TRANSGRID REVISED REVENUE PROPOSAL

An independent review

Prepared for

AUSTRALIAN ENERGY REGULATOR

PB Quality System:

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EXECUTIVE SUMMARY

As part of the AER's assessment of TransGrid's revised revenue proposal for the regulatory period 2009 - 2014[1], PB Strategic Consulting (PB) has been engaged to review certain aspects of the revised proposal. Specifically, the matters are associated with the revised forecast capital expenditure (capex), operational expenditure (opex), and the contingent project drivers and their triggers and include:

a) the reassessed project scope and costs of the:

- Dumaresq-Lismore 330 kV line project
- Cooma 132 kV substation replacement project
- Beaconsfield West 132 kV GIS replacement project
- Williamsdale 330/132 kV substation

b) the arguments raised in relation to:

- the instrument transformer replacement program
- the scoping factors, and the extension of the findings on detailed sample project reviews to the remainder of the forecast capex allowance
- the application of the weighting of the escalators over a fixed 5-year period
- the application of cost estimation risk factor
- whether the scope and revised triggers for the contingent projects are reasonable, objective and verifiable
- the defect maintenance level and costs on new assets and how this has been incorporated in the forecast opex allowance.

PB's review has been conducted with due regard to the NER, particularly chapter 6A, and PB's complete terms of reference for this engagement is included in Appendix A. PB has been required to:

- consider any new information provided by TransGrid and advise of any changes to the recommendations made by PB in its previous reports
- set out what new information has led to the revision of any of its previous recommendations. If no such changes are made, PB must set out why TransGrid's responses and new information do not lead to a revised recommendation
- have regard to industry submissions raised in relation to the above issues
- provide details of any modifications to TransGrid's revised opex and capex model as a result of any changes recommended.

The following sections outline PB's independent review of the revised information presented by TransGrid in relation to these matters, and our findings and recommendations to the AER.

[1] TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, TransGrid, January 2009.

Dumaresq-Lismore 330 kV line project

This project involves the construction of a new 330 kV transmission line from Dumaresq - Lismore and associated switchyard works by 2011/12 to meet growing demand in the far north coast of NSW and to address corresponding voltage and line loading limitations.

In its revised revenue proposal, TransGrid presented a response to the adjustments applied by the AER. As part of PB's review of these matters, the following conclusions have been made:

- the $1.3m upward adjustment proposed by TransGrid for the centre circuit breaker at Dumaresq is reasonable and it should be accepted as prudent
- the 15% Scoping Cost Factor applied to this project is still considered unreasonable and the original reduction from 15% to 10% should be retained such that PB's original $4.0m downward adjustment is still appropriate
- the use of a 10% escalation factor for this committed project to account for (real) inflation due to the use of an older estimating process is not reasonable, and PB's 6.2% CPI adjustment, as previously recommended, should be retained such that PB's original $7.4m downward adjustment is still valid
- the double counting of the $22m easement costs has been appropriately removed from the inputs to the CAM.

Given these matters, the overall variation recommended by PB for the Dumaresq-Lismore 330 kV transmission line project is a reduction of $11.4m from the revised submission of $162.2m.

Cooma 132 kV substation replacement project

This project involves the proposed replacement of the existing Cooma substation due to the poor condition and performance of the existing plant through a greenfield substation development at Cooma North, with an anticipated commissioning date of 2013/14.

In its revised revenue proposal, TransGrid presented a response to the adjustments applied by the AER. As part of PB's review of these matters, the following conclusions have been made:

- the revised options analysis still fails to reasonably demonstrate that TransGrid's preferred option (of remote reconstruction at Cooma North) is the economic option
- the basis for the application of non-standard cost estimating factors by TransGrid, or the brownfield factor suggested by SKM, is not transparent and supported by project specific information
- the revised option analysis, as undertaken by PB, indicates that the in-situ rebuild project option (excluding busbars) is the economic option when a supportable brownfield adjustment is included
- full consideration has not been given to the refurbishment of the transformers and regulators by TransGrid, and no further evidence has been submitted to demonstrate consideration of the potential management options for the existing Cooma transformers
- TransGrid has confirmed the project will release the existing 132/66 kV No. 3 transformer, which is in serviceable condition, for use on a subsequent project and appropriate adjustment to reduce TransGrid's forecast capex allowance is proposed to reflect this.

Given these matters, PB recommends a $13.9m reduction in the project base estimate to reflect the selection of option 3 over option 1 as the preferred option for the Cooma substation replacement project. In addition, a reduction of $1.6m is recommended to account for the avoided cost of procuring a additional 132/66 kV transformer for a separate project.

The overall variation recommended by PB for the Cooma 132 kV substation replacement project is a reduction of $18.0m from the revised submission of $40.6m.

Beaconsfield West 132 kV GIS replacement project

This project involves the replacement of the 132 kV gas insulated switchgear (GIS) at Beaconsfield substation due to the condition of the equipment. The commissioning date is anticipated to be 2012/13.

In its revised revenue proposal, TransGrid presented a response to the adjustments applied by the AER. As part of PB's review of these matters, the following conclusions have been made:

- the basis for TransGrid's original doubling of the DCF and NCF factors has still not been demonstrated in a transparent manner and lacks documented objectivity
- further, the basis for TransGrid's revised application of an additional 30% 'in-situ factor' to the entire project estimate has not been demonstrated to be transparent, lacks documented objectivity and double counts the brownfield allowances already included in the base estimate
- the removal of TransGrid's non-standard factors, and separation of the building costs, enables a reasonable greenfield estimate to be determined, to which a demonstrable 23% brownfield factor can be applied, resulting in a $6.1m reduction in the project allowance.

Given these matters, the overall variation recommended by PB for the Beaconsfield West 132 kV GIS replacement project is a reduction of $7.2m from the revised submission of $51.1m.

Williamsdale 330/132 kV substation

TransGrid originally included Williamsdale stage 2 as a contingent project. In its revised revenue proposal, TransGrid has proposed that the stage 2 project be incorporated into its forward capital expenditure allowance on the basis of developments since the submission of the original revenue proposal, where TransGrid:

- has acquired the Williamsdale substation site
- has received advice from the ACT Minister for Planning that no further environmental assessment is required.

PB undertook a detailed review of this project related capex and in our view the need, scope and timing of the project has been demonstrated, and a reasonable range of options had been considered. Notwithstanding this finding, PB recommends a small risk allowance of $0.85m (included in the base estimate to cover potential property acquisition costs) should be removed given that it would represent an allowance inconsistent with TransGrid's accepted capital accumulation process for committed projects.

Given these matters, the overall variation recommended by PB for the Williamsdale 330/132 kV substation project is a reduction of $0.85m from the revised submission of $34.7m.

Instrument transformer replacement program

This program involves the replacement of instrument transformers (ITs) that display high results from Dissolved Gas Analysis (DGA) testing conducted as part of TransGrid's routine condition monitoring program.

In its revised revenue proposal, TransGrid presented a response to the adjustments applied by the AER. As part of PB's review of these matters, the following conclusions have been made:

- in contrast to PB's previous advice that it was plausible that a number of the instrument transformers proposed for replacement could be re-used, TransGrid's revised information has demonstrated that there would only be a small number technically suitable for re-use. On this

basis, and notwithstanding the following matter, PB considers TransGrid's revised capex allowance for this project is prudent

- TransGrid has not demonstrated consistency in the application of its risk assessment for the revised program of expenditure, and given this understanding PB considers TransGrid's selection of a more expensive option is not efficient or economic. PB recommends a $193k downwards adjustment (representing the cost difference between the two key options assessed) should be made to the revised forecast capex allowance.

Given these matters, the overall variation recommended by PB for the instrument transformer replacement program (after inclusion of escalation) is a reduction of $0.21m from the revised submission of $16.6m.

Use of scoping factors and extension of the findings

TransGrid's project cost estimating process employs three %-based cost estimating factors; a Design Cost Factor (DCF), a Network Cost Factor (NCF) and an Ancillary Works Factor (AWF). TransGrid has developed standard values for these cost estimating factors based on standard project types. However, TransGrid's estimating process allows the application of non-standard cost estimating factors to non-standard projects.

In the AER's draft determination, the AER considered PB's advice concerning TransGrid's application of non-standard cost estimating factors, and concluded that there was scope for overestimation and a lack of justification for some cost factor adjustments. On the basis of these considerations, the AER concluded that it would apply a $13m reduction to TransGrid's proposed capex allowance.

In its revised revenue proposal, TransGrid presented a response to the adjustments applied by the AER. As part of PB's review of these matters, the following conclusions have been made:

- on the balance of the revised information presented, and notwithstanding TransGrid's systematic review of the application of non-standard scoping factors across its preferred projects, PB considers that TransGrid has failed to demonstrate that the application of non-standard factors has not influenced the results of its options analysis, or the selection of its preferred development outcomes, and therefore potentially its revised forecast capex allowance. On this basis, PB has simply recalculated the value of its proposed adjustment based on the revised Beaconsfield West findings and determined the adjustment to be $5.1m

- the $0.95m upwards adjustment included by TransGrid in its revised proposal to correct for an identified software error in its cost estimating process is reasonable.

Given these matters, the overall variation recommended by PB associated with TransGrid's use of non-standard scoping factors is a reduction of $5.1m from the overall forecast capex allowance.

Application of the weighting of the escalators over a fixed 5-year period

In its draft determination, the AER applied a downwards adjustment of $4.7m relating to application of labour and materials escalators across the forward capex portfolio to ensure the year-on-year variability of expenditure was appropriately accounted for.

As part of its revised proposal, PB notes TransGrid's statements regarding the complexity and its investment in its capital accumulation model (CAM), in particular the inability of the CAM to accommodate additional escalation factors for different project types or component input categories on an annual basis. Furthermore, PB notes that TransGrid considers that the escalation variance presented in its analysis demonstrates that the variance attributable to the annual application of escalators is small and therefore its process should be considered to be reasonable.

In response to this matter, PB considers that whilst the percentage change in forecast capex requirements may appear small, due to the scale of the escalation allowance proposed by TransGrid, the resulting $4.7m variance in escalation is not immaterial in the context of the other adjustments applied in the draft determination and should be maintained. It is also noted that the consequences of more accurately

capturing the impact of the escalators given the widely varying year-on-year expenditure profile as recommended by PB, may have resulted in a consequential increase in TransGrid's forecast allowance rather than the reduction.

Application of cost estimation risk factor

As part of its original revenue proposal, TransGrid undertook a quantified assessment of the risks associated with the way it estimates the project capital costs associated with its portfolio of works over the 2009-2014 regulatory period. The risk adjustment accounted for the expected variation between anticipated outturn costs and the base cost estimates and amounted to $77.1 million.

In the AER's draft determination, the AER reiterated that it generally accepted the modelling approach and methodology applied by TransGrid, and as facilitated by Evans & Peck, but was concerned that the process of 'risk workshops' was not transparent and that there may be scope for the variance estimates to include cost variations captured through other means. The AER also adopted the median (P50) risk profile. Consequently the AER reduced TransGrid's cost estimating risk allowance by $11.4 million.

In its revised revenue proposal, TransGrid presented a response to the adjustments applied by the AER. As part of PB's review of these matters, the following conclusions have been made:

- the explanations of the workshop process provided by TransGrid do not clearly demonstrate how factors other than quantity variation have been excluded from the risk workshop variance estimates
- the process of correcting the variance estimates for the influence of historical escalation expectations when compared to the revised escalation procedure applied in TransGrid's CAM process, has not been demonstrated. On the basis of the documentation provided, PB remains of the view that the change in escalation expectations appear to have influenced the result of the workshop
- the documentation provided by TransGrid has not transparently demonstrated the process by which escalation has been excluded from the risk variance and that in some cases escalation appears to have been directly included into the risk variance estimates that form the basis for the calculation of risk allowance
- no verification of the workshop outcomes against other variance estimates such as historical records or similar businesses has been demonstrated
- an adjustment of $6.54m should be applied to TransGrid's revised revenue proposal to remove the influence of escalation in the base risk variance estimates used by TransGrid in its CAM process.

Therefore PB remains of the view that escalation has not been fully excluded from the risk allowance proposed by TransGrid, and recommends an adjustment of $6.54m be applied to TransGrid's revised capex allowance for this purpose.

Revised triggers for the contingent projects

TransGrid has redefined the trigger events, and supplied additional information on the drivers for six contingent projects not approved by the AER in its draft decision.

In the case of the following four projects, PB recommends to the AER that the proposed revisions adequately meet the requirements of clause 6A.8.1 of the NER in that:

- the project is reasonably required to be undertaken to achieve the capex objectives
- the proposed contingent capex is not otherwise provided in the capex allowance and reasonably reflects the capex criteria
- the indicative cost exceeds either $10 million or 5 per cent of the maximum allowed revenue (MAR) for the first year of the regulatory control period (cost threshold)

- the information provided in relation to contingent projects complies with the AER's submission guidelines made under clause 6A.10.2.

and that the trigger event:

- is reasonably specific and capable of objective verification
- 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
- is probable during the next regulatory control period but not sufficiently certain that the event will occur in the next regulatory control period.

Contingent Project	Capital cost ($m)
CBD and inner metropolitan area supply	$342
Gadara Tumut load area	$54
Orange 330/132 kV Substation	$46.8
Reactive support at seven sites	$36

However, in the case of the following two projects, PB considers that TransGrid's proposed revisions do not adequately meet the requirements of clause 6A.8.1 in that:

- the contingent project expenditure proposed provides market benefits and is not required to ensure TransGrid achieves its security and reliability obligations, and therefore does not meet the requirement of the NER in that the contingent capital expenditure must reasonably reflect the capital expenditure objectives (6A.8.1(b)(1)), as stated by TransGrid, and
- one defined option for the trigger solely references a satisfactory Regulatory Test outcome, and this is not considered by PB to be an appropriately defined trigger for a contingent project as it fails to meet the 'specific and verifiable' requirements required by clause 6A.8.1(c)(1) of the NER. In PB's view, an appropriately defined trigger should detail the external event that has changed key input factors leading to the need for the capital investment that was not previously required before the event.

Contingent Project	Capital cost ($m)
QNI Upgrade – series compensator	$60
Victorian Interconnector development	$35

The following four contingent projects were considered to satisfy the requirements of clause 6A.8.1 of the NER as part of TransGrid's original revenue proposal, however TransGrid has refined and resubmitted these projects as part of its revised revenue proposal with the intent to clarify any outstanding issues regarding the defined trigger events. PB has considered in detail the updated trigger event definitions as part of this review, and as an outcome of our review, PB concludes that the proposed revisions adequately meet the requirements of clause 6A.8.1 of the NER. On this basis, we recommend to the AER that they be accepted.

Contingent Project	Capital cost ($m)
Hunter Valley to Coast 500 kV	$300
Yass to Wagga 500 kV	$329
Banaby – Yass reinforcement	$45
Richmond Vale 500/330 kV substation	$80

Defect maintenance levels and impacts on forecast opex allowance.

As part of our original review, PB considered that TransGrid's methodology of calculating the opex allowance for the assets commissioned during the next regulatory period overstated the maintenance expenditures required given that these assets would be recently commissioned and also covered by either the manufacturer's and or construction warranty.. PB's recommendation to the AER on this matter resulted in a reduction in the overall opex allowance of $15m (real 2007/08).

In response to this matter, TransGrid has raised three main issues as part of its revised proposal:

- there is no significant change to the age mix of assets making up TransGrid's asset base, leading to the conclusion that there is no expectation that defect rates would be impacted by the effect of new assets
- there is evidence that new assets can experience higher defect rates than for mid life equipment (for example, as a result of manufacturing defects)
- warranties provide only limited coverage and do not cover the emergency response, fault detection and site supervision components of any equipment malfunction.

On the balance of the significant additional information provided by TransGrid, including the SKM report in Appendix L of the revised proposal, PB has concluded that it will not alter its original recommendation to the AER given that the revised proposal:

- indicates a reasonable warranty period exists for all asset classes
- indicates a reduction in defect ratios across the major categories during the current regulatory period (notwithstanding issues associated with some recent major and complex projects)
- indicates TransGrid is experiencing lower average switchbay maintenance costs for newly commissioned assets compared to assets commissioned during previous regulatory periods (over a two year sample period 2006 to 2008).

PB considers TransGrid is a competent transmission service provider capable of designing and constructing new transmission assets that do not require any (or at least minimal) defect rectifications for the first few years of their operation after the expiration of typical warranty periods.

Whilst PB has not been persuaded by the additional information and data provided by TransGrid as part of its revised proposal to alter our view in these matters, we do recognise however that TransGrid has advised that the defect rectification expenditures include regular maintenance activities such as lawn mowing, garden maintenance and substation cleaning that PB would normally consider to be of a routine nature. Hence in this report, we propose that our original recommended opex adjustment be revised. Our new recommended adjustment to forecast opex expenditures is the forecast defect rectification component of the forecast total maintenance expenditures relating to the assets proposed to be commissioned during the next regulatory period, subsequently reduced by a reasonable amount to compensate for the regular maintenance component of these forecasts, plus an amount to compensate for some costs that are associated with organising and managing works under warranty.

PB recommends to the AER that it maintain its position as detailed in Section 5.6.5 of its draft determination, namely to reduce the total costs forecast by TransGrid's opex model to reflect the impact of the expected lower maintenance costs associated with new assets proposed in the significant capital works program. PB continues to recommend quantifying these cost reductions by calculating the defect rectification costs for growth related assets using the TransGrid opex model, but subsequently we recommend reducing these total defect rectification costs by a reasonable and moderate amount to compensate for the non-routine, but regular maintenance works included by definition in these defect rectification forecasts and also to compensate TransGrid for some minor non-recoverable costs associated with organising and managing works under manufacturer's or construction warranties.

In the absence of specific data to support the magnitude of these subsequent adjustments, PB believes that $300k per annum would be a reasonable estimation of the sum of the non-routine maintenance costs included in the total defect rectification costs associated with the assets proposed to be commissioned during the next regulatory period, as well as the non-recoverable costs associated with managing and organising warranty works over the same period. This recommendation translates into a total reduction of $1.5m over the five year regulatory period.

The calculated defect rectification costs using the TransGrid opex model for the assets proposed to be commissioned during the next regulatory period is $15m, therefore PB's recommended adjustment to TransGrid's total forecast opex expenditures to allow for the expected lower maintenance costs associated with new assets is a net reduction of $13.5m.

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).

Prior to the publication of the AER's draft decision[2] on 31 October 2008, PB documented its independent review of TransGrid's revenue proposal in our report entitled "TransGrid Revenue Reset - An independent review" and a related supplementary report, prepared for the AER.

TransGrid submitted a revised revenue proposal to the AER on 14 January 2009. The revised proposal provides additional information addressing matters raised in the AER's draft decision and attempts to demonstrate how the revised expenditure satisfies the requirements of the NER.

As part of the AER's assessment of the revised proposal, PB Strategic Consulting (PB) has been engaged as an independent expert to review aspects of TransGrid's revised proposal - specifically, forecast capital expenditure (capex), operational expenditure (opex), and contingent projects and their triggers. 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 certain aspects of TransGrid's revised revenue proposal. This work involves reviewing TransGrid's response and providing advice to the AER regarding ten specific areas of TransGrid's revision. These relate to:

a) the reassessed project scope and costs of the:

- Dumaresq-Lismore 330 kV line project
- Cooma 132 kV substation replacement project
- Beaconsfield West 132 kV GIS replacement project
- Williamsdale 330/132 kV substation

b) the arguments raised in relation to:

- the instrument transformer replacement program
- the scoping factors, and the extension of the findings on detailed sample project reviews to the remainder of the forecast capex allowance
- the application of the weighting of the escalators over a fixed 5-year period
- the application of cost estimation risk factor

[2] AER, TransGrid Transmission Determination 2009-10 to 2013-14 Draft Decision, 31 October 2008.

- whether the scope and revised triggers for the contingent projects are reasonable, objective and verifiable
- the defect maintenance level and costs on new assets.

As part of this engagement, PB has been required to:

- consider any new information provided by TransGrid and advise of any changes to the recommendations made by PB in its previous reports
- set out what new information has led to the revision of any of its previous recommendations. If no such changes are made, PB must set out why TransGrid's responses and new information do not lead to a revised recommendation
- have regard to industry submissions raised in relation to the above issues
- provide details of any modifications to TransGrid's revised opex and capex model as a result of any changes recommended.

The overall objective of this review is to formulate an independent view on the reasonableness, prudence and efficiency of the revised expenditure proposed for the next regulatory control period. The review of TransGrid's revised capital expenditure has been limited to the issues raised by TransGrid in response to the AER's draft determination.

It is intended that the results and conclusions of this review by PB will assist the AER in its requirement to determine the regulated revenue requirements associated with TransGrid's electricity transmission assets over the next regulatory control period from 1 July 2009 to 30 June 2014.

1.3 REPORT STRUCTURE

The content of this report is as follows:

Section 2 details our analysis of the issues raised in relation to the TransGrid's revised forecast capex allowance.

Section 3 details our analysis of the issues raised in relation to the TransGrid's revised contingent project scope and triggers.

Section 4 details our analysis of the issues raised in relation to the TransGrid's revised forecast opex allowance.

2. REVIEW OF REVISED FORECAST CAPEX

PB has been engaged to respond to a selected set of issues raised by TransGrid in its revised proposal in relation to matters affecting the ex-ante forecast capex allowance adjustments identified by the AER as part of its draft determination. Our review, discussion and conclusion regarding these eight separate items are detailed in the following section.

2.1 DUMARESQ-LISMORE 330 KV LINE PROJECT

This project involves the construction of a new 330 kV transmission line from Dumaresq - Lismore and associated switchyard works by 2011/12 to meet growing demand in the far north coast of NSW and to address corresponding voltage and line loading limitations.

In its Draft Determination[3], the AER considered that the Dumaresq - Lismore 330 kV transmission line project represents prudent investment. However, the AER was not satisfied that TransGrid has proposed a level of capex that reasonably reflects the efficient costs that a TNSP in the circumstances of TransGrid would require to meet the capex objectives, as required by clause 6A.6.7(c).

Adjustments were applied that related to:

- insufficient justification for the number of 330 kV circuit breakers proposed for the Dumaresq substation (-$2.6m)
- the lack of transparency in the application of a generic 'scoping cost factor on line works' applied to line construction costs. A reduction in this factor from 15 per cent to 10 per cent was applied to reflect an efficient scoping allowance on the basis that the scope of this project is relatively well known to TransGrid and reasonably reflects the costs that would be incurred (-$4.0m)
- the application of unreasonably high CPI adjustment (10.1%) in TransGrid's modelling. The AER agreed with PB's analysis that a CPI adjustment of 6.2% was more reflective of actual inflation (-$7.4m)
- the double counting of a $22m easement in the project (-$22m).

This project had an estimated capital cost of $166m in TransGrid's original revenue proposal however, the $22m easement cost component was also included as a separate easements project within TransGrid's Capital Accumulation Model resulting in a total of $188m being included in the forecast capex allowance. On the basis of the adjustments described above, the project allowance was reduced by $36m in the AER draft determination.

