.97	156.61	161.60	735.35
Opex model version 4 forecast expenditures	135.23	144.39	149.73	161.76	166.49	757.60
Variation	(3.69)	(3.76)	(4.76)	(5.15)	(4.89)	(22.25)

Source: PB and TransGrid.

7.3.4 Opex model version 4.5a

TransGrid has included an allowance of $1.0m per annum in its revenue proposal for the purpose of investigating and encouraging innovative demand management (DM) techniques and opportunities in partnership with the NSW Distribution Network Service Providers (DNSPs). TransGrid has had a decade of experience in DM initiatives and based on this experience, it considers an active investigation process is required to identify, develop and assess DM opportunities in order enhance the likelihood of projects proceeding.

TransGrid's specific experience in aggregating smaller DM projects such as load shedding and small scale generation should enable practical proposals to be developed outside of the Sydney metropolitan area. Hence, TransGrid has already put in place separate Memoranda of Understanding with the three DNSPs in NSW. We consider this proposed allowance to be reasonable as it should result in new DM proposals being instigated.

However in the TransGrid opex model this allowance has also been escalated by the proposed capital expenditure and also escalated from $06/07 to $07/08. We do not believe

that this is a reasonable proposition but do agree that the labour component should be escalated to reflect the impact of the forecast real increase in labour costs.

Version 4.5a of the TransGrid opex model has been developed to remove the escalation of the DM allowance by the capital expenditure proposed for the next regulatory period as well as the escalation to 07/08 dollars as it is considered that the $1.0m allowance is already expressed in 07/08 dollars. Table 7-5 indicates the annual forecast operational expenditures with these issues rectified as well as the issues discussed in sections 7.3.1, 7.3.2 and 7.3.3.

Table 7-5 – Comparison of TransGrid's opex model version 4.5a opex expenditure forecasts to the opex model version 4 opex forecasts.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5a forecast expenditures	131.49	140.58	144.91	156.54	161.52	735.04
Opex model version 4 forecast expenditures	135.23	144.39	149.73	161.76	166.49	757.60
Variation	(3.74)	(3.81)	(4.82)	(5.22)	(4.97)	(22.56)

Source: PB and TransGrid.

7.3.5 Agreed revised base annual operating expenditures

Table 7-6 shows the agreed revised base annual operating forecasts that PB and TransGrid agree represents a reasonable starting point for the remainder of our review. The impact of any additional PB recommendations will be based on these revised forecasts.

Table 7-6 – Agreed revised annual operational expenditure forecasts.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5a forecast expenditures	131.49	140.58	144.91	156.54	161.52	735.04

Source: PB and TransGrid.

7.4 FORECAST OPERATING EXPENDITURE

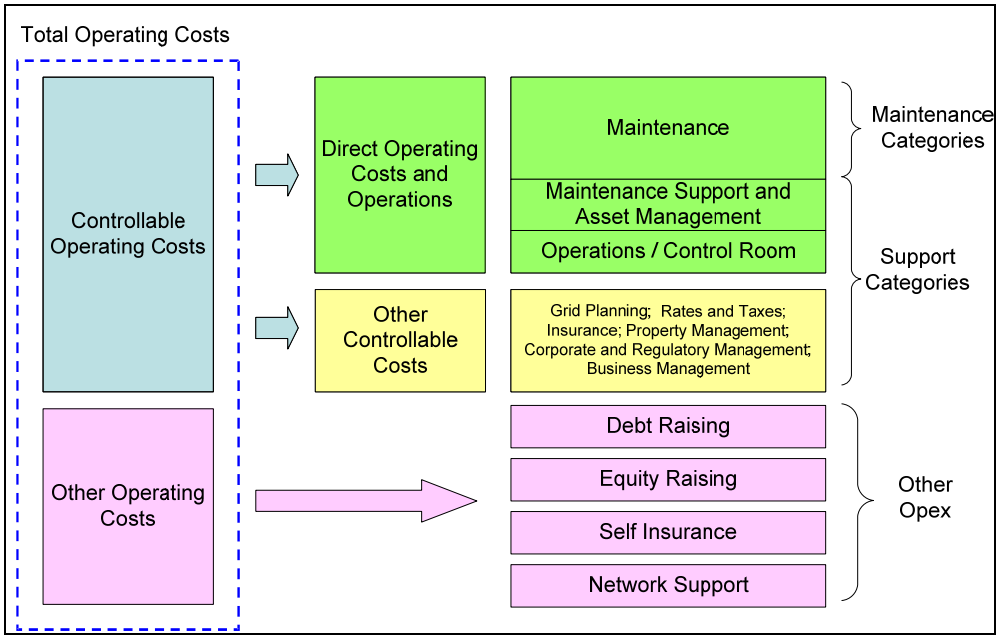
In this section we describe the methodology used by TransGrid to forecast future operational expenditures.

7.4.1 Forecasting methodology

The forecasting methodology that TransGrid has used to calculate its forecast operational expenditures for the next regulatory period are described in the following sections. Figure 7-1, as presented in the TransGrid Revenue Proposal, demonstrates the categories TransGrid uses to define both controllable operating costs and other operating costs. Generally, TransGrid has used an opex model to forecast controllable operating costs and specific forecasts for other operating costs.

Each of the categories and classifications used in the model (excluding 'Other Opex') consist of Labour and Materials & Expense classifications. This breakdown allows the Labour and Material & Expense classifications to be treated differently by the cost drivers used in the model.

Figure 7-1 – TransGrid's opex categories



Source: TransGrid Submission.

TransGrid opex model

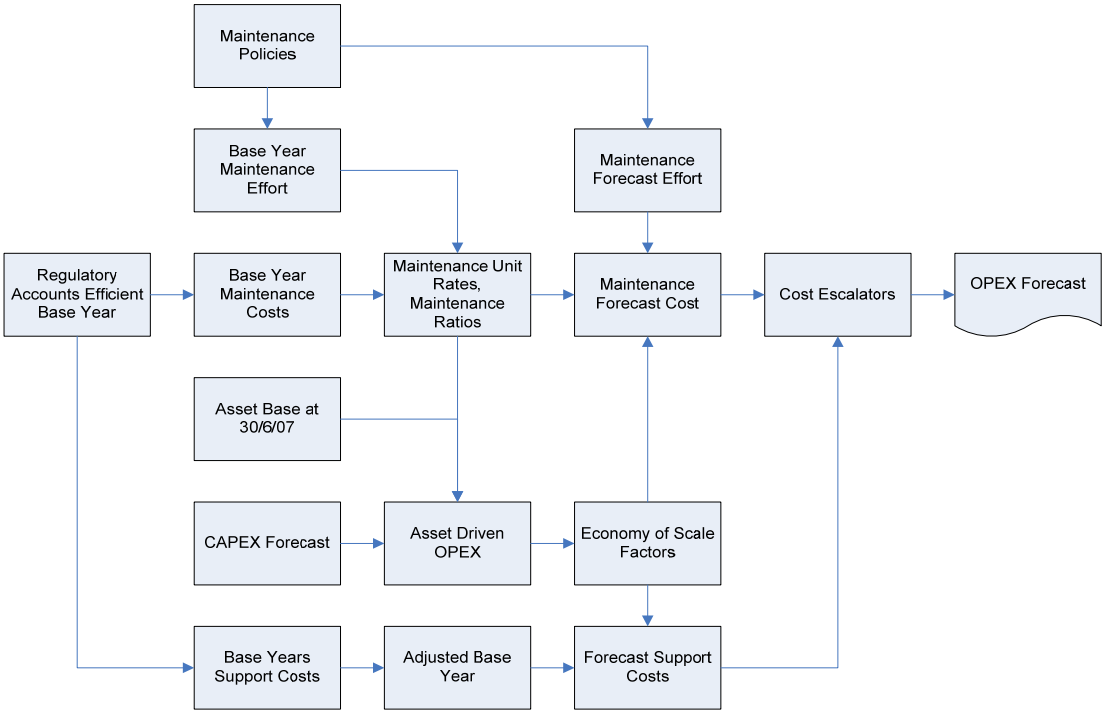
TransGrid has developed an opex model to forecast controllable operating costs. The model basically escalates efficient base-year values to reflect the impact of escalating real costs and the growth of the assets under management resulting from the capital works programs proposed for the next regulatory period. This is accomplished by determining maintenance unit rates, ratios and maintenance effort from the base-year costs and records, and escalating these values to reflect the impacts of asset growth and real increases in costs.

Economy of scale factors are incorporated into the calculations to reflect the expected efficiencies TransGrid should be capable of achieving in performing this additional work over the next regulatory period.

TransGrid has assumed that the cost of materials will increase in line with CPI i.e. they will remain constant in real terms and hence material costs have not been escalated in the opex model.

A diagram representing the operation of the TransGrid opex model is included for clarification (Figure 7-2).

Figure 7-2 – TransGrid's opex model flowchart



Specific changes to the works programs are also factored into the model such as the proposed changes to the vegetation management work practices. This is accomplished by reducing the forecast maintenance effort required to deliver the revised vegetation management program.

In addition an opex/capex trade off is incorporated into the modelling by reducing the forecast maintenance effort by the hours identified as being saved by the implementation of the proposed asset replacement capital works program.

The model also includes non-recurring maintenance projects which TransGrid calls major operating projects and whilst these projects have been separately identified, the model is used to escalate costs such as the expected real increase in labour.

The TransGrid opex model operates in 2006/07 dollars. The calculations are converted into 2007/08 dollars for reporting purposes.

Forecast scope changes

The TransGrid modelling also takes account of a number of expenses which are not expected to be incurred throughout the forecast period. These are associated with irregular workloads, or expected savings from projects currently in progress.

Examples of forecast scope changes are as follows:

All categories – due to the performance of TransGrid's superannuation funds, the fund managers have advised that TransGrid will not be required to make contributions for 2007/08 & 2008/09 years in the forecast period covered by the Opex Model.

Operations – the implementation of a "Virtual Control Room" has resulted in a reduction of staff required. Expense associated with these staff (redundancy payments) was incurred in 2007/08.

Property Management – savings in rental associated with the relocation of staff from 201 Elizabeth St and the resulting reduction in floor space under lease.

Insurance – a zero-based forecast is used for the insurance category and this is included as a scope change. The TransGrid forecast used is based on a broker estimate.

Customer Relations – an allowance for participation in future schemes similar to the Demand Management Planning Project.

Regulatory – cyclical expense associated with Revenue Reset processes is forecast through the coming period.

Conclusion

PB has reviewed the operation of the TransGrid opex model including the model inputs and whilst the model is complex in nature, we have formed the view that the final agreed version 4.5a incorporates assumptions and forecasting methodologies that produce reasonable forecasts of operational expenditures.

7.4.2 Direct operating costs and operations

Costs associated with 'direct operating and maintenance', 'maintenance support and asset management' and 'operations', are discussed below.

Direct operating and maintenance

Maintenance, maintenance support and asset maintenance and operations have all been forecast by determining the base year labour hours and material and expense costs and escalating these by an asset growth factor and also real forecast labour cost factor. TransGrid has assumed that operating material costs will increase in line with CPI and that contractor labour costs included in direct operating and maintenance costs will increase at the same rate as electricity, gas and water (EGW) forecast rates.

In addition, economy of scale factors have been applied to the asset growth factors to reflect expected economies of scale that TransGrid expect to achieve in carrying out the additional work. The expected trade-off in additional operating and maintenance costs resulting from the proposed asset replacement/refurbishment program are incorporated in the opex model by reducing the projected increase in labour hours. The reduction in labour hours has been calculated by using TransGrid's works management program to predict the reduction in maintenance effort.

The defect labour hours are projected using historical data which correlates routine inspection and testing labour to expected defect rectification labour hours. TransGrid has proposed to substantially alter its Vegetation Management process and the reduced costs associated with the implementation of this new process have been factored into the opex model.

Maintenance support and asset management

This cost category includes all expenditure directly related to the management and support of the maintenance effort. Hence it includes the management of the field based maintenance teams, asset management functions, maintenance of IT systems related to the maintenance functions, logistics, fleet management, supply management and apprentice training.

The forecast expenditure trend over the next regulatory is a steady increase in costs from just over $12m (07/08) to slightly more than $14m (07/08) over the five years. This increase is primarily due to wage escalation incorporated in the forward estimates. A 25% economy of scale factor has been used in the forecasts for support and asset management expenditures in the opex modelling.

TransGrid has advised that efficiency initiatives have been incorporated in the forward estimates including:

- separation of asset management from maintenance
- closure of the Tamworth material store
- reduced inventory holdings
- disposal of under-utilised plant
- introduction of vehicle pools to increase utilisation
- reduction in lost time injury rates
- outsourcing of safety training.

Operations

Operations opex includes all costs relating to the real time operation of the system. It includes network operations, operations planning, operating facilities such as SCADA and monitoring system performance. The forecast expenditures for operations escalates steadily over the next five year regulatory period from approximately $9m (07/08) to just over $10m (07/08). The increase in costs is due primarily to real labour cost escalation and the proposed appointment of additional Full Time Equivalents (FTEs) in the technical support and operation planning functions.

TransGrid has advised that efficiency initiatives have been incorporated into the forward estimates including the establishment of a virtual control room resulting in the reduction of one shift and a 10% saving in operations opex.

7.4.3 Other controllable costs

In this section we briefly discuss TransGrid's other controllable operating cost forecasts.

Grid planning

Grid Planning includes functions such as main grid planning, system analysis, market and scenario modelling, load forecasting, NER regulatory consultation and the production of the NSW Annual Planning Report (APR). All these functions are core for a transmission business operating in the NEM. In addition, TransGrid is the NSW Jurisdictional Planning Body and the NSW member of the Inter Regional Planning Committee IRPC. It also conducts joint planning with connected distributors.

The Grid Planning group forecast operating expenditures rise steadily over the next regulatory period from approximately $4.20m (07/08) to approximately $4.90m (07/08). The major contributor to this increase would be the real increase in labour costs and the proposed increase in staffing levels.

The economy of scale factor incorporated in the TransGrid model relating to grid planning is 25%. TransGrid advised that efficiencies incorporated into the grid planning forward estimates include the decision not to replace one managerial position and also the progressive transition from 'in-house' software to proprietary software which is expected to free-up staff from software support functions.

Insurance

TransGrid has a combination of externally provided insurance coverage and self retained risks. Currently TransGrid has insurance cover for property, liability to third parties, motor vehicles, Board room risk (Directors and Officers liability and employment practices liability) and employee risk (fidelity/crime, group personal accident and corporate travel). Retained risks include towers, lines and underground cables.

TransGrid engaged Willis Risk Practice Australia (WRP) to conduct an independent review of TransGrid's insurance arrangements. The review included the identification of key risks, determining the frequency and severity of these risks and then identifying those risks that are insurable in the general market.

From its knowledge of the market and it's analysis of future trends, WRP also provided forecasts for future premium spends as well as the associated risk management costs. Risk management costs include TransGrid's claims management and Insurance Brokers costs associated with managing insurance cover and subsequent claims. These risk management cost forecasts are based on the average costs TransGrid incurred during the period June 2003 to June 2008.

PB has reviewed the WRP report and considers the forecast premium and risk management expenditure recommendations contained in the report to be reasonable

Insurance forecasts are detailed in Table 7-7

Table 7-7 – WRP forecast insurance premium and risk management costs.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Premium costs	4.86	5.21	5.61	5.94	6.13	27.75
Risk management costs	0.78	0.79	0.80	0.82	0.84	4.03
Total	5.64	6.00	6.41	6.76	6.97	31.78

Source: WRP Report.

Conclusion

PB has reviewed the WRP report and considers the findings and recommendations reasonable. We have also checked that these forecasts are incorporated into the TransGrid opex model and found a minor discrepancy. This issue was rectified as one of the agreed variations and is discussed in section 7.3.2 of this report

Property management

Property management incorporates the following functions:

- acquisition of new land and easements to enable development of the network
- management of the corporate property portfolio including a computerised cadastral data base
- disposal of surplus property assets
- provision of survey data for line design and network purposes.

The Property Management group anticipate no additional staff are required within this group over the next regulatory period. The forward estimates show a steady increase in operating costs from approximately $3.6m (07/08) in 2009/10 to approximately $3.95m (07/08) in 2013/14 which is primarily due to real growth in wages. The economy of scale factor used for property management in the opex model is 10%.

TransGrid has advised that efficiency initiatives including a 2% saving in the head office lease management fee, significant reduction in rental outgoings for radio repeater station licences and a restructured lease arrangement for head office (saving $400k per annum) has been incorporated into the forecasts.

The Property Management Group also includes environmental management which is responsible for setting TransGrid's environmental policies, establishment of environmental training, environmental auditing and the establishment of outsourced contracts for major projects, training and vegetation management. Environmental compliance is also the responsibility of this group. This includes compliance with, and monitoring of, both legislative requirements and ISO 14001.

The environmental expenditure trend also shows a steady increase over the next regulatory period – again, in response to the real labour escalation factored into the model. The forward estimates show a steady increase in operating costs from approximately $3.00m (07/08) in 2009/10 to approximately $3.45m (07/08) in 2013/14. The economy of scale factor used for property management in the opex model is again 10%.

Corporate and regulatory management

TransGrid's Corporate and Regulatory Management Group includes all functions responsible for corporate governance and customer relations and regulatory affairs. The forecast expenditures for corporate governance, customer relations and regulatory affairs are discussed separately. Corporate governance includes the TransGrid Board and executive costs, corporate costs, corporate audit and risk and legal costs. Similar to the 'other controllable cost' categories, corporate governance forecast operating expenditures show a steadily rising cost trend in the next regulatory period.

Costs are forecast to rise from approximately $6.70m (07/08) in 2009/10 to approximately $7.4m (07/08) in 2013/14 which is primarily due to real growth in wages. The economy of scale factor used for corporate costs in the opex model was 10%.

Customer Relations and Regulatory is responsible for functions such as regulatory relationships, regulatory strategy, NEM dispute handling, customer relationships, connection enquiries and applications, transmission pricing and strategic projects. These functions are considered core to a transmission business operating in the NEM.

Customer Relations and Regulatory also includes an allowance of $1.0m per annum for the purpose of investigating and encouraging innovative demand management (DM) techniques and opportunities in partnership with the NSW Distribution Network Service Providers (DNSPs). TransGrid has extensive experience in developing DM initiatives and considers only active investigation results in DM opportunities being developed and subsequently proceeding.

TransGrid's specific experience in aggregating smaller DM projects such as load shedding and small scale generation should enable practical proposals to be developed outside of the Sydney metropolitan area. Hence, TransGrid has already put in place separate Memoranda of Understanding with the three DNSPs in NSW. PB considers the allowance reasonable and believes it should result in additional DM proposals being implemented. Operating expenditures for the Customer Relations group are forecast to rise from approximately just over $3.0m (07/08) in 2009/10 to approximately $3.5m (07/08) in 2013/14 – this is primarily due to real growth in wages. The economy of scale factor used for customer relation costs in the opex model was 10%.

Regulatory expenditure is forecast to rise significantly over the next regulatory period as a result of additional compliance requirements in relation to generator performance standards, increasing focus on demand side response and embedded generation, and the preparation of a revenue reset proposal during the years 2011/12 to 2013/14.

Operating expenditures for the Regulatory group are forecast to rise from approximately just over $1.75m (07/08) in 2009/10 to just under $4.00m (07/08) in 2013/14 due to the cost drivers described above. The economy of scale factor used for regulatory costs in the opex model was 10%.

Business management

The TransGrid Business Management group includes the finance, IT and human relations functions.

Finance is responsible for complying with the Corporations law, taxation law both Federal and State, preparation of the Regulatory Accounts and compliance with the International Accounting Standards.

Operating costs for Finance are forecast to rise from approximately $4.40m (07/08) in 2009/10 to approximately $5.00m (07/08) in 2013/14 which is primarily due to real growth in wages. The economy of scale factor used for business management costs in the opex model was 10%.