2.1.1 Revised Proposal

In its revised revenue proposal[4], TransGrid presents a response for each of the adjustments applied by the AER, leading to its revised capex allowance for this project as shown in Table 2-1. This figure includes both the easement costs (project ID 9095) and the main project allowance (project ID 9096) as represented in the TransGrid CAM.

3 TransGrid Transmission Determination 2009-10 to 2013-14 Draft Decision, Australian Energy Regulator, 31 October 2008.

4 TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, TransGrid, January 2009.

Table 2-1 – Revised Dumaresq - Lismore project estimate ($m, 2008)

2010	2011	2012	2013	2014	Total
21.7	72.7	67.8	-	-	162.2

Source: TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 21.

A summary of the TransGrid response is provided in the following sections.

Number of circuit breakers at Dumaresq

TransGrid accepted the AER finding that the additional expenditure associated with the connection of the Lismore line through double breaker arrangement is not required to achieve the capital expenditure objectives.

TransGrid did not accept the AER's finding that the provision of the centre circuit breaker in the 'breaker-and-a-half' arrangement at Dumaresq was not reasonably demonstrated to be prudent and efficient. TransGrid raised the following issues to support the inclusion of the centre circuit breaker.

- a reduction in reliability and operational flexibility from the existing arrangements
- the introduction of additional constraints on the flow-path to undertake maintenance that could otherwise be avoided
- the potential separation of Queensland from the remainder of the NEM for the maintenance of equipment in the centre switchbay
- the avoidance of potential market impacts caused by transmission constraints and outages arising from the removal of the centre circuit breaker.

Furthermore, TransGrid noted:

> *"TransGrid considers that the proposed capital expenditure on the centre circuit breaker is required in order to achieve the capital expenditure objectives in clause 6A.6.7 of the Rules. In particular, the centre circuit breaker is essential for maintaining the quality, reliability and security of supply of prescribed transmission services and for maintaining the reliability and security of the transmission system through the supply of prescribed transmission services."*[5]

On the basis of the issues noted above, TransGrid proposed that $1.3m be reinstated into the forward capital revenue allowance to provide for the centre circuit breaker in the 'breaker-and-a-half' arrangement at Dumaresq.

Application of scoping factors

TransGrid did not accept the AER's reduction of the Scoping Cost Factor (SCF) on line works applied to the project from 15% to 10% on the basis that the scope of the project is relatively well known to TransGrid.

TransGrid raised the following issues to support the application of a 15% Scoping Cost Factor to this project.

- the feasibility report was prepared in 2006 in accordance with the processes and estimating database that were in use at the time of preparation
- the SCF used for this project is analogous to the Ancillary Works Factor (AWF) currently applied in TransGrid's feasibility process

[5] TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 18.

- the process used to derive and document the standard AWF for this project type has been accepted by PB
- the standard AWF for this project type should therefore be applied in place of the SCF.

On this basis, TransGrid proposed that the 15% SCF be retained for this project.

Application of escalation to project cost estimate

TransGrid did not accept the AER's reduction in escalation from 10.1% to 6.2% applied to the feasibility study cost estimate to escalate the costs from the 2006 basis of the feasibility study to the 2008 basis of the revenue submission.

TransGrid raised the following issues to support the use of a 10.1% escalation adjustment:

- the AER has stated that it has an obligation to provide businesses with a reasonable opportunity to recover efficient costs associated with their ongoing operation
- the AER has permitted capex allowances to be escalated in real terms for input cost increases above that associated with CPI
- TransGrid has calculated that the application of the historic escalation factors and component weightings contained in the AER's Draft Decision results in an escalation of 14.8% for the two years
- TransGrid's application of 10.1% escalation was based on recent project information for the committed Dumaresq-Lismore 330 kV line project.

On the basis that TransGrid's proposed figure of 10.1% is lower than the 14.8% escalation obtained using the AER's Draft Decision escalation figures, it considers that the proposed escalation for this project is reasonable and prudent.

Easement double count

TransGrid accepted the AER finding that the easement expenditure of $22m associated with this project was double counted in its original revenue proposal. In light of this issue, TransGrid has stated that it has conducted a review of its capex program and confirmed that this has not occurred elsewhere.

TransGrid has not proposed any further adjustments to this project relating to the easement double count.

2.1.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination for this project contained in section 3.3.1 and Appendix I of TransGrid's revised revenue proposal. The findings of PB's review are discussed below.

Number of circuit breakers at Dumaresq

In its original assessment of the Dumaresq - Lismore 330 kV line project, PB recommended a downwards adjustment of $2.6m to cover the removal of two of the circuit breakers at the Dumaresq Switchyard. In PB's view, these circuit breakers only provided limited benefits under normal operation.

PB made the recommendation on the basis that TransGrid has not outlined the technical or economic basis for its decision to include these additional circuit breakers in its original proposal. In its revised revenue proposal, TransGrid has outlined the basis for its decision to include the two additional circuit breakers at Dumaresq.

PB notes that TransGrid has accepted that the connection of the Lismore line through a double breaker arrangement may not be required to achieve the capex objectives. Therefore PB has assessed the additional supporting material provided by TransGrid with regard to the provision of the remaining additional centre breaker at Dumaresq.

Based on the additional information provided in the Revised Revenue Proposal, including connection arrangement diagrams for the Dumaresq site, PB agrees that the provision of the centre breaker is required to maintain the reliability and operational flexibility currently available at Dumaresq. Furthermore, PB acknowledges TransGrid's concern regarding the introduction of additional transmission constraints during maintenance activities, including the potential need to separate QLD from the NEM that could be avoided through the inclusion of the centre circuit breaker.

PB also recognises the potential market impacts under maintenance conditions associated with the removal of the centre circuit breaker as highlighted by TransGrid, but note that no attempt was made to quantify these, or provide any description of a practical reduction in maintenance windows to support the additional expenditure

On the basis of the revised information provided, PB is of the view that TransGrid has sufficiently demonstrated that the inclusion of the centre circuit breaker is prudent to maintain the reliability and operational flexibility currently available at Dumaresq. PB recommends that $1.3m be reinstated to TransGrid's capex allowance to provide for the centre circuit breaker in the 'breaker-and-a-half' arrangement at Dumaresq and highlights that a more transparent and detailed description of the duration or extent of constraints under the described maintenance conditions should be included with the original options analysis documentation to support the scope of proposed developments of this nature.

Application of scoping factors

In its original assessment of the Dumaresq - Lismore 330 kV line project, PB recommended a downwards adjustment of $4.0m to account for the reduction in the Scoping Cost Factor (SCF) applied to the project from 15% to 10%. In PB's view, the scope of the project was relatively well known to TransGrid and the scope inputs to the estimation process itself were inherently conservative. Therefore, PB recommended to the AER that the Scoping Cost Factor be reduced to account for these issues.

TransGrid has highlighted that the SCF was a parameter used in a previous estimating process and is analogous to the current Ancillary Work Factor (AWF) reviewed as part of its original revenue submission. Whilst PB accepts that the parameters may be similar in coverage and application in the two processes, PB also notes that the project specific considerations, such as the variation in line length identified in our original report[6] limit the validity of the direct substitution of the standard factors.

Notably, the existing 124km long 96L corridor comprises approximately 58% of the proposed 215km route[7] which would be constructed on an existing route where a 15% standard AWF would apply under the current process. The remaining 42% of the line would be constructed on a greenfield corridor where a lower 10% standard AWF would be applied. Therefore, on a weighted average basis, an AWF (SCF) in the order of 12.9% would be obtained using the current standard factors.

Furthermore, PB remains of the view that the use of the 'longest probable feasible line route' in preparing the original cost estimate would tend to overstate the scope, and therefore, cost of the project. PB notes that the line route options considered for the project vary in length by approximately 23km, or 10.6%[8]. Therefore, PB considers that the further reduction of the SCF

6 TransGrid Revenue Reset – An Independent Review, PB, Revision 4.0, November 2008, p. 120.

7 Dumaresq-Lismore 330 kV Transmission Line Feasibility Study report, FS PSR-96, TransGrid, September 2006, p. 9.

8 ibid.

applied to this project to 10% is not unreasonable as this represents the lowest standard AWF applicable to 330 kV line works.

On the basis of the project specific information discussed above, PB remains of the view that the 15% SCF applied to this project is unreasonable. In its revised revenue proposal, TransGrid has not provided additional information to demonstrate that these issues have not led to an artificial overstatement of the original estimate. Therefore PB recommends that the original reduction in the Scoping Cost Factor applied to the project from 15% to 10% be retained.

Application of escalation to project cost estimate

PB notes TransGrid's analysis that compares its original application of a 10% escalation adjustment to the project cost estimate, to the 14.8% figure that is derived from the historical escalation factors and component weightings reported as part of the AER's draft determination. However, PB considers that since the original estimate for this project was not prepared according to the updated estimating process to which the historical escalation factors has been applied, then we consider that comparisons between the two estimation and escalation processes should be treated with caution. Specifically, TransGrid has undertaken a significant review of the estimation process and units costs to account for recent changes in key input costs.

PB also notes that the historical labour and material escalators informing the 14.8% figure were used in a theoretical manner to support the derivation of forecast escalators and were not actually applied to any historical costs.

As part of its original cost estimation process, TransGrid stated that the estimate was compared to the recent Wollar-Wellington construction budget[9] to ensure consistency with recent detailed estimate prices. PB notes that this was in addition to the 10% inflation allowance that was applied and other adjustments to the project noted as taking account of recent contract prices for line bay estimates. Therefore, PB is of the opinion that TransGrid has already made allowance for the real escalation of input costs in its base estimate.

As part of its revised proposal, TransGrid also advised that:

> *"The 10 per cent was applied at the time of the preparation of the capex forecast for TransGrid's Revenue Proposal to take account of recent project information due to the project being a committed project and thus not within the feasibility estimating process."*[10]

PB highlights that the approach of adopting real labour and material escalation (above CPI) is not consistent with TransGrid's stated and verified position for committed projects, where no such escalation has been made.[11]

Therefore, on the basis that:

- the estimate and escalation process applied by TransGrid for this project falls outside TransGrid's normal processes, as reviewed for TransGrid's original revenue proposal
- the non-standard process adopted by TransGrid for this project included an allowance for real escalation of input costs based on recent experience
- the project was already a committed project at the time of inclusion into the forward capex allowance for this revenue proposal,

9 Dumaresq-Lismore 330 kV Transmission Line Feasibility Study report, FS PSR-96, TransGrid, September 2006, p. 17.

10 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 20.

11 TransGrid, May 2008, TransGrid Revenue Proposal 1 June 2009 – 30 June 2014, p. 52

PB does not consider that the use of a 10% escalation factor in this case, and specifically noted as being 'for inflation', is a reasonable approach.

On this basis, PB is of the view that the use of actual CPI escalation factors over the period under question is consistent with TransGrid's standard treatment of committed projects and PB recommends that the original adjustment of $7.4m is maintained.

Easement double count

PB notes TransGrid's statement that the easement double count has not been repeated elsewhere. PB has reviewed the Capital Accumulation Model (CAM) to confirm the removal of the $22m easement double count from the accumulation process and found that the related easement acquisition project was maintained (project ID 9095) and the double count was removed from the main project allowance (project ID 9094).

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.9 and Appendix I of its revised proposal, and the associated supporting documentation. As a consequence of PB's assessment, we consider that:

- a $1.3m upward adjustment proposed by TransGrid for the centre circuit breaker at Dumaresq is reasonable and it should be accepted as prudent
- the 15% Scoping Cost Factor applied to this project is unreasonable and the original reduction from 15% to 10% should be retained for this project. This maintains the $4.0m downward adjustment
- the use of a 10% escalation factor for a committed project for (real) inflation due to the use of an older estimating process is not reasonable, and the original 6.2% CPI adjustment should be retained. This maintains the $7.4m downward adjustment
- the double counting of the $22m easement costs has been appropriately removed from the inputs to the CAM.

Table 2-2 sets out PB's recommendation for the Dumaresq-Lismore 330 kV transmission line project. Consistent with TransGrid's stated approach, PB's recommended adjustment does not include additional risk and escalation allowances as this project has been categorised by TransGrid as a committed project.

Table 2-2 – PB Recommendation for Dumaresq-Lismore 330 kV line ($m, 2008)

	2010	2011	2012	2013	2014	Total
Submitted	21.7	72.7	67.8	-	-	162.2
Proposed variation	1.5	5.1	4.8	-	-	11.4
PB Recommended	20.2	67.6	63.0	-	-	150.8

Source: TransGrid, CAM V1.8_Future Deliverables 21bB & PB analysis.

2.2 COOMA 132 KV SUBSTATION REPLACEMENT PROJECT

TransGrid has proposed to replace the existing Cooma substation through a greenfield substation development at Cooma North, with an anticipated commissioning date of 2013/14. TransGrid has stated that the driver of this proposed project is the condition of the Cooma substation equipment, and issues with the arrangement of the substation. The estimated cost of this project was stated in TransGrid's original 2009–2014 revenue proposal as $43 million.

In its draft determination[12], the AER considered PB's advice concerning TransGrid's selection of the replacement of the Cooma substation at a new site – the most expensive option considered – on the basis that it resulted in satisfactory reduction in performance-related risk. However, PB raised a number of specific concerns regarding TransGrid's proposal, which were considered by the AER; in particular:

- full consideration was not given to the refurbishment of the transformers and regulators
- provision for a 330 kV substation layout was made in the remote replacement option, but not in the other options. The justification for this provision was not provided by TransGrid
- some costs for new control and protection associated with the in-situ replacement options appeared overstated.

In reference to TransGrid's preferred North Cooma development option, the AER concluded that *"TransGrid did not reasonably demonstrate the efficiency and value of this option over the alternatives available"*.

Furthermore, the AER considered that a prudent and efficient TNSP in TransGrid's circumstances would not have selected the preferred option, and that the most efficient option to address the identified need would be to refurbish the substation on its existing site (without busbar works). Consequently, the AER proposed a $19m decrease to TransGrid's capex allowance to reflect this position.

2.2.1 Revised proposal

In its revised revenue proposal, TransGrid presents a response to the points raised by the AER in its Draft Determination leading to its revised capex allowance for this project as shown in Table 2-3. A summary of TransGrid's response is provided below, and it is specifically noted that the revised position reflects a reduction from the original requirement of $8.1m.

Table 2-3 – Revised Cooma substation reconstruction project estimate ($m, 2008)

2010	2011	2012	2013	2014	Total
-	0.08	1.16	7.72	25.91	34.91

Source: TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 25.

Option evaluation and selection

As part of its revised proposal, TransGrid undertook a thorough reassessment of this project, which involved a detailed review of the options; development of revised cost estimates; independent review of the cost estimates by SKM; consideration of an additional new option[13]; and sensitivity analysis.

In its revised proposal, TransGrid noted that the level of accuracy of the initial cost estimates varied across the options, and that the estimates reflected the conceptual stage of development of the project. TransGrid stated that the revised estimates however, are at an improved level of accuracy and are equivalent.

TransGrid has also noted that the higher revised estimates for the non-preferred in-situ rebuild options reflect the complex project staging, and provision for implementation of major works within an in-service substation. These estimates were independently assessed by Sinclair Knight Merz (SKM), and found to be within 5 per cent of TransGrid's revised estimates.

12 Australian Energy Regulator, 2008, Draft Decision TransGrid transmission determination 2009-10 to 2013-14, 31 October 2008, p. 54.

13 Option 4 - the replacement of the substation on a new site close to the existing substation.

TransGrid has prepared revised project evaluation documentation and a revised business case. In its revised options evaluation, TransGrid considers four options:

1. reconstruction of the substation at a new greenfield site ('Cooma North')
2. an in-situ project package, including replacement of the busbars
3. an in-situ replacement, excluding replacement of the busbars
4. replacement of the substation on a new greenfield site close to the existing substation (new option)

TransGrid's revised business case finds that the greenfield development options (options 1 and 4) have the two highest NPV's. Option 4 is the preferred option on the basis of being the most economic, however, TransGrid considers the difference in the NPV of these options to be small. It is also noted by TransGrid that these greenfield options result in the lowest residual risk, and that the small difference between the NPV of all the options requires consideration of other factors in selecting the preferred option.

TransGrid conclude that, as the two greenfield options (options 1 and 4) are very close in NPV terms, option 1 (Cooma North) is the preferred option as it *"better facilitates future development, eliminates line congestion around the existing Cooma Substation and minimises in the longer term the impact on the community"*.

Transformer condition

TransGrid has noted that the refurbishment of No. 1 and No. 2 transformers and the regulators is not considered to be an economic outcome as the condition monitoring results indicate that the winding and insulation systems would need to be replaced. Hence, TransGrid is of the view that the cost of refurbishment is prohibitive. TransGrid has also noted that the existing No.3 Transformer is suitable for re-use and would be released for a subsequent project.

Allowance for 330 kV layout

TransGrid has removed the provision for future development of a 330 kV switchyard from all project options.

New control and protection costs

TransGrid maintains that the protection and control costs for the in-situ replacement option(s) were not overstated, and that the estimates were presented in a different format to the estimates typically prepared from its Capex Estimating Database. To ensure a like-for-like comparison of the costs for the options prepared using the interim estimate approach, the estimates for labour, building and cabling costs have to be added to the control and protection costs. It is also noted that TransGrid has engaged SKM to independently assess these estimates.

TransGrid has proposed to reinstate the recommended $8.4m protection and control cost reduction included in the AER's draft decision, as it is maintained that the apparent 'overstatement' of these costs is a consequence of the definition of the scope of works included in the protection and control line item, and that there is no actual overstatement.

2.2.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.2 and Appendix C of TransGrid's revised revenue proposal, as well as the revised supporting documentation. The findings of PB's review are discussed below.

Option evaluation and selection

TransGrid's reassessment of this project involves a detailed review of the options; development of revised cost estimates; independent review of the cost estimates; consideration of an additional option[14]; as well as the inclusion of a sensitivity analysis. Accordingly, TransGrid's supporting documentation has been revised to reflect the findings of this reassessment.

PB has reviewed the revised options analysis presented in the Network Asset Replacement Project Evaluation (Document No. 6194 ARPE, Rev 3), and the information provided in the Network Asset Replacement, Option Comparison (Version 3, 08/01/09) and responses to PB's specific questions related to TransGrid's revised documentation. In particular, PB notes a substantial increase in the in-situ option cost estimates has resulted from this revision, where in the case of Option 2 this amounts to an increase of 55%. Table 2-4 summarises the variation between the original submission and the revised submission. The independent review of the option estimates by SKM as presented in Appendix C of the revised revenue proposal is also noted in support of the revised estimates.

Table 2-4 – Option summary ($m, 2008)

Option	Original estimate	Revised estimate	Original NPV	Revised NPV	Original risk score	Revised risk score
Do nothing	-	-	-	-	287.6	288
1. Reconstruction (remote reconstruction option)	$36.23	$34.91	-$16.57m	-$15,745	40.2	40
2. In-situ project package including busbars	$24.08	$37.20	-$13.05m	-$16,868	116.8	50
3. In-situ project package excluding busbars	$18,27	$23.30*	-$10.24m	-$16,010	148.8	91
4. Reconstruct – Nearby Site (new option)	-	$33.70	-	-$15,186	-	40

*Source: PB analysis. * Note that this estimate excludes the cost of subsequent replacement of the busbars, which is included in the revised NPV analysis for this option.*

In our final report to the AER[15], PB expressed a general concern regarding TransGrid's options analysis. Specifically in the case of the Cooma options analysis, PB expressed concern regarding the completeness and comparability of the option's estimates, and in particular that in order to be meaningful in the context of making the investment decision, the estimates must include all the costs associated with the in-situ redevelopment of the operational Cooma substation. In the revised options estimates, it is apparent that TransGrid has attempted to address these concerns. However, PB has reviewed the revised project cost information (as supported by SKM's independent review) and we are not satisfied that the revised option estimates are reasonable. Specifically, PB is concerned with the reliance on general and non-standard scoping factors and the inconsistencies in their application, potentially leading to double counting of brownfield issues in TransGrid's estimates.

Proposed non-standard factors

Based on the details provided, the majority of the significant change in cost associated with option 2 and option 3 arises from TransGrid taking account of the brownfield issues associated with the in-situ rebuild options by applying non-standard NCF, DCF and AWF cost estimating factors. TransGrid has identified in their POSE documentation[16] that these adjustments were

14 Option 4 - the replacement of the substation on a new site close to the existing substation.

15 TransGrid Revenue Reset – An Independent Review, PB, Revision 4.0, November 2008 p. 123.

16 TransGrid, POSE6194D Cooma Substation In-Situ Project Package (With Busbar Replacement), revision 2, November 2008. p. 12.

based on discussions with a contractor when investigating a rebuild option for the Queanbeyan substation. PB notes that this discussion has also been cited by TransGrid as justification for their adjustment of cost estimating factors used for the Beaconsfield West GIS replacement project.

Whilst PB acknowledges that the in-situ rebuild of Cooma substation is more complex than a typical substation augmentation project, PB considers that the justification for the scale of TransGrid's adjustment of its standard factors remains arbitrary and lacks transparency. PB's analysis of the justification of the factors used by TransGrid is detailed in section 2.3.2 of this report.

In addition, the non-standard factors applied by TransGrid have been applied to base estimates that appear to have already made allowance for some degree of brownfield issues for components of the project scope. For example, the cost to demolish and remove the existing Auxiliary Services Building, busbar and bay steelwork and footings has been included in the estimate for the civil and building work[17].

Given these matters, PB is of the view that the magnitude of the non-standard cost estimating factors applied by TransGrid remains unjustified, and that the process of the application of such factors double counts allowances for brownfield issues that are already made in the base estimates.

Similarly, with regard to the SKM review, PB notes that no substantiated evidence has been provided for the specific 30% brownfield factor applied in its estimating process to account for in-situ work on brownfield projects other than SKM's assertion that in its experience*"…estimates for brownfield projects typically suffer from optimism bias*[18]*."* No analysis of historical projects has been included in the document, no reference has been made to the key factors that would attribute to the necessary increase in costs has been discussed, and no assessment of the degree to which the optimism bias has been covered by the quantity variations within TransGrid's risk allowance has been made. On this basis, PB is of the view that the SKM approach in applying factors, like TransGrid's, lacks transparency and specific reference to the project case under investigation

Consequently, PB does not consider that the revised option analysis provides a transparent basis for comparing the potential options when making a substantial investment decision regarding the long term requirements at Cooma substation.

Brownfield adjustments

Notwithstanding the comments above, PB acknowledges that some form of non-standard factors are appropriate for the in-situ rebuild options in this project given that the base costs have been established in the context of their application for greenfield sites, and that the works will be undertaken within a live substation. PB also acknowledges that the application of a brownfield factor by SKM is a reasonable means of making allowance for the additional complexity of in-situ replacement projects.

However, PB considers that any brownfield factors applied must be justified by a suitably rigorous analysis, especially given the materiality of the costs associated with the application of the brownfield factors, for example, these factors should be applied at the equipment or component level in the estimating process, rather than as a general escalator to the overall project cost to allow specific insight into areas where the additional costs are expected to arise.

Furthermore, in PB's view where a brownfield factor is to be used as a generic escalator, it should only be applied to a greenfield cost estimate that is well defined as such, in order to avoid compounding any existing brownfield allowances made within the base estimate. This

17 TransGrid, POSE6194D Cooma Substation In-Situ Project Package (With Busbar Replacement), revision 2, November 2008.

18 HA01143 – Response to PB Query on Cooma Cost Estimate (rev 2), SKM, February 2009 p. 4.

matter underlines the importance of clearly describing each aspect of a cost estimate and documenting as much detail as possible, as well as the intention and quantification of any generic costing factors to be applied. This is especially the case where the quality and accuracy of the cost estimates ultimately dictates the selection of the preferred option.

With regard to establishing an appropriate, transparent brownfield escalation factor, PB notes the range of 1.6%- 29% for brownfield factors arising from the analysis undertaken by SKM in support of the recent SP AusNet revenue proposal[19], where the application of brownfield factors was a material issue given the nature of the replacement works undertaken by SP AusNet at its existing sites. Specifically, PB notes SKM's statements that:

> *"These brownfield adjustments were based on a comparison of the labour hours typically included in an asset valuation building block, and actual labour hours recorded by an Australian TNSP for a limited number of contracts."*[20]

> *"these brownfield factors demonstrate the increased costs, predominately increased labour costs, which stem from having to construct / reconstruct assets within the confines of a live substation. These extra costs arise from things such as forward / reverse switching, man-handling tools and equipment in a live substation, temporary works and generally lower productivity levels."*[21]

PB recognises SKM's expectation that higher factors may be encountered for even more complex in-situ work, however, no justification for the scale of any further adjustment is provided in the report.

With specific reference to the Cooma development, PB notes that SKM's proposed brownfield factors of 30% is at the upper end of the range substantiated by SKM as part of the SP AusNet supporting work, and PB also considers that the complexity of the Cooma substation replacement would be mitigated through the construction of a new auxiliary services building and bench extensions to accommodate some of the replacement plant. On this basis, the project is not considered to be a pure brownfield replacement project (where every piece of new equipment is installed in the physical location of existing assets) due to a mix of greenfield works and the augmentation nature of a significant proportion of the work.

Given the information at hand and the process undertaken to develop the figure, PB considers that the 23% factor for 132 kV switchbays, noted by SKM in the case of the SP AusNet review, represents a reasonable expectation of the brownfield costs anticipated for work at a live substation similar to Cooma, and that this figure has been derived from an appropriate analysis of actual historical data.

Revised Options Analysis

For the purposes of determining the sensitivity of the impact of the brownfield factors on TransGrid's selection of the preferred option at Cooma, PB has revised the factors applied to the cost estimates for the in-situ rebuild options contained in TransGrid's option analysis to re-construct costs that would be obtained where, in PB's opinion, appropriate corrections for brownfield issues have been taken into account in accordance with the intent of the SKM methodology. This process involves the following adjustments to TransGrid's cost estimates:

- removal of non-standard NCF, DCF and AWF factors from the base estimate
- separation of the Civil and Building works portion of the estimate where brownfield allowances have already been made

19 SKM, Escalation Factors affecting Capital Expenditure Forecasts, Revision 1.1, February 2007 p. 40. (provided as Appendix C to the SP AusNet Revenue Proposal 2008/09-2013/14).

20 ibid.

21 ibid.

- application of standard *greenfield* NCF (10%), DCF (10%) and AWF (10%) factors to the base estimate excluding civil and building works
- application of the (23%) brownfield factor to the estimate including the NCF, DCF and AWF factors, but excluding civil and building works
- application of the standard *greenfield* NCF (10%), DCF (10%) and AWF (10%) factors to the separate civil and building works base estimate.

The resulting cost estimates and the NPV analysis for the four options is shown Table 2-5, where it can be seen that PB's revised cost estimate for Options 2 and 3 have reduced by 9.5% and 9.7%, respectively.

Table 2-5 – Option summary – PB adjusted factors for in-situ options ($m, 2008)

Option	Original estimate	Revised estimate	Original NPV	Revised NPV	Original risk score	Revised risk score
Do nothing	-	-	-	-	287.6	288
1. Reconstruction (remote reconstruction option)	$36.23	$34.91	-$16.57m	-$15,745	40.2	40
2. In-situ project package including busbars	$24.08	$33.65	-$13.05m	-$14,637	116.8	50
3. In-situ project package excluding busbars	$18,27	$21.04*	-$10.24m	-$14,049	148.8	91
4. Reconstruct – Nearby Site (new option)	-	$33.70	-	-$15,186	-	40

*Source: PB analysis. * Note that this estimate excludes the cost of subsequent replacement of the busbars, which is included in the revised NPV analysis for this option. The timing for this additional work would be beyond the next regulatory control period.*

PB notes that solely from an economic assessment perspective, this revised options analysis demonstrates that the preferred option changes from Option 4 to Option 3 based on the option with the highest NPV

In reviewing the revised analysis and supporting arguments, PB notes that TransGrid has identified additional costs in its Prudency Evaluation[22] assessment presented in the Network Asset Replacement Project Evaluation document. Specifically, costs associated with future augmentation plans within the area, and community impact costs (e.g. implicitly the devaluation of adjoining lands, etc) have been identified. We note that these costs are not explicitly included in TransGrid's NPV calculations (as summarised in Table 2-4), but that they have been used (in part) as externalities to justify the selection of the preferred option, along with discussion and identification of implementation risks. We also note that while the costs associated with future augmentation plans are presented, the potential community impact costs are not quantified, and it also appears that the NPV analysis does not include the costs of the identified implementation risks.

Therefore PB's recommendations have been based on the adjusted options analysis summarised in Table 2-5 and TransGrid's presentation of the costs of additional risks contained in the ARPE documentation.

Selection of preferred option

On the basis of TransGrid's analysis results summarised inTable 2-4, it concluded that, whilst the two greenfield options (options 1 and 4) were very close in NPV terms, option 1 (Cooma North) is the preferred option as it "better facilitates future development, eliminates line

22 TransGrid, 2009, *Network Asset Replacement Project Evaluation,* Document No. 6194 ARPE, Rev. 3, Project No, 6194, Cooma Substation, p.16.

congestion around the existing Cooma Substation and minimises in the longer term the impact on the community".

However, PB's revised analysis presented in Table 2-5 to account for recommended adjustments to the original costs estimates demonstrates that option 3 (in-situ project package excluding busbars) is shown to have an NPV value that is approximately $1.7m higher than that TransGrid's preferred option 1. Fundamentally, the analysis presented by TransGrid is highly sensitive to input assumptions regarding the application of scoping factors and brownfield adjustments.

We note that through its supporting arguments, TransGrid essentially modifies its NPV analysis (as presented in Table 2-4) by reducing the difference between option 1 and the remaining options by the present value of the cost estimates for future augmentation plans (i.e. $0.39m - 330 kV augmentation). This results in an NPV difference between TransGrid's preferred option 1 and option 3 of approximately $1.3 million. For option 1 to be preferred over option 3, the cost of implicit community impact, strategic alignment, and implementation risks associated with option 3, needs to be quantified to at least $1.3 million in the NPV analysis.

In PB's opinion, whilst it is plausible that the cost of implicit community impact and strategic alignment could exceed $1.3m million in present value terms, the analysis provided by TransGrid has not demonstrated that a difference of this magnitude is expected. Therefore we are of the view that TransGrid has not reasonably demonstrated that option 1 (remote reconstruction option - Cooma North) is an efficient option, and that on the balance of the information presented by TransGrid, option 3 (in-situ project package excluding busbars) is the recommended prudent and efficient option.

Based on the analysis in Table 2-5, the cost associated with option 3 during the next regulatory control period would be $21.0m, whilst the cost included in TransGrid's revised capex allowance for option 1 is $34.9m. Therefore PB recommends that a downward adjustment of the $13.9m to account for the difference between the options is applied to the base project cost included in TransGrid's revised capex allowance.

Treatment of 66/11kV transformers

Of the options presented in the revised submission, PB noted that TransGrid's scope of work associated with options 1 and 4 appeared to differ to the scope associated with options 2 and 3. Specifically, under option 2 and 3 we note that two 10 MVA 66/11 kV transformers will be replaced at Cooma at TransGrid's cost. However, options 1 and 4 do not include the replacement of these transformers at TransGrid's cost as under options 1 and 4, the existing Cooma substation would be acquired by Country Energy, and hence the cost to replace these transformers would need to be borne by Country Energy.

To ensure that the most economic option had been chosen, PB requested that TransGrid demonstrate how the cost of these transformers had been treated in their options analysis.

In response to PB's questions, TransGrid advised that the cost associated with the 66/11 kV transformers (including compounds, bay equipment and associated control and protection) was $2.49m and that this cost had been included in all options to provide a like for like comparison for the business case documentation[23]. In addition, TransGrid provided an addendum[24] to their original supporting documentation to demonstrate how the 66/11kV transformer costs were demonstrated in the POSE documents provided in support of each option. PB considers that it is appropriate to include all costs, irrespective of to whom they are allocated, as part of the identification of a preferred option when joint planning between TNSP's and DNSP's is undertaken.

However, whilst TransGrid has advised that the costs of the 66/11kV transformers were included in the options analysis, TransGrid also confirmed that these costs were not removed

23 TransGrid , Issue 309 (A2) Response – Cooma Cost Estimate, February 2009 p. 1.

24 TransGrid, Issue 320 response – Cooma 66/11kV Transformers, February 2009.

from the costing of Option 1 or Option 4 for the purposes of inclusion into TransGrid's revised capex allowance. On this basis TransGrid noted that the forward capex estimate should be reduced by $2.49m for Options 1 and 4 to exclude the cost of the 66/11kV transformers that would be borne by Country Energy.

On the basis that the TransGrid analysis appropriately included the full comparable costs for all options, the validity of the NPV analysis is unaffected by the modification to the capital expenditure forecast by TransGrid.

Transformer condition

As part of original assessment and report to the AER[25], PB expressed concern that full consideration had not been given by TransGrid to the refurbishment of the transformers and regulators at Cooma. In forming this view, PB relied upon TransGrid's condition assessment reports and the project evaluation document. In particular, in PB's view, while the condition assessment reports clearly showed the poor condition of these transformers, TransGrid did not present any assessment of the transformers remaining life, or consideration of the estimated costs or benefits undertaking any remedial action to extend the life of these transformers (e.g. drying out the transformer, etc). In PB's view, when dealing with high value items of plant, assessment of management options based on condition information should be undertaken prior to concluding that replacement is the most efficient option. It is our view, that such an analysis was not presented. Consequently, while PB concluded that the need for the proposed Cooma project was reasonably demonstrated by TransGrid, the assessment of all reasonable and potential life-cycle management options for the transformers was not demonstrated.

In TransGrid's revised submission, no further evidence has been submitted to demonstrate consideration of the potential management options for the Cooma transforms. Consequently, PB remains of the view that full consideration had not been given to the refurbishment of the transformers and regulators.

TransGrid confirms the existing No.3 Transformer is suitable for re-use and would be released for a subsequent project, PB recommends a $1.6m reduction in the project estimate for this project to account for the avoided cost of procuring a 132/66 kV transformer for a separate project.

Allowance for 330 kV layout

PB notes that TransGrid has removed the $4.94m provision for a 330 kV layout from all project options.

New control and protection costs

TransGrid maintains that the protection and control costs for the in-situ replacement option(s) were not overstated, and that the estimates were presented in a different format to the estimates normally prepared from the Capex Estimating Database. In addition, TransGrid has presented an independent assessment of the option estimates undertaken by SKM.

PB has reviewed the revised information presented, and is satisfied that the estimates are reasonable.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.2 and Appendix C of TransGrid's revised revenue proposal, as well as the revised supporting documentation. In PB's view:

[25] TransGrid, 2009, *Network Asset Replacement Project Evaluation,* Document No. 6194 ARPE, Rev. 3, Project No, 6194, Cooma Substation.

- the revised options analysis does not reasonably demonstrates that TransGrid's preferred option 1 (remote reconstruction option - Cooma North) is the most efficient option identified
- the application of non-standard cost estimating factors by TransGrid and the brownfield factor by SKM is not transparent and supported by project specific information
- the revised option analysis, as undertaken by PB, indicates that option 3 (in-situ project package excluding busbars) is the economic option when supportable brownfield adjustments are included
- that full consideration has not been given to the refurbishment of the transformers and regulators as no further evidence has been submitted to demonstrate consideration of the potential management options for the Cooma transformers
- the project will release the existing 132/66 kV No. 3 transformer for use on a subsequent project and appropriate adjustment should be made to reflect this.

Therefore PB recommends a $13.9m reduction in the project base estimate to reflect the selection of option 3 over option 1 as the preferred option for the Cooma substation replacement project. In addition, a reduction of $1.6m is recommended to account for the avoided cost of procuring a 132/66 kV transformer for a separate project.

Table 2-6 sets out PB's recommendation for the Cooma substation replacement project. PB's recommended adjustment includes risk and escalation calculated using TransGrid's CAM, and the net $15.5m adjustment to the base costs outlined above.

Table 2-6 – PB Recommendation for Cooma substation replacement ($m, 2008)

	2010	2011	2012	2013	2014	Total
Submitted	-	0.10	1.41	8.99	30.12	40.61
Proposed variation	-	-0.05	-0.63	-3.99	-13.37	-18.03
PB Recommended	-	0.05	0.78	5.00	16.75	22.58

Source: TransGrid, Issue 309 (A2) Cooma Cost Estimates p. 1.

2.3 BEACONSFIELD 132 KV GIS SUBSTATION REPLACEMENT PROJECT

TransGrid has proposed the replacement of the 132 kV gas insulated switchgear (GIS) at Beaconsfield substation due to the condition of the equipment. The commissioning date is anticipated to be 2012/13, and is estimated to cost $48.1m.

In the AER's Draft Determination[26], the AER considered PB's advice concerning TransGrid's options analysis, and in particular concerns relating to the application of non-standard costing factors in the cost estimates for this project. On the basis of consideration of these concerns, the AER concluded that an adjustment of -$8.1m should be applied to TransGrid's capex allowance.

2.3.1 Revised proposal

In its revised revenue proposal, TransGrid presents a response to the points raised by the AER in its draft determination in regards to the application of the non-standard cost factors. A high level summary of TransGrid's response is provided below.

[26] Australian Energy Regulator, 2008, Draft Decision TransGrid transmission determination 2009-10 to 2013-14, 31 October 2008, pp. 55-56.

Application of non-standard cost factors

TransGrid stresses that the use of non-standard cost factors is appropriate for complex and unique projects such as Beaconsfield. In its revised submission, TransGrid notes that:

> *"The replacement of the Beaconsfield West GIS equipment requires quite a different approach to that adopted for standard projects. The application of standard cost factors to a non-standard complex project, such as Beaconsfield West GIS replacement, would not provide realistic cost inputs and would result in an underestimate of the capital expenditure required to undertake the project."*[27]

In support of this statement, TransGrid lists a number of specific issues that impact on the projects costs; specifically:

- the project's uniqueness, both nationally and internationally
- the difficult, long and complex staging needed to maintain operation of the in-service substation particularly given the nature of the substations supply area (i.e. the Sydney CBD, Eastern and Southern suburbs)
- the need for a detailed expert review of the building condition
- the complex building design and construction practices required to integrate into the existing building within the operational substation environment
- the replacement and relocation of secondary systems in a live substation
- special GIS design requirements
- unique integration challenges associated with the existing plant and network connections.

Moreover, TransGrid notes that:

> *"The doubling of the design and network cost factors … was derived from a detailed analysis of the project, involving consultation with engineering consultants, GIS equipment suppliers and construction contractors."*

TransGrid also notes that a leading Australian substation construction contractor was consulted to develop an estimate of the additional construction costs. The substation construction contractor identified a number of factors that TransGrid noted as leading to increased construction costs. In particular TransGrid states that:

> *"Following this consultation and consideration of the quantum of issues identified, the standard DCF and NCF factors were doubled to cover the anticipated increased project delivery costs associated with the Beaconsfield West 132 kV GIS Replacement project"*[28].

Subsequent to the AER's draft decision, SKM was engaged by TransGrid to provide an independent assessment of the cost factors used in the Beaconsfield estimate. TransGrid notes that SKM's review of the Beaconsfield estimate found that *"… the use of non-standard cost factors is reasonable and that the cost factors used by TransGrid are in fact below what SKM would expect for a project of this type"*[29]. TransGrid further notes that it is likely that *"… the original cost estimate would be below the realistic costs required to achieve the capital expenditure objectives"*.

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27 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 26.

28 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 27.

29 ibid.

In TransGrid's revised revenue proposal, TransGrid has adopted the SKM recommended cost factors in the revised project estimate shown in Table 2-7.

Table 2-7 – Revised Beaconsfield capex estimate ($m, 2008)

2010	2011	2012	2013	2014	Total
2.57	7.22	9.68	24.17	-	43.63

Source: TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 28.

2.3.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination for this project contained in section 3.3.3 and Appendix D of TransGrid's Revised Revenue Proposal[30]. The findings of PB's review are discussed below.

Application of non-standard cost factors

TransGrid stresses that the use of non-standard cost factors is appropriate for complex and unique projects such as Beaconsfield. The uniqueness and complexity of the project, along with the issues involved in the in-situ redevelopment of a substation are cited by TransGrid in justification of the application of non-standard cost factors to the Beaconsfield cost estimates.

SKM in-situ factor

In SKM's independent report, TransGrid's application of standard cost factors is discussed. In particular, it is noted that *"TransGrid does not have a standard set of cost-factors to apply to an in-situ GIS replacement project as there have been no in-situ replacements of this type in the past from which to generate the cost factors."*[31] It is also noted that the standard cost factors are for a 330 kV AIS[32] substation augmentation projects, which already include an adjustment to the NCF and AWF to account for brownfield issues. Furthermore, SKM's independent review states that: *"As the Beaconsfield West project is an in-situ GIS replacement, as opposed to an AIS substation augmentation, it is considered reasonable for TransGrid to use a non-standard cost factor allocation for the project"*[33].

In our final report to the AER[34], PB acknowledged the uniqueness and complexities of the in-situ replacement of the 132 kV GIS at Beaconsfield, and in this regard, PB agrees with the view expressed by both TransGrid and SKM that use of non-standard factors would be reasonable. However, as stated in our final report to the AER, while PB accepts that the uniqueness and complexities of the project as the basic reasons for the application of non-standard cost factors, we are of the view that the basis for the original doubling of these costs is not clear and lacks documented objectivity.

SKM, in its independent review, expresses the opinion that *"TransGrid's cost factor allocation for the Beaconsfield West project is considered to have optimism bias"*[35], and that *"As a result, it is likely that TransGrid's costs under-estimate the actual cost of delivering the Beaconsfield*

30 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014.

31 SKM, 17 December 2008, Review of Cost Factor Allocation for the Replacement of Beaconsfield West 132 kV GIS, p 3.

32 AIS – Air Insulated Switchgear.

33 SKM, 17 December 2008, Review of Cost Factor Allocation for the Replacement of Beaconsfield West 132 kV GIS, p 6.

34 TransGrid Revenue Reset – An Independent Review, PB, Revision 4.0, November 2008 p. 125.

35 SKM, 17 December 2008, Review of Cost Factor Allocation for the Replacement of Beaconsfield West 132 kV GIS, p 3.

West GIS replacement project"[36]. SKM go on to state that *"As the Beaconsfield West project is an in-situ substation replacement, SKM would, as a minimum, apply an in-situ replacement factor of 30% to the total project cost (including standard cost factors) as estimated by TransGrid"*[37]. This review then proceeds to escalate the total project cost (based on standard cost factors) by the proposed 30%, and concludes by comparing TransGrid's estimate (using non-standard cost factors) with SKM's estimate (using standard cost factors) as follows:

TransGrid total project cost = y(1.5) + x(1.725)

SKM total project cost = y(1.625) + x(1.8688)

Where x = project cost excluding plant; y = plant cost.

It is PB's view, that this analysis does not demonstrate the basis for the scale of adjustment to the standard NCF[38] and DCF[39] cost factors. Rather, the analysis asserts that the cost should be 30% higher than the standard estimate, and then simply demonstrates how acceptance of this assertion would impact on the escalation of the elements of the estimate (i.e. plant, project costs excluding plant components). PB is of the view that the proposed 30% is an arbitrary figure as no substantiation or justification has been supplied by SKM or TransGrid. PB is also of the view that, given the high costs, uniqueness, and complexity of this project, that the attendant project risks warrant a more detailed analysis of the staging, expertise, access and design issues in order to substantiate the cost factors to apply. PB notes that in considering the value of the cost factor, SKM states that

> *"…it is likely that SKM would apply an increased cost factor allocation and in-situ replacement factor to the project, although the extent of the increase is difficult to quantify without carrying out more detailed analysis".*

PB notes that in presenting this analysis, SKM states that;

> *"SKM has assisted TransGrid in the concept phase and is currently undertaking a feasibility study for the replacement of Beaconsfield West 132 kV GIS. … As part of SKM's role in the Beaconsfield West project, SKM has conducted numerous internal and external discussions regarding the complexity of the project and a potential in-situ replacement factor for the project."*[40] *. It is also noted that "… SKM attempted to find a similar case of an in-situ GIS replacement project that has been successfully performed. SKM's investigation found only one example of an in-situ replacement in Zurich, Switzerland of a similar scale to that proposed at Beaconsfield West. However, it was noted that even this project presented less complexity than TransGrid's project. Discussions with the utility involved with the replacement supported the contention that the cost factor allocation proposed by TransGrid appears to be below that typically required for undertaking such a project."*

PB acknowledges that SKM's involvement with this project and its discussions with a Zurich based utility that had undertaken a similar project, would provide insight into the potential risks and complexities of the Beaconsfield project. However, PB considers that while such insight would allow the potential risks and complexities of the Beaconsfield project to be identified, it does not demonstrate the cost of managing such potential risks and complexities.

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36 ibid.

37 ibid, p 4.

38 NCF - the Network Cost Factor includes costs associated with field supervision, site management and commissioning of the project. TransGrid, 'CAPEX Estimation Database Manual', page 5.

39 DCF - the Design Cost Factor includes costs associated with the design, specification preparation, tendering process, the environmental assessment and project management. TransGrid, 'CAPEX Estimation Database Manual', page 5.

40 SKM, 17 December 2008, Review of Cost Factor Allocation for the Replacement of Beaconsfield West 132 kV GIS,, p 5.

When the project is assessed in the context of TransGrid's revised submission, involving the addition of SKM's 'in-situ' factor, PB is of the view that the 30% factor proposed by SKM is generic and remains largely unsubstantiated for this project. Furthermore, SKM's application of this factor appears to double count the brownfield adjustments applied in TransGrid's standard augmentation factors.