TransGrid has advised that efficiency initiatives such as alignment of the chart of accounts for the five year regulatory period, review of asset lives to align with industry standards, on line payment approval process and direct interface of major banking processes with the financial systems have been included in the forward estimates.

TransGrid has outsourced most IT services but has taken a strategic decision to maintain certain management functions such as system design, project management, service delivery and infrastructure in house. PB believes this decision is in the best interest of TransGrid and its customers as it facilitates competitive sourcing of the majority of the non strategic IT functions but maintains the strategic functions and capability in house. The IT group is primarily engaged in project management and infrastructure management. Operating costs for IT are forecast to rise steadily over the next regulatory period from approximately $11.00m (07/08) in 2009/10 to approximately $12.06m (07/08) in 2013/14 which is primarily due to real growth in wages. The economy of scale factor used for business management costs in the opex model was 10%. TransGrid has included several efficiency measures in the forecasts for IT including the rationalisation of outsourced IT services to a single contractor and the implementation of a quality system for IT service delivery and service support.

Human Relations is responsible for services such as staff recruitment, workplace relations, payroll and superannuation administration, staff development and compliance with anti-discrimination legislation.

Operating costs for Human Resources are forecast to rise from approximately just over $4.00m (07/08) in 2009/10 to approximately $4.60m (07/08) in 2013/14 which is primarily due to real growth in wages. The economy of scale factor used for business management costs in the opex model was 10%. Efficiency initiatives such as the centralisation of the patrol function and the implementation of employee self service have been incorporated into the forward expenditure estimates.

Conclusion

The TransGrid opex model escalates controllable opex cost in all categories by the capex growth factors to incorporate the impact of the additional assets under management which would result from the proposed capital work program. However, where the economy of scale factors are only 10% the correlation with network asset growth is relatively low. This is due to the fact that only 10% of the capital works escalation ratio is applied to these cost categories to determine the additional expenditures required for the next regulatory period.

In order to check the reasonableness of the opex modelling on other controllable cost categories which have a very low correlation to asset growth, PB requested that TransGrid provide additional information in order to determine the approximate bottom-up cost estimates for four cost categories. The four categories reviewed are corporate governance, customer relations, regulatory and business management. Three of the categories (except regulatory management) showed a reasonable alignment between the bottom-up estimates, including any additional proposed FTEs, and the expenditure forecasts calculated in the TransGrid opex model. However, the costs associated with the Regulatory group had a low correlation

possibly due to the expenditure trends associated with regulatory resets towards the end of the next regulatory period.

Table 7-8 shows the impact of the forecast real increase in labour costs on TransGrid's forward operational estimates. We note that reducing the real labour cost escalator to zero results in a total reduction in forecast operational expenditures over the next 5 year regulatory period of $49.76m (07/08).

Table 7-8 – Comparison of TransGrid's opex model version 4.5a opex expenditure forecasts to the opex model version 4.5d (zero labour escalation) opex forecasts and the variation.

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5a forecast expenditures	131.49	140.58	144.91	156.54	161.52	735.04
Opex model version 4.5d forecast expenditures	127.81	134.71	136.00	143.11	143.65	685.28
Variation	(3.68)	(5.87)	(8.91)	(13.43)	(17.87)	(49.76)

Source: PB and TransGrid.

On balance, PB concludes that the operational forecasts for Other Controllable Cost categories calculated using the TransGrid opex model are reasonable.

7.4.4 Opex base year

TransGrid's opex model operates on the basis of forecasting future costs from an efficient base year. The audited 2006/07 results represent the base year costs from which all 'non business as usual' and other one-off costs have been deducted.

Base year adjustments

TransGrid has determined a number of expenses incurred in the 2006-07 base year to be unusual or 'one-off' expenditures. These have been removed from the audited results to calculate efficient base year expenditure. The expenditures deducted from the 2006/07 actual costs are:

- Maintenance Support and Asset Management, where the deferred payment of access licences associated with repeater sites occurred in the base year. This is combined with an expected reduction due to re-negotiation of other licences
- Operations, where the implementation of a 'Virtual Control Room' has resulted in a reduction of staff required in future years. Expense associated with these staff is removed from the base year
- Grid Planning, where the expense associated with a number of pass-through projects was incurred in this year. These expenses are removed from the base year and reflected in the Network Support category
- Customer Relations, where the expense associated with the Demand Management Planning Project
- Regulatory, where the cyclical expense associated with the Revenue Reset process
- Insurance Premiums, where the base year insurance premium is reduced to zero to allow a zero-based forecast based on broker estimates to be used for the insurance category

- Information Technology, where savings associated with the rationalisation of outsourced services are included here.

In total these adjustments result in a reduction of the 2006/07 audited operating expenditures of $9.67m (07/08). The individual costs removed from the base year audited results to account for one off non recurring expenditures are shown in worksheet "I - $ Adjustment" of version 4.5a of the TransGrid opex model.

In addition, as a result of the PB review, the issues detailed in Section 7.3 also impact the calculation of the base year costs which are now incorporated into the final versions of the TransGrid opex model i.e. version 4.5 and later versions. The impact of modelling these issues on the base year costs is shown in Table 7-9.

The final base year cost incorporated into all versions of the TransGrid opex model after version 4.5a is $114.90m (07/08).

Table 7-9 – Efficient opex base year calculations

$m (real 07/08)	Version 4	Version 4.2	Version 4.4	Version 4.5	Version 4.5a
Efficient base year costs	117.42	118.54	118.54	114.90	114.90

Source: PB and TransGrid.

In total the audited 2006/07 operating expenses have been reduced by $12.19m (07/08) to remove all the one off and 'non business as usual' costs. This total includes the $9.67m (07/08) removed in the TransGrid opex models and a further $2.52m (07/08) resulting from the agreed variations detailed in Section 7.3.

Efficiency of base year costs

Following its review, PB has formed a view on the efficiency of the TransGrid base year costs incorporated into TransGrid's opex modelling based on a number of reports and studies and TransGrid's operating performance in the current regulatory period. These include:

- TransGrid's opex performance during the current regulatory period
- ITOMS benchmarking results[171]
- the SKM report[172]
- the UMS Group benchmarking report included with the TransGrid submission.[173]

TransGrid has provided a substantial amount of information, including benchmarking, to support its contention that the adjusted base year costs represent efficient costs for the prudent operation and maintenance of its assets. Each of the benchmarking studies/reports has been reviewed by PB. Our findings are set out in the following section.

Performance during current regulatory period.

The ACCC in its 2005 decision incorporated a 2% efficiency factor into the annual operation allowances for the current regulatory period. TransGrid has implemented opex efficiencies such that its actual and forecast annual operational expenditures are or are forecast to be lower than the ACCC allowances. TransGrid predicts that its total operating costs over the current period will be $22.35m (07/08) which is approximately 3% less than the ACCC allowances. This indicates that TransGrid has been able to implement efficiency measures

171 ITOMS 2007 Report (Revision date 13/1/2008).

172 SKM Review of TransGrid's Operating Cost Model Inputs (29 May 2008).

173 UMS group TransGrid Transmission Efficiency Review (8 May 2008).

over the current regulatory that have resulted in opex savings which will now be passed onto customers.

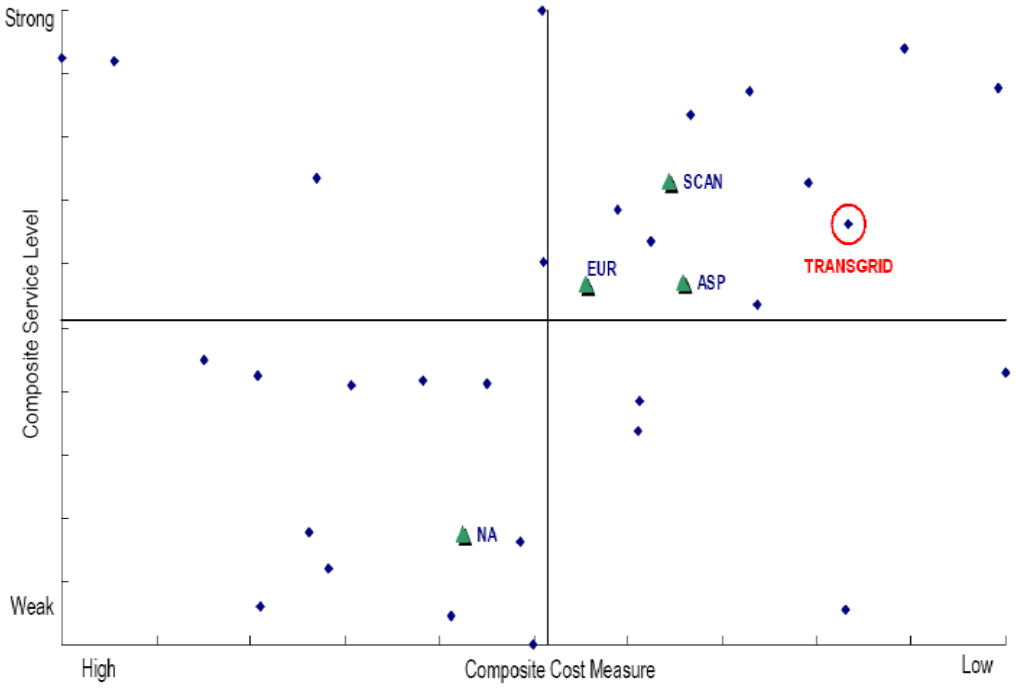
TransGrid is a mature transmission business having maintenance, operating processes and data management systems which have developed over a considerable period of time. TransGrid's expects to achieve efficiency gains of approximately 5% in total operational expenditures, when compared to the ACCC total opex allowance over the current period. The ACCC allowance already included a 2% efficiency factor.

ITOMS benchmarking.

TransGrid participates in the international ITOMS benchmarking studies and has provided details of the ITOMS 2007 results in its Revenue Proposal. ITOMS is a specific transmission benchmarking study with participants from North America, Europe, Scandinavia, Australia/New Zealand, South Africa, Asia and United Arab Emirates. This benchmarking study is held in high regard by market participants and the normalisation factors have been developed over an extended period of time. Hence, PB has formed the view that ITOMS benchmarking study provides a reasonable insight into the relative efficiency of the study participants

TransGrid has provided charts which show that, overall, it is a low cost provider – achieving a high service level. This is demonstrated in Figure 7-3 which shows TransGrid's position relative to the average of the Scandinavian, European and Australian transmission service providers which participated in the benchmarking study.

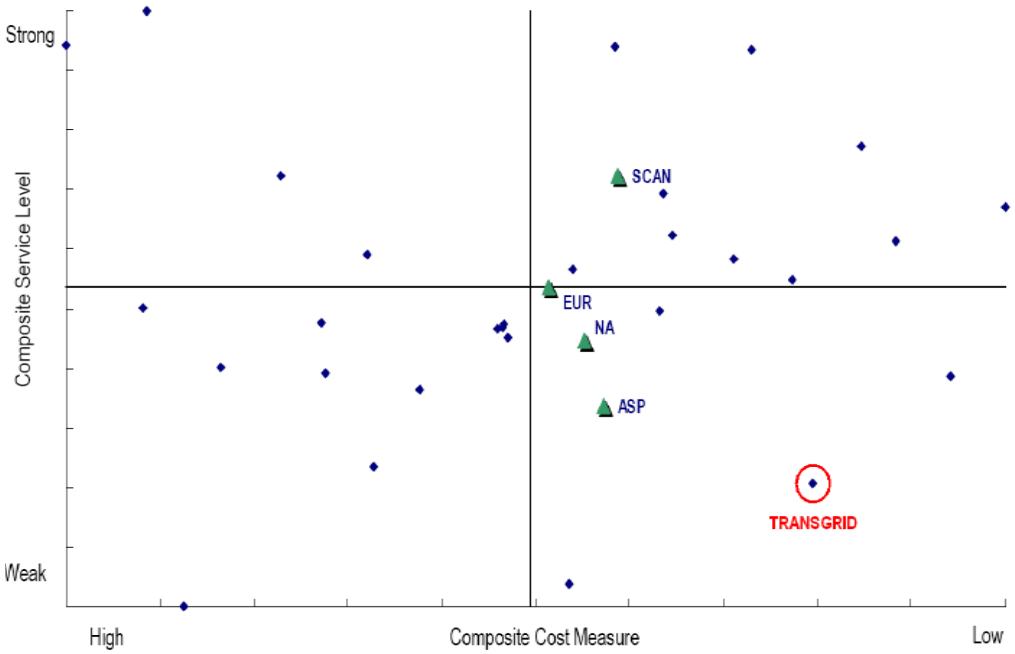
Figure 7-3 – ITOM's results - overall



Source: TransGrid.

Figure 7-4 related to substation maintenance and shows TransGrid to be a low cost provider but with a comparatively low Service Levels. TransGrid has indicated that the assessed service level was adversely impacted by SF6 gas leaks and outages associated with three tank 330 kV transformers, both of which have been replaced or are scheduled for replacement.

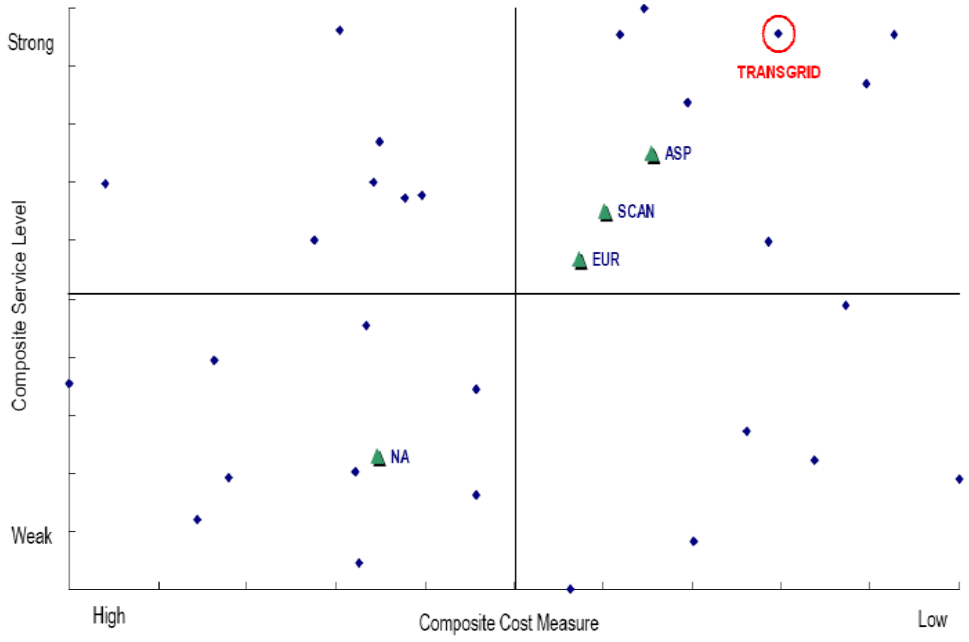
Figure 7-4 – ITOM's results – substations maintenance



Source: TransGrid.

In regard to transmission lines the ITOMS results indicate that TransGrid is a low cost provider achieving high service levels. This is shown in Figure 7-5. In combination, PB believes that these results indicate that TransGrid is generally a low cost provider achieving high levels of service.

Figure 7-5 – ITOM's results – transmission lines



Source: TransGrid.

SKM report

SKM was engaged by TransGrid to review its operating cost model inputs. The engagement included a high level review of TransGrid's maintenance policies as well as review of the resource allocation to standard maintenance tasks.

SKM concluded that the maintenance *"policies attempt to provide for a minimisation of maintenance whilst maintaining and achieving the corporate objectives of safety, reliability, security and the availability of the network within a quality management framework."*

Furthermore, SKM concluded that the *"policies are up-to-date and incorporate maintenance activities that are practiced throughout the industry."*

SKM's high level review of TransGrid's resource allocation suggested that its performance could be considered *"reasonable and efficient".* SKM identified a small number of tasks where its estimates varied from TransGrid's allocation, but the variances were not always in TransGrid's favour i.e. TransGrid's allocation was considerably lower that the SKM estimate. However SKM concluded that *"when taken in context of the overall maintenance effort, the difference was insignificant."*

Overall *"SKM generally considers that TransGrid's internally resourced maintenance workforce is reasonably efficient in delivering a prudent level of asset maintenance."*

The SKM report also addressed TransGrid's maintenance tasks to determine if the allocation of resources to these tasks were reasonable and efficient. For this review SKM investigated a large sample of TransGrid's resource allocation to substation, transmission, protection maintenance and metering maintenance tasks.

This review indicated that the TransGrid's allocation of hours to substation, protection, metering and transmission was reasonable and in line with those in the electricity industry within Australia. Whilst there were some tasks where TransGrid's allocation of hours were considerably different to those in the SKM database, these had either an immaterial impact on total maintenance hours when all tasks were combined or resulted in a reduction in the hours which SKM considered reasonable for the tasks.

This finding was specifically reviewed by PB as the finding is a significant indicator of the cost efficiency of TransGrid's internally resourced maintenance operations.

UMS Group report

TransGrid engaged the UMS Group (UMS) to provide an overall assessment of its operating efficiency. The approach UMS adopted was to assess TransGrid's performance against a global peer group based on a repeatable methodology with valid comparisons. TransGrid's performance was compared to a total of twelve other comparable transmission businesses including four based in Australia.

PB believes that some key indicators provided insight into relative operational efficiency. These are Operations and Maintenance O&M per km of line', 'O&M per regulated asset base', 'O&M per GWh delivered', 'O&M per FTE', 'km of line per FTE'. All of the comparison metrics were referred to minutes off supply and system availability, as these issues are integrally related.

On a global basis, TransGrid is seen to benchmark well below average in regards to 'O&M per km of line' and 'O&M per GWh delivered'. Within the Australian environment, TransGrid benchmarks below the average in 'O&M per regulated asset base' and 'O&M per GWh delivered' and approximately average for 'O&M per km of line'.

In addition TransGrid is below the global average for 'GWh delivered per FTE', 'km of line per FTE' and 'O&M per FTE'. These results indicate that TransGrid is a low cost provider of transmission services.

As mentioned previously operating costs are also integrally related to network performance and TransGrid's system availability is among the industry best ranking in the top quartile against its global peers. In relation to minutes off supply TransGrid is positioned well below the average of its global peers.

It is often difficult to assess cost efficiency when the majority of the maintenance work is resourced internally and where there are no easily identifiable benchmarks. However, the UMS report addresses the issue of outsourcing and cost efficiency. TransGrid outsources approximately 30% of its operating activities, which is well below average of the study peer group. However, its staffing levels appear to be just below the average of the peer study group and TransGrid has low overall costs. These measures provide insight into the relative cost efficiency of TransGrid's maintenance activities.

Conclusion

On balance PB has formed the view that TransGrid is currently a prudent and efficient provider of transmission network services, implementing prudent maintenance policies in a cost efficient manner. Accordingly we believe that the base year cost of $114.90m (07/08) represents a reasonable operational expenditure from which to project future recurring operational costs.

7.4.5 Defect ratios

The methodology TransGrid has used in its opex modelling to forecast defect rectification expenditures is to relate routine maintenance costs to historical defect costs. Table 7-10 shows the historical ratios over the current regulatory period to 2006/07, the average of these ratios and the ratios that TransGrid has used in the opex modelling to forecast defect rectification costs.

Table 7-10 – Historical and forecast defect ratios.

Category	04/05 Defect Ratio	05/06 Defect Ratio	06/07 Defect Ratio	Average 2004-2007	Forecast Defect Ratio
Lines	109%	78%	95%	94%	95%
Substations	38%	121%	125%	95%	120%
Communications	231%	232%	196%	220%	200%
Secondary Systems	49%	28%	29%	35%	30%
Land and Easements	732%	82%	48%	287%	40%

Source: PB and TransGrid.

Generally TransGrid has used approximately the average historical defect ratios to forecast defect rectification expenditures with the exception of substations and land and easements.