Given SKM's stated involvement in the concept phase and feasibility study of the project and the "*numerous internal and external discussions regarding the complexity of the project and a potential in-situ replacement factor for the project*"[41], PB is of the view that a more specific analysis should have been undertaken for a unique project of this nature.

Consequently, PB does not consider that TransGrid's revised proposal to apply a 30% in-situ factor represents prudent and efficient investment.

TransGrid doubling of NCF and DCF factors

With regard to providing additional support for its original position, TransGrid has stated in its revised revenue submission that *"The doubling of the design and network cost factors … derived from a detailed analysis of the project, involving consultation with engineering consultants, GIS equipment suppliers and construction contractors"*[42]. PB also notes that TransGrid consulted a *"leading Australian substation construction contractor"* to provide an estimate of the additional construction costs, and that *"Following this consultation … the standard DCF and NCF factors were doubled …"*[43]. In response to PB's request to provide the contractors report TransGrid advised:

> *"The consultation took the form of a general briefing on the approach taken by contractors to factoring in the increased costs and risks involved in in-situ rebuilds. The consultation did not take the form of a formal engagement and there was no report provided...."*

This consultation is also described in TransGrid's original response to PB's question regarding the basis for doubling the factors at Beaconsfield[44]. In this document TransGrid identifies that the discussion was undertaken in the context of investigating the option of rebuilding the Queanbeyan substation in-situ. Whilst TransGrid states that the contractor "*..indicated additional construction contract costs could be expected for an in-situ rebuild option…"*[45], no indication is given in the document with regard to the magnitude of the cost impact.

PB acknowledges that TransGrid provided a supporting email outlining its notes from discussions with a contractor[46] regarding in-situ costs and that this email does provide some quantification of the expected project variance that lead to TransGrid's initial decision to double the NCF and DCF. These variances primarily relate to a general doubling of the time required to undertake a range of activities for brownfield projects in comparison to greenfield installations.

However, in the absence of a formal document from the contractor to demonstrate the rigour of the analysis or quality of the information that was used to justify the level of expenditure sought, PB is of the view that an informal 'general briefing' with a substation contractor regarding possible additional construction contract costs associated with a potential in-situ rebuild project does not form a reasonable basis for the justification of $8.1m of additional capital expenditure. However, PB accepts that the discussion notes provide insight into the range of expected contract cost variance matters associated with in-situ rebuild projects.

41 ibid.

42 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 27

43 ibid.

44 TransGrid, PB Advice – Number 6 Issue F8, p. 3.

45 ibid.

46 TransGrid, Additional capex questions from PB – Beaconsfield D1 (Issue 315), 23 February 2009.

Therefore, PB accepts the uniqueness, complexities and attendant risks of the project as the basic reasons for applying non-standard cost factors. However, as no analysis has been presented to demonstrate the veracity of doubling (or otherwise adjusting) these factors, PB remains of the view that the basis for the scale of adjustment of these costs is not clear and lacks documented objectivity.

Consequently, PB does not consider that TransGrid's original proposal to double the NCF and DCF represents prudent and efficient investment.

Application of brownfield factor

PB notes that the application of brownfield factors has been discussed in section 2.3.2 with regard to the Cooma substation replacement. The issues surrounding the Beaconsfield 132 kV GIS replacement are similar, in that the SKM methodology applies the brownfield factor to a base estimate which includes TransGrid's standard augmentation factors and building costs that are not entirely representative of a greenfield construction. Therefore, it appears that brownfield allowances made in the base estimate are compounded by the brownfield factor resulting, in PB's opinion, the estimate being overstated.

In the case of the Beaconsfield building works, TransGrid states:

> *"An allowance of $4.5M has been allocated for the building extension related works based on the 132 kV GIS building costs for Holroyd substation …but scaled for the larger building size, multi-level design of the extension, and interfacing with the existing building. This allowance also covers costs to assess the structural integrity of the existing building …"*[47]

As the building cost estimates have previously been modified to make allowance for the brownfield nature of the site and therefore, no further brownfield allowance should be applied to these costs.

PB recommends that the same process that has been applied to the in-situ rebuild options in the case of the Cooma substation replacement project be applied for the Beaconsfield GIS replacement project to account for the additional costs associated with brownfield issues. PB also considers that the 23% brownfield factor for 132 kV switchbays applied in the case of Cooma is supported for Beaconsfield.

Similarly, given that much of the work at Beaconsfield will take place in a new building, with *"the 132 kV cables progressively cut-in following its construction"*.[48] PB considers that the degree of complexity of the brownfield in-situ replacement work has been significantly mitigated.

Therefore PB has revised the factors applied to the cost estimate contained in TransGrid's option analysis to reflect costs that would be obtained where, in PB's opinion, appropriate corrections for brownfield issues have been undertaken in accordance with the intent of the SKM methodology. This process involves the following adjustments to TransGrid's cost estimates:

- removal of the non-standard NCF, DCF and AWF factors from the base estimate
- separation of the Civil and Building works portion of the estimate where brownfield allowances have been made
- application of the standard *greenfield* NCF (10%), DCF (10%) and AWF (10%) factors to the base estimate excluding civil and building works

47 TransGrid, POSE 6378 – Beaconsfield West 132 kV GIS Replacement, Revision 7, December 2008, p. 7.

48 ibid, p. 6.

- application of the brownfield factor to the estimate, including the NCF, DCF and AWF factors but excluding civil and building works
- application of the standard *greenfield* NCF (10%), DCF (10%) and AWF (10%) factors to the separate civil and building works base estimate.

This results in a total project cost of $37.43m and a net reduction of $6.1m in the estimate proposed by TransGrid for this project over the next regulatory control period.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.3 and Appendix D of TransGrid's revised revenue proposal, as well as the revised supporting documentation. In PB's view:

- the basis for TransGrid's original doubling of the DCF and NCF factors has not been demonstrated to be transparent and lacks documented objectivity
- the basis for TransGrid's revised application of an additional 30% 'in-situ factor' to the entire project estimate has not been demonstrated to be transparent, lacks documented objectivity and double counts the brownfield allowances already included in the base estimate
- the removal of TransGrid's non-standard factors and separation of the building costs enable a greenfield estimate to be obtained, to which a demonstrable 23% brownfield factor can be applied. This results in a $6.1m reduction in the project estimate proposed by TransGrid in its revised revenue proposal.

Table 2-8 sets out PB's recommendation for the Beaconsfield GIS replacement project. PB's recommended adjustment includes risk and escalation calculated using TransGrid's CAM and the $37.43m base project cost outlined above.

Table 2-8 – PB Recommendation for Beaconsfield GIS replacement ($m, 2008)

	2010	2011	2012	2013	2014	Total
Submitted	2.93	8.34	11.35	28.50	-	51.13
Proposed variation	-0.41	-1.16	-1.58	-3.99	-	-7.15
PB Recommended	2.52	7.17	9.77	24.51	-	43.98

Source: TransGrid, CAM V1.8_Future Deliverables 21bB & PB analysis.

2.4 WILLIAMSDALE 330/132 KV SUBSTATION PROJECT

This project comprises the second stage of the development of the Williamsdale 330/132 kV substation to establish an additional 330 kV supply to Williamsdale, independent of the Canberra 330/132 kV substation. The project is required to comply with changes to the ACT government Network Service Criteria applicable from 1 June 2012.

TransGrid originally included Williamsdale stage 2 as a contingent project, with a trigger that planning approval from the ACT government is received. This trigger was not considered by PB to be appropriate for a contingent project in accordance with the requirements of clause 6A.8.1 of the NER. To enable the provision for this expenditure in a contingent project, PB recommended that the contingent project scope be redefined to cover the Walleroo Switching Station only and that the provision of the second transformer at Williamsdale should be included in the Williamsdale Substation Stage 1 works.

In its draft determination, the AER agreed with PB's assessment that the receipt of planning approvals was not an appropriate trigger for a contingent project under the NER requirements. However with regard to the provision for this project in the forward capital expenditure allowance, the AER stated:

For the Williamsdale 330 kV substation, there also appears to be some ambiguity regarding the exact trigger and project scope…

...To the extent that the underlying need for the investment already exists, TransGrid may wish to consider the appropriateness of this project as part of its capex allowance.[49]

2.4.1 Revised proposal

In its revised revenue proposal, TransGrid has proposed that the Williamsdale Stage 2 project be incorporated into its forward capital expenditure allowance on the basis of developments since the submission of the original revenue proposal, where TransGrid:

- has acquired the Williamsdale substation site
- has received advice from the ACT Minister for Planning that no further environmental assessment is required.

TransGrid noted the comments from the AER draft determination, with respect to the potential inclusion of this project in its capex allowance and has proposed that provision be made for the following scope of work in its ex-ante allowance:

- establishment of a new 330 kV switching station at Wallaroo (northwest of Canberra) on the route of the Yass-Canberra 330 kV transmission line no 9
- formation of 330 kV circuits from Yass-Wallaroo and from Wallaroo-Canberra
- construction of a short section (approx 3 km) of 330 kV line from Wallaroo to the route of the Canberra-Williamsdale 330 kV line
- connection of the new line at Wallaroo and to the Canberra-Williamsdale 330 kV line (a section of 330 kV line from Canberra would be disconnected at this point)
- provision of an additional 375MVA 330/132 kV transformer at Williamsdale.

A revised Project Evaluation Summary document[50] has been provided by TransGrid to support the project.

TransGrid's proposed capex allowance for this project is shown in Table 2-9.

Table 2-9 – Revised Williamsdale 330 kV substation stage 2 project estimate ($m, 2008)

2010	2011	2012	2013	2014	Total
2.95	11.67	20.10	-	-	34.72

Source: TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 30.

2.4.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination for this project contained in section 3.3.4 of TransGrid's Revised Revenue Proposal[51] and the revised supporting documentation supplied for this project. The detailed findings of PB's review are contained in Appendix B and summarised below.

49 ibid, p. 29.

50 Project Evaluation Summary PES5564 Williamsdale 330 kV Supply, TransGrid, January 2009, p. 22.

51 *TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014*, TransGrid, January 2009.

Inclusion of project in capex allowance

The contingent project trigger that was proposed by TransGrid in its original revenue proposal for the project related to obtaining planning and environmental approvals from the ACT government.

Significant progress has been made in obtaining the required approvals, and the acquisition of the Williamsdale site has occurred in the period since the submission of the original revenue proposal. Therefore, PB considers that the level of certainty that the project will be required during the next regulatory control period is such that the inclusion of the project in TransGrid's proposed forward capital expenditure program is now appropriate.

Need

PB notes that the need for the project is established by the following requirements contained in the ACT Utilities Exemption 2006 No. 1, Disallowable Instrument DI2006-47:

- provision of the second geographically separate supply to the Canberra substation
- additional capacity totalling 375MVA immediately following a single special contingency.

The provision of a second geographically separate supply point is currently being undertaken through the establishment of Williamsdale Substation and related works.

Timing

The driver of this project has been stated by TransGrid to be the requirement to comply with ACT Government Regulatory Instrument DI2006-47. Under this document TransGrid has an obligation to provide a total 375MVA capacity immediately following a special contingency by 1 July 2012.

Given the statutory compliance nature of this project through the reliability standards mandated and the specific completion date required under the regulatory instrument, PB considers that the timing for the project has been reasonably demonstrated by TransGrid.

Alternatives

TransGrid has presented a total of six project options for the provision of additional capacity at Williamsdale. Two of these options have been excluded on the basis of reasonable technical and environmental considerations, while the remaining options have had capital costs estimated to enable the comparative assessment of the highest NPV option. The options that were considered as part of the economic assessment are summarised in Table 2-10.

Table 2-10 – Options considered

Option	Estimate[1]	NPV
Option A – Bungendore-Williamsdale 330 kV Line	$83.6m to $105.6m	-$46.5m to -$58.5m
Option B – Wallaroo Switching Station	$34.7m	-$19.7m
Option D – Yass-Williamsdale Single Circuit 330 kV Line	$56.5m	-$31.1m
Option E – Yass-Canberra/Williamsdale Double Circuit 330 kV Line	$70.0m	-$38.4m

Note 1: This estimate is in real 2006/07 dollars, and does not include real labour and material escalation impacts or any risk allowance.

Source: TransGrid 2008, 'Project Evaluation Summary 5564 Williamsdale 330 kV Supply', p. 29.

Option A involves bypassing the Canberra substation and the Canberra-Williamsdale 330 kV lines with a geographically separate 330 kV transmission line. Options B, D and E involve the use of the existing Yass-Canberra-Williamsdale 330 kV line routes and investigating the efficiency of transmission line augmentations compared to the provision of a new switching station at Wallaroo.

PB has considered the options presented by TransGrid in this instance, and is satisfied that it has assessed a reasonable range of options to meet the stated need.

Scope efficiency

PB notes that Option B results in a significantly lower capital cost and higher NPV, and that this is consistent with the increased utilisation of existing infrastructure under this option. The inclusion of Options B, D and E considers whether it is more efficient to construct a new switching station between Yass and Canberra or to duplicate or rebuild the existing 330 kV line.

On the basis of the costs presented by TransGrid, the length of the Yass-Canberra 330 kV line is such that the provision of the Wallaroo switching station and comparatively short line works to bypass the Canberra substation, under Option B, represents efficient investment compared with the remaining options, which require far more extensive line construction works.

After inspection of the design layout proposed and the switchgear requirements, PB is also satisfied that the proposed substation works are reasonable and efficient.

Therefore PB considers that, of the options presented by TransGrid, Option B does represent an efficient and reasonable scope for meeting the stated need.

Cost efficiency

TransGrid has presented the costs for four options for the Williamsdale stage 2 substation project and these are summarised in Table 2-10.

TransGrid's preferred Walleroo Switching Station (Option B) represents a significant reduction in the cost over the Bungendore-Williamsdale 330 kV line option (Option A) that was recommended in the original Application Notice prepared for the Southern Supply for the ACT[52]. PB understands that the Walleroo Switching Station option was developed following the clarification that the provision of two independent 330 kV transmission lines was not necessary to satisfy the requirements of the regulatory instrument.

TransGrid states:

> *"Following consultation with the ACT jurisdiction, feasible options that enhance the capacity of Williamsdale may be developed that include either one or two independent 330 kV transmission lines to Williamsdale. "*[53]

Given the significant reduction in the capital cost required to satisfy the stated project need under this option, PB considers that this option represents an efficient option on the basis that it exhibits the lowest cost and highest NPV of the options analysed.

PB has reviewed the cost estimate for the project provided in the supporting PES document[54] and is satisfied that the base estimate costs for the switching station, transformer and line work components are consistent with the scope of work proposed. However, PB notes that TransGrid has included a $0.85m risk allowance into the base estimate for property costs to

52 Application Notice, Proposed New Large Transmission Network Asset – Southern Supply to the ACT, TransGrid/ActewAGL

53 Project Evaluation Summary PES5564 Williamsdale 330 kV Supply, TransGrid, January 2009, p. 11.

54 ibid, p. 22.

cover land acquisition that may be required above the quantifiable estimated costs for the project. PB is of the view that provision is already made for risk allowances on projects at a portfolio level in the risk process applied by TransGrid and no further allowance should be made at project level. Furthermore, as this project has been identified by TransGrid as a committed project and, on the basis of TransGrid's accepted process of excluding risk and escalation for committed projects, PB considers no risk allowance should be included for this project.

Therefore PB recommends that the $0.85m allowance be removed from TransGrid's revised ex-ante capex proposal on the basis that it represents a risk allowance inconsistent with TransGrid's capital accumulation process. PB notes that this risk allowance has been applied as a project specific adjustment. No other adjustments were identified in the supporting documentation to indicate that the application of additional risk allowances to committed projects was a systemic issue.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.4 of TransGrid's revised revenue proposal, as well as the supporting documentation provided. In PB's view:

- the need, scope and timing of the project were demonstrated and a reasonable range of options had been considered
- a risk allowance of $0.85m has been included into the base estimate to cover potential property acquisition costs and this allowance should be removed.

Table 2-11 sets out PB's recommendation for the Williamsdale 330/132 kV substation project. Consistent with TransGrid's stated approach, PB's recommended adjustment does not include additional risk and escalation allowances as this project has been categorised by TransGrid as a committed project.

Table 2-11 – PB recommendation for Williamsdale 330/132 kV substation ($m, 2008)

	2010	2011	2012	2013	2014	Total
Submitted	2.95	11.67	20.1	-	-	34.72
Proposed variation	-0.07	-0.29	-0.49	-	-	-0.85
PB Recommended	2.88	11.38	19.61	-	-	33.87

Source: TransGrid, CAM V1.8_Future Deliverables 21bB & PB analysis.

2.5 INSTRUMENT TRANSFORMER REPLACEMENT CAPEX

This program involves the replacement of instrument transformers (ITs) that display high results from Dissolved Gas Analysis (DGA) testing conducted as part of TransGrid's routine condition monitoring program.

In its draft determination, the AER agreed with PB's finding that TransGrid's proposed replacement program for instrument transformers *"does not adequately address the reasonable options that have been identified for asset replacement."* [55] Furthermore, the AER noted that TransGrid's selection of the preferred option was based on factors other than those addressed in the options comparison documentation.

As a result, an adjustment of $4.4m was made by the AER to allow for the economic option to be adopted, as demonstrated by TransGrid's options evaluation process. This involved the replacement of three-phase IT sets where one single-phase unit recorded a high DGA result,

55 *TransGrid Transmission Determination 2009-10 to 2013-14 Draft Decision*, Australian Energy Regulator, 31 October 2008, p. 63.

and the reuse of the remaining two single-phase units for new installations and maintenance replacements (Option 2).

2.5.1 Revised proposal

In its revised revenue proposal, TransGrid presents further analysis of the feasibility of pursuing the option recommended by the AER and presented a revised costing for this option. TransGrid also provided a more detailed set of information regarding the risk assessment of the project to support its selection of an alternative option (Option 3).

TransGrid's proposed capex allowance for this program is shown in Table 2-12 and a summary of TransGrid's response is provided below.

Table 2-12 – Revised instrument transformer replacement program estimate ($m, 2008)

2010	2011	2012	2013	2014	Total
2.39	3.10	3.29	3.18	3.22	15.19

Source: TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 33.

Use of retained instrument transformers

TransGrid did not accept the adjustment applied by the AER on the basis that only a small number of the ITs proposed for replacement would be technically suitable and available for reuse.

To support its position, TransGrid has carried out a detailed review of the 105 IT sets that have been identified for replacement over the next regulatory control period based on existing condition monitoring results. The review was undertaken to determine the number of units that would be available for re-use based on the condition criteria noted in TransGrid's business case documentation[56]:

- DGA results below TransGrid's Condition Monitoring Manual 'Caution' or ' Danger' levels
- less than 30 years old.

The outcome of this review in the supporting documentation[57] identifies that a total of 19 single phase units, or 6% of the ITs covered by this project are potentially suitable for reuse.

TransGrid notes that the low levels of reusable spare units would mean that the spares are best directed toward providing emergency spares in preference to planned replacements. Furthermore, the significant reduction in the number of units that were assumed to be available results in a significant reduction in the cost reduction that would be achieved through planned and emergency re-use.

On this basis TransGrid argues the cost and practical differences between the options becomes insignificant and therefore that the emergency reuse only option should be pursued.

Risk assessment

TransGrid did not accept the adjustment applied by the AER on the basis that the selection of the preferred option was based on factors other than those addressed in the options comparison documentation.

56 Network Asset Replacement Project Evaluation 4910 ARPE Revision 2, TransGrid, December 2008 p. 8.

57 Network Asset Replacement Option Comparison 4910, TransGrid, December 2008 p. 15.

TransGrid has provided additional information to support the risk assessment process applied to this project. TransGrid has also provided the following explanations for the apparent discrepancies in the outcome of the risk analysis:

- the re-use of older instrument transformers would tend to increase the likelihood and consequence of failure over replacement with new instrument transformers
- the retention of older instrument transformers would allow for faster replacement in the event of a failure and therefore the reliability risk would tend to decrease
- the greater re-use of older instrument transformers for planned replacements would tend to increase the likelihood and consequence of failure over replacement with new instrument transformers or emergency re-use only
- the greater re-use of older instrument transformers would increase the cost consequence of collateral damage in the event of a failure compared with replacement with new instrument transformers or emergency re-use only.

TransGrid argues that when these considerations are taken into account, the relative risk scores are consistent and justified.

2.5.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.5 of TransGrid's revised revenue proposal and the supporting documentation provided. The findings of PB's review are discussed below.

Use of retained instrument transformers

On the basis of TransGrid's review as presented in the revised AROC documentation[58], PB is satisfied that TransGrid has demonstrated a significant limitation on the number of instrument transformers that would be available for re-use. TransGrid's analysis indicates that 19 single-phase units of the 315 single phase units proposed for replacement would be suitable for re-use.

Given the significant reduction in potential for instrument transformer re-use from that inferred in TransGrid's original analysis, PB accepts that the cost of Option 2 would increase significantly. TransGrid's revised costing for this option indicates that the cost advantage of Option 2 over Option 3 would be $193k.

On the basis of TransGrid's review and the revised costing provided, PB considers it has been demonstrated that the cost of undertaking the recommended option 2 is significantly higher than originally indicated due to the small number of units suitable for re-use. Therefore an additional $4.2m should be reinstated into TransGrid's forward capital expenditure allowance to allow for the additional IT replacements with new units as per Option 2 of the evaluation.

Risk assessment

PB notes that in TransGrid's original analysis, Option 3 was preferred despite a significantly lower NPV than Option 2. The selection of the more expensive option was justified on the basis of risk and other factors that were not included in the original options comparison documentation.

In addition to the explanation of the risk rankings outlined above, TransGrid has provided a revised risk assessment as part of the resubmitted options comparison documentation.

PB accepts TransGrid's explanations regarding the increased likelihood and consequence of failure associated with re-use of units, and that the retention of older instrument transformers

[58] ibid.

would allow for faster replacement, resulting in a decrease in the consequence of the reliability risk.

However, PB does not accept TransGrid's explanation that increased re-use for planned replacements (i.e. option 2) would increase the cost consequence of collateral damage in the event of a failure over emergency re-use only (Option 3).

PB notes that the emergency re-use option (Option 3) would still maintain the older instrument transformers in service and therefore there would be no change in the cost consequence of failure of a re-used unit under option 3 relative to the failure of a re-used unit under Option 2.

Similarly, PB highlights the further inconsistency of the safety risk factor for Option 2 accounting for 50 points (or 85%) of the total risk score of 59 for the option. In contrast, under Option 3 the safety risk was assigned a score of zero on the basis of a relative reduction in the consequence of failure, but not the likelihood, compared with Option 2. TransGrid's comment in the risk assessment table for Option 2 is as follows:

> *"Condition of ITs being managed by option but re-used ITs have remaining risk of explosive failure with porcelain shards to injure staff. Re-used ITs also have greater risk of failure than new ITs used in Option 1."*[59]

However, no equivalent comment was noted for the safety risk factor assessment for TransGrid's preferred Option 3.

On the basis that PB would expect a reduction in the number of re-used units to reduce the likelihood but not the consequence of occurrence, PB would expect Option 2 and Option 3 to have a similar safety risk factor. Given this example of subjective inconsistency in the process that forms a key input into the TransGrid's option selection decision, PB reiterates its concern relating to the consistency in application of the TransGrid risk assessment process.

PB has also identified a third inconsistency within the TransGrid risk assessment process with regard to the definition of an acceptable risk. TransGrid recommended Option 3 over Option 2 on the basis of the quantified risk assessment results. However the project evaluation document states the following advantage with regard to Option 2.

> *"Adequate management of the safety risks associated with the use of oil filled, porcelain ITs."*

Given that the safety risks associated with Option 2 are stated by TransGrid to be adequately managed, and that the actual safety risk factors between Option 2 and Option 3 are expected to be similar, once the abovementioned correction for consequence and likelihood is made, PB is of the view that the efficiency of the risk assessment based selection of Option 3 over Option 2 has not been objectively demonstrated.

Therefore PB considers that provision should only be made in the forward capex allowance for Option 2 and consequently, no further reinstatement of capex above and beyond that previously identified is recommended. Therefore the $193k difference between Option 3 and Option 2 should be removed from TransGrid's revised forecast capex allowance.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this program contained in section 3.3.5 of TransGrid's revised revenue proposal, as well as the revised supporting documentation. In PB's view:

- TransGrid has demonstrated that there would only be a small number of instrument transformers available for reuse and that this was not considered in TransGrid's

[59] Network Asset Replacement Option Comparison 4910, TransGrid, December 2008 p. 7.

original analysis. PB recommends that the resulting adjustment of $4.2m be included in TransGrid's revised forward capex allowance for this program

- TransGrid has not demonstrated the consistency of the risk assessment process applied to this program and therefore TransGrid's selection of the more expensive option is not considered to be efficient. PB considers that provision should only be made in the forward capex allowance for Option 2 and that the remaining $193k adjustment representing the cost difference between Option 3 and Option 2 should be removed from TransGrid's revised forecast capex allowance.

Table 2-13 sets out PB's recommendation for the Instrument Transformer replacement program. Consistent with TransGrid's stated approach, PB's recommended adjustment does not include additional risk allowances for replacement programs, but does allow for escalation.

Table 2-13 – PB recommendation for the instrument transformer replacement program ($m, 2008)

	2010	2011	2012	2013	2014	Total
Submitted	2.55	3.36	3.62	3.52	3.55	16.58
Proposed variation	-0.03	-0.04	-0.05	-0.04	-0.05	-0.211
PB Recommended	2.51	3.31	3.57	3.47	3.50	16.37

Source: TransGrid, CAM V1.8_Future Deliverables 21bB & PB analysis.

2.6 APPLICATION OF COST ESTIMATING SCOPING FACTORS

TransGrid's estimating process employs three cost estimating factors; the Design Cost Factor (DCF), Network Cost Factor (NCF) and Ancillary Works Factor (AWF)[60]. TransGrid has developed standard values for these cost estimating factors based on standard project types. However, TransGrid's estimating process allows the application of non-standard cost estimating factors to non-standard projects.

In the AER's draft determination, the AER considered PB's advice concerning TransGrid's application of non-standard cost estimating factors, and concluded that there was scope for overestimation and a lack of justification for some cost factor adjustments. On the basis of these considerations, the AER concluded that it would apply a $13m reduction to TransGrid's proposed capex allowance[61].

2.6.1 Revised proposal

In its revised revenue proposal, TransGrid presents a response to the AER's conclusion as set out in the draft determination in regards to the application of cost estimating factors. A high level summary of TransGrid's response is provided below.

Application of cost estimating factors

TransGrid's response *"rejects the implication that its cost estimating processes lead to a systemic over estimation of capex project costings"*[62]. TransGrid states that it needs to ensure realistic cost estimates, and has used historic project costs to develop cost estimating factors for project types that have been undertaken previously on a number of occasions. However, as it is not practical to fit all projects to standard cost estimating templates, TransGrid notes that it modifies the estimating factors to accommodate non-standard projects.

60 TransGrid, Capex Estimating Database Manual, D2008/05616, January 2008, page 5.

61 Australian Energy Regulator, 2008, Draft Decision TransGrid transmission determination 2009-10 to 2013-14, 31 October 2008, pp. 60-62.

62 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 33.

In setting out its response, TransGrid noted that it *"agrees with the AER and PB that the application of other than standard cost factors for any project should be justified on a project by project basis"*[63]. TransGrid stated that it considers the use of non-standard factors justified for complex and difficult projects. It was noted that there are only four future projects of this type, which are identified as:

- Beaconsfield West 132 kV GIS replacement
- Holroyd - Chullora 330 kV cables
- Holroyd 330/132 kV substation
- Chullora 330/132 kV substation.

TransGrid noted that the Holroyd-Chullora cables, Holroyd substation, and Chullora substation projects were reviewed by PB and that adjustments were not proposed by the AER for these projects.

TransGrid states that the application of non-standard cost factors has been demonstrated to be limited to the four projects noted above, and that justification for the application of non-standard factors has been provided in each of these cases. TransGrid also note that *"… the AER had previously accepted the cost estimates for three of these projects"*[64]. Consequently, TransGrid *"… considers that the cost factors and cost estimates used to prepare its Revenue Proposal reasonably reflected the costs associated with its capital program"*[65] and does not consider the AER's $13m reduction to TransGrid's proposed capex allowance to be reasonable.

TransGrid's revised capex forecast proposal incorporates the reinstatement of the $13m capex reduction.

Incorrect application of non-standard factors

In preparing its revised Revenue Proposal, TransGrid systematically reviewed the application of cost estimating factors to all projects included in the Revenue Proposal, and found that non-standard cost factors had been applied incorrectly due to a software error for nine projects. As part of its revised proposal, the detailed results of the analysis were presented, the errors have been corrected to ensure only standard cost factors have been used. This has resulted in a net increase of $950k in the forecast capex allowance, where the range of individual errors varied from an over-estimate of $73k to an under-estimate of $574k.

TransGrid's revised capex forecast proposal incorporates an additional $0.95m correction for the incorrect application of the network cost factor.

2.6.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination contained in section 3.3.6 of TransGrid's Revised Revenue Proposal[66] and supporting documentation. The findings of PB's review are discussed below.

Application of cost estimating factors

TransGrid states that it *"… needs to ensure that a realistic estimate of input costs is determined"* and that *"Not all projects are able to be fitted to a standard cost estimating template and the estimating process and system need to have the flexibility to deal with*

63 ibid, p. 34.

64 ibid.

65 ibid, p. 35.

66 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014.

non-standard projects"[67]. PB agrees with this view, however we also consider that the application of non-standard cost factors for any project should be transparently documented and justified on a project by project basis. That is, PB is not concerned with the use of non-standard cost factors per se, but with the thorough justification of the value of the cost factors applied. This is especially the case given the materiality of the cost factors on the overall estimate and how they can influence project selection as part of economic assessments. PB is strongly of the view that both the development of the standard factors in the first instance, and the justification for the use of any non-standard factors on a project by project basis should be based on a detailed examination of the underlying cost elements (i.e. cost drivers) commensurate with the expenditure proposed.

TransGrid has stated that non-standard factors were incorrectly applied to nine projects, and that non-standard factors should be applied to four future projects which are noted as:

- Beaconsfield West 132 kV GIS replacement
- Holroyd - Chullora 330 kV cables
- Holroyd 330/132 kV substation
- Chullora 330/132 kV substation.

TransGrid also states that PB reviewed the Holroyd-Chullora cables, Holroyd substation, and Chullora substation projects. PB disagrees with this statement. Detailed project reviews were undertaken for the Beaconsfield West 132 kV GIS replacement and the Holroyd-Chullora 330 kV cables only. While PB did note the Holroyd 330/132 kV substation and Chullora 330/132 kV substation projects, this was only in the wider context of a detailed review of the Holroyd-Chullora 330 kV cables project, and no detailed review was undertaken of these projects to identify the use of non-standard factors.

TransGrid also states that *"… the AER had previously accepted the cost estimates for three of these projects"*[68]. In undertaking a detailed review of the Beaconsfield West project, PB noted the application of non-standard cost estimating factors in the estimate used within the forecast capex portfolio. As non-standard factors were being applied within this estimate, PB made enquiries with TransGrid regarding the justification for the application of these factors[69] and TransGrid's response[70] was considered in forming our recommendations. However, in reviewing the Holroyd-Chullora cables project, the use of non-standard factors was not apparent in the project estimate. PB notes that non-standard factors were used in some of the feasibility study estimates, but were not directly apparent in the Holroyd-Chullora cables project estimate.

In the case of the Beaconsfield project, at the time of our final report to the AER, in PB's opinion TransGrid had not provided information to support the claim that doubling the cost estimating factors led to a reasonable estimate of the costs. Consequently, PB's considered that the doubling of the cost estimating factors appeared arbitrary and was not an auditable practice. As noted above, PB is concerned with lack of thorough justification for the value of the cost estimating factors applied. As our opinion is that the use of non-standard cost estimating factors is arbitrary, and as the use of non-standard cost estimating factors is a procedural matter within TransGrid's cost estimating process, PB recommended that the findings of Beaconsfield project be applied across the portion of the forecast portfolio that was not subject to detailed review.

PB remains of the view that the use of unjustified non-standard cost estimating factors is a procedural issue within TransGrid and this is supported by the additional corrections identified

67 ibid, p. 33.

68 ibid, p. 34.

69 Reference should also be made to section 2.3.2 in relation to the application of cost estimating factors at Beaconsfield.

70 TransGrid, PB Advice – Number 6 Issue F8, p. 3.

by TransGrid as part of its review. Notwithstanding this position, PB accepts that TransGrid has systematically reviewed its preferred project portfolio and found that the application of non-standard factors in the selected options was limited to 13, or 6%, of the 205 projects included in its forward capital works program. These projects consisted of the four projects identified above and an additional nine projects where an incorrect network cost factor was applied due to a software problem.

However, PB is concerned that the application of non-standard factors to options as part of economic assessments may also have affected the options analysis undertaken. This could result in potentially efficient options being excluded from the assessment on the basis of arbitrary increases in the cost estimating factors. Specifically, PB cites the non-standard factors applied to TransGrid's non-preferred options in the case of the Cooma Substation replacement project, and notes that these factors were material in the selection of TransGrid's preferred option. Therefore, whilst TransGrid's systematic and retrospective review covered the preferred options for projects included in the forecast capex allowance, no analysis was undertaken of the application of non-standard factors, or effective non-standard factors (resulting from the quantifiable project specific considerations that were not cost estimated), in TransGrid's options selection process.

On the basis that the application of non-standard factors is likely to have influenced the result of TransGrid's project options analysis, and in light of PB's comments from our original report regarding the deficiencies indentified in TransGrid's options analysis, PB remains of the view that the application of non-standard factors is a procedural issue within TransGrid's estimating process and recommends that the adjustment be retained as a proxy for likely inefficiency in the options analysis process.

Therefore, PB has re-calculated the adjustment on the basis of the difference between our final recommendation for the Beaconsfield West GIS replacement project ($37.5m) and TransGrid's original submission for the project ($40.9m).

The -$3.4m correction recommended for the unjustified increase in DCF and NCF factors in the Beaconsfield West project, represents 0.39% of the value of the $943.4m of reviewed projects (including the additional Williamsdale substation stage 2). On the basis that this is likely to be a systemic issue with the cost estimating and options analysis process, we recommended that an 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 arbitrary application of the factors.

The adjustment of 0.39% was applied on a pro-rata basis across the $1.42b of the network capital works portfolio that was not reviewed, resulting in PB's recommendation of a correction of -$5.07m.

Incorrect application of non-standard factors

PB notes that TransGrid has identified the problem relating to the selection of non-standard factors for transmission line projects as a software issue. TransGrid has advised that the error has been corrected and that a commercial estimating package is being procured to replace the existing cost estimating database.

Therefore PB accepts the additional $0.95m upward adjustment applied by TransGrid to correct for this software error. PB notes that this adjustment is already included in TransGrid's revised capex allowance.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this matter as contained in section 3.3.6 of TransGrid's revised revenue proposal, as well as the revised supporting documentation. In PB's view:

- TransGrid has not demonstrated that the application of non-standard factors has not influenced the results of its options analysis, and therefore its proposed forward

capex allowance. Therefore PB maintains its recommended adjustment should be retained. PB has recalculated the value of the adjustment to be $5.07m based on the revised Beaconsfield West recommendations

- the $0.95m upward adjustment applied by TransGrid to correct for a software error in its cost estimating process is reasonable. PB notes that this adjustment has already been included in TransGrid's revised capex allowance. Therefore no further adjustment by PB is required.

PB recommends a net $5.07m downward adjustment should be applied to TransGrid's revised forward capex allowance, as shown in Table 2-14. This adjustment has been applied pro-rata across the annual capex requirement for the project portfolio.

Table 2-14 – PB recommendation for cost estimating factors adjustment ($m, 2008)

	2010	2011	2012	2013	2014	Total
PB Recommended	-1.02	-0.90	-1.28	-1.04	-0.82	-5.07

Source: PB analysis.

2.7 APPLICATION OF LABOUR AND MATERIAL ESCALATORS

In its draft determination, the AER applied an adjustment of $4.7m relating to application of labour and materials escalators across the forward capex portfolio to ensure the year-on-year variability of expenditure was appropriately accounted for.

The AER noted that it considers:

> *"…that using the same set of weightings for each year of its capex program is likely to distort TransGrid's cost estimates. As the type of projects undertaken in each year vary, so to will the particular proportions of various inputs used in its capex program. Accordingly the weighting of escalation factors should reflect the year to year variability of TransGrid's capex program…"*

The adjustment was based on TransGrid's calculation of the variance in applying escalation on an annual rather than weighted average basis. The estimate of the variance in escalation calculated by TransGrid was based on a median scenario and was then compared to the scenario probability weighted average calculated in the CAM process and presented in TransGrid's original Revenue Proposal.

2.7.1 Revised proposal

In its Revised Revenue Proposal[71], TransGrid presents further discussion relating to the appropriateness of TransGrid's treatment of escalation on a five year weighted average rather than annual basis.

A summary of the TransGrid Response is provided below.

Suitability of the escalation process

TransGrid has noted that the method employed in the calculation of input cost variation contained in its Revenue Proposal was based on a method developed and accepted in previous revenue determinations.

[71] TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, TransGrid, January 2009, p. 30.

Capability of the CAM

TransGrid considers that its Capital Accumulation Model (CAM) is the most sophisticated model developed by a TNSP for a Revenue Proposal to date. TransGrid also notes that the investment in the CAM has been substantial and considers that this investment has been consistent with the NER requirements to develop realistic forecasts of cost inputs.

In TransGrid's opinion, the development of the model to allow annual escalation of cost inputs would require complex modifications to the CAM and Cost Estimating Database (CED). Furthermore, TransGrid notes that it does not consider undertaking these modifications to be reasonable in the context of developing a capex forecast that reflects the efficient and prudent costs of achieving the capital expenditure objectives.

Accuracy of escalation variance estimate provided

TransGrid has provided further description relating to the process used in calculating its estimate of the escalation variance that may occur if escalation was applied on an annual rather than five-yearly weighted average basis.

TransGrid notes that this calculation has involved complex manual processing of expenditure and escalation data in a spreadsheet external to the CAM and CED in order to translate the data into a form that could be used to determine the potential impact. Due to the complexity of the process, TransGrid only carried out the process for the Median Project Spend Profile and not each of the 36 scenarios included in the model.

Based on this calculation, TransGrid notes that the variance in the cost due to the annual application of escalation was a 1.5% drop in the total cost escalation allowance. On the basis that it considers this variance to be small, TransGrid believes that its analysis demonstrates that the calculation of escalation in the CAM reasonably reflects the costs associated with the capital program.

2.7.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination for this project as contained in section 3.3.8 of TransGrid's revised revenue proposal. The findings of PB's review are discussed below.

Suitability of the escalation process

PB notes the AER's concern with regard to the escalation factors and process applied by TransGrid and the inclusion of additional factors to those approved in recent revenue determinations. In particular, with regard to the escalators proposed by TransGrid, the AER has stated:

> *"It is important to note that the AER accepts that such costs are likely to be included in base (unit) cost estimates. However, what is questionable is the extent to which real growth is expected and whether it can be forecast on a reasonable basis..."*
>
> *"…Moreover, they represent a move towards compensation for all input costs at a fine level of detail and go beyond the AER's general obligation to provide businesses a reasonable opportunity to recover efficient costs, and in this sense are also inconsistent with the incentive frameworks for capex."*

PB notes that the variation in the escalator categories and weighting adjustment is reliant on a number of commodity and earnings projections that have proven to be highly volatile in the period following the original submission of TransGrid's Revenue Proposal..

With regard to TransGrid's application of a five-year weighted average labour and materials cost escalation factor, PB is of the view that for the given size of TransGrid's capital works

program, the significant value of the escalation component, and the variance in project type and magnitude undertaken in each year of the regulatory control period, then a more detailed analysis of the cost escalation sensitivities is warranted.

Given the limitations in the base escalation process stated by TransGrid, PB considers it reasonable that TransGrid be required to undertake an additional analysis to demonstrate the efficiency and sensitivities of its proposed escalation allowance, and notes that this can have the effect of either increasing or decreasing the resulting escalation allowance.

Capability of the CAM

PB notes TransGrid's statements regarding the complexity and investment in the CAM. In particular, we note the inability of the CAM to accommodate additional escalation factors for different project types or component input categories on an annual basis.

PB accepts that much of the complexity in the CAM is related to accommodating a large number of scenario based probability calculations and project based risk calculations. However, PB is of the view that the complexity of the CAM is not a reasonable basis for omitting a requirement to assess the impact of changes in the timing of the application of escalators.

Furthermore, PB is of the opinion that the CAM and CED appear to have the capability to accommodate the approximate annual application of escalation on the basis of project type and that this has in fact been undertaken by TransGrid by applying separate land escalation factors to easement acquisitions in its original Revenue Proposal. On this basis, the extension to using separate labour escalators and materials escalators for different project types, such as transmission lines or substations projects, does not appear to be unreasonable or inconsistent with the processes currently employed by TransGrid.

Notwithstanding PB's views with regard to the capability of TransGrid's CAM and CED, PB considers that the escalation component included in the forward capex allowance should be appropriately tested for sensitivities to annual expenditure profiles to maintain transparency and to eliminate all reasonably quantifiable variance in the calculation of the base escalation allowance (to which a further risk adjustment is subsequently applied). PB accepts that due to the structure of the TransGrid CAM process, this analysis may be more efficiently undertaken outside the standard process.

Accuracy of escalation variance estimate provided

PB notes that TransGrid considers that the escalation variance presented in its analysis demonstrates that the variance attributable to the annual application of escalators is small and therefore its process should be considered to be reasonable. However, PB also notes that whilst the percentage change may appear small, due to the scale of the escalation allowance proposed by TransGrid, the resulting $4.7m variance in escalation is not immaterial in the context of the other adjustments applied in the Draft Determination.

In the absence of a more detailed escalation calculation, PB is of the view that the reasonableness of the escalation variance should be assessed on the same basis as the reasonableness of the analysis presented to support the claim. Therefore, insofar as the median spend profile presented by TransGrid is considered to be reasonable, the median escalation allowance variance supported by this analysis is also considered to be reasonable. PB maintains that a reduction of -$4.7m in the escalation allowance calculated on a five year weighted average basis in the CAM should be applied.

In PB's opinion, support for any additional escalation allowance above the level supported by TransGrid's analysis should be explicitly justified by demonstrating the range of variance arising from the annual application of escalators for each of the 36 scenarios.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this project contained in section 3.3.8 of TransGrid's Revised Revenue Proposal[72], as well as the revised supporting documentation. In PB's view:

- the median spend profile presented by TransGrid is considered to be reasonable, the median escalation allowance variance supported by this analysis is also considered to be reasonable. Therefore PB recommends that the original -$4.7m adjustment to the escalation allowance be retained.

Therefore a net $4.7m downward adjustment should be applied to TransGrid's revised forward capex allowance as shown in Table 2-15. This adjustment has been applied pro-rata across the annual capex requirement for the project portfolio.

Table 2-15 – PB recommendation for escalation variance ($m, 2008)

	2010	2011	2012	2013	2014	Total
PB Recommended	-0.94	-0.83	-1.19	-0.97	-0.76	-4.70

Source: PB analysis.

2.8 APPLICATION OF COST ESTIMATING RISK FACTORS

As part of its original revenue proposal, TransGrid undertook a quantified assessment of the risks associated with the way it estimates the project capital costs associated with its portfolio of works over the 2009-2014 regulatory period. The risk adjustment accounted for the expected variation between anticipated outturn costs and the base cost estimates and amounted to $77.1 million[73].

In the AER's draft determination, the AER reiterated that it generally accepted the modelling approach and methodology applied by TransGrid, and as facilitated by Evans & Peck, but was concerned that the process of 'risk workshops' was not transparent and that there may be scope for the variance estimates to include cost variations captured through other means. The AER also adopted the median (P50) risk profile. Consequently the AER reduced TransGrid's cost estimating risk allowance by $11.4 million.

2.8.1 Revised proposal

In its revised revenue proposal, TransGrid presents a response to the AER's conclusion as set out in its Draft Determination in regards to the use of cost estimation risk factors. A high level summary of TransGrid's response is provided below.

Use of median (P50) risk

TransGrid notes that it accepts the AER's finding in relation to the use of the median (P50) risk, but note that its original proposal was reasonable given that small amount of adjustment.

Suitability of workshop approach

TransGrid engaged Evans & Peck to review the AER's draft decision. Evans & Peck agreed that the detailed analytical analysis of past projects is preferable to the use of risk workshops to determine the upper and lower bounds of variations in key inputs. However, TransGrid

72 TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, TransGrid, January 2009.

73 TransGrid, May 2008, TransGrid Revenue Proposal 1 July 2009-30 June 2014, p 72.

states that in the absence of such detailed data, the risk workshops provide *"… the best estimates of a reasonable risk allowance"*[74].

Exclusion of cost escalation

TransGrid did not accept the adjustment recommended by PB and applied by the AER to correct for the apparent inclusion of escalation in the risk allowance.

With respect to the specific quotes from the supporting documentation cited by PB, TransGrid acknowledges that the examples quoted by PB are not legitimate risk factors to be included in the determination of cost estimating variance, however it also maintains that these statements were included only to provide context, and a complete analysis of sources of historical project cost variations. Therefore, TransGrid is of the view that the inclusion of all of the issues and risks which contribute to cost changes does not imply that these issues were then used to determine the risk ranges for project components. On this basis, TransGrid restated that it considers that the workshops disregarded cost escalation and focussed on quantity variations only and that the details of the risks and other issues contributing to the project cost variance that were provided in support of its original revenue proposal have been misinterpreted.