The forecast defect ratio for substations was based only on the 2005/06 and 2006/07 years as the allocation of costs associated with property maintenance was re-allocated from routine to defect maintenance after 1 July 2005 and hence the 2004/05 year ratio was ignored.

In relation to the land and easements defect ratio, TransGrid is materially changing its future maintenance approach to easements, which will involve a sustainable shift from reactive to routine maintenance. This will involve a significant expenditure during the coming period but ongoing routine vegetation managements costs are forecast to decrease. TransGrid has used estimates of contractor costs combined with programmed routine maintenance costs to develop the forecast defect ratios during the next regulatory period.

Conclusion

PB believes that the method TransGrid has used to forecast defect rectification expenditures is sound and that the forecast defect ratios it has incorporated into its opex modelling are reasonable.

7.4.6 Cost escalation

In the TransGrid opex model, real labour cost escalation is applied to both TransGrid's internal labour costs as well as the labour component of the externally sourced materials and expense component of operational expenditures. TransGrid has not applied real cost escalation to the materials component of the material and expense cost classification.

TransGrid internal labour

TransGrid engaged the Competition Economists Group (CEG) to prepare a report on the "Escalation factors affecting expenditure forecasts" for the remainder of this regulatory period and the next regulatory period. A summary of CEG's recommendations in relation to real wage escalations from the base year to 2013/14 is shown in Table 7-11.

PB has validated TransGrid's application of these CEG forecast real percentage increases to the internal labour component of operating expenses in the opex model. PB suggests that these recommended labour escalators be reviewed prior to the publication of the AER's final report due to the current volatile economic environment.

Table 7-11 – CEG recommended real wage escalation percentages

Category	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
EGW workers NSW (real)	4.3%	3.1%	3.6%	3.9%	1.9%	2.8%	3.5%	3.7%

Source: CEG.

Contract labour

In order to escalate the labour component of the materials and expense classification, TransGrid reviewed 20 cost accounts to ascertain an average labour component of each account. This information was used to assess the ratio of labour in the materials and expense classification of the direct and other controllable operating cost categories.

Whilst the method used requires a degree of judgement, PB is of the view that this approach was reasonable in circumstances where contractors are unlikely to provide specific data as to the labour component of each invoice. PB reviewed the cost accounts used by TransGrid to determine the labour percentages and is of the view that the ratios used by TransGrid appear reasonable.

The TransGrid opex model escalates the labour component of the materials and expense classification of direct and controllable operating cost categories by the same real percentage increase as applied to internal labour. TransGrid was questioned as to why the lower forecast real general wage percentage increases were not applied. PB is advised that these outsourced services relate to either professional services such as legal, audit or environmental or for the provision of services such as construction or IT, where wages increases closely follow the EWG real increases. TransGrid has not escalated the labour component of materials and expense during 2007/08 and 2008/09 as a significant number of contracts are already in place for this period and labour rates are therefore locked in.

PB's review of the services included in the material and expense category confirms that this approach appears reasonable as the majority of services provided in this cost category are supplied either by professionals such as engineers, accountants and lawyers or by contracting

firms employing electrical tradespersons subject to similar wage pressures as TransGrid's internal labour force. If these services were primarily for cleaning, gardening/mowing and general trades such as painting and carpentry then the application of the general wage rate escalator would have been more appropriate.

7.4.7 Asset escalation

TransGrid has used a ratio methodology in its opex model to forecast the changes in operation and maintenance effort required as a result of the growth-related capital expenditure. The TransGrid opex model determines the ratio of regulated network assets commissioned annually (by asset category) to the current replacement cost of the asset category and increases the annual maintenance effort by this ratio.

PB agrees that this method is reasonable provided the inputs to the ratios are reflective of the value of the new assets being commissioned and the value of the existing assets. Other methods which attempt to quantify the increase in asset quantities are difficult to apply, particularly when a probabilistic approach to planning has been adopted. This section only addresses the commissioning of new assets as replacement capital expenditure is addressed elsewhere in the report.

Effective asset growth

In order to determine the annual effective annual growth of the assets under management TransGrid has developed a spreadsheet which collates the growth in specific asset classes over the current and next regulatory period on an as commissioned basis. The spreadsheet is used to summate the capital projects commissioned on an annual basis, and this data provides the basis in determining the percentage increase in assets under management.

The project costs used in the spreadsheet reflect current construction costs across lines, substations, communications, secondary systems and land and easements.

Current asset base replacement cost

In order to determine the ratio of assets commissioned annually to the value of the existing asset base, TransGrid has calculated the current value of its existing assets. PB understands that TransGrid has based this calculation on the revaluation of its assets and that this was undertaken on 30th June 2004. The 2004 replacement value has been subsequently adjusted to take into account movements such as additions and disposals, and indexation at 2.49% each year (in accordance with CPI allowed in ACCC Decision 2005). The resultant value of the asset base as at 30 June 2007 is calculated, by TransGrid, to be $6,851m (06/07).

In the TransGrid opex model this valuation is adjusted annually on a compounding basis to reflect the growth in the asset base resulting from the capital works programs over the next regulatory period.

Conclusion

PB agrees that the methodology used to escalate operational effort in the TransGrid opex model to reflect the impact of the proposed capital works program is reasonable; however, we believe that the valuation of the existing TransGrid assets is low. This results in the ratio of new asset to the existing assets being higher than appropriate and hence the model forecasts are also higher than appropriate.

This issue is further addressed in Section 7.7.1 which also contains PB's recommended adjustments to the forecast annual operational expenditures.

7.4.8 Economy of scale factors

TransGrid recognises that there are economies of scale associated with operation and maintenance of new assets by an established service provider, and hence has incorporated economy of scale factors into its opex modelling.

Methodology

The TransGrid opex model incorporates economy of scale factors as shown in Table 7-12 in the calculation of forecast annual expenditures. These economy of scale factors are similar to the factors used by both Powerlink and ElectraNet in forecasting their future operational expenditures.

Whilst TransGrid has not provided detailed information on how these factors relate directly to their business, PB is of the view that they appear reasonable. For example, PB has checked the variable component of business management costs recently for several businesses and TransGrid's 10% economy of scale factor for this cost category aligns well with its experience.

In addition, TransGrid's 95% economy of scale factor for maintenance also aligns well with our recent experience in a number of businesses. Also, from a qualitative perspective, PB's view is that new assets require approximately the same resource inputs for inspection, testing and operation as existing assets. This means that economies of scale are limited to the impacts of new technology and possibly also minor efficiency gains in scheduling and reduced travelling times etc.

Table 7-12 – Economy of scale factors

Category	Economy of scale factor	Rationale
Maintenance	95%	There is almost a one-to-one increase in maintenance effort, but some minor efficiencies are available
Maintenance Support and Asset management	25%	Support of maintenance activities is linked to the size of the asset base but significant economies of scale are achievable.
Operations	25%	Significant economies of scale are possible through efficient management of this process.
Grid Planning	25%	Operational support from grid planners is linked to the size of the asset base but significant economies of scale are achievable.
Rates and Taxes	100%	Rates and taxes are direct charges which will be directly proportional to asset growth.
Insurance	0%	Not applicable as costs are based on a zero-based forecast.
Property Management	10%	There is an indirect relationship to the size of the asset base and substantial economies of scale can be realised.
Environmental	25%	Environmental support of maintenance activities is linked to the size of the asset base but significant economies of scale are achievable
Corporate and regulatory management	10%	There is an indirect relationship to the size of the asset base and substantial economies of scale can be realised.
Business management	10%	There is an indirect relationship to the size of the asset base and substantial economies of scale can be realised.

Source: TransGrid.

Conclusion

PB is of the view that the efficiency of scale factors incorporated into TransGrid's opex modelling are reasonable and represent the potential gain in efficiencies TransGrid is likely to achieve in implementing the additional proposed works.

7.4.9 Replacement capital works (opex/capex trade-off)

TransGrid has included a reduction in forecast operating expenditures resulting from the asset replacement capital works program proposed for the next regulatory period. The reduction has been calculated using TransGrid's works management system.

Methodology

TransGrid uses maintenance plans developed from the relevant maintenance policies to determine maintenance scheduled tasks (MSTs) that are programmed into the works management system. To determine the reduction in maintenance resulting from the proposed asset replacement program, TransGrid has replaced the MSTs associated with the assets programmed for replacement in the works management system with the MSTs for the new assets. The difference between the two works programs represents the reduction in maintenance resulting from the asset replacement capital works program. This exercise has been carried out 'offline' so as not to interfere with the programmed maintenance until the assets are actually replaced.

PB believes that this methodology is robust compared to the ratio methods that are usually used in the absence of this level of detailed information being available. The annual forecast operational labour saving expected to result from the implementation of TransGrid's proposed asset replacement program is shown in Table 7-13.

Table 7-13 – Operational labour savings resulting from the implementation of proposed asset replacement capital works program.

Maintenance Savings (hours)	09/10	10/11	11/12	12/13	13/14	Total
Lines	552	1,154	396	1,468	1,280	4,850
Substations	506	401	14	141	658	1720
Secondary Systems	513	586	633	1,472	1,981	5,185
Total Maintenance Savings	1571	2,141	1043	3,081	3,919	11,755

Source: TransGrid.

The reduction in maintenance effort results in opex savings in both routine maintenance and defect maintenance and the combined impact of both these savings is shown in Table 7-14. These expenditure savings have been calculated by TransGrid outside the opex model as the model essentially reduces the forecast annual maintenance effort by these hours to calculate future operational expenditures.

Table 7-14 – Opex savings resulting from implementation of proposed asset replacement program.

Maintenance Savings $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Lines	0.25	0.53	0.20	0.74	0.71	2.43
Substations	0.24	0.22	0.03	0.11	0.38	0.98
Communications	-	-	-	-	-	-
Secondary Systems	0.15	0.20	0.23	0.51	0.71	1.80
Land and Easements	-	-	-	-	-	-
Total Maintenance Savings	0.64	0.95	0.46	1.36	1.80	5.21

Source: TransGrid.

Conclusion

This methodology appears sound and the resultant savings appear reasonable compared to the magnitude of the proposed asset replacement capital works program of $493m (07/08). The saving of $5.21m (07/08) represents just over 1% of the proposed capital expenditure. PB has questioned TransGrid regarding the forecast reduction in maintenance resulting from the asset replacement capital works program and has been advised that savings would continue to be accrued during the following regulatory period.

PB has also confirmed that these forecast operational savings have been incorporated into the TransGrid opex model.

7.4.10 Vegetation management

TransGrid is currently undertaking an Easement Transition Project, to move to a more consistent maintenance workload. The change involves a move from a reactive approach to easement management to a proactive approach with a resultant reduction in easement defects as reflected in the defect ratios for land and easements going forward.

This move will involve significant works initially and a total allowance of $7.67m (07/08) has been allowed in the MOPS forecasts for easement work. The easement transition project is expected to reduce annual land and easements maintenance costs from a high of 14.25m (07/08) in 2005/06 to $9.12m (07/08) in 2013/14.

In forecasting the total Land and Easements category, estimates of outside contractor costs along with programmed routine maintenance requirements have been used as the basis to develop the forecast. TransGrid has incorporated the reduction in its opex model.

Conclusion

PB has reviewed the approach TransGrid is taking in managing its land and easements and has formed the view that it should achieve the required outcomes at a lower cost than the current reactive approach. The lower forecast operating costs have been factored into the opex modelling.

7.4.11 Major operating projects

Major Operating Projects (MOPS) are defined, by TransGrid, as one-off operating projects relating to asset condition. The MOPS consist of 265 individual projects ranging in total cost from several thousand dollars to over $2.5m, and totalling $46.0m. The total cost includes labour escalation but does not include any increase for asset growth. The projects have been grouped into the major asset classes as shown in Table 7-15

Table 7-15 – Major operating projects

$m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Lines	2.43	1.71	1.73	1.77	1.81	9.45
Substations	3.97	4.73	5.05	5.04	5.37	24.16
Communications	0.81	0.83	0.85	0.87	0.90	4.26
Land and Easements	4.08	1.11	1.04	0.94	0.96	8.13
Total MOPS	11.29	8.38	8.67	8.62	9.04	46.00

Source: TransGrid.

In order to review the prudence of these projects PB requested that TransGrid provide a spreadsheet grouping projects in accordance with the relevant asset strategy. This has been provided and PB has conducted a high-level review of this spreadsheet as well as the complete listing of projects. Whilst each project has not been reviewed in detail, it appears to PB that the projects included in the MOPS category are all maintenance related and include a combination of non-recurring building, easement, equipment corrosion, transformer oil leaks and PCB disposal projects etc. Based on this review PB believes that the MOPS projects appear reasonable.

TransGrid has incorporated the MOPS in the opex modelling by using the base year unit rates. The budget estimates for these projects are converted to a MOPS man-hour forecast, which is then used to calculate the final operating cost in a similar way to the other maintenance classifications.

Conclusion

PB has concluded that the projects included in the MOPS listing appear prudent and that the costs for these projects have been included in the TransGrid opex model in a similar fashion to other maintenance cost categories which are considered to be reasonable.

7.5 SELF INSURANCE

TransGrid has included in operational expenditure an amount totalling $9.54m for self-insurance. This is intended to cover the operational cost resulting from uncertain events where the cost of the event is not fully recovered from insurance. This includes items where TransGrid does not have insurance cover either because insurance cover is not available or because TransGrid considers it is more effective to self-insure for the cost of the event, and for items where TransGrid's insurance has a deductible (or excess) applicable.

7.5.1 Risk premium estimate

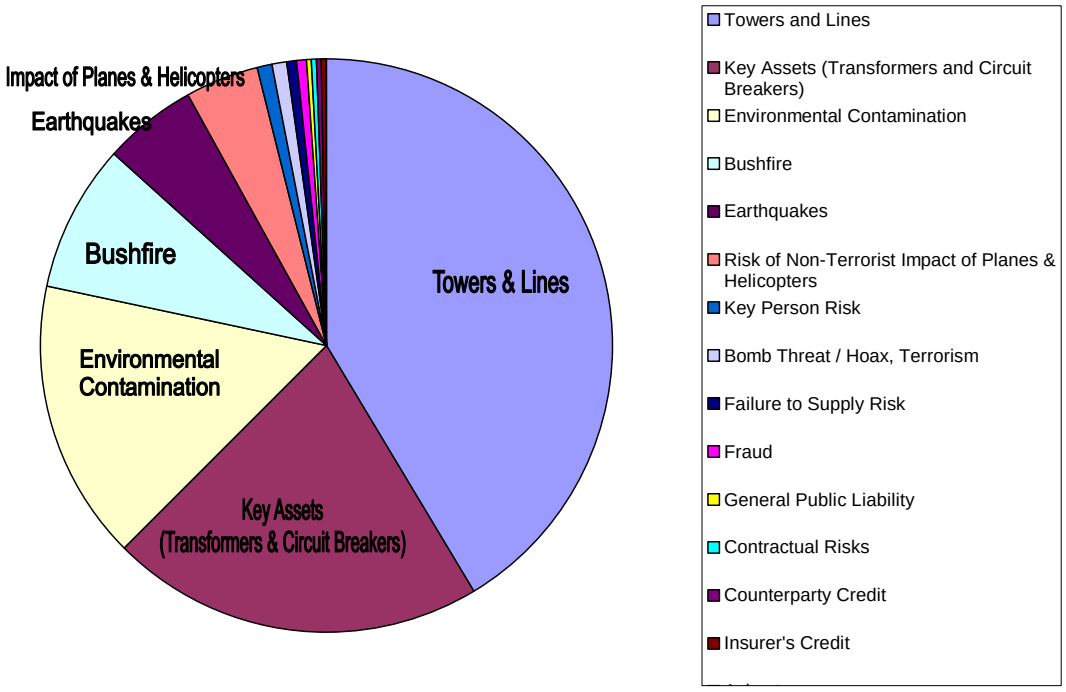
TransGrid engaged SAHA International Limited (SAHA) to quantify the risk premium to include in the operational cost forecast. In its report[174], SAHA has calculated the risk premium using established risk calculation methodology. In many cases the cost and frequency of events is based on TransGrid's historical data. Where relevant TransGrid historical data is not available, SAHA has used other sources, including its own judgement to estimate the cost and frequency of events.

In its regulatory proposal to the AER, TransGrid has included an annual forecast cost of $1.91m for self insurance. During the review process, PB raised a number of questions and queries regarding the self insurance estimates. There were two changes as a result of these queries. Firstly, SAHA revised its report to correct some minor errors, to recalculate self insurance costs based on TransGrid's Capitalisation Procedure, and to modify the frequency of some events. Secondly, TransGrid revised its operational expenditure forecast to remove self insured events from the base year of the operational forecast model. The revision of the SAHA report resulted in an increase in forecast self insurance costs of $1.26m to $3.17m per annum[175]. The main reason for the increase in the forecast self insurance costs was the application of TransGrid's capitalisation procedure. In the initial report, SAHA assumed that repairs to assets were 50% operating expenditure and 50% capital expenditure. In the revised report, SAHA applied TransGrid's capitalisation procedure which had the effect of increasing operational expenditure and therefore total forecast cost for the regulatory control period.

In the following sections of this report, PB considers the revised self insurance forecast of $3.17m per annum.

Figure 7-6 shows the premium categories for each of the self-insurance items. Six categories make up 96% of the annual premium with the largest, Towers and Lines, contributing 41% of the annual premium. In the following sections we examine each of the six major categories.

Figure 7-6 – Self insurance premium categories



174 SAHA International, TransGrid Self Insurance Quantification, 20 May 2008 and SAHA International, Self Insurance Risk – Supplementary Report – Response to AER/PB, 5 August 2008.

175 The impact of the removal of self-insurance events on operational expenditure is shown in Table 7-4.

Towers and lines

This category of self insurance covers the cost of damage to towers, lines and cables from an exogenous event (other than earthquake, bushfire, terrorism and impact of aircraft). Damage in this category is caused by events such as storms, falling trees and ground subsidence affecting cables.

The costs of repairs have been calculated using an average between the weighted average repair and replacement cost, and the actual recorded cost. The frequency of incidents and the number of poles or towers affected has been calculated based on historical data. PB considers that, unless historical data is verified to be inaccurate or insufficient or there is some other overwhelming reason why historical data should not be used, that historical frequency of events should be multiplied by historical costs to determine a risk premium[176]. TransGrid has supplied PB with information that indicates that the historical recorded repair cost is not likely to be representative of future repair costs. We accept this information and therefore consider that the average used is a reasonable estimate of the repair cost.

Within the towers and lines category, the conductors and underground cables risk premium component is based on historical costs and frequencies and PB considers the calculation to be a reasonable estimate of the risk premium. The consequential third party damage risk premium has been calculated from the actual deductible ($250,000) and an estimate of frequency, as there is no history of third party damage. We consider this estimate of the frequency, 1 in 20 years, of third party damage to be reasonable as TransGrid has a substantial number of assets and the potential for these assets to result in a third party claim is real and not remote. We therefore consider the calculation of risk premium associated with third party damage to also be reasonable.

In summary, we consider that the total risk premium for Towers and lines of $1.31m per annum is a reasonable estimate of the cost of self insurance.

Key assets (transformers and circuit breakers)

The risk premium for power transformers and circuit breakers has been calculated based on historical costs and frequencies. SAHA notes that this calculation may understate the risk premium due to ageing of equipment. We consider the use of historical frequencies to be appropriate as TransGrid has a comprehensive asset monitoring, maintenance and replacement regime that should result in little change to the failure rate over the next regulatory control period. The third party risk premium associated with transformers and circuit breakers has been calculated in the same way as the third party risk premium for towers and lines.

PB considers that the self insurance risk premium for key assets calculated by SAHA is a reasonable estimate of the cost of self insurance.

Environmental contamination

This category of self insurance covers the cost of TransGrid polluting the surrounding environment as a result of incidents such as leaking tanks and oil spills.