Furthermore, TransGrid highlights the significant change in the cost estimates for certain items of plant in a relatively short period of time are well above escalation expectations. TransGrid note that:

> *"…these items of plant are rarely purchased by TransGrid (or other utilities in Australia), and hence there is a lack of depth of data from which to develop initial estimates of the cost of these items. Hence, the risk factor needs to cover off the cost estimating risk that exists for such items of plant."*

Calculation of the adjustment to the risk allowance

TransGrid has provided a short report regarding the calculation of risk allowance as Appendix F to their Revised Revenue Proposal[75]. Evans & Peck object to the application of the methodology used by PB in calculating the recommended risk adjustment. The primary concern raised in the report is that Evans & Peck believe that the 13% escalation used by PB includes the risk adjustment as well as escalation and therefore a 'mean' escalation of 10.3% should be used in its place.

Evans & Peck states its understanding of the process as:

> *" 1. (Incorrectly) de –escalates the risk allowance.*
>
> *2. Removes a component relating to escalation which PB believes has been inherently and inappropriately included as a risk during the workshop process.*
>
> *3. Re-escalates the adjusted allowance to recognise future price increases."*

Evans & Peck has provided alternative calculations based on their understanding of the process and the adoption of a 'mean' escalation. They conclude that the calculations are provided on a 'without prejudice' basis and that they remain of the view that there is no justification for removing the alleged 'escalation' component of the risk allowance.

Subsequently, TransGrid concludes by stating that it has demonstrated that the proposed cost estimation risk factor of $72m is reasonable for the purpose of developing the estimated capex allowance.

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74 TransGrid, January 2009, TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, p. 41.

75 Evans & Peck, Response to AER/PB Comments on regulatory Reset Capex Allowance, December 2008.

2.8.2 PB review

PB has reviewed TransGrid's response to the AER's draft determination as contained in section 3.3.9 and Appendix F of TransGrid's revised revenue proposal. The findings of PB's review are discussed below.

Use of median (P50) risk

PB notes that TransGrid has accepted the use of the median risk arising from the probabilistic analysis.

Suitability of workshop approach

PB acknowledges that in the absence of detailed historical information, the risk workshop is a reasonable means of developing the risk variance estimates. However, the risk workshop process must be demonstrably transparent, and explicitly and objectively identify the risk components that are to be both included and excluded in the variance estimates arising from the workshop. That is, the workshop scope and objectives should be clearly set out so that the outcomes of the workshop are themselves clearly defined.

In PB's view, in the absence of a clear distinction and consistency in the coverage of the risk estimate, the outcomes can inadvertently include factors that have been accounted for elsewhere in the cost estimation and accumulation process.

Given the lack of specific information presented by TransGrid regarding the workshop process (such as documents outlining the agenda, the objectives and the context of the data gathering; a list of questions asked; a summary of responses provided; or any general meeting notes, etc), or a validation of the workshop outcomes against historical data or known variance estimates for a similar business, PB is concerned that TransGrid has not specifically identified the process by which all expected escalation related increases have been excluded from the risk variance estimates.

Exclusion of cost escalation

PB has identified three points in TransGrid's cost estimation and CAM process where corrections occur to improve the accuracy of the project estimate to more closely align with actual outturn project costs. These are the:

- annual review and adjustment of database input unit costs and cost estimating factors in the CED
- application of escalation in the CAM
- application of risk allowance in the CAM.

PB notes that TransGrid's cost estimation database is updated annually to ensure that the estimates obtained are comparable to the project outturn costs and the current market rates for labour and materials. This process aims to correct for escalation up to the date of the estimate and, in PB's opinion, is consistent with normal practice for maintaining an estimating database.

Escalation from the date of the cost estimate until the end of the regulatory period is applied in the CAM on the basis of forecast escalation inputs, as reviewed by the AER. PB agrees that the application of forecast escalation to the project cost estimates is appropriate. TransGrid has defined this escalation as 'normal' (expected) escalation and stated that this escalation is excluded from the risk variance estimates.

The risk allowance has been determined on the basis of variance estimates obtained from the risk workshop process and is intended to cover business risks that are not addressed by maintaining the estimating process or applying cost escalation in the accumulation process noted above. However, PB is concerned that TransGrid has not explicitly demonstrated how

the risk workshop process has excluded the 'normal' (expected) escalation from the determination of the risk variance estimates.

In Appendix F to TransGrid's Revised Revenue Proposal, Evans & Peck states:

> *"The workshop process focussed entirely on variations in physical quantities, and should therefore be immune from price escalation issues. It is naive to think that the experienced workshop participants would confuse "normal" escalation with cost overrun. At worst, escalation outside the bounds of expectations could influence the process."*[76]

PB notes that:

- whilst the participants were experienced in their field, no supporting information has been provided to demonstrate their experience in the risk workshop process, or that they were experienced in separating out unit cost variance from material quantity variance
- both the current CAM process and the application of risk to the project portfolio through a risk workshop process have been recently introduced to TransGrid to support the preparation of its 2009-2014 revenue proposal.

In light of this, PB has reviewed the original supporting documentation to further test the extent to which evidence exists to indicate that the historical escalation expectations have influenced the risk variance estimates. PB considers that the recent changes to the CAM process influence the risk workshop results as follows:

Quantity focused workshop process

PB notes from Evans & Peck's statement (quoted above), that the workshop process focussed entirely on 'variations in physical quantities' and accept that this would be an appropriate means by which the escalation applied in the CAM could be excluded from the workshop process.

However, in its discussion regarding the categorisation of risks in the development of the distributions used for the risk allowance calculation TransGrid provided the following example of the application of the workshop process:

> *"… characteristics can be imputed by reasoned facilitation in a workshop environment – for example "how often do land costs come in more than 20% below estimate, how often are they more than 200%, how often more than 150%".*[77]

In contrast to TransGrid's stated position, PB notes that this example does not focus on quantity variation (i.e. change in the area of land acquired) but rather on the direct cost variation associated with the purchase of land for the project. In the absence of further processing or qualification, estimates provided in response to this question would include:

- unit cost estimation error
- escalation above expectations at the time of the original estimate
- variance in quantities.

Given that the question focuses on direct cost variation, it is not clear how 'normal' escalation in the context of the forward capex portfolio could have been excluded from the response. At the very least, the definition of 'normal' escalation would be dependant on the escalation

[76] Response to AER / PB Comments On Regulatory Reset Capex Risk Allowance, Evans & Peck, 17 December 2008 p. 1.

[77] Response – PB Advice 6 E1 E2 E3 E8, TransGrid, p. 3.

expectations current at the time of the estimate and, in PB's opinion, would not be compatible with the revised escalation expectation applicable to future projects.

Similarly, PB notes that the unit cost estimation error arising from historical projects is also addressed through the annual review of TransGrid's cost estimation procedure. Therefore its inclusion in the risk allowance would also tend to overstate the expected variance unless a similar distinction between the expected variance and unexpected variance was applied. In addition, all corrections to the cost estimating database undertaken subsequent to the original estimate would need to be discounted from the final estimated variance.

Furthermore, the unclear distinction between the division of cost, escalation and quantity variation included in the risk variance estimate arising from the workshop process is illustrated by the following statement provided by TransGrid under the heading 'Risks contributing to extra cost'.

> *"Tripling of property costs primarily due to passage of time and the need to buy out a land owner … resulting in significantly greater size of land to that expected" – Williamsdale 330/132 kV substation"*[78]

Therefore PB is of the view that a clear distinction between unit cost, quantity and escalation variance in TransGrid's supporting documentation for the risk workshop process is not apparent. On the basis of the documentation provided, PB remains of the view that the inclusion of factors other than quantity variation is included in the risk workshop variance estimates.

Influence of historical escalation expectations

TransGrid states that the workshop was conducted with reference to a number of historical projects, which were undertaken prior to the introduction of the CAM process for estimating risk and escalation at a portfolio level. Prior to the introduction of CAM, PB understands that the escalation process applied by TransGrid generally included allowance for CPI increases only. This is consistent with the historical escalation applied in the CED and the Revenue Determination for the current 2004/5-2009/10 Regulatory Control Period.

In this case, any real increases in input costs would be considered 'escalation outside the bounds of expectations' and could therefore be included into the risk variance estimates resulting from the risk workshop. This would be in accordance with Evans & Peck's acknowledgement that unexpected escalation *'could influence the process'*.[79]

PB notes that TransGrid has adopted an involved escalation process for this Revenue Determination involving the use of 10 individual escalation category forecasts weighted on a portfolio level across 14 component cost input types. Given the complexity of the process, PB considers that distinguishing between expected and unexpected escalation would be difficult, even for experienced practitioners.

Therefore PB is of the view that TransGrid has not demonstrated how the risk workshop process addressed the significant change from the historical escalation expectations to the revised escalation procedure, as applied in TransGrid's CAM process. On the basis of the documentation provided, PB remains of the view that the change in escalation expectations appear to have influenced the result of the workshop.

Direct inclusion of escalation in risk variance estimates

In its original review, PB highlighted five examples where escalation appeared to be included in the risk variance on the basis of the documentation provided by TransGrid. TransGrid agreed that these factors are *"not legitimate risk factors as they are already covered by cost*

78 ibid, p. 3.

79 ibid.

escalation factors." TransGrid proposed that three of these statements were not identified as 'risks', per se, but rather as issues that contributed to cost variance.

PB accepts that the following comments were not specifically categorised as a risk in the original TransGrid document.

> *"Market forces driving up contract costs." - Coffs Harbour 330/132 kV substation*[80]

> *"Property increased from $420k to $1.25M due to market rates…" - Coffs Harbour 330/132 kV substation*[81]

However, TransGrid also identifies *"Land costs again higher than originally estimated"*[82] as a specific risk for the Coffs Harbour 330/132 kV substation project. In the context of the project specific comments regarding the influence of market rates as the cause of the land cost variance, PB considers that the land cost risk variance is likely to include at least part of the effect of the escalation of market rates.

Furthermore, contrary to TransGrid's assertion contained in its revised proposal, the following statement is also specifically identified under the heading 'Risk contributing to extra cost'.

> *"General increases in contractor rates." - Yass - Wagga 132 kV line rebuild*[83]

On the basis of TransGrid's acknowledgement that these factors are 'not legitimate risk factors' but are specifically identified as risk in the variance analysis for these projects, PB remains of the view that escalation appears to have been directly included into the risk variance estimates that form the basis for the calculation of risk allowance.

Calculation of the adjustment to the risk allowance

PB notes that the Evans & Peck's interpretation of the process, as indicated in its calculation description, is not consistent with the PB process used to calculate the adjustment. Significantly, the Evans & Pecks calculations vary in how the correction for the escalation of the risk allowance, that is included in the escalation allowance, is made.

Evans & Peck asserts that an escalation of 10.3% should be used in place of 13% to exclude the inclusion of risk in the adjustment. It is PB's view that Evans & Peck has applied a different methodology than that used by PB. PB's approach adjusts the risk component of the escalation allowance and the escalation components of the risk allowance separately to ensure that adjustments are not double counted.

Due to the significant change in the escalation component in TransGrid's revised proposal, PB has recalculated its risk allowance adjustment based on the figures contained in TransGrid's CAM[84] supplied in support of its revised revenue proposal. PB notes that the adjustment has been calculated on the basis of future projects only, as no risk is applied to committed projects or programs.

For the avoidance of doubt with regard to the methodology used by PB, the details of the calculated adjustment are outlined below:

> *Step 1 - Risk component of escalation allowance:*

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80 Response – PB Advice 6 – E1 Attachment, TransGrid, p. 6.

81 ibid, p. 6.

82 ibid, p. 6.

83 ibid, p. 1.

84 TransGrid, snap_CAM V1.8_Combined Output deliverables 21bB.

total escalation including risk ($203.89m) - total escalation excluding risk ($198.20m)

= total risk component of escalation ($5.68m)

Step 2 - Escalation percentage of the base estimate:

total escalation excluding risk ($198.20m) / total base estimate ($1,741.97m)

= 11.4% of the base capex estimate

Step 3 – Remove the risk component of the escalation allowance from the risk allowance to correct for double counting of escalation in the CAM process and the risk allowance:

total risk allowance ($72.00m) - risk component of escalation allowance ($5.68m)

= new base risk allowance excluding direct escalation ($66.32m)

Step 4 – Remove the escalation component of the new risk allowance to remove the influence of escalation in the base risk variance estimates themselves:

new risk allowance ($66.32m) x11.4% = $7.55m

Therefore final base risk allowance excluding all escalation = $58.77m

Step 5 – Re-escalate the final base risk allowance to replace direct escalation:

final base risk allowance x 11.4% = $6.69m

Therefore PB adjusted risk allowance = $65.45m

Therefore, the total adjustment recommended by PB is a $6.54m reduction in the $72.00m risk allowance sought by TransGrid in their Revised Revenue Proposal.

Conclusion

PB has reviewed TransGrid's response to the AER's draft determination for this project contained in section 3.3.9 and Appendix F of TransGrid's Revised Revenue Proposal[85], as well as the revised supporting documentation. In PB's view:

- the explanations of the workshop process provided by TransGrid do not clearly demonstrate how factors other than quantity variation have been excluded from the risk workshop variance estimates
- the process of correcting the variance estimates for the influence of historical escalation expectations when compared to the revised escalation procedure applied in TransGrid's CAM process, has not been demonstrated. On the basis of the documentation provided, PB remains of the view that the change in escalation expectations appear to have influenced the result of the workshop
- the documentation provided by TransGrid has not transparently demonstrated the process by which escalation has been excluded from the risk variance and that in some cases escalation appears to have been directly included into the risk variance estimates that form the basis for the calculation of risk allowance
- no verification of the workshop outcomes against other variance estimates such as historical records or similar businesses has been demonstrated
- an adjustment of $6.54m should be applied to TransGrid's revised revenue proposal to remove the influence of escalation in the base risk variance estimates used by TransGrid in its CAM process.

Therefore PB remains of the view that escalation has not been fully excluded from the risk allowance proposed by TransGrid, and recommends an adjustment of $6.54m be applied to

85 TransGrid Revised Revenue Proposal 1 June 2009 – 30 June 2014, TransGrid, January 2009.

TransGrid's revised capex allowance as shown in Table 2-16. This adjustment has been applied pro-rata across the annual capex requirement for the project portfolio.

Table 2-16 – PB Recommendation for risk allowance adjustment ($m, 2008)

	2010	2011	2012	2013	2014	Total
PB Recommended	-1.31	-1.16	-1.66	-1.35	-1.06	-6.54

Source: PB analysis.

2.9 RECOMMENDATIONS

PB has undertaken a review of the eight separate items raised by TransGrid in its revised proposal in relation to matters affecting the ex-ante forecast capex allowance adjustments identified by the AER as part of its draft determination. This review has been based on the information provided in TransGrid's Revised Revenue Proposal, its appendices and additional supporting documentation provided by TransGrid.

The adjustments arising from the outcomes of PB's review of the specific items requested by the AER are summarised in Table 2-17. As a result of our review, PB recommends a downward adjustment of $54.0m (2.1%) of the revised ex-ante capex allowance.

Table 2-17 – PB Recommendations ($m, 2008)

Expenditure $m (real 2007/08)	Ref.	2009/10	2010/11	2011/12	2012/13	2013/14	Total
Dumaresq - Lismore 330 kV line	2.1	-1.53	-5.11	-4.77	0.00	0.00	-11.40
Cooma 132 kV Substation	2.2	0.00	-0.05	-0.63	-3.99	-13.37	-18.03
Beaconsfield 132 kV GIS replacement	2.3	-0.41	-1.16	-1.58	-3.99	0.00	-7.15
Williamsdale 330/132 kV substation	2.4	-0.07	-0.29	-0.49	0.00	0.00	-0.85
Instrument Transformer replacement program	2.5	-0.03	-0.04	-0.05	-0.04	-0.05	-0.21
Cost Estimating Scoping Factors	2.6	-1.02	-0.90	-1.28	-1.04	-0.82	-5.07
Annual Application of Labour and Material Escalators	2.7	-0.94	-0.83	-1.19	-0.97	-0.76	-4.70
Cost Estimating Risk Factors	2.8	-1.31	-1.16	-1.66	-1.35	-1.06	-6.54
PB total adjustment		-5.3	-9.5	-11.6	-11.4	-16.1	-54.0
TransGrid Submitted total capex		530.2	460.1	585.3	536.0	403.9	2,515.5
PB total adjustment - %		-1.00%	-2.07%	-1.99%	-2.12%	-3.98%	-2.14%
PB recommended capex		524.9	450.6	573.6	524.6	387.9	2,461.6

Note: Totals may not add due to rounding.

3. REVIEW OF REVISED CONTINGENT PROJECTS

This section reviews the suite of 10 network projects that have been updated and resubmitted as contingent projects by TransGrid as part of its revised revenue proposal. In accordance with clause 6A.8 (Contingent Projects) of the NER, PB's review of the revised submission has considered the appropriateness of including the projects as part of TransGrid's revenue proposal.

3.1 RESUBMITTED CONTINGENT PROJECTS

The following six contingent projects were not approved by the AER in its draft decision. TransGrid has supplied additional information for each of these projects for consideration by the AER and PB against the NER requirements.

Contingent Project	Capital cost ($m)
CBD and inner metropolitan area supply	$500
Gadara Tumut load area	$54
Orange 330/132 kV Substation	$46.8
Reactive support at seven sites	$36
QNI Upgrade – series compensator	$60
Victorian Interconnector development	$35

3.1.1 CBD and inner metro area supply

The following bullet points summarise the key changes made by TransGrid in its revised submission:

- **Update of scope:** TransGrid has clarified the expenditure is associated with the timing and advancement of capital costs to replace the retired EnergyAustralia distribution network assets rather than a new project, and revised the capital cost estimate.
- **Update of trigger:** TransGrid has provided a list of the four cables that EnergyAustralia considers are applicable to this contingent project.

PB's assessment of the updated proposed contingent project

This project is associated with the retirement of more than two out of four 132 kV distribution network cables owned and controlled by EnergyAustralia. Of the four cables identified, two cables are expected to be retired in 2017 – when the next 330 kV cable is commissioned by TransGrid in November 2017. The remaining two cables are expected to stay in service until the subsequent 330 kV cable is commissioned, and for which no date has been specified.

TransGrid states that if EnergyAustralia determines that the condition of the cables deteriorates more rapidly than predicted[86], and as a result, more than two of the four cables have to be removed from service prior to the currently scheduled date for the installation of the

[86] TransGrid Revised Revenue Proposal dated January 2009; Appendix J; Page 7

next 330 kV cable to the CBD, then EnergyAustralia will be unable to meet its reliability obligations to supply the Sydney CBD.

The retirement of either the third or fourth cable before the commissioning of the next 330 kV cable means that the ability of EnergyAustralia to supply Sydney CBD in a secure and reliable manner will be exceeded unless the TransGrid transmission-based augmentation is advanced. This proposed contingent project is the advancement of the installation of the subsequent 330 kV cable into the CBD area from Potts Hill to Surry Hills.

PB highlights that this proposed contingent project is unique in that its driver is related to the condition and operation of existing regulated electricity distribution network assets. Contingent projects are more typically expected to be associated with drivers such as new point loads or generators that require deep or shared network investment. In this case where the drivers are associated with existing network assets, PB would anticipate that any prospective forecast expenditure required for such assets should be captured within the regulated owners expenditure allowances. However, in the context of this project, PB acknowledges that the proposed transmission based solution could require material capex by TransGrid, and be a reasonable and efficient outcome for the stated distribution network issue, and that importantly TransGrid has no control over the driver and the trigger occurrence. These factors support TransGrid's approach of treating this project as a contingent project.

Consistent with previous findings, PB has not identified any allowance in the forecast capital expenditure relating to this project. The estimated cost of this project has been revised down by TransGrid from $650m to $500m in light of more detailed scoping of the components. This still exceeds the materiality threshold of $33.4m for a contingent project. PB has reviewed PES 6276 which includes a detailed outline of works required in 2017 as part of the preferred option 1. In this report, it is recommended that based on the lowest overall NPV costing, the cost of this relevant scope of work is $342m [87]. On this basis, PB recommends that the capital expenditure of this proposed contingent project be revised down from $500m to $342m.

The trigger event is the receipt by TransGrid of a written notification from EnergyAustralia that:

- it is proposing to retire more than two of the four 132 kV cables listed below two or more years before the predicted November 2017 commissioning date of the next 330 kV cable to be constructed to the Sydney CBD by TransGrid; and
- as a consequence, EnergyAustralia will be unable to meet its reliability of supply obligation in relation to Sydney CBD.

Cable number	Cable name
929 or 919/3	Lane Cove to Dalley St via Willoughby
92L/3	Lane Cove to Dalley Street
92M/3	Lane Cove to Dalley Street
928/3	Lane Cove to Dalley Street

On the basis that TransGrid has now defined the four EnergyAustralia cables, and the timing in respect to the early retirement of two of the four cables, PB is of the view that the trigger now meets the requirements of Clause 6A.8.1(c)(1) in that it is 'reasonably specific and capable of objective verification'. PB does note that there is an implicit assumption that should EnergyAustralia inform TransGrid that early retirement is required, EnergyAustralia can clearly support the reasoning behind the advanced retirement of the cables. PB recognises that the responsibility for planning and maintenance of the four cables resides outside the jurisdiction of TransGrid and that TransGrid would be dependent on external information supplied by EnergyAustralia.

87 PES 6276 CBD 330 kV Supply, Page 14

PB's previous assessment identified concerns regarding the proposed scope of work, and whether the cost and overall benefits were reflective of the need and sufficiently related to a specific location or the network as a whole. As the timing and volume of the trigger has now been clarified, this has allowed clarification of the scope of the project, and as such now meets the requirements of the NER. Further, it is now clear to PB that the relevant 132 kV cables referred to as part of the trigger are critical cables that traverse a route from the northern shoes of Sydney to the CBD. Given this understanding, PB is of the view that it is reasonable that the transmission solution is a feasible outcome, as in such a growth-driven and well-developed environment, the higher transfer capacity associated with a 330 kV cable could be economic compared with multiple 132 kV developments.

PB has also reviewed the locational benefits and now understands with the added clarity around the scope of the project, that the project supports the Sydney CBD area, and therefore that the trigger is an event that generates increased costs at a reasonably specific location (or regions as is the case) rather then the transmission network as a whole.

PB agrees with TransGrid in that the advanced retirement of more than two 132 kV cables more than two years in advance of current plans is an uncertain event, but it may happen given that the cables are nearing the end of their life - therefore this satisfies the NER requirements of the trigger being probable but not certain.

In general, PB is satisfied that TransGrid has met the requirements of clause 6A.8 of the NER for this contingent project.

Table 3-1: CBD supply – cable into CBD, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m [88])	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓($342m)	✓	✓	✓

3.1.2 Gadara/Tumut load area

The key change presented by TransGrid in its revised submission has been the modification of the trigger event to quantify that a step-change increase in electricity demand of more than 20 MW of industrial load in that area is required, rather than a general reference to load growth, which is captured as part of annual planning reviews.