The uninsured historical cost to TransGrid of environmental contamination is $1.5m per annum. This has been adjusted downward as a result of an incident[177] that is considered to be

176 We also note that selected use of non-historical costs can lead to an overall increase in estimated cost. However, in this case there is also evidence of the selected use of costs in the category of Environmental Contamination that lead to a decrease in estimated cost. This provides some assurance that a balanced approach has been taken.

177 The Brindabella incident which resulted from excessive clearing of easements by TransGrid, which in turn resulted in sediment run off. SAHA have removed this incident as SAHA considers the incident was under the control of TransGrid and is likely to be a one off incident.

a once-off and also as a result of the remediation of some sites resulting in fewer potential sites where an environmental incident is likely to occur.

It is apparent that there are a number of uncertainties regarding the potential for environmental damage both in terms of the number of potential sites and the cost of remediation. We would recommend that TransGrid considers undertaking a survey of its sites in order to provide a better understanding of the risk faced from environmental damage. The results of this survey would also improve the accuracy of the estimated cost of environmental damage. Notwithstanding this, we consider that the estimate of $500,000 per annum is a reasonable estimate of the cost of self insurance for environmental contamination.

Bushfire

This category of self insurance covers the cost of damage caused to TransGrid's assets and also the potential cost of damage to third-party assets where the bushfire is ignited by TransGrid's network.

The calculation of the risk premium associated with bushfires ignited by TransGrid's network has been split into three categories; very minor bushfire, minor bushfire, and major bushfire. TransGrid holds insurance for third party liability associated with bushfires with a deductible of $1m. The risk premium for very minor bushfires has been calculated based on historical costs and frequencies. The risk premium for minor bushfires has been calculated based on an estimated probability of 1 in 20 years and the cost of deductibles. The risk premium for major bushfires has been calculated based on an estimated probability of 1 in 200 years and the cost of deductibles plus a self-insured component. The frequencies for minor and major bushfires reflect the relative probability of each event and the self-insured cost associated with major bushfires has been estimated and compared with ActewAGL's costs experienced as a result of the Canberra bushfires.

The calculation of the risk premium associated with damage to TransGrid's assets as a result of bushfire has also been split into the same three categories; very minor bushfire, minor bushfire, and major bushfire. TransGrid carries some insurance for its assets damaged by bushfires but this cover does not extend to transmission power lines. No damage to assets is assumed to result from very minor bushfires. The calculation of risk premium for minor bushfires and major bushfires is based on average assets per square km, the estimated number of square km affected by a bushfire, and the estimated frequency of bushfires from data provided by the NSW Rural Fire Services.

PB considers that the self insurance risk premium for bushfire calculated by SAHA is based on reasonable estimates of frequency, assets affected and costs and therefore is a reasonable estimate of the cost of self insurance for this item.

Earthquake

The risk faced from earthquakes includes damage to TransGrid's assets and also damage resulting from TransGrid's assets failing during an earthquake and affecting a third party.

SAHA has mapped the probability of earthquakes of a particular magnitude affecting TransGrid's assets and calculated an average length of line affected by an earthquake. The resulting risk premium is $112,475 per annum for a magnitude 5 earthquake, $17,653 per annum for a magnitude 6 earthquake, and $34,625 per annum for third party liability.

While a magnitude 6 earthquake has never been experienced in NSW, a number of magnitude 6 earthquakes have been experienced in the adjoining states of SA and Queensland. The estimate of frequency of 1 in 166 years used to calculate the costs indicates that a magnitude 6 earthquake is considered a very remote event.

PB has reviewed the assumptions and costs used to calculate the risk premium associated with earthquakes and considers the assumptions are reasonable given the considerable uncertainty of the damage from earthquakes. We therefore consider that the self insurance

risk premium for earthquake damage of $165,000 per annum is a reasonable estimate of the cost of self insurance for this type of event.

Impact of planes and helicopters

This category of risk includes impact from planes and helicopters but does not include the cost of impact from an act of terrorism.

There are two components of cost associated with wire strikes from aircraft; third party liability, and damage to assets. The calculation of the risk premium associated with third party liability is based on the deductible amount of $250,000 and a frequency estimate of 1 every 3 years. SAHA has analysed the Air Transport Safety Bureau data and ascertained that there are 5.1 aviation wire strikes per year in NSW. TransGrid appears to have experienced three aviation wire strikes since 2000[178]. We consider that it is likely that TransGrid experiences less aviation strikes per year than the distribution business due to both the length of line and also the design of TransGrid assets which are generally physically larger and more prominent than distribution assets. It has been assumed by SAHA that every aviation strike results in third party liability equal to the deductible of $250,000. Given that there does not appear to have been any third party liability recorded as a result of aviation wire strikes, we do not consider that an estimate of 1 aviation strike each 3 years resulting in third party liability equal to the deductible of $250,000 is reasonable.

PB considers that it is possible that TransGrid will never experience a third party claim as a result of an aviation strike. However, we note that TransGrid has experienced three aviation strikes over the past eight years and there are a number of aviation strikes on lines in NSW each year. This frequency is approximately the same as the frequency of 1 in 3 years used by SAHA to calculate the cost of aviation wire strikes. We therefore consider that a frequency of 1 in 3 years is a reasonable estimate of the frequency of aviation wire strikes. Having estimated the frequency of aviation strikes it is necessary to estimate the proportion of aviation strikes that result in a third party claim. Neither TransGrid's submission nor the SAHA report provides any information to make an estimate of the proportion of aviation strikes that will result in a third party claim and there is no historical evidence of third party claims resulting from aviation strikes. PB has no specific information that assists in estimating the proportion of aviation strikes that will result in a third party claim however, we consider it unlikely that more than 50% of aviation strikes will result in a third party claim. We therefore consider that an appropriate risk premium for third party claims as a result of aviation strikes is $41,663 per annum ($250,000 x 0.333 x 0.5).

PB considers the frequency of 1 in 3 years used to calculate the damage to TransGrid assets as a result of aviation strikes to be reasonable. The cost associated with this damage is the average cost to repair and replace towers and lines ($134,181) and as a result PB considers the risk premium for damage to TransGrid's self insured assets of $44,727 ($134,181 x 0.333) to be reasonable.

In summary, PB recommends reducing the risk premium for impact from planes and helicopters by $205k from $128,000 per annum to $87,000 per annum ($42,000 + $45,000).

178 The three air strikes are the strike recorded in the SAHA report, a further strike advised by TransGrid in response to the PB Draft Report (glider into 4 Yass – Marulan 330 kV line on 16 July 2008) and the recent RAAF plane into 87 Armidale – Coffs Harbour 330 kV line on 13 August 2008).

Other self insurance expenditure categories

Other self insurance categories and the annual estimated risk premium are shown below:

- Key Person Risk $31,000
- Bomb Threat / Hoax, Terrorism $23,500
- Failure to Supply Risk $19,000
- Fraud $14,500
- General Public Liability $12,500
- Contractual Risks $11,500
- Counterparty Credit $ 9,500
- Insurer's Credit $ 5,400

In total these items have an annual risk premium of $126,900. PB has reviewed each of the other self insurance categories and considers the estimates are based on reasonable assumptions and therefore considers the estimate for each category to be a reasonable estimate of the self insurance premium.

7.5.2 Summary of self insurance cost

PB considers that the reasonable cost of self insurance to be included in the revenue determination is $3.128m per annum. This comprises the sum proposed by TransGrid ($3.169m) reduced by $41,000 per annum for Non-terrorist Impact of Planes and Helicopters, as per Table 7-16.

Table 7-16 – Self insurance opex allowance

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Self insurance from TransGrid proposal (May 2008)	1.91	1.91	1.91	1.91	1.91	9.55
Revised TransGrid proposal (August 2008)	3.17	3.17	3.17	3.17	3.17	15.85
PB Recommended self insurance	3.13	3.13	3.13	3.13	3.13	15.65
Variation from May 2008 proposal	1.22	1.23	1.22	1.22	1.22	6.11

Source: PB and TransGrid.

7.6 NETWORK SUPPORT COSTS

TransGrid has included in its submission network support forecast payments for each year of the regulatory control period. These payments relate to three proposed projects:

- Western 500 kV Conversion
- Reactive power capability
- Import capability from Snowy

Payment of network support costs

The provisions of the NER provide for an annual adjustment to the amount passed-through to customers as a result of network support payments where the value of network support payments differs from the value allowed in the revenue determination. In effect this will likely result in an annual adjustment to revenue as a result of network support payments in all cases except where network support costs are known in advance with certainty.

Of the three network support payments proposed by TransGrid for inclusion in the revenue determination only one project has a high degree of certainty (Western 500 kV Conversion) and even for that project the exact value of the network support payments is not yet known. It is therefore probable that each of the amounts passed-through to customers as a result of network support payments made by TransGrid during the next regulatory period will be subject to adjustment. Further, the cost of network support payments cannot be estimated to the same degree of accuracy as other costs such as construction works or maintenance programs as network support services are provided by external parties on an opportunistic basis. As a result of the adjustment within the regulatory period and the way in which network support payments are estimated, the accuracy of the estimated expenditure is lower than other expenditure proposed by TransGrid.

Western 500 kV conversion

The Western 500 kV Conversion is a project that has already commenced. TransGrid made an application to the AER on 7 December 2007 for pass-through payments for network support for this project for financial year 2008/09. This application was approved by the AER on 24 January 2008. The project description included with the pass-through application indicated that the project was staged over several financial years through to 2009/10 with the final stage of the project, the connection of the Bayswater unit 3 to the 500 kV scheduled for April 2010.

PB has not undertaken a detailed review of the proposed pass-through costs for 2009/10 network support payments that relate to this project as this is beyond the scope of this review. However, the pass-through of costs for 2009/10 is consistent with the proposed capital expenditure program for 2009/10. i.e. the network support payment is made in order to defer capital expenditure.

Reactive power capability

TransGrid proposes to enter into network support arrangements from thermal power stations for reinforcement of supply to Newcastle, Sydney and Wollongong areas. This support commences in 2010/11 and continues through to 2013/14. The project that may be deferred as a result of the network support payments is the Bannaby - South Creek 500 kV Lines & Sub. TransGrid has made a high-level estimate of the network support payments of $3m per annum based on an estimated capital cost of $32m.

The estimated network support payment is approximately 10% of the capital cost of the Bannaby - South Creek 500 kV Lines & Sub project. PB considers that the size of the proposed network support payment is appropriate to defer a project of capital cost $32m.

TransGrid has now advised that this project will be deferred as a result of the 2008 demand forecast updates. The deferral of the Bannaby - South Creek 500 kV Lines & Sub project may change the need to make network support payments however this is uncertain as some network support payments may still be necessary in order to provide adequate network capacity.

Import capability from Snowy

TransGrid proposes to enter into network support arrangements from either demand side proponents or new generators in southern NSW to defer the Snowy – Yass/Canberra 330 kV

Lines upgrade project. TransGrid has made a high-level estimate of the network support payments of $3m per annum for the period 2010/11 through to 2013/14.

The estimated network support payment is approximately 10% of the capital cost of the Snowy – Yass/Canberra 330 kV Lines upgrade project. PB considers that the size of the proposed network support payment is appropriate to defer a project of capital cost $34m.

There is little certainty around the amount, location and timing of these network support payments. TransGrid plans to undertake further planning analysis next year to provide more certainty regarding this proposal. PB observes that the proposed payment schedule is in accordance with the planned project expenditure.

7.6.1 Network support payments summary

The proposed payments for the Western 500 kV conversion have a high probability of occurring as planned and, given that TransGrid has already entered into contracts to provide network support relating to this project, the estimated value of the payments are likely to be appropriate.

The estimated values proposed by TransGrid for network support relating to the Bannaby - South Creek 500 kV Lines & Sub. and Snowy – Yass/Canberra 330 kV Lines upgrade are a reasonable magnitude. However, there is uncertainty around the timing of these payments. It is possible that TransGrid will need to make network support payments relating to these projects in the 2010/11 year however, we consider it also possible that these payments may be deferred. The NER provisions allow for this uncertainty by providing an adjustment to network support pass-through costs within the regulatory control period.

Given there is a reasonable (not remote) probability that network support payments will be made, that the payments proposed by TransGrid are of an appropriate magnitude, and that there is a provision in the NER for adjusting any under or over payments, PB considers that TransGrid's proposal should be accepted.

Table 7-17 – Network support payments summary

Expenditure $m (real 2007/08)	09/10	10/11	11/12	12/13	13/14	Total
TransGrid proposed network support payments	21.50	6.00	6.00	6.00	6.00	45.50
PB Recommended network support payments	21.50	6.00	6.00	6.00	6.00	45.50
Variation	-	-	-	-	-	-

Source: PB and TransGrid.

7.7 PB ADJUSTMENTS TO CONTROLLABLE OPERATING FORECASTS

Whilst PB is generally of the view that the methodology, modelling assumption and inputs incorporated into version 4.5a of the TransGrid opex model are reasonable, there are two issues which we believe have an impact on the forecast operating expenditures not included in the TransGrid modelling. These two issues and the recommended variations in the annual forecast controllable operating expenditures are discussed in the following two sections.

7.7.1 Current asset base replacement cost

The TransGrid opex model calculates the additional operating expenditures required to operate and maintain the new asset commissioned during the next regulatory period. The method used to forecast the additional operating expenditures is to increase the operating forecasts by the ratio of the value of the new assets to the current replacement cost of the existing asset base. PB agrees with this methodology as the proposed capital works programs create the new assets that will need to be operated and maintained.

However, PB notes the importance associated with the correct calculation of the ratio. The new assets are valued at their current construction costs and hence it is important that the value of the existing asset base be valued accordingly. Hence it is imperative that the value of the existing asset base also reflects current construction costs so the ratio is calculated using 'like for like' values. PB contends that regulatory roll forward numbers used by TransGrid from 2004/05 to determine the current replacement cost of their existing network do not necessarily reflect current construction costs.

In the TransGrid opex model the current replacement cost of the existing asset base has been determined by using a revaluation of the optimised replacement value as at 30th June 2004. Since 2004, the replacement value has been adjusted to take into account movements such as additions and disposals and indexation at 2.49% each year (in accordance with CPI allowed in ACCC Decision 2005). PB believes that the resultant value of $6,851m (06/07) which has been used in the opex model is too low and that this has an adverse effect on the forecast operating expenditures i.e. the forecasts are higher than may be required.

If the replacement value of the existing asset base is higher then the ratio decreases and the increase in forecast operating expenditures is also lower. PB contends that this method of rolling forward the June 2004 revaluation results in a value that does not reflect the significant increase in construction costs that have occurred since 2004.

PB has requested that TransGrid recalculate the current replacement cost of the existing asset base by applying the real escalation in construction and property costs experienced since 2004. These real increases are shown in Table 7-18.

Table 7-18 – Real cost escalation and CPI from 2004/05 to 2006/07

Expenditure $m (real 07/08)	04/05	05/06	06/07
Network Escalation (real)	2.81%	4.95%	6.15%
Property Escalation (real)	4.10%	4.10%	4.10%
CPI	2.36%	2.98%	2.44%

Source: PB and TransGrid.

Applying these real cost escalation factors to the revaluation of the optimised replacement value as at 30th June 2004 results in a 14% increase in the replacement values of the TransGrid network from the value used in version 4.5a of the TransGrid opex model, namely $6,851m (06/07). This revised replacement cost of the network, $7,814m (06/07), has been modelled in version 4.5b2 of the TransGrid opex model and the results of this modelling are shown in Table 7-19. These results reflect the impact of new assets based on the capital works programs as submitted in the TransGrid submission and hence would need to be remodelled if this program changes. Table 7-19 also shows the impact of this variation on forecast operational expenditures in isolation.

Table 7-19 – TransGrid's opex model version 4.5a operational expenditure forecasts, opex model version 4.5b2 operational expenditure forecasts and the variations

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5a forecast expenditure	131.49	140.58	144.91	156.54	161.52	735.04
Opex model version 4.5b2 forecast expenditure	131.15	139.56	143.73	154.92	159.55	728.91
Variation	(0.34)	(1.02)	(1.18)	(1.62)	(1.97)	(6.13)

Source: PB and TransGrid.

Recommendation

PB recommends that the forecast additional operational expenditures be calculated in the TransGrid opex model using a current replacement value of the existing network of $7,814m (06/07) as we believe this value is representative of the significant real increases in construction and land costs that have occurred since the 2004 revaluation.

7.7.2 Asset growth escalation

PB is of the opinion that growth in operational expenditures is intrinsically linked to forecast growth related capital works programs, as these programs result in additional new assets that require both maintenance and operating effort. However the TransGrid opex model assumes that the amount of additional operating expenditures is directly related to the increase in new assets under management. PB notes that TransGrid does apply economy of scale factors when calculating the impact of these new assets on forecast operating expenditures but these efficiency factors relate to the ability of an existing business to integrate the management of additional asset efficiently.

The TransGrid opex model assumes that the business is operating under a 'business as usual' scenario. PB contends that if the forecast growth related capital works programs are the same as those in the period up until the 2006/07 base year then the model outputs would be reasonable. However, the forecast growth-related capital works programs are significantly larger than those in place up until 2006/07 and we believe that this has an impact on the reasonableness of the opex forecasts the current model produces.

To clarify our view we believe that the overwhelming majority of the new assets scheduled for commissioning during the next regulatory period will not require any defect rectification expenditures during that period other than those identified and rectified during the warranty period. Based on this assumption we have calculated the defect rectification forecast expenditures using version 4.5a of the TransGrid opex model both with and without the growth capex escalators to determine the variation in annual forecast expenditures. We recommend that the difference between these two amounts be deducted from the TransGrid forecast operational expenditures.

Whilst it may be argued that these new assets could produce some minor number of defects during the next regulatory period PB believes that the reduced routine maintenance resulting from the effects of new technology will offset these minor costs. For example, new transmission lines constructed using concrete poles will not require any ground line inspection and maintenance for at least two inspection cycles whereas the opex modelling would be projecting maintenance ratios base predominantly on wood poles inspection regimes.

The results of these calculations are shown in Table 7-20. They are based on the capital works program as submitted in the original TransGrid submission and the results will be different in this program is altered. In addition the impact of our recommendation has been

modelled in isolation and modelling our two recommendations concurrently will produce different outcomes

Table 7-20 – Comparison of opex model version 4.5a opex defect forecasts including capex growth to opex model 4.5a defect forecasts without capital growth.

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5a defect expenditure without capex growth	24.61	26.38	26.17	28.57	28.01	133.74
Opex model version 4.5a defect expenditure including capex growth	24.61	29.31	29.71	33.78	34.33	151.74
Variation	0.00	(2.93)	(3.54)	(5.21)	(6.32)	(18.00)

Source: PB analysis.

Our modelling indicates that the inclusion of the growth-related assets proposed to be constructed during the next regulatory period in the TransGrid opex model results in additional defect rectification forecast expenditure of $18m (07/08) over the five year period.

Recommendation

PB recommends that the defect rectification included in the TransGrid opex model resulting from the new growth assets proposed to be commissioned during the next regulatory period be removed from the annual operating forecasts.

7.7.3 Controllable opex recommendations

PB recommends that the two adjustments to the TransGrid opex model detailed in sections 7.7.1 and 7.7.2 be incorporated to forecast future operational expenditures. These two adjustments are associated with escalating the 2004 value of the TransGrid asset base to reflect actual real cost increases and removing the forecast defect rectification costs associated with the assets proposed to be commissioned during the next regulatory period.

In order to determine the combined impact of these two recommendations PB has re-run version 4.5b(2) of the TransGrid opex model which facilitates adjusting the replacement cost of the existing TransGrid asset base. The model was run twice, with and without the growth factors, in order to determine the change in defect rectification costs associated with the commissioning of the proposed new assets during the next regulatory period. Table 7-21 shows the annual defect rectification forecasts for the assets proposed to be commissioned during the next regulatory period combined with the impact of the revised asset base valuation.