PB's assessment of the updated proposed contingent project

The contingent project is required in order to increase the capacity of the network that supplies the Visy Gadara Mill. The proposed capex includes the development of a 132 kV transmission line from Wagga to either Tumut or Gadara substations.

Consistent with previous findings, PB has not identified any provision in the forecast capital expenditure that relates to this project. The project scope is estimated to cost $54m and based on a high level review by PB of the scope and costs outlined in PES 6218, PB is of the view that the proposed cost is a reasonable cost of a 132 kV transmission-line development based project. The cost of the project exceeds the threshold of a contingent project which is $33.4m.

TransGrid has revised the trigger event to be:

- the lodgement with TransGrid of a request to increase the agreed maximum demand for this industrial load by more than 20 MW and the subsequent

88 In the case of TransGrid – this figure of $35m is based on the (revised) 2009/10 smoothed revenue of $706.6m, refer Transgrid Revised Revenue Proposal dated January 2009, p. 99.

acceptance by the operator of this industrial load of TransGrid's offer to connect via the execution of the related connection documentation.

In PB's view, this revised trigger event is specific, quantified and capable of objective verification based on existing and forecast load levels. The trigger event will generate increased costs that relate to a specific location rather than benefiting the transmission network as a whole, and the event is probable but not sufficiently certain as the decision to increase demand lies with the developer. PB acknowledges that this proposed contingent project now satisfies the NER requirements.

The occurrence of the trigger event during the next regulatory period is in PB's view probable but uncertain as it depends on the decision of the Visy Gadara Mill customer to proceed with the relevant expansion.

Table 3-2: Gadara/Tumut load area, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓($54m)	✓	✓	✓

PB also notes the commercial-in-confidence submission in relation to this matter by Visy, dated 16 February 2009.

3.1.3 Orange 330/132 kV substation

The following bullet points summarise the key changes presented by TransGrid in its revised submission:

- **Update of scope:** TransGrid has revised the scope of works to more closely reflect the works required to meet the network augmentation requirements to meet the spot load development alone.
- **Update of trigger:** TransGrid has revised the trigger to include the acceptance of an Offer to connect for the spot load increase rather than just a general increase in load.

PB's assessment of the updated proposed contingent project

The revised project scope is the construction of a 330 / 132 kV substation along the existing Mt Piper to Wellington 330 kV line. The revised scope includes a single transformer, terminal works, and 330 kV and 132 kV line construction. The total revised budget is $46.8m. The project has been identified as required due to the expectation that the owner of the Cadia gold mine is likely to commit to an expansion of the mine.

Consistent with previous findings, PB has not identified any allowance in the forecast capital expenditure relating to this project. Based on PB's high level review of the scope and costs outlined in PES 6262, PB is of the view that the estimate of $46.8m is reflective and reasonable for the proposed scope of works. Furthermore, the revised project cost of $46.8m exceeds the required contingent project threshold of $33.4m.

The revised trigger event is defined as:

- the lodgement with TransGrid or Country Energy of a request to increase the agreed maximum demand for this mine by more than 40 MW, and the subsequent acceptance by the operator of this mine of TransGrid's or Country Energy's Offer to Connect via the execution of the related connection documentation.

In PB's view this revised trigger is specific, quantified and capable of objective verification based on existing and forecast load levels. The trigger event will generate increased costs that relate to a specific location rather than benefiting the transmission network as a whole, and the event is probable but not sufficiently certain as the decision to increase demand lies with the developer. PB acknowledges that this proposed contingent project now satisfies the NER requirements.

Table 3-3: Orange 330 kV substation, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓($46.8m)	✓	✓	✓

PB also notes the commercial-in-confidence submission in relation to this matter by Newcrest Mining Limited, dated 19 February 2009.

3.1.4 Reactive support at seven sites

In addition to providing information to clarify the background of this contingent project, the following bullet points summarise the key changes by TransGrid in its revised submission:

- **Update of scope:** TransGrid has revised the scope of this project specifying the number, size and locations of the required capacitor banks
- **Update of trigger:** TransGrid has now included the commerciality of the decision to install capacitors versus entering into network support contracts for the service in the interests of providing the lowest cost service to the customer

PB's assessment of the updated proposed contingent project

TransGrid has revised the trigger event to be:

- the receipt of offers from each Generator for the provision of the network support services during the next regulatory control period which are required to maintain the power transfer capability from power stations to the main NSW load centres and to meet TransGrid's related reliability obligations;

and

- the determination (via the completion of the clause 5.6.6 process and the regulatory test) that the installation of shunt capacitor banks at or near a power station constitutes a least cost option for meeting TransGrid's specific reliability obligation in relation to the power transfer capability from that power station to the main NSW load centres (as compared to the option of acquiring network support services from that power station at the offered price).

TransGrid currently uses reactive support from generators that is above and beyond the minimum standards they are required to contribute under the NER provisions. It does so in order to maintain reliability standards across the transmission network. TransGrid highlights that access to this additional reactive support has not been commercially secured in the past, and it has indicated that it intends to enter into network support contracts with these generators across the 2009/10-2013/14 regulatory period.

TransGrid's revised scope for this proposed contingent project is the prospective installation of shunt capacitor banks totalling 1,600 MVAr in capacity in eight separate banks of 200 MVAr each, at a total indicative cost of $36m, at or near any of the seven separate power station based switchyards, as listed below:

- Bayswater
- Liddell
- Eraring
- Vales Point
- Munmorah
- Mt Piper
- Wallerawang

In regards to TransGrid's revised proposal, and consistent with previous findings, PB has not identified any allowance in the current forecast capital expenditure for reactive support at the seven identified sites. However, a pass-through opex allowance in the non-controllable operational expenditure projections has been included for this purpose. The project is expected to cost $36m, which is in PB's view a reasonable estimate for the scope of work described.

One of PB's original concerns for this contingent project related to the cost being the aggregate of a number of smaller individual capacitor banks that may or may not be required. PB acknowledges TransGrid's view that under the NER, the AER must consider the maximum likely scope for the proposed contingent project, or else the AER would be pre-empting the final outcome. Given that the outcome of TransGrid requiring to install all eight of the capacitor banks may be economic and feasible, PB accepts that the aggregate project as a whole could exceed the contingent project materiality threshold.

The trigger is stated as the receipt of offers from each Generator for the provision of network support followed by the determination via the completion of the regulatory test or clause 5.6.6 of the NER where either method determines that the procurement of shunt capacitors is the least cost option. In PB's view this trigger is not sufficiently specific to be capable of objective verification. As part of the revised proposal review process, PB recommended to TransGrid that to meet the terms of clause 6A.8, the trigger should explicitly state a specific volume of reactive shunt capacitance – for example 1,600 MVAr or that the cost of procuring reactive support from the generators will exceed a set threshold – i.e. $36m. TransGrid subsequently submitted the following revised wording for part one of the contingent project trigger:

- The sum total of offers from each Generator for the provision of the network support services during the next regulatory control period exceeds the total cost of $36m for installing eight 200MVAr shunt capacitor banks, which are required to maintain the power transfer capability from power stations to the main NSW load centres and to meet TransGrid's related reliability obligations;[89]

PB accepts that this revised wording of the trigger meets the NER requirements of being specific and verifiable and generating increased cost. On this basis, PB is satisfied that TransGrid has met the requirements of clause 6A.8 of the NER for this contingent project.

Table 3-4: Reactive support, summary of PB's revised trigger

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓ (4.5m x 8)	✓	✓	✓

89 TransGrid, Issue 332 Response – Contingent Project Triggers; p.1.

3.1.5 QNI upgrade – line series compensation project

In addition to providing information to clarify the background of this contingent project, the key change presented by TransGrid in its revised submission is the modification of the trigger event from one referring purely to market benefits tests and regulatory test results, to specifying the role of the proposed National Transmission Planner (NTP) in framing the trigger. The revised triggers are outlined below.

PB's assessment of the updated proposed contingent project

The scope of this proposed contingent project has now been more clearly defined as the augmentation of the power transfer capacity of QNI by the commissioning of series capacitors along transmission lines owned by both TransGrid and PowerLink. PB has not identified any projects in the proposed future capital expenditure that would constitute partial or full provision of this project - however we note the proposed Dumaresq-Lismore 330 kV line will have some influence on QNI transfer levels.

The indicative cost of the proposed augmentation is $120m, based on an increased bi-directional transfer capacity of 150 MW to 200 MW. TransGrid estimates that approximately 50% of the work will be required in NSW and therefore they will be required to undertake additional capital expenditure of $60m. TransGrid also suggests that this split may change depending on the actual project implemented.

TransGrid has submitted two revised trigger events:

- the publication by the NTP of formal advice to the effect that augmentation of QNI should be pursued which would require capital expenditure during the 2009/10-2013/14 regulatory period; OR
- if the introduction of the NTP is delayed TransGrid is likely to make a decision based on it's analysis that this contingent project is likely to satisfy the regulatory test and will initiate a clause 5.6.6 process in relation to this contingent project.

The first trigger is revised to include formal advice from the NTP to the effect that augmentation of QNI should be pursued. Although a decision by the NTP is a valid contribution to a trigger event, in PB's view the trigger does not pass the requirement to be reasonably specific as it does not state the size or volume of the proposed augmentation. As part of the revised proposal review process, PB recommended to TransGrid that a more appropriate trigger would explicitly highlight that an increase in transfer capacity of between 150-200 MW is required, in order for it to be reasonably specific and capable of objective verification. TransGrid subsequently submitted the following revision to their first trigger event:

- The trigger event is the publication by the NTP of formal advice to the effect that augmentation of QNI, to the extent of a capacity increment of 150 MW to 200 MW above the current capacity as determined by NEMMCO constraint equations, should be pursued within a timeframe that would require capital expenditure in the 2009/10 to 2013/14 regulatory control period.[90]

Based on this new wording, PB is satisfied that the first trigger event now meets the requirement of being specific and capable of objective verification.

With respect to the second part of the trigger definition, (namely TransGrid's decision to invest based on its analysis of the project satisfying a regulatory test application), PB considers this trigger fails to meet the requirements of the NER in that the defined trigger, or satisfactory completion of the Regulatory Test, is not an event in itself that specifically generates any increased cost.

[90] TransGrid, Issue 332 Response – Contingent Project Triggers; p. 2.

In PB's view, an appropriately defined trigger should detail the external event (which is beyond the control of the TNSP) that has changed key input factors leading to the need for the capital investment that was not previously required before the event. For example – a quantified description of changes in the rates of demand growth or changes in the location and cost structure of power stations modelled as part of the Regulatory Test assessment.

Further to this matter, if a trigger was presented in a manner consistent with this principal, PB considers the need for solely referencing the Regulatory Test outcome would be redundant. On this basis, PB maintains that reference to the Regulatory Test process outcomes as being a trigger for a contingent project fails to meet the 'specific and verifiable' requirements of triggers as covered by clause 6A.8.1(c)(1) of the NER. This position was accepted by the AER as part of its draft determination[91].

In addition to these matters concerning the wording of the trigger event, and importantly with regard to this proposed project is that the NER requires that the contingent capital expenditure reasonably reflects the capital expenditure objectives (6A.8.1(b)(1)). As part of its revised proposal, TransGrid states that:

> *"The expenditure is required so that TransGrid can continue to achieve its security, reliability and quality obligations in relation to the provision of prescribed transmission services (as those obligations are defined by the NER and related statutory requirements) by responding to national planning initiatives in its geographical area of responsibility."*[92]

PB notes that the capital expenditure objectives (6A.6.7(a)) relate to expenditure that is required to:

(1) meet the expected demand for prescribed transmission services over that period

(2) comply with all applicable regulatory obligations associated with the provision of prescribed transmission services

(3) maintain the quality, reliability and security of supply of prescribed transmission services

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

On the basis that TransGrid states that the upgrade to QNI is aimed at achieving increased market efficiency by permitting the transfer of energy from the marginally-bid power station in the lower cost region to supply demand in the other region[93], PB does not accept that capturing market benefits meets any of the capital expenditure objectives outlined above, in particular clause 6A.6.7(a)(3) relating to the maintenance of the quality, reliability and security of supply of prescribed transmission services.

Following discussion between PB, TransGrid and the AER on this matter, TransGrid submitted the following revised wording to demonstrate compliance with rule 6A.8.1:

- The upgrading of the interconnection capability across the QNI interconnection improves the NSW import capability. This has benefits to NSW in improving the capability for NSW to gain access to any excess generation above demand in Queensland. Hence the security and reliability of supply to NSW loads are improved and this assists TransGrid in continuing to meet its reliability and security obligations.[94]

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91 AER, TransGrid Transmission Determination 2001-10 to 2013-14 Draft Decision, 31 October 2008, p. 82.

92 TransGrid Revised Revenue Proposal dated January 2009; Appendix J; .p. 40.

93 TransGrid Revised Revenue Proposal dated January 2009; Appendix J; Page 36

94 TransGrid, Issue 332 Response – Contingent Project Triggers; p.2.

Notwithstanding this clarification, and while PB accepts that the upgrade increases interconnection capability and therefore supply options to meet regional demand, PB maintains that the contingent project expenditure proposed is not required to ensure TransGrid achieves its security and reliability obligations and therefore that it does not meet the requirement of the NER that the contingent capital expenditure reasonably reflects the capital expenditure objectives (6A.8.1(b)(1)), as stated by TransGrid.

On this basis, PB recommends that this project is not accepted as a contingent project.

Table 3-5: QNI upgrade – series compensator, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	×	✓ ($60m)	×	✓	✓

3.1.6 Victorian interconnector development

The following bullet points summarise the key changes by TransGrid in its revised submission:

- **Update of scope and capital cost:** TransGrid has clarified that this project is the increase of interconnector capacity from NSW to Victoria, and that TransGrid's share of the capital cost is expected to increase by $2m to $35m.
- **Update of trigger:** TransGrid has revised the trigger to recognise the function of the National Transmission Planner (NTP) in that the NTP may issue formal advice that the project should go ahead within a timeframe.

The two revised trigger events submitted by TransGrid are as follows:

1. The trigger event is the publication by the NTP of formal advice to the effect that augmentation of the NSW to Victoria interconnection to the extent of this capacity increment (approximately 180 MW above the current capacity of 1900 MW) should be pursued within a time frame that would require capital expenditure in the 2009/10 to 2013/14 regulatory control period.

2. If the introduction of the NTP is delayed, or if the NTP arrangements turn out to be different then at some point in time during the next regulatory control period TransGrid is likely to make a decision based on its analysis of the above factors that this Proposed Contingent Project is likely to satisfy the regulatory test. At that stage TransGrid would be likely to initiate a clause 5.6.6. process in relation to this Proposed Contingent Project.

PB's assessment of the updated proposed contingent project

This project is the augmentation of the interconnector from Victoria to NSW to allow an increase in the imports and exports between the two states. PB has not identified any projects in the proposed future capital expenditure that would constitute partial or full provision for this expenditure.

The revised scope of this project is defined as installation of series capacitor compensation in the lower Tumut-Wagga and Wagga-Jindera 330 kV transmission lines; uprating the Lower Tumut-Wagga transmission line by replacement of terminal equipment; replacement of other equipment that has insufficient fault level capacity; and the installation of a shunt capacitor bank at a total cost of $35m.

The revised expected cost of this project is $35m for TransGrid's part of the scope and the rest is being picked up by a Victorian transmission business. Based on the information

provided by TransGrid, PB is of the view that the scope and cost is reflective of the necessary expenditure and the assets scoped appear to relate to providing prescribed services.

In PB's view, the first trigger event meets the NER requirements as the trigger of an increase in the capacity of 180 MW is specific and capable of objective verification.

With respect to the second part of the trigger definition, (namely TransGrid's decision to invest based on its analysis of the project satisfying a regulatory test application), and consistent with our findings for the QNI contingent project, PB considers this trigger fails to meet the requirements of the NER in that the defined trigger, or satisfactory completion of the Regulatory Test, is not an event in itself that specifically generates any increased cost.

In PB's view, an appropriately defined trigger should detail the external event (which is beyond the control of the TNSP) that has changed key input factors leading to the need for the capital investment that was not previously required before the event. For example – a quantified description of changes in the rates of demand growth or changes in the location and cost structure of power stations modelled as part of the Regulatory Test assessment.

Further to this matter, if a trigger was presented in a manner consistent with this principal, PB considers the need for solely referencing the Regulatory Test outcome would be redundant. On this basis, PB maintains that reference to the Regulatory Test process outcomes as being a trigger for a contingent project fails to meet the 'specific and verifiable' requirements of triggers as covered by clause 6A.8.1(c)(1) of the NER. This position was accepted by the AER as part of its draft determination.

Also in a similar manner to the proposed QNI upgrade contingent project, on the basis that TransGrid states that the upgrade is aimed at achieving increased market efficiency by permitting the transfer of energy from the marginally-bid power station in the lower cost region to supply demand in the other region[95], PB does not accept that capturing market benefits meets TransGrid's stated capital expenditure objective of maintaining the quality, reliability and security of supply of prescribed transmission services.

Following discussion between PB, TransGrid and the AER on this matter, TransGrid submitted the following revised wording to demonstrate compliance with rule 6A.8.1:

- The upgrading of the interconnection capability across the NSW-Victoria interconnection improves the NSW import capability. This has benefits to NSW in improving the capability for NSW to gain access to any excess generation above demand in Victoria. Hence the security and reliability supply to NSW loads are improved and this assists TransGrid in continuing to meet its reliability and security obligations.[96]

Notwithstanding this clarification, and while PB accepts that the upgrade increases interconnection capability and therefore supply options to meet regional demand, PB maintains that the contingent project expenditure proposed is not required to ensure TransGrid achieves its security and reliability obligations and therefore that it does not meet the requirement of the NER that the contingent capital expenditure reasonably reflects the capital expenditure objectives (6A.8.1(b)(1)), as stated by TransGrid.

On this basis, PB recommends that this project is not accepted as a contingent project.

95 TransGrid Revised Revenue Proposal dated January 2009; Appendix J; Page 36

96 TransGrid, Issue 332 Response – Contingent project triggers; p.2.

Table 3-6: Interconnection development from Victoria – summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	×	✓ ($35m)	×	✓	✓

3.2 CLARIFICATION OF PROJECT TRIGGERS

The following four projects were considered to satisfy the requirements of clause 6A.8.1 of the NER as part of TransGrid's original revenue proposal, however TransGrid has revised and resubmitted these projects as part of its Revised Revenue Proposal January 2009 with the intent to clarify any outstanding issues regarding the trigger events for these projects. PB has considered in detail the updated trigger event definitions as part of this review.

Contingent Project	Capital cost ($m)
Hunter Valley to Coast 500 kV	$300
Yass to Wagga 500 kV	$329
Banaby – Yass reinforcement	$45
Richmond Vale 500/330 kV substation	$80

3.2.1 Hunter Valley – Central Coast 500 kV line

TransGrid has clarified the need for the Kemps Creek 500/330 kV transformer component as part of its revision and has added $30m to the proposed cost which originally totalled $300m. Additionally, the trigger was refined to recognise the network limitation that would arise as a result of the generation or load developments detailed. The trigger is defined as:

Receipt by TransGrid of an application to:

- connect a new power station with a generating capacity in excess of 400 MW, or
- increase the generating capacity of an existing power station by more than 400 MW,

In relation to TransGrid's transmission network located in the north or west of New South Wales; or

- agreement with Powerlink concerning the proposed development of the Queensland network interconnection which enables the import capability into NSW to be increased by more than 400 MW; or
- the receipt by TransGrid of an application to connect a spot load in the Newcastle area exceeding 200 MW; or
- the receipt by TransGrid of an application to increase an existing spot load in the Newcastle area exceeding 200 MW; and

In each case, the relevant application or development causes a network limitation to arise on the 330 kV network between Liddell / Bayswater and Tomago / Newcastle.

PB's assessment of the updated proposed contingent project

This proposed contingent project was accepted as having satisfied the requirements of clause 6A.8.1 of the NER in the AER's draft decision, however TransGrid has revised and resubmitted this contingent project.

In PB's previous review of this project, it deemed the capex required to transfer the Bayswater unit 1 & 2 ($31m) generating units and the installation of a 500/330 kV transformer ($30m) to be outside the requirements of the NER and recommended a reduction to the estimated cost of the contingent project from $331m to $270m.

In its resubmission, TransGrid agreed that the Bayswater units would be funded via pass-through to Transmission network users and therefore would not be classed as capex.

TransGrid also explains in more detail the need for the 500/330 kV transformer at Kemps Creek, detailing that this need is a direct consequence of the additional power that will be transferred over the Eraring to Kemps Creek Line when more power is injected at Eraring via a new line from the Hunter Valley. Given this clearer understanding of the role the transformer will play, PB acknowledges that capex associated with this transformer is integral to delivering the services associated with the overall contingent project, bringing the total capex to $300m.

Table 3-7: Development of a second 500 kV link, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓ ($300m)	✓	✓	✓

3.2.2 Yass – Wagga 500 kV double circuit line

In its updated submission, TransGrid has queried the AER's decision not to include 200 MW of wind generation in the trigger, and reworded the second part of the trigger to include an 'or' clause instead of an 'and' clause.

PB's assessment of the updated proposed contingent project

This proposed contingent project was accepted as having satisfied the requirements of clause 6A.8.1 of the NER in the AER's draft decision, however TransGrid has revised and resubmitted this contingent project.

The AER did not extend the trigger event to include wind farm developments with outputs exceeding 200 MW in its draft decision of this contingent project. In its resubmission, TransGrid highlights that the critical determinative factor for this trigger is event is an increase in generation output located within the nominated area in excess of 200 MW [97] and that the technology used to generate this increased output is irrelevant. In PB's view this is reasonable and the trigger should not be prescriptive with respect to the technology of the new generation.

Additionally, TransGrid submitted an amendment to the final clause of the trigger to read 'or' instead of 'and' [98], i.e:

"The generation development or increased export capability causes a network limitation to arise on the system between Murray and Upper Tumut/Lower Tumut **OR** between Upper Tumut/Lower Tumut and Yass Canberra."

97 TransGrid Revised Revenue Proposal, Appendix J – Contingent Projects, January 2009, p. 49.

98 ibid.

As these transmission lines operate in an integrated arrangement, in PB's view this is a reasonable change to the trigger and satisfies the requirements of the NER.

Table 3-8: Yass to Wagga 500 kV transmission line, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓ ($329m)	✓	✓	✓

3.2.3 Bannaby – Yass reinforcement

TransGrid made some minor changes to the trigger to reflect a technology neutral position to new generation development that may drive this augmentation.

PB's assessment of the updated proposed contingent project

This proposed contingent project was accepted as having satisfied the requirements of clause 6A.8.1 of the NER in the AER's draft decision, however TransGrid has revised and resubmitted this contingent project.

TransGrid's revised submission addresses the wording of the trigger to omit the reference to "coal-fired or gas-fired" generators. In PB's view this would improve the definition of the trigger as the event should be independent of the type of technology used to generate the 200 MW increase in generation.