Table 7-21 – Comparison of opex model version 4.5b(2) defect forecasts including capex growth and revised asset value to version 4.5b(2) defect forecasts without capital growth but including revised asset value, and variations.

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5b(2) defect expenditure without capex growth	24.44	26.21	26.01	28.40	27.83	132.89
Opex model version 4.5b(2) defect expenditure including capex growth	24.44	28.80	29.14	33.03	33.45	148.86
Variation	0.00	(2.59)	(3.13)	(4.63)	(5.62)	(15.97)

Source: PB analysis.

In order to calculate our recommended annual operational expenditure forecasts, version 4.5b(2) of the TransGrid opex model was re-run after revising the asset base valuation to $7,814m (06/07) to reflect our recommendation and then deducting our recommended adjustment for defect rectification of the newly commissioned assets. The result of these calculations is shown in Table 7-22 which sets out PB's recommended annual operational expenditure forecasts for the next regulatory period.

Table 7-22 – PB recommended opex forecasts

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
Opex model version 4.5b(2) forecast operational expenditure (revised asset value)	131.15	139.56	143.73	154.92	159.55	728.91
Recommended Defect rectification adjustments	-	(2.59)	(3.13)	(4.63)	(5.62)	(15.97)
PB Recommended opex allowances	131.15	136.97	140.60	150.29	153.93	712.94

Source: PB analysis.

Table 7-23 shows the PB recommended annual operational expenditure forecasts, the agreed TransGrid forecasts based on the TransGrid model version 4.5a and the variances. PB is recommending an additional total reduction in forecast expenditures of $22.10m (07/08) over the five year period compared to the revised forecasts incorporating the agreed variations.

Table 7-23 – Comparison of PB's recommended annual operational forecasts to the TransGrid agreed forecasts (version 4.5a of the opex model)

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
PB recommended annual operational expenditure	131.15	136.97	140.60	150.29	153.93	712.94
TransGrid agreed annual operational expenditure forecasts.(version 4.5a)	131.49	140.58	144.91	156.54	161.52	735.04
Variation	(0.34)	(3.61)	(4.31)	(6.25)	(7.59)	(22.10)

Source: PB analysis.

Table 7-24 shows the PB recommended annual forecast operational expenditure forecasts compared to the original TransGrid forecasts included in its submission as calculated by the TransGrid opex model version 4.0. In total, PB's recommended operational forecasts are $44.66m (07/08) or 5.9% less than the TransGrid forecasts in its original submission.

Table 7-24 – Comparison of PB's recommended annual operational forecasts to the TransGrid operational expenditure forecasts in the submission

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
PB recommended annual operational expenditure	131.15	136.97	140.6	150.29	153.93	712.94
TransGrid's original operational expenditure forecasts (submission)	135.23	144.39	149.73	161.76	166.49	757.6
Variation	(4.08)	(7.42)	(9.13)	(11.47)	(12.56)	(44.66)

Source: PB analysis.

7.8 TOTAL OPERATIONAL EXPENDITURE RECOMMENDATION

Summarised in Table 7-25 below are PB's recommendations for operational expenditure. Included in this table are debt and equity raising costs. PB's scope for this review did not extend to debt and equity raising costs and therefore PB makes no recommendation in respect of these costs. TransGrid's proposed debt and equity raising costs are included in the table below for completeness only.

Table 7-25 – Total operational expenditure recommendation

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
TransGrid's proposal						
Controllable opex	135.2	144.4	149.7	161.8	166.5	757.6
Debt raising	3.7	4.0	4.3	4.8	5.1	21.9
Equity raising	0.9	1.7	3.1	4.0	4.2	13.9
Self-insurance	1.91	1.91	1.91	1.91	1.91	9.6
Network Support	21.5	6.0	6.0	6.0	6.0	45.5
Total regulatory opex	163.2	158.0	165.0	178.5	183.7	848.4
PB's recommendation						
Controllable opex	131.15	136.97	140.60	150.29	153.93	712.9
Debt raising	3.7	4.0	4.3	4.8	5.1	21.9
Equity raising	0.9	1.7	3.1	4.0	4.2	13.9
Self-insurance	3.13	3.13	3.13	3.13	3.13	15.65
Network Support	21.5	6.0	6.0	6.0	6.0	45.5
Total regulatory opex	160.4	151.8	157.1	168.2	172.4	809.9
Variation	(2.8)	(6.2)	(7.9)	(10.3)	(11.3)	(38.5)

Source: PB and TransGrid.

8. SERVICE STANDARDS

The service target performance incentive scheme (STPIS) established by the AER has an objective to assist in the setting of efficient capital and operating expenditure allowances by balancing the incentive to reduce actual expenditure with the need to maintain and improve reliability for customers. This objective is met by establishing appropriate parameters to be included in the scheme and by setting appropriate values for targets and other attributes of the scheme.

The parameters forming the STPIS were fixed prior to the time when TransGrid was required to submit its Revenue Proposal. In this section, we review TransGrid's proposed values for the established parameters, including recommending appropriate targets, collars, caps and weightings.

8.1 OVERVIEW OF STPIS

The AER's STPIS version 2 was released in March 2008. This scheme sets out the treatment of service standards to apply to TransGrid for the next regulatory period.

The performance parameters to apply to TransGrid are:

- transmission line availability
- transformer availability
- reactive plant availability
- loss of supply event frequency greater than 0.05 system minutes
- loss of supply event frequency greater than 0.25 system minutes
- average outage duration
- market impact.

The scope of this review does not require PB to review the values proposed by TransGrid under the market impact component of the scheme.

The STPIS states that:

- TransGrid must propose values for targets, caps and collars
- performance history over the last 5 years is to be used to set performance targets, but modified to take into account the impact that the proposed capex programs allowed for in the revenue cap may have on performance, statistical outliers and material changes in regulatory obligations
- a proposed cap and collar may result in symmetric or asymmetric incentives
- the weighting given to each performance parameter within the incentive scheme must in aggregate place 1% of annual revenue at risk.

The objectives of the service target performance incentive scheme are set out section 1.4 of the STPIS. These require that the incentive scheme should:

- contribute to the achievement of the national electricity objective
- be consistent with the principles in NER clause 6A.7.4(b)
- promote transparency in: (1) the information provided by a TNSP to the AER and (2) the decisions made by the AER

- assist in the setting of efficient capital and operating expenditure allowances in its transmission determination by balancing the incentive to reduce actual expenditure with the need to maintain and improve reliability for customers and reduce the market impact of transmission congestion.

In undertaking this review, PB has assessed the proposed values for targets, collars and caps against these objectives.

8.2 TRANSGRID'S REVENUE PROPOSAL

TransGrid's proposed targets and weightings for each of the parameters, are set out in Table 8-1. Definitions for the terms used in the performance parameters can be found in Part 4 of the STPIS.

Table 8-1 –TransGrid's proposed targets and weightings

Parameter	Unit of proposed target	Proposed target	Proposed weighting %
Transmission line availability	%	99.12	20
Transformer availability	%	98.58	15
Reactive plant availability	%	99.13	10
Loss of supply events > 0.05 system minutes	number	4	25
Loss of supply events > 0.25 system minutes	number	1	10
Average outage duration (capped 7 days)	minutes	790	20

Source: TransGrid Proposal, Page 107.

TransGrid's Revenue Proposal includes caps and collars that limit the amount of revenue at risk to 1% of the annual MAR. The full reward/penalty is applied at the cap/collar values such that if actual performance exceeds the cap/collar, the cumulative value of the weightings place a maximum of 1% of annual revenue at risk for poor performance and provide for a maximum 1% bonus for out-performing the targets.

Except for the average outage duration parameter, all of the parameters contain caps and collars that are not symmetrical in that the rate at which the reward accrues is different (quicker) than the rate at which the penalty accrues.

The Revenue Proposal included rounding of targets to the nearest whole number for the two loss of supply events parameters.

8.3 DEFINITIONS

Robust definitions for each of the performance parameters are essential for repeatable outcomes. Version two of the STPIS provides definitions for the parameters to apply to TransGrid. In this section we discuss a number of the specific definitions to be applied to TransGrid's performance parameters. A complete definition for each performance parameter is provided in Part 4 of the STPIS.

No changes are proposed for the availability parameters and the average outage duration parameter.

Two changes have previously been decided by the AER for the loss of supply parameters for the next regulatory period. Firstly, loss of supply events that exceed the larger threshold (0.4

system minutes) are currently excluded from the calculation of the smaller threshold (0.05 system minutes) parameter. In future, all events that pass the thresholds will be counted in the calculations. Secondly, the larger threshold has been changed from 0.4 to 0.25 system minutes.

PB confirms that TransGrid is readily able to determine events that exceed the new threshold levels and that the changes do not affect the collection of data. PB concludes that these changes will not impact on the availability or accuracy of the historical data on which targets are based.

8.4 DATA COLLECTION AND REPORTING

Given that correct operation of the service performance incentive scheme depends on the quality of the service performance data, data collection and reporting must be based on robust and repeatable processes. This will ensure that valid comparisons can be made over the appropriate time period.

TransGrid maintains a list of equipment that it defines to be a 'circuit' for the purposes of the STPIS. TransGrid provided this list in the form of a spreadsheet[179]. PB checked the list and confirmed that it contains 180 transmission lines, 160 transformers (including the recently decommissioned Armidale No.4 Transformer) and 123 reactive plant items. Recently commissioned and decommissioned equipment items are clearly identified.

In its outage management system "TOS", TransGrid identifies "circuits" by the line number or equipment name, hence ensuring that outages of circuits are consistently identified. Outages of non-circuits are also recorded. PB obtained a list of these outages[180] and found that none of the works on the list impacted a 'circuit', being work on batteries, protection and other secondary systems.

TransGrid's data collection has been subject to the AER's annual audit process. Data prior to 2003 has not been audited, as these years preceded the STPIS commencement. Data for 2004 (July to December), 2005 and 2006 has been audited by the AER's consultant, Sinclair Knight Merz (SKM). Data for 2007 was not audited by an AER consultant.

PB examined the auditor's reports and found that the audits had examined TransGrid's data collection and reporting processes and found them suitable. SKM noted that the data collection and reporting process relied on manual processes and recorded several inconsistencies due to human error. In each case, it concluded that these were isolated incidents and that the performance indicator reporting system was free from material error.

For 2007 data, PB reviewed the data collection and recording process and found that it was substantially the same as that described by SKM in previous years. Only one small change had been made to the data collection and recording processes. In mid 2007, an on-line system 'HVPRI' was implemented which replaced a paper based system used to record planned outages. No material change to the accuracy of reported figures is expected from this change.

TransGrid has advised that it is in the process of implementing a new data collection and recording system that will be operational in 2008. The implementation of the new system removes a portion of the manual process and hence the potential for manual errors, PB confirms that it should not affect the accuracy of the reported data.

PB concludes that historical data and future data collected using these processes should be suitable for use in a service performance incentive scheme.

179 Lists of Circuits as at 31-12-2007.xls.

180 TOS 2007 Other Outages.xls.

8.5 EXCLUSIONS

The STPIS allows that certain outage events may be excluded from the calculation of the service incentive. These exclusions have been subject to review in the audit process described in the preceding section, for 2004 to 2007. In some years, exclusions have been proposed by TransGrid that have subsequently been rejected by the AER. These exclusions have made a material change in the calculation of service performance for the loss of supply parameters.

TransGrid has provided a list of events excluded from the data used to calculate the loss of supply parameters. Only one event has been excluded from the historical data. This was an event in 2004 that was subject to the audit of data in that year. Historical data prior to the commencement of auditing (1998 to 2003), has not been assessed for events that meet the criteria for exclusions. Given that only one exclusion has occurred in the 5-years to 2008, PB accepts that the lack of assessment is unlikely to materially impact the setting of targets, collars and caps based on this historical data.

When assembling data for PB's assessment, TransGrid found a discrepancy in its historical data from that previously provided to the AER as part of the annual audit process. Some events had been incorrectly excluded from the data. Corrected data was provided to PB and this is shown in Table 8-2.

TransGrid has provided a list of excluded events for the availability and average outage duration parameters. PB confirms that the excluded events appear to meet the criteria for exclusions set out in the STPIS.

PB concludes that the historical data, with excluded events removed as shown in Table 8-2, is suitable for use in setting performance targets.

8.6 TARGETS

The STPIS requires that targets be equal to the average performance history over the most recent 5 years, which may be adjusted for statistical outliers, changes in the capital works program and material changes in regulatory obligations. Targets may be based on a different time period where this is consistent with the objectives set out in clause 1.4 of the STPIS.

The historical data for the most recent 5-years as reported by TransGrid is shown in Table 8-2 and is discussed in the following sections.

Table 8-2 –TransGrid service performance 2003 to 2007

Parameter	Actual performance					
	2003	2004	2005	2006	2007	Ave
Transmission line availability	99.62	99.67	99.51	99.56	99.38	99.55
Transformer availability	99.00	99.31	98.90	98.84	97.46	98.70*
Reactive plant availability	99.34	99.42	99.63	98.92	99.22	99.31
Loss of supply events > 0.05 system minutes	9	1	1	2	5	3.6
Loss of supply events > 0.25 system minutes	1	1	0	0	1	0.6
Average outage duration (capped 7 days)	830	726	723	928	911	824

*Note: *This figure is incorrectly stated as 98.72 in TransGrid's Revenue Proposal and Service Target Performance Incentive Scheme (SERV01)*

Source: TransGrid, 11 August 2008, AER Review Availability - Breakdown by Functions 2003-2007.xls and, 28 July 2007, Average Unplanned Outage Duration 2003-2007.xls.

8.6.1 Circuit availability parameters

TransGrid has based its proposed targets for circuit availability parameters on the 5 years from 2003 to 2007, adjusted to reflect changes to its capital works program from the 2003–2007 period to the forecast 2009–2014 period. Clause 3.3(k) of the STPIS states that proposed targets may be subject to reasonable adjustment to allow for increases and decreases to the volume of capital works.

Figure 8-1 – Availability parameters historical performance

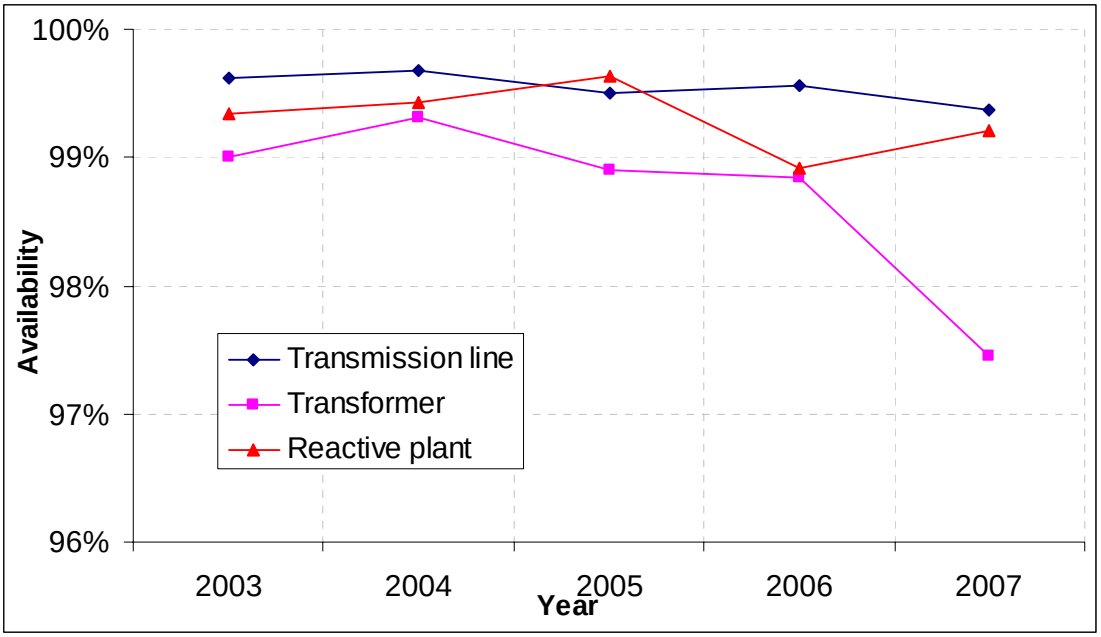


Figure 8-1 shows the historical performance. The large change in 2007 for transformer availability was due to a unit failing at Sydney South, and an increase in the capital works program. These events are not considered to be statistical outliers and hence an adjustment for statistical outliers has not been made.

Adjustments to the targets for changes in the capital works program have been made based on a bottom-up assessment of the outage hours associated with future capex projects. Standard outage times were established and applied where appropriate by considering the general scope of each project[181]. Where standard outage times were not appropriate, TransGrid proposed a specific estimate of outage hours.

PB reviewed the outage times assigned to the projects. We found that:

- the outage hours are based on the same project list as used to forecast capital expenditures
- the standard outage hour estimates assigned to various standard work packages appear appropriate (for example, the connection of equipment into a new switch-bay culminated in outages of 36 hours duration, and protection replacement required 8 hours of outages.)
- to simplify the calculation of the impact of planned outages on the availability parameters, all of the outage hours for a project are considered to occur at the completion date
- where a project's completion date varies with the 36 scenarios used to forecast capital expenditures, the median of the completion dates is used to determine whether outage hours were included or excluded from the calculation of service performance for the next regulatory period.

With respect to this last point, using the median completion date is an assumption and unlike the probabilistic approach adopted for forecasting capital expenditure, where capital expenditure for each project is weighted by the probability of the given scenario and the overall results are aggregated to arrive at a forecast total. In the simple approach adopted by TransGrid, a possibility exists that more outage hours than required may be included in the calculation. This is because the median date is more likely (on average) to fall within the regulatory period than outside of the regulatory period. On this basis, PB has tested the impact of TransGrid not using a probability weighted average by recalculating the completion dates. Using this approach, it was found that within the next regulatory period, only one project's completion date changed (project 3978 delayed by one year to 2014) when compared to the technique of adopting the median date.

In addition, where a project does not appear in all scenario's, the outage hours assigned to the completion date should be reduced to reflect the likelihood of the project proceeding. PB tested the impact of TransGrid not reducing the outage hours to reflect the likelihood of the project proceeding. This test was undertaken by multiplying the outage hours by the sum of the probabilities for the relevant scenarios. The change in approach was found to affect three projects (6241-probability 98%, 6384-probability 2%, and 6388-probability 22%).

The impact on performance targets of the changes to the application of the probabilistic approach described above is a small change in the third decimal, which is not considered material, so no adjustments are recommended by PB

PB also examined the 5 most significant projects in the proposed works program based on anticipated outage durations. Of these, project 5567 has 10,080 outage hours assigned for the outage of line 39, Bannaby to South Sydney 330 kV. On review, PB found that the project plan requires the line to be removed and a new 500 kV line to be constructed in the same easement. Network operational needs require the partly constructed 500 kV line to be linked to the remaining portion of the 330 kV line and energised over the summer period. PB considers that when the line is taken out of service after the summer period that it will effectively be removed entirely and hence de-commissioned. PB recommends that the outage hours associated with this line be reduced to reflect only the outage that occurs before the return to service for the summer period. TransGrid advises that this will be from mid-March to mid-November, which is 5,832 hours. The reduction in outage hours for this project from 10,080 to

181 Standard Outages Estimates Used in Revenue Reset Forecasts.doc.

5,832 materially impacts the adjustment of the performance targets for the transmission line availability parameter.

The adjustment to the circuit availability parameter targets due to the unavailability required to undertake the proposed capital works is consistent with the provisions of clause 3.3(k) of the STPIS. Given that the proposed capital works have been planned on the basis of meeting TransGrid's regulatory obligations, PB considers the adjustment of the historical circuit availability targets to reflect the forecast capital program to be reasonable.

As a result of our review, PB's recommended circuit availability parameters are outlined in Table 8-3.

Table 8-3 – Impact of adjustments to circuit availability parameters

Parameter	Historical average	Adjust for capex program	Recommended target
Transmission line availability	99.55	-0.35	99.20
Transformer availability	98.70*	-0.15	98.55
Reactive plant availability	99.31	-0.18	99.13

*Note: *This figure is incorrectly stated as 98.72 in TransGrid's Revenue Proposal and Service Target Performance Incentive Scheme (SERV01)*

Source: PB analysis.

8.6.2 Loss of supply parameters

For the loss of supply parameters, TransGrid has based its proposed targets on the previous 5 years from 2003 to 2007, and the caps and collars on the 10 years from 1998 to 2007. In its report presenting the targets for the loss of supply parameters TransGrid has also considered the network performance over 10 years in setting the targets[182]. TransGrid states that a ten year period has been considered for this parameter due to the relatively small number of events experienced, and in order to adequately reflect the long term performance of TransGrid's network.

PB notes that the STPIS[183] allows that targets can be based on a time period other than the last 5 years where this is consistent with the objectives set out in clause 1.4 of the STPIS. Whilst TransGrid has considered the targets derived from a 10 year average, it has proposed use of the targets contained in the SAHA report – based on the 5 year historical performance. PB notes that setting targets based on the average for the 5 years to 2007 leads to the same targets as on the 10 year basis when rounding is applied. Table 8-4 shows the averages for each of the loss of supply parameters.

182 TransGrid, Service Target Performance Incentive Scheme, SERV 001, Rev 0, June 2008, page 19.

183 AER, Final Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme: March 2008, Clause 3.3(h).

Table 8-4 – Availability parameter targets comparison of 5 year and 10 year averages

Parameter	5 yr average	Target based on 5yr average	10 yr average	Target based on 10yr average
Loss of supply events > 0.05 system minutes	3.6	4	4.2	4
Loss of supply events > 0.25 system minutes	0.6	1	0.9	1

Source: PB analysis.

Given that the targets proposed by TransGrid are based on the average of the 5 year period to 2007 and consistent with the longer term performance over 10 years, PB recommends that the targets proposed by TransGrid be adopted.

8.6.3 Average outage duration parameter

TransGrid has based its proposed targets for the average outage duration parameter on the average performance of the 5 years from 2003 to 2007. This approach is consistent with the STPIS.

TransGrid provided a list of outage events for checking. At the time of providing this list, TransGrid noted that there is a discrepancy between this list and the values in TransGrid's revenue proposal. The main contributing factor was an incorrect formula[184]. Table 8-2 shows the revised historical performance.

As part of its review, PB requested, and received, a list of excluded events in the period 2003 to 2007. These appear to meet the criteria for exclusions allowed by the STPIS. The durations of events have also been correctly capped at 7 days (168 hours).

PB recommends that the performance target be set at the average of the revised historical performance for 2003 to 2007, which is 824 minutes.

8.7 RECOMMENDED TARGETS

Table 8-5 shows the targets recommended by PB.

Table 8-5 – Recommended targets

Parameter	Unit of proposed target	Recommended target
Transmission line availability	%	99.20
Transformer availability	%	98.55
Reactive plant availability	%	99.13
Loss of supply events > 0.05 system minutes	number	4
Loss of supply events > 0.25 system minutes	number	1
Average outage duration (capped 7 days)	minutes	824

Source: PB analysis.

184 Cell I4 in the Exclusions sheet, within "TransGrid- 2007 Service Standards Compliance Reporting.xls".

8.8 CAPS AND COLLARS

For the performance incentive scheme to provide an appropriate incentive to TransGrid, the difference between the cap and collar values should be significantly wider than the natural fluctuation in the measure that might arise due to exogenous events. Otherwise, natural variations in performance could lead to significant revenue swings and/or the cap/collar values being exceeded.

Where natural variations in performance are distributed around the average in a normal distribution, the cap and collar values should ideally be about two standard deviations above and below the average of the historical data, that is about one year in twenty would be expected to reach the cap or collar through natural variation. Use of a lesser standard deviation is not recommended. For instance, a standard deviation of 1.5 would lead to a probability of the cap/collar being reached approximately one in every seven years.

TransGrid has set collar values that are consistent with the above principles. For the availability and average outage duration parameters, TransGrid has proposed to set collar values at two standard deviations below the performance target. For the loss of supply parameters, the collar has been set at the 90th percentile using the curve of best fit. These approaches appear to provide suitable collar values. In particular, the collar for the loss of supply parameters has been calculated from 10 years of historical data (rather than the most recent 5 year performance). Given the small number of events that exceed the loss of supply threshold values, using a longer time period should better capture the variability in this parameter and hence PB supports this approach.

TransGrid has also set caps that appear to be consistent with the above principles. For the loss of supply parameters the cap has been set at the 10th percentile of the curve of best fit while for the average outage duration, the cap is set at two standard deviations above the performance target. This approach provides an asymmetric reward/penalty for the >0.05 system minutes loss of supply parameter—with rewards accruing at a faster rate than penalties—and a symmetrical reward/penalty for the average outage duration parameter and the >0.25 system minutes loss of supply parameter. Based on the revised historical data[185], the cap value for the average outage duration is 649 and the collar value is 999.

The use of 90th and 10th percentiles assigns equal probability of reaching the cap or collar values and is therefore considered to be appropriate for determining reasonable caps and collars based on asymmetric historical data.

Whilst PB acknowledges that the use of 95th and 5th percentiles may arguably be considered more analogous to a criterion based on two standard deviations from the mean, we note that should these criteria be applied over the 15 year data available for the >0.05 system minutes loss of supply parameter, the target and collar would be 1 and 3 events higher, respectively, and the cap would be 1 event lower. This would result in a significantly lower incremental penalty for each loss of supply event and would also allow a greater number of loss of supply events per year. Therefore PB is of the view that the approach proposed by TransGrid results in more appropriate cap and collar values that more accurately reflect recent performance.

For the availability parameters, a different approach is proposed when setting the cap value, recognising that performance is already high and therefore improvements are more difficult to achieve than performance reductions. TransGrid has added the forecast unavailability for capital works over the 2009 to 2014 regulatory period to the historical unavailability due to operations and maintenance. The historical operations and maintenance unavailability represents the unavailability required to maintain the network according to current work practices.

Therefore, the proposed cap values for the availability parameters represent the upper limit of performance, given current work practices and forecast work volumes. TransGrid proposes to

185 TransGrid submitted revised historical data in a spreadsheet dated 28 July 2007 “Average Unplanned Outage Duration 2003-2007.xls”.

apply an efficiency factor of 10% to these values, stating *"the efficiency factor is intended to incentivise performance improvements while avoiding significant encroachment of the cap into unavailability required to meet other regulatory obligations"*. To gain the maximum reward, TransGrid would need to reduce its unavailability due to all outages, other than those due to forced and faults, by 10% over current levels. This approach appears to provide a reasonable performance improvement goal and therefore to provide suitable cap values.

For consistency with the rounding of targets to the nearest whole value, the values of collars and caps for the loss of supply parameters have also been rounded to the nearest whole number.

Table 8-6 shows PB's recommended collar and cap values as an outcome of our review of those proposed by TransGrid.

Table 8-6 – Recommended ramping factors for service performance parameters

Parameter	TransGrid's proposed values			Recommended values		
	Collar	Target	Cap	Collar	Target	Cap
Transmission line availability	98.92	99.12	99.24	98.99	99.20	99.31
Transformer availability	97.29*	98.58*	98.85*	97.26	98.55	98.83
Reactive plant availability	98.67**	99.13	99.33	98.65	99.13	99.33
Loss of supply events > 0.05 system minutes	7	4	2	7	4	2
Loss of supply events > 0.25 system minutes	2	1	0	2	1	0
Average outage duration (capped 7 days)	917	790	663	999	824	649

*Note: *These figures are based on an incorrect average historical performance of 98.72. PB recommended figures are based on an average historical performance of 98.70.*

*** This figure has rounding errors. PB recommended figures are taken from TransGrid, 11 August 2008, AER Review Availability - Breakdown by Functions 2003-2007.xls*

Source: PB analysis.

8.9 WEIGHTINGS FOR EACH PARAMETER

The overall amount of annual revenue at risk under the incentive scheme is 1%. Of this, TransGrid has proposed weightings that placed 45% of the revenue at risk for parameters related to security of supply (spread across a number of circuit availability measures) and the remainder allocated to parameters related to reliability of supply (two loss of supply event measures) and operational response (an outage duration measure).

In proposing these weightings TransGrid has considered the change to the calculation of the loss of supply parameters and their ability to react to the incentives provided by the scheme. The approach proposed by TransGrid results in the same percentage of the revenue at risk allocated to security of supply based parameters and to reliability of supply based parameters.

Specifically, TransGrid proposes that the weighting applied to the loss of supply parameters should be reduced so that the amount of revenue at risk for a single (large) event remains approximately the same when calculated under both the current and future schemes. The reduction in the overall revenue at risk of 0.1% has added to the average outage duration parameter. This reflects TransGrid's view that it can react to the stronger incentive provided by allocating a larger amount of revenue at risk for the average outage duration parameter. Conversely, TransGrid considers that its already high performance as measured by circuit availability makes it unlikely that it could respond to an increased incentive for this parameter.

PB considers that the following factors are important in setting appropriate weightings:

- weightings should provide a material incentive. With the aggregate incentive set at 1% of revenue, a parameter specific weighting of less than 10% of the total revenue at risk is considered to be too weak to provide an incentive[186]
- the parameter 'loss of supply greater than 0.25 system minutes' should be allocated the highest weighting so as to match transmission customers' high expectations regarding reliability of supply.[187]

PB notes that TransGrid's proposed weightings are consistent with these considerations. Previously the average outage duration parameter was the minimum rate of 10% (now proposed to be 20%) and events that exceed 0.25 system minutes attract a penalty of 35% (previously 20%).

PB considers that the weightings proposed by TransGrid are reasonable and provide appropriate incentives to maintain and improve reliability for customers, which is consistent with the objectives for the scheme as set out in clause 1.4 of the STPIS.

8.10 RECOMMENDATIONS

In summary, we recommend that the values for the six performance parameters shown in Table 8-7 be included in TransGrid's performance incentive scheme.

Table 8-7 – Recommended performance incentive scheme

Measure	Unit	Max penalty	Start penalty	Target	Start bonus	Max bonus	Weighting (%)
Transmission line availability	%	98.99	99.20	99.20	99.20	99.31	20
Transformer availability	%	97.26	98.55	98.55	98.55	98.83	15
Reactive plant availability	%	98.65	99.13	99.13	99.13	99.33	10
Loss of supply events > 0.05 system minutes	number	7	4	4	4	2	25
Loss of supply events > 0.25 system minutes	number	2	1	1	1	0	10
Average outage duration (capped 7 days)	minutes	999	824	824	824	649	20

Source: PB analysis.

186 Where the parameters are not independent, weightings for a sub-measure can be less than 10%. For instance, a circuit availability parameter for feeders may be set at 5% and a circuit availability parameter total (including all equipment) may be set at 25%. Under this arrangement, a feeder outage would incur a 30% penalty (5 plus 25).

187 PB notes that the large Loss of Supply (>0.25 system minutes) events were previously excluded from the small Loss of Supply (>0.05 system minutes) parameter. For the 2009-2014 regulatory period large loss of supply events will be included in the small loss of supply events for consistency with other participants in the STPIS. Therefore the total weighting applied to the large loss of supply events is the sum of the weight applied to both of the loss of supply parameters.

CONCLUSIONS

PB has been engaged by the AER to conduct a review of aspects of TransGrid's proposal in support of the AER undertaking its revenue determination assessments. This work has involved conducting a review of TransGrid's historical and forecast capital expenditure (capex), its operational expenditure (opex) and its service standards proposals.

Through its assessment of the historical and forecast (ex-ante) expenditure proposals for both capex and opex, PB has been able to formulate an independent view on the prudency and efficiency of the expenditure proposed for the forthcoming regulatory period.

In this independent review of the TransGrid expenditure proposals PB has considered, examined and provided its expert opinion, on the following items and expenditure categories:

- historical network capital expenditure (capex) over the current regulatory period
- forecast (ex-ante) network capex
- non-system capex (e.g. IT, vehicles, 'support-the-business' costs etc.)
- forecast operational expenditure (opex)
- service standards
- capital governance framework.

The process adopted by PB in undertaking this review involved presentations, a series of meetings between PB and TransGrid to discuss detail on opex, capex (system and non-system) and service standards, detailed technical reviews on a number of selected individual projects and internal analysis and deliberation by the PB team.

PB enjoyed the full cooperation of TransGrid throughout the process – with unhindered access to appropriate staff and information. The agreed project timetable was adhered to by all parties. These two issues have enabled PB to make its independent assessment within the timetable required by the AER.

In this section we set out PB's key conclusions arising from the independent review of the TransGrid's revenue proposal.

CAPITAL GOVERNANCE AND INVESTMENT DECISION MAKING

As part of the review, and through the detailed project reviews, PB has examined the processes and systems associated with TransGrid's investment decisions and the management of its transmission assets.

PB makes the following observations regarding TransGrid's governance processes and systems:

TransGrid is seriously committed to ensuring that appropriate governance process are in place and has undertaken a significant review and restructure of its governance processes as they apply to major capital projects.

In response to the issues raised during the previous Revenue Cap decision and in recognition that a significant future program of capital projects was planned, TransGrid has undertaken a significant review and restructure of its governance processes as they apply to major capital projects. This has involved the introduction of new approval processes, some restructuring of the organisation, new reporting processes, new project monitoring processes and, importantly, some cultural change within the organisation

PB is of the view that TransGrid is following its defined process to manage potential variations in critical issues such as changes in scope, timing or cost between initial approval and final construction phase approval. It is apparent that TransGrid is seriously committed to ensuring that appropriate governance

processes are in place regarding its investments, and to the delivery of the capital program as evidenced by the Capital Works Steering Committee documentation. The level of senior management and Board reporting is sufficient to ensure that uncontrolled variations to scope, cost, or timing should not occur without approval of the appropriate parties. While the project scope and timing of a number of ex-post capex projects have changed, most projects are delivered on-time and within the approved budget – indicating that TransGrid's project management processes are effective in controlling project costs and delivery timetables.

TransGrid has evidenced that it considers non-network alternatives.

TransGrid is required, through the National Electricity Rules, to consider non-network alternatives to network augmentation. TransGrid has established processes to considered non-network alternatives, and further, can demonstrate situations where non-network alternatives have been implemented.

No clearly defined criteria are applied to strategic property purchases and there is a risk that property purchased may ultimately not be required, may not be suitable, or the purchase may influence options analysis outcomes.

PB is of the view that no clearly defined criteria are applied to strategic property purchases, and PB considers that there is a risk that property may be purchased that is either not required, not suitable, or that acquired properties may influence options analysis outcomes. While recognising the importance of strategic land acquisition, PB considers the lack of a clearly documented property purchase process that applies to strategic acquisition (i.e. prior to the project receiving formal justification) is an issue that could potentially lead to inconsistent and inefficient property expenditure.

PB makes the following observations regarding TransGrid's planning process:

TransGrid's planning and documentation processes appear well structured and consistent with good industry practice and reflective of its reliability based planning obligations under the NER and NSW jurisdictional requirements.

TransGrid's planning and documentation processes are well defined and integrated within the business with appropriate review points that align with critical decisions. Both the process and the supporting documentation appear to be consistently applied across the organisation.

PB is of the view that the formal processes detailed by TransGrid demonstrates a prudent approach to forward planning, structured primarily to meet the regulatory reporting requirements of forecasting future network constraints and the associated forward capital expenditure requirements.

TransGrid's main system planning is based on specific criteria that reflects its planning obligations under the NER and NSW jurisdictional requirements. The use of scenario based planning involves a range of scenarios based on relevant factors and PB believes this represents good industry practice. However, we are of the view that there are clear opportunities for TransGrid to supplement the project selection processes through the assessment of relative changes in market benefits, such as reduced transmission losses and market constraints.

TransGrid's application of alternative analysis (options analysis) is limited, and in cases sampled the documentation has not captured all the information relevant to demonstrating the difference in value between the alternatives considered.

In PB's view, the quality and completeness of the options analysis presented by TransGrid in some key instances is below good industry practice, and this represents a weakness in a generally sound process. In some cases sampled, we believe that TransGrid's documentation and application of alternative analysis fails to support the investment decision making process adequately as it does not capture all the information relevant to demonstrating the difference in value between the alternatives considered.

PB's observations and opinions regarding TransGrid's asset management strategy include:

TransGrid's asset management processes are consistent with good industry practice.

In PB's view, the TransGrid asset management process is consistent with good industry practice and employs condition monitoring and condition based replacement triggers to maximise the life of assets. PB is of the opinion that TransGrid has well-structured and well-documented policies and processes to support its core transmission service provision role.

Furthermore, based on the documentation presented, and interactions with staff during our review of TransGrid's revenue proposal, sufficient evidence exists to support the view that the documented asset management process and policies are very well implemented within the business.

PB's observations and opinions regarding TransGrid's coordination with other parties include:

TransGrid has an established process for consultation with interested parties which is structured to comply with its obligations under the NER.

TransGrid conducts joint planning sessions with major generators, and the NSW DNSPs. These planning sessions are held largely on an as needed basis, but typically at least annually, and provide an opportunity to consult on capital projects that impact each of the parties. A joint demand forecasting meeting is also held with the NSW DNSPs on an annual basis.

HIGH-LEVEL BENCHMARKING AND COMPARATIVE ANALYSIS

As part of this review PB has undertaken a high level comparative analysis and has reached the following conclusions:

TransGrid benchmarks relatively high with a per annum capex to RAB value of around 12.8% – this is not materially different to other businesses.

While typically TNSP's invest between 7% and 14% of their RAB on capex per annum, the measure for TransGrid is relatively high within this benchmark group at around 12.8% for a RAB value of $4,113m. However the TransGrid position is not in any way materially different than the other businesses. With TransGrid's historical annual capex at around 6.8% of its RAB value, this indicates that there has been a considerable increase in capex in the forecast five year period compared with the previous five years.

TransGrid is well below the benchmark group with a per annum non-growth capex to RAB value of around 2.5% – which may be indicative of the age and condition of the plant and equipment and/or indicative of relatively efficient asset replacement strategies.

Typically the TNSP businesses benchmarked invest between 5% and 5.5% of their RAB on non-growth capex per annum. The measure for TransGrid is well below the other points within the benchmark group at around 2.5% for a RAB value of $4,113m. This finding suggests that TransGrid has relatively efficient asset replacement strategies and may be indicative of the age and condition of the plant and equipment it owns.

TransGrid is investing a similar amount of growth related capex per MW increase in peak summer demand compared with its peers.

PB's benchmarking has shown that TransGrid is investing a similar amount of growth related capex per MW increase in peak summer demand compared with its peers, and that along with Queensland, the NSW demand growth is the greatest in the NEM by magnitude. On the basis of capex per kilometre length of circuit (line) as a function of network length (km of line), TransGrid was found to be close to that of the other businesses benchmarked. On a capex per GWh of transmitted energy TransGrid benchmarks relatively low; indicating some of the economies of scale of the network that transmits the greatest annual energy.

TransGrid's proposed operating expenditure per dollar of RAB is the second lowest in the benchmark sample group.

Typically TNSP businesses invest between 4% and 8% of their RAB on opex per annum. As might be expected, the indicative trend is for opex (as a proportion of RAB value) to decrease as the asset base increases. This is likely to reflect the fixed costs of operations and maintenance, and hence the economies of scale available to the larger businesses. TransGrid's proposed operating expenditure per dollar of RAB value is the second lowest in the benchmark sample group.

TransGrid's investment benchmarks favourably with TNSPs in other NEM jurisdictions.

At a high level, TransGrid's investment compares favourably with TNSPs in other NEM jurisdictions, and is seen to be spending considerably less (as a proportion of RAB) on non growth related capex. This in combination with relatively low opex indicators, is likely to be indicative of the current condition and age of the plant and equipment as well as relatively efficient asset management strategies.

HIGH-LEVEL REPLACEMENT CAPEX ESTIMATES

PB's observations and opinions regarding TransGrid's replacement capex proposal include:

TransGrid's proposed network replacement capex is approximately 38% below PB's high-level indicative cap benchmark and on the basis of this simple model TransGrid's proposed ex-ante replacement capex allowance of $493.4m is not unreasonable.

TransGrid's proposed total network ex-ante replacement capex of $493.4m is approximately 38% below PB's high-level indicative cap of approximately $800m which is based on the limiting scenario where all assets older than the weighted average economic life of the asset base are replaced. As TransGrid's asset management approach is condition based, and does not involve a significant proportion of brownfield replacement works; this result is not unreasonable or surprising. Notwithstanding the results of PB's detailed project reviews, which target project efficiency from a bottom-up perspective, we have formed the view that the ex-ante capex allowance proposed for replacement of $493.4m is not unreasonable.

COST ESTIMATING

PB's observations and opinions regarding TransGrid's cost estimating includes:

TransGrid's cost estimating database is sound and suitable for the purposes intended.

In PB's view the framework TransGrid has established regarding its cost estimating database is sound and suitable for the purposes intended, however the use of generic factors is of concern to PB (refer to the following point).

TransGrid's use of %-based cost estimating factors lacks transparency, consistency in application, and their use is un-auditable.

TransGrid applies a number of cost estimating factors to account for field supervision, design, and ancillary works. These factors can account for a significant proportion of the cost estimates and PB is of the view that their application lacks transparency, they are inconsistently applied, and their use is un-auditable. Given the significant value of the cost estimating factors within the project cost estimates, we believe TransGrid should be encouraged to ensure their application is transparent, consistent, and auditable.

TransGrid's unit plant and equipment costs benchmarked within PB's anticipated reasonable ranges.

In benchmarking TransGrid's plant and equipment costs at a unit level, PB found overall TransGrid's unit costs were not unreasonable when compared to the benchmark, and were reasonable relative to those experienced by other TNSP's.

TransGrid's should be encouraged to apply more rigour to the development of its high level project estimates and proposed project definitions, particularly for projects of a significant value.

The high level capital estimates and options assessments derived from the accelerated planning process are unlikely to be of a standard that will satisfy the regulatory consultation process without further assessment, and while PB considers it reasonable that a number of projects may be subject to the accelerated process, we are also of the view that more rigor needs to be applied to proposed project definitions and the associated cost estimates, particularly for projects of a significant value where the assumptions may have bearing on the selection process

HISTORICAL NETWORK CAPEX

PB's review of TransGrid's historical capex has led to the following conclusions:

No issues were identified with regards to augmentation, land & easements, and replacement capex.

As part of our review, PB has not identified any issues within three of the four regulatory categories of historical capex. These three historical expenditure sub categories were augmentation, land & easements, and replacement capex. However, within the support the business category, it was found that scope changes caused actual cost increases above the ACCC's aggregate allowance. Investigation has shown that these scope changes were managed by TransGrid and driven by specific broader business requirements.

No issues or areas of concern were identified with the control of historical capex.

Overall, PB has not identified any issues or areas of concern with the control of historical capex that need to be considered as part of TransGrid's proposed forecast capex for the 200/10-2013/14 regulatory control period.

FORECAST NETWORK CAPEX

PB has undertaken a detailed review of nine projects within TransGrid's proposed ex-ante network capex allowance. The projects have covered all project categories as well as a broad range of asset types and comprise approximately 32% of the proposed network-related capex allowance of $2.47b. From our review, PB's observations and opinions include:

With regards to the forecast capex allowance methodology:

The methodology use by TransGrid in the preparation of the capex proposal is systematic, appropriate for this purpose, and has been suitably applied in determining its ex-ante capex proposal

The methodology use by TransGrid in the preparation of the ex-ante capex proposal involves determination of the progress and expected outturn cost of committed projects, the scoping and estimating of the capital costs of network augmentation, connection, and replacement projects, as well as non-network projects (e.g. business support, IT, etc). In PB's view, this is a systematic and appropriate process, and we are of the opinion that TransGrid has suitably applied this process in determining its ex-ante capex proposal.

With regards to the probabilistic methodology and scenario planning process:

TransGrid's scenario planning and probabilistic methodology is sound, and represents a robust process that is well documented and evidenced, and the development of the scenario probabilities is well considered, with realistic final scenario probabilities.

In PB's opinion, TransGrid's scenario planning and probabilistic methodology is a robust process that is well documented and evidenced. We are also of the view that the development of the scenario probabilities is well considered, with the final scenario probabilities being realistic. From our assessment we are satisfied that the ex-ante capex portfolio is relatively insensitive to reasonable changes in the scenario probabilities, with this lack of sensitivity being largely explained by the fact that the timing of only 12% (approx.) of the capex projects are sensitive to the scenarios. This, combined with a relatively small range

between the high medium and low demand forecasts, explains the relative insensitivity of TransGrid's ex-ante capex portfolio to the scenario probabilities.

With regards to the cost accumulation methodologies and outcomes:

In general the material escalators are reasonable, however TransGrid's proposed producer's margin escalator has not been reasonably determined and an adjustment is recommended.

In PB's opinion, the escalation factors proposed by TransGrid for producer's margin escalation are not reasonable over the period 2010 and 2011 on the basis that they are informed from a single company forecast that may not be representative of the industry as a whole. PB has recommended that no real escalation or producers' margin is applied beyond 2010, which results in a recommended reduction of $9.35m in the overall ex-ante capex proposal. PB is of the opinion that the remainder of the material escalators are reasonable.

TransGrid's proposed steelwork escalation weightings unreasonably weight toward higher escalated components.

In PB's opinion, the escalation weightings proposed for steelwork are unreasonably weighted towards higher escalating labour components. PB has recommended weighting adjustments to correct the disparity which TransGrid considers to be reasonable.

The 5 year aggregate weighting of escalator components does not account for the variation in the project work being undertaken from year to year, and an adjustment is recommended to reflect that it should

In PB's opinion, the application of an aggregate weighting by component across the 5 year capital works program does not account for variation in the actual annual expenditure within each component of the capital works program. PB has recommended that the $3.6m variance identified in TransGrid's analysis of this issue is removed from the total ex-ante capex allowance.

TransGrid's proposed s-curves are reasonable.

In PB's opinion the process used to derive the s-curves is based on judgement and experience rather than TransGrid's historical experience, and on this basis the process is not considered to be transparent. In addition we are of the view that the output is highly sensitive to changes in the input parameters derived from individual opinion. However, PB has examined the s-curves used to calculate the timing of the expenditure over the regulatory period and we are of the view that they are generally conservative when compared to TransGrid's historical experience. The s-curves proposed by TransGrid were found to generally distribute expenditure later into a project when compared to historical experience and other TNSP's. On this basis, PB does not recommend any specific changes to the s-curves proposed by TransGrid.

Given recent significant global economic developments, the impacts on the labour and material cost escalation rates should be considered by the AER in making its determination.

The CEG escalation recommendations are derived from sources available at the time of the report and are typically based on forecasts dated from 2007 to early 2008. The use of these forecasts is considered to be reasonable in the context of the report date. However, significant changes to economic conditions have occurred since this date. Therefore PB recommends that the impacts on the labour and material cost escalation rates arising from these recent global changes should be considered by the AER in making its determination.

With regards to the risk adjustment:

The methodology used in modelling the risk adjustment is generally sound and appropriate to its application.

PB has considered the process to determine the risk allowance and the application of this process by TransGrid to the ex-ante capex portfolio. In our view, there are risks faced by TransGrid in the variation of

project costs between the concept estimate and the completion/approval estimate, and we believe that where the cost variation risk can not be reasonably managed by TransGrid, then this risk should be equitably shared between TransGrid and its customers. In our view the methodology used by TransGrid in modelling the risk adjustment is generally sound and appropriate.

The methodology used in determining the cost variance for the cost distributions is not transparent, lacks evidence and is ultimately un-auditable.

While PB supports the application of a risk based approach in the determination of the ex-ante capex allowance, the methodology employed should be evidence based, transparent, and ultimately auditable. PB is of the view that estimation of cost variation should ideally be based on historical cost records in order to achieve these objectives. Where such historical data is not available, and "expert judgement" is used to estimate cost variance, then these variance estimates should be tested against supporting data to demonstrate that there is no inherent bias in the estimates, and that the estimates do not include cost variation that is accounted for through other means (e.g. the application of escalators, or estimating allowances). Similarly, only variations in costs that are not reasonably managed by TransGrid should be included in the estimation of cost variance. That is, TransGrid should manage the risk of cost variations that are reasonably under its control. After reviewing the methodology used by TransGrid in determining the cost variance for the cost distributions, PB is of the view that it is not transparent, lacks evidence and is ultimately un-auditable.

The methodology used in determining the cost variance for the cost distributions fails to ensure that only cost variances appropriate to the analysis are captured and adjustments to the risk allowance are recommended.

In PB's opinion, TransGrid has failed to ensure that the estimates of cost variance used in the risk analysis do not include cost variations that are captured through other means. That is, we believe that the estimates of the variance used in the risk calculations include variations in cost due to escalation of labour and materials. As the risk allowance is also escalated by the material and labour escalators, the resulting figures double count the impact of labour and material escalation on the risk portion of the project costs. Hence, PB recommends that an adjustment is made to remove the inclusion of the escalation from the risk allowance.

With regards to replacement or reconfiguration of a connection asset:

No connection assets were identified that are clearly inappropriately classified.

While an audit was not within the scope of this review, throughout our review we did not identify any connection assets that are clearly inappropriately classified.

With regards to deliverability of the ex-ante projects and programs:

TransGrid has adopted a number of appropriate strategies that will contribute to the successful delivery of a capital program of the size proposed, and should be able to deliver the planned program across the five years to 2013/14.

Overall, PB considers that TransGrid has demonstrated a high probability of delivering the capital works program in 2008/09 and, as the program for the next regulatory period is of a similar size, should be able to deliver the planned program across the five years to 2013/14. While there are some areas, such as a detailed skills analysis, that might improve confidence in TransGrid's capacity to deliver the proposed capital program, we consider that TransGrid has adopted a number of appropriate strategies that will contribute to the successful delivery of a capital program of the size proposed.

As an observation, and notwithstanding the highly unlikely situation, PB notes that should any of the contingent project triggers be realised and require significant additional capital investment, TransGrid may not be in a position to deliver. While PB is of the view that the likelihood of a contingent project being triggered is quite small, and as there is range of capital investment associated with the various proposed contingent projects, we are of the view that the AER should revisit the issue of deliverability should a contingent project be triggered.

As an outcome of our review, PB's recommendation of an efficient and reasonable level of forecast network capex is $2,498.2m, a reduction of 4.9% from the original proposal. Adjustments recommended by PB to arrive at this level are detailed in Table C-1.

Table C-1 – Final recommendation for TransGrid's total forecast capex allowance

Expenditure $m (real 2007/08)	Ref.	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Bannaby - South Creek 500 kV lines and substation	5.4.3	-	-	-	-	-	-
Holroyd - Chullora 330 kV cable	5.4.4	-	-	-	-	-	-
Dumaresq - Lismore 330 kV line	5.4.5	(1.2)	(17.6)	(17.6)	-	-	(36.4)
SW NSW microwave & satellite	5.4.6	-	-	-	-	-	-
Wallerawang No.1 &No.2 transformer	5.4.7	(0.3)	-	-	-	-	(0.3)
Cooma 132 kV substation replacement	5.4.8	4.8	4.8	3.8	(6.5)	(25.2)	(18.2)
Beaconsfield West 132 kV GIS replacement	5.4.9	(0.4)	(1.2)	(1.8)	(4.7)	-	(8.1)
Newcastle 330 kV substation transformer replacement	5.4.10	-	-	-	(10.5)	-	(10.5)
Hunter Valley - Central Coast 500 kV line easements	5.4.11	-	-	-	(0.1)	(0.9)	(1.0)
Replacement programs	5.4.12	(0.8)	(2.0)	(1.0)	(0.9)	(0.9)	(5.6)
Escalation adjustments (factors)	5.3.1	(0.4)	(1.6)	(3.3)	(2.6)	(1.3)	(9.4)
Yearly weightings	5.3.2	1.1	1.9	(4.2)	(2.3)	(0.1)	(3.6)
Agreed CAM adjustments	5.4.1	(2.0)	(1.8)	(2.9)	(2.0)	(1.2)	(9.9)
Risk allowance adjustments	5.3.4	(2.4)	(2.2)	(3.4)	(2.4)	(1.4)	(11.7)
Cost estimating factors adjustment	3.5.3	(2.8)	(2.6)	(4.0)	(2.8)	(1.7)	(13.9)
PB total adjustment		(4.4)	(22.3)	(34.3)	(34.8)	(32.6)	(128.6)
TransGrid submitted total ex-ante capex		536.8	495.9	748.0	523.8	322.3	2,626.8
PB total adjustment - %		(0.8%)	(4.5%)	(4.6%)	(6.7%)	(10.1%)	(4.9%)

Source: PB analysis.

CONTINGENT PROJECTS

PB's review of contingent projects capex has led to the following conclusions and recommendations:

PB has recommended that nine of the 18 proposed contingent projects are included; with the remainder of the projects rejected due to the lack of reasonably specific and objectively verifiable trigger events.

PB has reviewed the 18 projects proposed by TransGrid as contingent projects (and 14 projects where additional information was provided), and tested these against the requirements defined in schedule 6A.8.1 of the NER. In some cases, PB is of the opinion that the trigger events proposed by TransGrid are not reasonably specific so as to objectively verifiable, and consequently trigger the cost identified.

Of the 18 proposed contingent projects, PB has recommended that nine projects are included in TransGrid's proposal as contingent projects.

NON-NETWORK CAPEX

TransGrid has forecast its non-network capex for the period 01 July 2009 to 30 June 2014 to be $156.3m ('as incurred', real 2007/08). PB has examined the non-network capex over the ten year period 01 July 2003 to 30 June 2014. Our review included the detailed review of two major categories of non-network capex and has been informed by benchmarking comparisons.

PB's observations and opinions regarding TransGrid's non-network capex proposal include:

TransGrid's total non-network capex proposal is in line with similar businesses and is reasonable.

Using top-down benchmarking measures, PB found that the total non-network capex proposal made by TransGrid is in line with similar businesses. We reviewed the non-network expenditure against the number of staff, the RAB at the last review, average opex and average capex and determined that TransGrid was typically below the industry average. At a high level, PB is of the opinion that TransGrid's non-network capex is reasonable.

TransGrid is expending an equivalent amount to other businesses on business IT.

PB carried out benchmarking analysis by using measures informed by the value of the RAB, and opex and capex levels and identified that overall TransGrid is expending an equivalent amount to other businesses in the area of IT.

While TransGrid has a strong IT policy and management governance structure, in some minor areas policies have not been prescriptively followed – however this did not materially impact on the investment decisions.

During our review of business IT related capex, we noted that the process and procedures adopted were not being prescriptively followed, however in the cases examined this has no material impact on the investment decision. Of the three projects that PB has reviewed in detail, PB is of the opinion that the process for establishing the cost of these projects is sound, and we conclude that the expenditure is efficient. On this basis we do not recommend any adjustments to TransGrid's proposed IT expenditure.

TransGrid's process for vehicle expenditure forecasting is sound, the need for investment is reasonable, and the proposed expenditure is efficient.

TransGrid employs a contemporary whole of life cycle approach to its vehicle fleet that was introduced in 2006. In principle, this approach appears to be a more cost effective and a more appropriate method for vehicle replacement that is aligned to condition based replacement. However, the policy is in its infancy and will take some time to affect the longer aged trends used in benchmarking.

FORECAST OPERATIONAL EXPENDITURE

PB has undertaken a critical review of TransGrid's opex submission, associated documentation, historical opex performance, and in particular TransGrid's opex model, the underlying model assumptions and forecasting methodologies used to determine the proposed operating expenditure for the next regulatory period. In addition PB also reviewed the methodology used by TransGrid to allocate costs between opex and capital works.

PB's observations and opinions regarding TransGrid's opex proposal include:

TransGrid's opex model (version 4.5a) and its inputs incorporates assumptions and forecasting methodologies that produce reasonable projections of operational expenditures.

PB has reviewed the operation of the TransGrid opex model including the model inputs and whilst the model is complex in nature, we have formed the view that the final agreed version 4.5a incorporates assumptions and forecasting methodologies that produce reasonable projections of operational expenditures.

The Willis Risk Practice Australia report findings and recommendations are reasonable, and are incorporated into TransGrid's opex model (version 4.5a).

TransGrid engaged Willis Risk Practice Australia (WRP) to conduct an independent review of TransGrid's insurance arrangements. The review included the identification of key risks, determining the frequency and severity of these risks and then identifying those risks that are insurable in the general market. WRP also provided forecasts for future premium spends as well as the associated risk management costs. These risk management cost forecasts are based on the average costs TransGrid incurred during the period June 2003 to June 2008. PB has reviewed the WRP report and considers the forecast premium and risk management expenditure recommendations contained in the report to be reasonable.

TransGrid's Other Controllable Cost categories forecasts are reasonable.

The TransGrid opex model escalates controllable opex cost in all categories by the capex growth factors to incorporate the impact of the additional assets under management which would result from the proposed capital work program. In order to check the reasonableness of the opex modelling PB reviewed corporate governance costs, customer relations costs, regulatory and business management costs. From our review, on balance, PB concludes that the operational forecasts for Other Controllable Cost categories calculated using the TransGrid opex model are reasonable.

The base year cost of $114.90m (2007/08) represents a reasonable operational expenditure from which to project future recurring operational costs.

On balance PB has formed the view that TransGrid is currently a prudent and efficient provider of transmission network services, implementing prudent maintenance policies in a cost efficient manner. Accordingly we believe that the base year cost of $114.90m (07/08) represents a reasonable operational expenditure from which to project future recurring operational costs.

TransGrid's method of forecasting defect rectification expenditures is sound and the forecast defect ratios incorporated into the opex modelling are reasonable.

Generally TransGrid has used the approximate average historical defect ratios to forecast defect rectification expenditures with the exception of substations and land and easements. The forecast defect ratio for substations was based only on the 2005/06 and 2006/07 years as the allocation of costs associated with property maintenance was re-allocated from routine to defect maintenance after 1 July 2005 and hence the 2004/05 year ratio was ignored. PB believes that the method TransGrid has used to forecast defect rectification expenditures is sound and that the forecast defect ratios it has incorporated into its opex modelling are reasonable.

The methodology used to escalate operational effort in TransGrid's opex model to reflect the impact of the proposed capital works program is reasonable; however, we believe that the valuation of the existing TransGrid assets is low.

TransGrid has used a ratio methodology based on the ratio of regulated network assets commissioned annually (by asset category) to the current replacement cost of the asset category to forecast the changes in operation and maintenance effort required as a result of the growth-related capital expenditure. PB agrees that this method is reasonable provided the inputs to the ratios are reflective of the value of the new assets being commissioned and the value of the existing assets. While PB agrees that the methodology used to escalate operational effort in the TransGrid opex model to reflect the impact of the proposed capital works program is reasonable; we are of the view that the valuation of the existing TransGrid assets is low. This results in the ratio of new asset to the existing assets being higher than appropriate and hence the model forecasts are also higher than appropriate.

We recommend that the forecast additional operational expenditures should be calculated using a current replacement value of the existing network of $7,814m (06/07).

The TransGrid opex model calculates the additional operating expenditures required to operate and maintain the new asset commissioned during the next regulatory period. The method used to forecast the additional operating expenditures is to increase the operating forecasts by the ratio of the value of the new assets to the current replacement cost of the existing asset base. PB agrees with this methodology as the

proposed capital works programs create the new assets that will need to be operated and maintained. However, PB recommends that the forecast additional operational expenditures be calculated in the TransGrid opex model using a current replacement value of the existing network of $7,814m (06/07) as we believe this value is representative of the significant real increases in construction and land costs that have occurred since the 2004 revaluation.

The efficiency of scale factors incorporated into TransGrid's opex modelling are reasonable.

The TransGrid opex model incorporates economy of scale factors as part of the calculation of forecast annual expenditures. These economy of scale factors are similar to the factors used by both Powerlink and ElectraNet in forecasting their future operational expenditures. PB is of the view that the efficiency of scale factors incorporated into TransGrid's opex modelling are reasonable and represent the potential gain in efficiencies TransGrid is likely to achieve in implementing the additional proposed works.

The methodology used by TransGrid to allocate costs between opex and capital works is reasonable.

PB considers this cost allocation methodology to allocate costs between opex and capital works is reasonable because wherever possible costs are directly allocated to either opex or capital works using the Oracle financial system. In addition we consider the use of direct labour cost as the cost driver for the allocation of field support costs to be appropriate.

The methodology adopted and applied to determine any opex/capex trade-off appears sound.

TransGrid has included a reduction in forecast operating expenditures resulting from the asset replacement capital works program proposed for the next regulatory period. The reduction has been calculated using TransGrid's works management system. This methodology appears sound and the resultant savings appear reasonable compared to the magnitude of the proposed asset replacement capital works program of $493m (07/08). The saving of $5.21m (07/08) represents just over 1% of the proposed capital expenditure. PB has questioned TransGrid regarding the forecast reduction in maintenance resulting from the asset replacement capital works program and has been advised that savings would continue to be accrued during the following regulatory period. PB has also confirmed that these forecast operational savings have been incorporated into the TransGrid opex model.

TransGrid's approach to managing its land and easements should result in lower costs than the current reactive approach.

TransGrid is currently undertaking an Easement Transition Project, to move to a more consistent maintenance workload. The change involves a move from a reactive approach for easement management to a proactive approach with a resultant reduction in easement defects as reflected in the defect ratios for land and easements going forward. PB has reviewed the approach TransGrid is taking in managing its land and easements and has formed the view that it should achieve the required outcomes at a lower cost than the current reactive approach. The lower forecast operating costs have been factored into the opex modelling.

The projects included in the MOPS listing appear prudent and reasonable costs have been appropriately incorporated in TransGrid's opex model.

Major Operating Projects (MOPS) are defined, by TransGrid, as one-off operating projects relating to asset condition. The MOPS consist of 265 individual projects ranging in total cost from several thousand dollars to over $2.5m, and totalling $46.0m. The total cost includes labour escalation but does not include any increase for asset growth. PB has concluded that the projects included in the MOPS listing appear prudent and that the costs for these projects have been included in the TransGrid opex model in a similar fashion to other maintenance cost categories which are considered to be reasonable.

The reasonable cost of self insurance to be included in the revenue determination is $3,128,000 per annum – a recommended reduction of $41,000 per annum compared to TransGrid's proposal.

TransGrid has included in its operational expenditure an amount totalling $9.54m for self-insurance. This is intended to cover the operational cost resulting from uncertain events where the cost of the event is not

fully recovered from insurance. This includes items where TransGrid does not have insurance cover either because insurance cover is not available or because TransGrid considers it is more effective to self-insure for the cost of the event, and for items where TransGrid's insurance has a deductible (or excess) applicable. PB has reviewed TransGrid's self-insurance proposal and considers that the reasonable cost of self insurance to be included in the revenue determination is $3,128,000 per annum. This comprises the sum proposed by TransGrid ($3,169,000) reduced by $41,000 per annum for Non-terrorist Impact of Planes and Helicopters.

Given the uncertainty around the timing of projects, TransGrid's proposed network support payments should be accepted.

The proposed payments for the Western 500 kV conversion have a high probability of occurring and the value of these payments is likely to be appropriate. The estimated values proposed by TransGrid for network support relating to the Bannaby - South Creek 500 kV Lines & Sub. and Snowy – Yass / Canberra 330 kV Lines upgrade are a reasonable magnitude, however there is uncertainty around the timing of these payments. It is possible that TransGrid will need to make network support payments relating to these projects in the 2010/11 year however, we consider it also possible that these payments may be deferred.

Given there is a reasonable (not remote) probability that network support payments will be made, that the payments proposed by TransGrid are of an appropriate magnitude, and that there is a provision in the NER for adjusting any under or over payments, PB considers that TransGrid's proposal should be accepted.

The defect rectification included in TransGrid's opex model resulting from new growth assets during the next regulatory period should be removed from the annual operating forecasts.

PB is of the opinion that growth in operational expenditures is intrinsically linked to forecast growth related capital works programs, as these programs result in additional new assets that require both maintenance and operating effort. However the TransGrid opex model assumes that the amount of additional operating expenditures is directly related to the increase in new assets under management. The TransGrid opex model assumes that the business is operating under a 'business as usual' scenario. PB contend that if the forecast growth related capital works programs are the same as those in the period up until the 2006/07 base year then the model outputs would be reasonable. However, the forecast growth-related capital works programs are significantly larger than those in place up until 2006/07 and we believe that this has an impact on the reasonableness of the opex forecasts the current model produces. PB recommends that the defect rectification included in the TransGrid opex model resulting from the new growth assets proposed to be commissioned during the next regulatory period be removed from the annual operating forecasts.

Table C-2 summarises PB's recommendations for TransGrid's operational expenditure. For completeness this table includes debt and equity raising costs which were not included in the scope of PB's review. PB makes no recommendation in respect of these costs.

The adoption of our recommendations results in total forecast opex for the 5-year regulatory period of $809.9m (real, 2007/08 dollars), a reduction of $38.5m (4.5%) from TransGrid's submitted opex forecast of $848.4m.

Table C-2 – Final recommendation for TransGrid's total opex forecast

Expenditure $m (real 07/08)	09/10	10/11	11/12	12/13	13/14	Total
TransGrid's proposal						
Controllable opex	135.2	144.4	149.7	161.8	166.5	757.6
Debt raising	3.7	4.0	4.3	4.8	5.1	21.9
Equity raising	0.9	1.7	3.1	4.0	4.2	13.9
Self-insurance	1.91	1.91	1.91	1.91	1.91	9.6
Network Support	21.5	6.0	6.0	6.0	6.0	45.5
Total regulatory opex	163.2	158.0	165.0	178.5	183.7	848.4
PB's recommendation						
Controllable opex	131.15	136.97	140.60	150.29	153.93	712.9
Debt raising	3.7	4.0	4.3	4.8	5.1	21.9
Equity raising	0.9	1.7	3.1	4.0	4.2	13.9
Self-insurance	3.13	3.13	3.13	3.13	3.13	15.65
Network Support	21.5	6.0	6.0	6.0	6.0	45.5
Total regulatory opex	160.4	151.8	157.1	168.2	172.4	809.9
Variation	(2.8)	(6.2)	(7.9)	(10.3)	(11.3)	(38.5)

Source: PB and TransGrid.

SERVICE STANDARDS

While the parameters forming the Service Target Performance Incentive Scheme (STPIS) were fixed prior to TransGrid's Revenue Proposal submission, PB has undertaken a review of TransGrid's proposed values for the established parameters. This review includes recommending appropriate targets, collars, caps and weightings.

PB's makes the following observations and recommendations regarding TransGrid's proposed STPIS parameter values:

TransGrid's historical and current data collection systems are suitable for the accurate reporting of the STPIS parameters.

TransGrid maintains a list of equipment that it defines to be a "circuit" for the purposes of the STPIS, and has an outage management system ("TOS"), that identifies "circuits" by the line number or equipment name, hence ensuring that outages of circuits are consistently identified. TransGrid's data collection is also subject to the AER's annual audit process. PB has examined the auditor's reports and found that the audits had examined TransGrid's data collection and reporting processes and found them suitable. For 2007 data, PB reviewed the data collection and recording process and found that it was substantially the same as that described by the auditors. PB has concluded that historical data and future data collected using TransGrid's processes should be suitable for use in a service performance incentive scheme.

TransGrid has proposed targets, caps, and collar values that are consistent with the STPIS principles.

For all parameters, TransGrid has proposed targets based on the historical data obtained over the past five years and adjusted the values to account for outages required to meet the proposed capital works program.

For the circuit availability parameters, collars have been set at two standard deviations below the performance target. Due to the high existing performance, caps for these parameters have been set based on the historical unavailability due to operations and maintenance and the forecast unavailability due to capital works. An efficiency factor of 10% has been applied to these values to provide a reasonable performance improvement incentive.

For the loss of supply parameters, the caps and collars have been set according to the 10th and 90th percentiles of the curve of best fit applied to TransGrid's 10 year historical performance. For the average outage duration parameter, the caps and collars have been set at two standard deviations above and below the performance target.

PB considers that the approaches adopted by TransGrid are consistent with the intent of the STPIS.

TransGrid's proposed weightings are reasonable and provide appropriate incentives to maintain and improve reliability for customers, which is consistent with the objectives for the scheme as set out in clause 1.4 of the STPIS

As PB considers that weightings should provide a material incentive, and a parameter specific weighting of less than 10% of the total revenue at risk is considered to be too weak to provide a sufficient incentive. Additionally, we are of the view that the 'loss of supply greater than 0.25 system minutes' parameter should be allocated the highest weighting so as to match transmission customers' high expectations regarding reliability of supply. PB notes that TransGrid's proposed weightings are consistent with these considerations and with the objectives for the scheme as set out in clause 1.4 of the STPIS. Hence we consider that the weightings proposed by TransGrid are reasonable and provide appropriate incentives to maintain and improve reliability for customers.

Adjustments to the targets, caps, and collar values are recommended based on the information presented and revisions to the outage hours associated with TransGrid's ex-ante capital works program. In summary, PB recommends that the values for the six performance parameters shown in Table C-3 be included in TransGrid's performance incentive scheme.

Table C-3 – Recommended performance incentive scheme

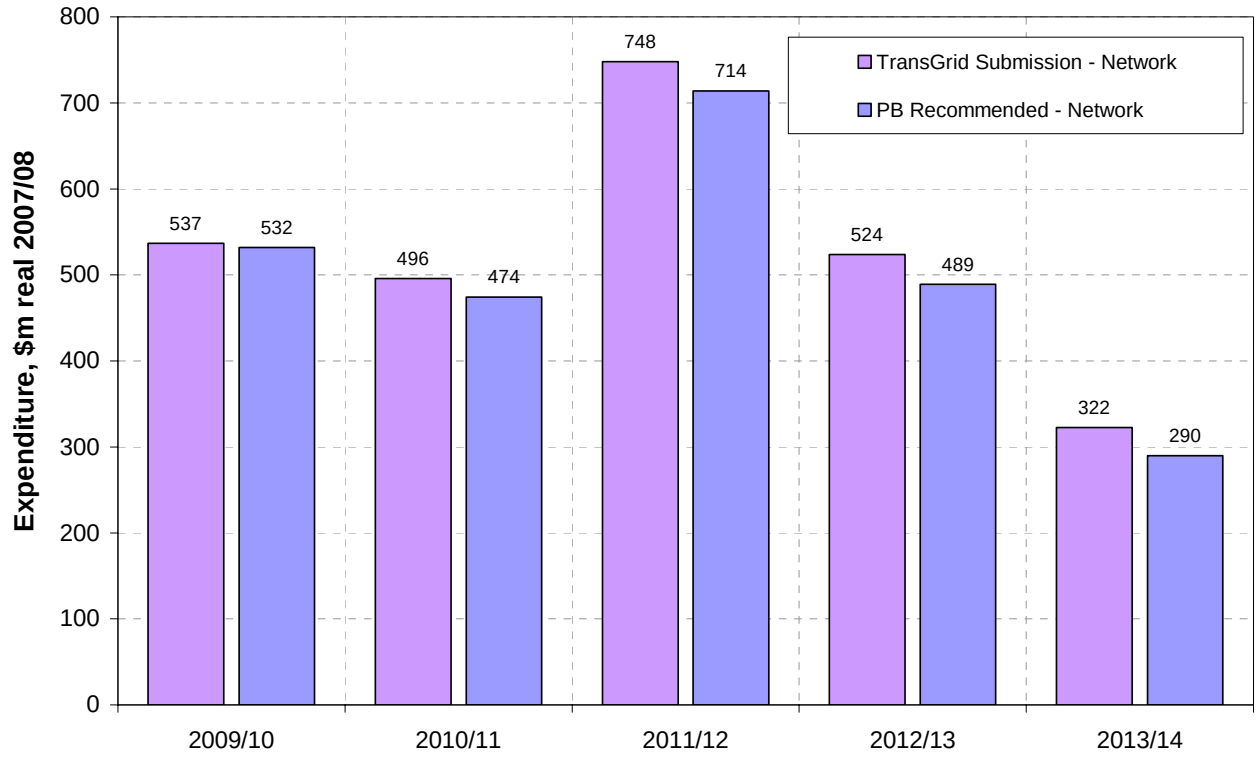
Measure	Unit	Max penalty	Start penalty	Target	Start bonus	Max bonus	Weighting (%)
Transmission line availability	%	98.99	99.20	99.20	99.20	99.31	20
Transformer availability	%	97.26	98.55	98.55	98.55	98.83	15
Reactive plant availability	%	98.65	99.13	99.13	99.13	99.33	10
Loss of supply events > 0.05 system minutes	number	7	4	4	4	2	25
Loss of supply events > 0.25 system minutes	number	2	1	1	1	0	10
Average outage duration (capped 7 days)	minutes	999	824	824	824	649	20

Source: PB analysis.

SUMMARY OF PB EXPENDITURE RECOMMENDATIONS

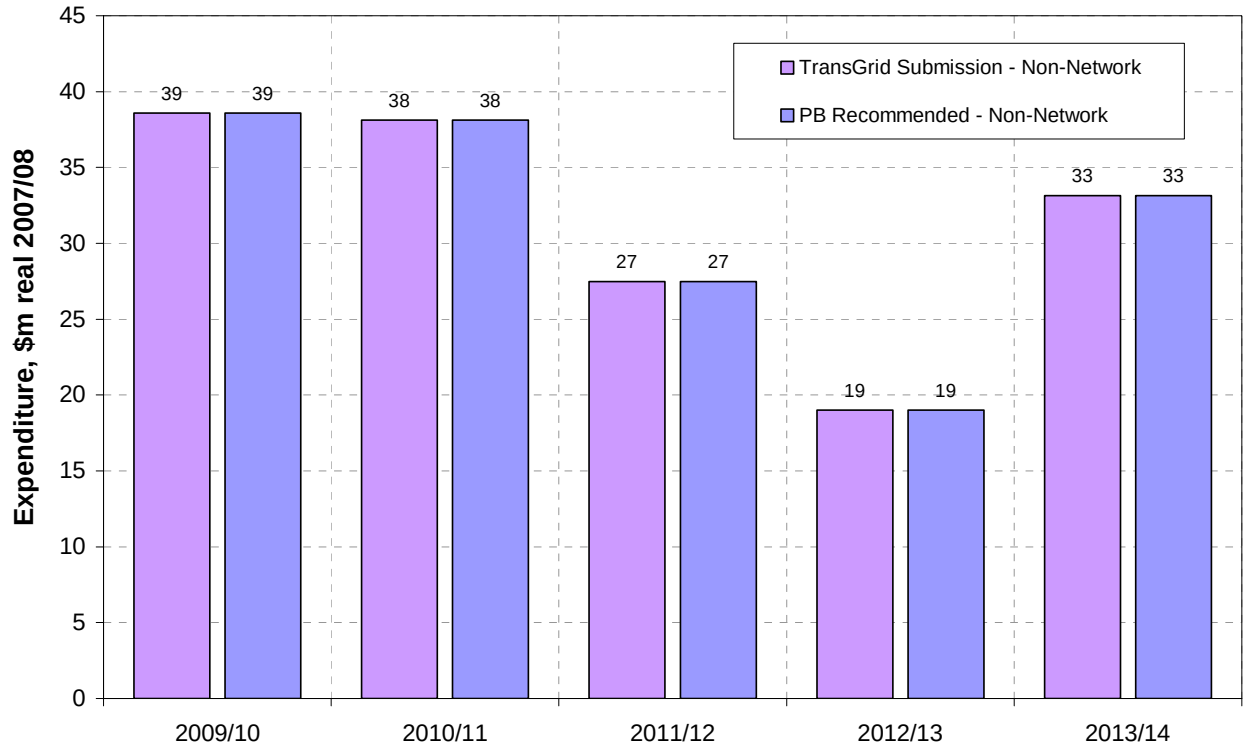
Figures C1 to C3 present PB's recommended adjustments to TransGrid's submission based on the overall findings of our review.

Figure C1 – Adjustments to forecast network capex ($m real 07/08)



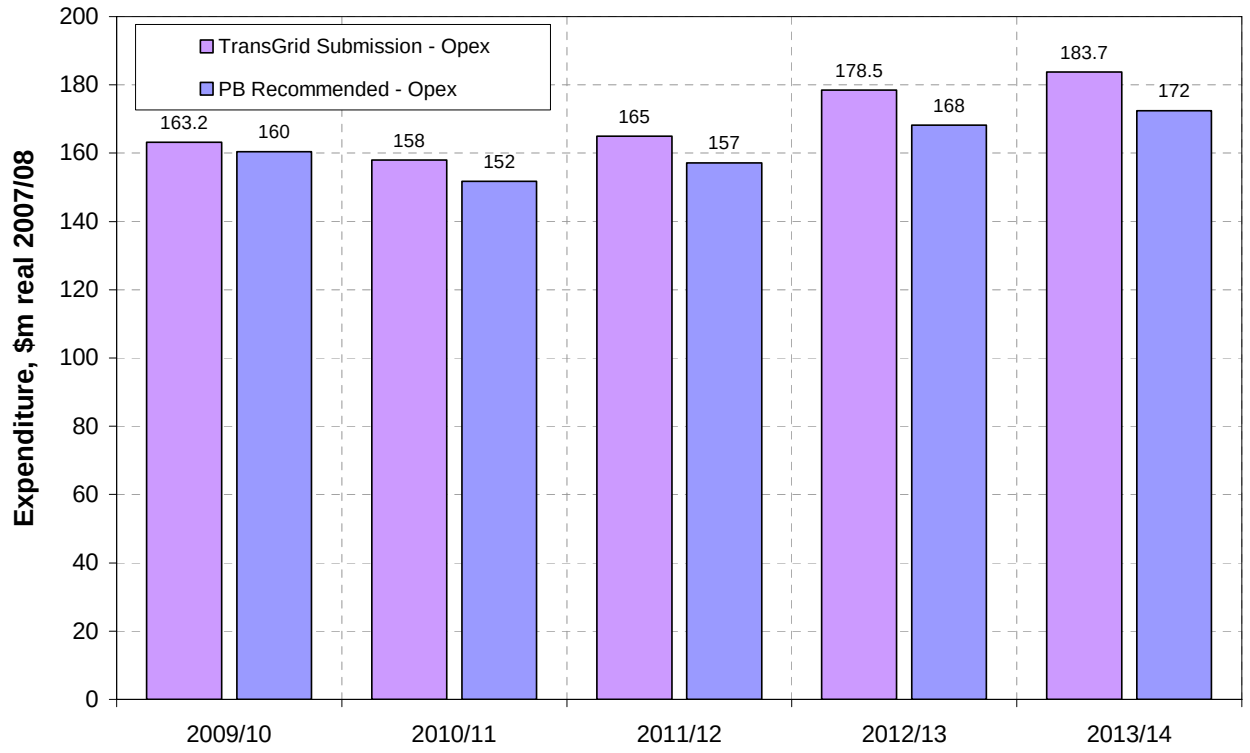
Source: PB analysis.

Figure C2 – Adjustments to forecast non-network capex ($m real 07/08)



Source: PB analysis.

Figure C3 – Adjustments to forecast opex ($m real 07/08)



Source: PB analysis.