Table 3-9: Yass reinforcement, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓ ($45m)	✓	✓	✓

3.2.4 New Richmond Vale 500/330 kV substation

TransGrid has proposed some minor changes to the wording of the drivers of the project to include the upgrade of the QNI alongside generation development in NSW. The trigger was revised to remove reference to the regulatory test and to instead more appropriately describe the constraint being addressed by the project.

PB's assessment of the updated proposed contingent project

This proposed contingent project was accepted as having satisfied the requirements of clause 6A.8.1 of the NER in the AER's draft decision, however TransGrid has revised and resubmitted this contingent project.

The first revision is included in the driver for the project and is shown below (amendment in bold).

The drivers for this project are either major load development in the Newcastle area or by generation development in NSW or **upgrading of the QNI**.

In PB's view "upgrading of QNI" is included in the drivers for the project and the trigger for this project is two fold:

1 The environmental consent authority determines that a 500 kV transmission line between the Hunter Valley and Eraring must utilise the route of an existing 330 kV line that supplies the Newcastle area in order to be approved.

and

2 The 500 kV transmission line construction causes a network limitation to arise on the system between the Hunter Valley and Tomago/Newcastle due to the thermal ratings of the remaining 330 kV transmission lines.

The amendment of the second trigger event (from "the project including the 500/330 kV substation satisfies the regulatory test") is in PB's view not sufficiently specific to pass the requirements of the NER as TransGrid has not defined a reasonable thermal limit or capacity that is objective and verifiable. PB recommended to TransGrid that a specific constraint level or upgrade requirement is identified to allow this project to be accepted as a contingent project.

TransGrid subsequently submitted the following revision to the second part of the trigger event:

2 The power transfer on the remaining 330 kV transmission line between Liddell and Tomago/Newcastle exceeds the Contingency Rating of the line (1430 MVA) under 'N-1' conditions either during the construction of the hunter Valley – Eraring 500 kV line or following its completion.[99]

PB is now satisfied that this revision to the second part of the trigger definition in conjunction with the first part is sufficiently specific and capable of objective verification and therefore satisfied that this contingent project meets all the requirements of the NER.

Table 3-10: New 500/330 kV substation at Richmond Vale, summary of review

Expenditure			Trigger event		
no provision	reflective	exceeds limit ($35m)	specific and verifiable	generates cost	probable but uncertain
✓	✓	✓ ($80m)	✓	✓	✓

[99] TransGrid, Issue 332 response – Contingent Project Triggers; p.1.

Table 3-11: Summary of Proposed Contingent Project Assessment.

Contingent Project	Capital cost ($m)	Expenditure			Trigger event		
		no provision	reflective	exceeds limit	specific and verifiable	generates cost	probable but uncertain
RESUBMITTED PROPOSED CONTINGENT PROJECTS							
CBD supply – cable into the CBD	342	✓	✓	✓	✓	✓	✓
Gadara Tumut Load Area	54	✓	✓	✓	✓	✓	✓
Orange 330 kV substation	46.8	✓	✓	✓	✓	✓	✓
Reactive support at seven sites	4.5 x 8	✓	✓	✓	✓	✓	✓
QNI upgrade – series compensator	60	✓	✗	✓	✗	✓	✓
Victorian Interconnector development	35	✓	✗	✓	✗	✓	✓
CLARIFICATION OF PROJECT TRIGGERS							
Hunter Valley to Coast 500 kV link	300	✓	✓	✓	✓	✓	✓
Yass to Wagga 500 kV double circuit line	329	✓	✓	✓	✓	✓	✓
Bannaby – Yass reinforcement	45	✓	✓	✓	✓	✓	✓
Richmond Vale 500/330 kV substation	80	✓	✓	✓	✓	✓	✓

Source: PB analysis

4. REVIEW OF REVISED FORECAST OPEX

PB has been requested to comment on Section 5.3.2 and Appendix "L" of the TransGrid Revised Revenue Proposal, which specifically covers the treatment of maintenance activity associated with defects of new assets. Our review, discussion and conclusion are detailed in the following section.

4.1 BACKGROUND INFORMATION

In preparing its comments in relation to TransGrid's revised proposal submitted to the AER in January 2009, PB has relied upon and reviewed the following information:

- the AER's Draft decision on TransGrid's transmission determination 2009-10 to 2013-14 (31 October 2008)
- PB's original independent review of the TransGrid Revenue Reset for the AER (12 November 2008)
- section 5.3.2 and Appendix L of the TransGrid Revised Revenue Proposal (January 2009), including independent advice on the treatment of defect ratios provided to TransGrid by SKM (19 December 2008)
- questions on defect maintenance on new assets referred to TransGrid by the AER on 23 January 2009
- TransGrid's response to these questions, and comments provided to the AER from Nuttall Consulting on these responses
- the responses to questions raised by PB from TransGrid during this review.

As part of its original review, PB acknowledged that new growth related assets commissioned during the next regulatory period would require routine maintenance such as inspection and testing as well as incurring standard operating costs, PB recommended that these be included in the forecast opex expenditures to the AER. However, PB also considered that TransGrid's methodology of calculating the opex allowance for the assets commissioned during the next regulatory period overstated the maintenance expenditures required given that these assets would be recently commissioned and also covered by either the manufacturer's and or construction warranty. PB's recommendation to the AER on this matter resulted in a reduction in the overall opex allowance of $15m (real 2007/08). PB notes that it has not applied this methodology to replacement-related assets as the opex implications are addressed when dealing with the capex/opex trade-off in PB's original report.

Specifically, in section 7.7.2 of PB's original report, it is stated that:

> *"..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.*
>
> *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."*

TransGrid has raised three main issues as part of its revised proposal:

- there is no significant change to the age mix of assets making up TransGrid's asset base, leading to the conclusion that there is no expectation that defect rates would be impacted by the effect of new assets
- there is evidence that new assets can experience higher defect rates than for mid-life equipment (for example, as a result of manufacturing defects)
- warranties provide only limited coverage and do not cover the emergency response, fault detection and site supervision components of any equipment malfunction.

Each of these matters are addressed by PB in the following sections.

The downwards adjustment to opex recommended to the AER in PB's original review was based on our view that newly commissioned assets require less total maintenance expenditures during the regulatory period in which they are commissioned than assets commissioned in previous regulatory periods. These assets are also covered by either the manufacturer's and/or construction warranties. Our view has been formed as a result of our extensive experience working for both electricity businesses and regulators in Australia and internationally. In order to quantify our adjustment in the original review, we recommended an amount equivalent to the TransGrid forecast defect rectification component of the total forecast maintenance expenditures relating to those assets proposed to be commissioned during the next regulatory period.

Whilst PB has not been persuaded by the additional information and data provided by TransGrid as part of its revised proposal to alter our view in this matter, we do recognise however that TransGrid has advised that the defect rectification expenditures include regular maintenance activities such as lawn mowing, garden maintenance and substation cleaning that PB would normally consider to be of a routine nature. Hence in this report, we propose that our original recommended opex adjustment be revised. Our new recommended adjustment to forecast opex expenditures is the forecast defect rectification component of the forecast total maintenance expenditures relating to the assets proposed to be commissioned during the next regulatory period, subsequently reduced by a reasonable amount to compensate for the regular maintenance component of these forecasts, plus an amount to compensate for some costs that are associated with organising and managing works under warranty.

4.2 NO SIGNIFICANT CHANGE TO AGE MIX OF ASSETS

In section 5.3.2 of TransGrid's revised revenue proposal, TransGrid included the following statement and presented Figure 4-1:

> *".. below shows the average age of various asset classes over the current and future regulatory period. This clearly shows that average age of assets is reasonably stable leading to the conclusion that there would be no expectation that defect rates would be impacted by the effect of any new assets."*

Figure 4-1 – System average age, across asset classes

In response to this matter, PB accepts that at a macro level the analysis is correct as the ratio of new assets proposed to be constructed during the next regulatory period compared to the number of assets in the existing asset base is very small. The impact of the proposed capital expenditure on the individual asset classes is shown in Figure 4-1, where it can be seen by example that the average life for the Protection and Substations asset classes reduces over the period but the impact on the entire system average life is very minimal. For the critical asset class of substations, PB notes that the average age is reduced slightly over the period 2009 to 2012.

Not withstanding the observation that TransGrid's forecast capex investment has a minimal impact on the system average age; PB believes that the impact on specific asset classes is significant. We contend that the average maintenance cost associated with new assets should be lower than for assets commissioned in preceding regulatory periods and hence would also expect lower defect rectification expenditures for several years after the initial warranty period has expired. Hence, overall operational expenditures for new assets could reasonably be expected to be lower than those associated with similar assets in their mid-life. PB maintains that the lower opex costs associated with new assets should be factored into the forecast of operational expenditures.

TransGrid's experience indicates average maintenance costs for recently commissioned assets are lower than average maintenance costs for assets commissioned in previous regulatory periods, see Figure 4-9, which shows TransGrid's presentation of its average maintenance cost per switchbay over a two year sample period (2006/07 and 2007/08) against various asset commissioning dates. It shows that the average maintenance costs for newly commissioned switch-bays are lower than those for switch-bays commissioned during previous regulatory periods.

PB considers that as the TransGrid opex model uses system averages to forecast future operational expenditure, it will tend to overstate the defect rectification expenditures required for newly commissioned assets. This view is the basis for PB's recommended adjustment to forecast opex expenditures associated with assets commissioned during the next regulatory period.

4.3 NEW EQUIPMENT DEFECTS

PB considers that new specialist electricity plant and equipment procured in accordance with recognised Australian and international standards from established manufacturers will generally experience minimal if any defects for several years following successful commissioning and expiry of the warranty periods. This is primarily our basis for excluding the majority of defect rectification costs for newly commissioned growth related assets during the remainder of the regulatory period in which they are commissioned. PB acknowledges that there could be some non recoverable costs and/or minor defect rectification costs associated with new assets within the remainder of the regulatory period, and has included an adjustment to our original recommendation to compensate for these minor costs.

TransGrid has further advised that:

> *"TransGrid includes in the category of "Defect maintenance" a number of non-routine tasks that are required on a regular basis, for example, substation cleaning and maintenance of grounds, including the substation buffer zone and fire break. To maximise the efficiency of the effort, such work is completed on a condition basis rather than on a programmed basis as it is affected by variable factors such as long-term weather conditions and substation access frequency. As this work is not included in the forecast routine maintenance program, it is by definition considered defect maintenance. This type of work is required immediately following the establishment of a new asset, and the type of time lag proposed by PB is inappropriate."*

PB acknowledges that by excluding some non-routine and conditional-based tasks such as substation cleaning and ground maintenance from its routine maintenance forecasts, these activities are by definition included in TransGrid's category of "defect maintenance". PB also notes that generally this type of maintenance is usually considered to be routine in nature when viewed over a twelve month period even though it is programmed on a condition basis. The contracts for this type of work are typically let for twelve monthly periods or longer and annual costs are generally relatively stable in real terms. The data supplied by TransGrid indicates that newly commissioned switchbays have lower average maintenance costs than similar older assets, and hence the inclusion of these activities in defect rectification expenditures does not influence our underlying contention that the newly commissioned assets have lower maintenance costs during regulatory period in which they are commissioned.

Regarding new equipment defects, we note that SKM in Appendix L of the TransGrid Revised Revenue Proposal states:

> *"In their response, TransGrid used a typical failure rate over time graph (bathtub curve) to reason that new assets suffer from higher rates of defects than assets in their mid-life. SKM generally accepts that manufacturing defects on new equipment, combined with design and installation errors will result in higher rates of defects on new equipment than mid-life equipment. However, SKM consider that within the mid-life / random failure zone, newer equipment will tend to have fewer defects that* [sic] *older equipment, and therefore in the event that the average age of a network decreases materially (i.e. the average drops several years), the cost of defects should also reduce."*

Whilst SKM goes on to conclude that the defect rate used in TransGrid's model and applied to new assets is appropriate because TransGrid has demonstrated that the average age for various asset categories and the system itself remains largely static, PB considers the above statement also highlights that the higher rates of defect for new assets primarily result from manufacturing defects, "burn in" failures and design and installation issues, which we believe are usually rectified within the standard warranty periods. After the warranty periods, PB expects that new assets should generally have lower maintenance costs than assets commissioned during previous regulatory periods.

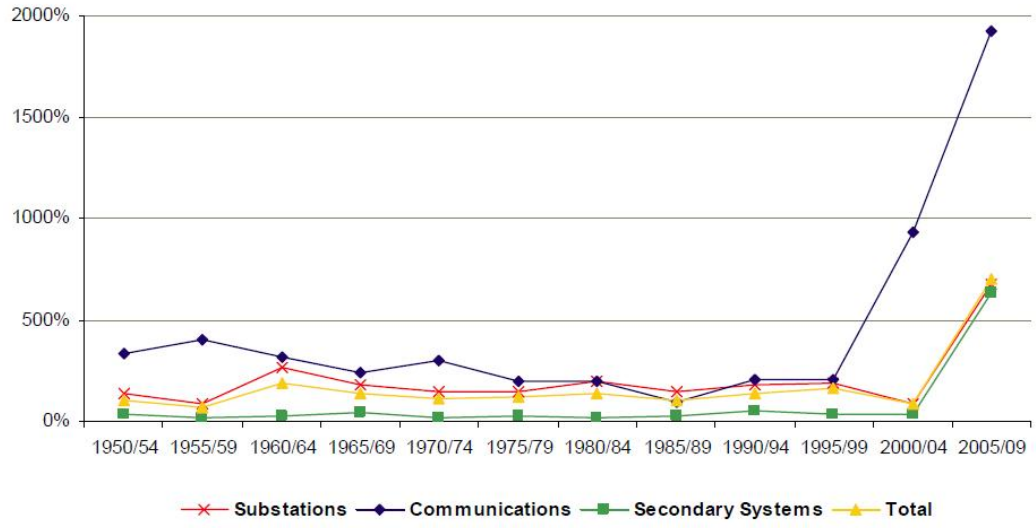
SKM also states in Appendix L of the TransGrid Revised Revenue Proposal that:

> *"SKM has found in the past that new equipment will sometimes require post commissioning / practical completion modification and adjustment to ensure suitable operation and reliability. This work is typically classified as a defect; however, the manufacturer will not be subject to a defect claim. While certain defect rectification work will be covered by a warranty, there are additional costs incurred by the equipment owner that are typically not covered."*

PB accepts that some new equipment requires modification or adjustment to ensure suitable operation and reliability, but contends that this work should be included in the capital cost of the project. Essentially, PB does not consider a capital project to be complete until it is fully commissioned with all equipment functioning as originally specified. We believe that the capital cost of a project should include all costs incurred until the project is operating in accordance with its design criteria. In light of this view, PB considers that any associated works carried out after practical project completion should be only very minor in nature and of insignificant value.

As part of its revised proposal, TransGrid presented Figure 4-2 to show the long term trend of defect ratios across asset classes. It indicates that defect ratios for equipment commissioned during the current regulatory period have increased significantly compared with the long run average.

Figure 4-2 – Defect ratio vs. commissioning date



TransGrid has advised that the data in Figure 4-2 has been calculated from a limited survey period covering the period 2005-2007 using the ratio of the historical costs of routine maintenance for each asset class to the corresponding historical costs for defect rectification. PB notes that this data has been extracted by TransGrid specifically for this chart and it was not used by TransGrid in modelling its opex expenditures.

The TransGrid opex model uses labour hours to determine the defect ratios, which are calculated using the ratio of routine maintenance hours for each asset class to the corresponding hours booked to defect rectification for the same asset class.

Figure 4-2 shows the defect ratios for substations, communication and secondary systems all increasing dramatically in the current regulatory period. They are considerably higher than the long term historical averages. TransGrid was requested to rework the data by excluding the impacts of the MetroGrid project, and this is discussed further below.

Based on the data in Figure 4-2, TransGrid concluded:

> *"TransGrid has carried out an analysis of its maintenance expenditure over the period 2005 - 07 and has graphed the ratio of defect expenditure to routine maintenance expenditure against the commissioning date of its assets (Figure 5.3). The graph clearly shows that, rather than new assets showing a significant reduction in defect costs, the defect costs for newer assets are significantly higher across all the asset categories."*

Whilst recognising the limited data in the survey period, PB believes that Figure 4-2 demonstrates that TransGrid's analysis of defect ratios calculated on a cost basis for the first three years of the current regulatory period are significantly higher that the long term averages and not aligned with historical trends. An examination of the underlying data[100] shows the material increase in defect ratios in the current regulatory period is a combination of smaller than normal spends on routine maintenance and higher than normal spends on defect rectification compared with historical spending patterns. To understand the reasons for this outcome, PB would need to investigate the underlying reasons for this change in expenditure patterns but notes that the average maintenance cost for newly commissioned switch-bays is substantially lower than for switch-bays commissioned during previous regulatory periods over the limited sample period 2006/07 to 2007/08. This TransGrid data implies that even though the defect ratios are higher, the average maintenance costs for the switch-bays commissioned during the current regulatory period are lower. This issue is further highlighted when the Haymarket substations maintenance costs are excluded.

Given the significant change in the later periods shown in Figure 4-2, PB requested TransGrid rework the data to remove the impacts of the Haymarket substation defects associated with the MetroGrid project. This request was made in the context that PB considered that these assets are technically different to TransGrid's other assets as they include unique underground SF_6 insulated transformers and switchgear. TransGrid provided Figure 4-3 and the following clarification:

> *"It was found that there were several substation line items included in the data that would have been filtered out had the cost categorisation rules in the Opex Model been applied. Specific instances were the inclusion of $2.3 million in costs associated with the self insurance category and $250,000 associated with rates for the Haymarket substation. Other impacts are the removal of costs allocated to substations that would be classified as Maintenance Support and Asset Management in the Opex Model"*

[100] The spreadsheet titled 'Issue 299 – Substation Defect Ratios' supplied by TransGrid with its response to the AER's questions on defect maintenance.

Figure 4-3 – Defect ratio vs. commissioning date (ex HYM)

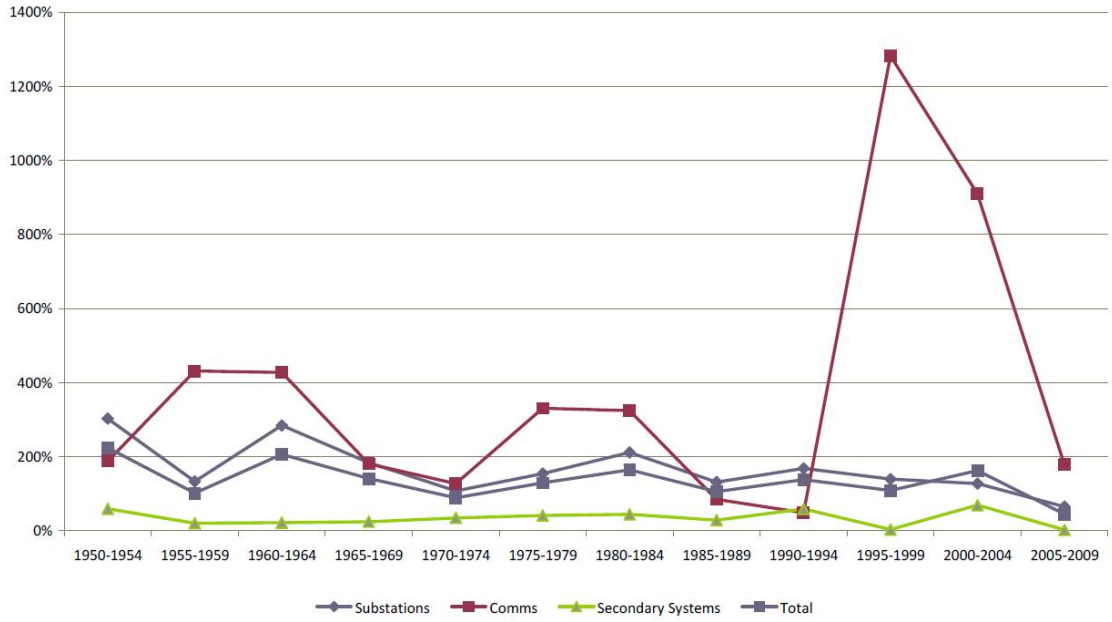


Figure 4-3 details the impact of the adjustments made by TransGrid, and generally the revised data shows a reduction in total asset defect ratios for a given commissioning date over the current regulatory period based on costs incurred during the period 2006/06 to 2007/08 only. Even though the survey period was limited to two years data, PB notes that this figure demonstrates that the substation defect ratio has consistently been lower for equipment commissioned since the period 1990-1994. PB has no reason to believe that extending the survey period would change the trends evident in Figure 4-3. Our view is that this trend and the average switchbay maintenance cost trend support our contention that average maintenance costs for newly commissioned assets will be lower during the regulatory period in which they are commissioned compared to assets commissioned during previous regulatory periods.

Figure 4-3 also indicates that secondary system defect ratios are lower for equipment commissioned in 2005-2009 than for equipment commissioned in 1990-1994. The total defect ratios show a generally reducing trend over the periods 1990-1994 to 2005-2009, even though there was a significant spike in communication defect ratios for equipment commissioned over the same period. However, PB contends that the downwards trend of the total defect data supports our position that newer assets have a lower defect ratio and experience lower maintenance costs than assets commissioned in previous regulatory periods after the expiry of warranty periods, especially in the key category of substations.

With regards to the irregularities associated with the communication defect ratios between 1995 through to 2004, TransGrid has advised:

> *"A spike in the defect ratio for Communications is observed in the periods 1995-1999 and 2000-2004. In the case of 1995-1999 this is associated with a single substation commissioned in this period, on which the total expense in the survey period was less than $2000. Routine maintenance costs in this period were only $78, leading to an unrepresentative defect ratio."*

In its response to the AER's questions on defect maintenance, TransGrid also stated:

> *"The Opex Model assumes that the average ratios across the existing asset base are appropriate. It is not expected that these ratios are fundamental to the asset class, but will be expected to change gradually over time as the new equipment influences the average more. The*

expectation is that these changes will be material over a longer time frame (10 to 20 years) but not from revenue period to revenue period."

PB agrees with these statements at a macro level and we believe the response to our request to remove the impact of the Haymarket Substation provides further support for our position - i.e. that newly commissioned assets experience lower maintenance costs than assets commissioned in previous regulatory periods.

4.3.1 TransGrid opex model details

TransGrid provided the information in Figure 4-4 in response to the questions posed by the AER relating to the calculation of the defect ratios incorporated into the TransGrid opex model.

Figure 4-4 – Defect ratio across work streams

Defect Ratios

Workstream	2004-05	2005-06	2006-07	Opex Forecast
Lines	109%	72%	93%	95%
Substations	34%	114%	116%	115%
Communications	231%	232%	196%	200%
Secondary Systems	49%	28%	29%	30%
Land and Easements	732%	82%	48%	46%

These defect ratios were calculated using the historical labour hour data over the last three years. In the case of land and easements, ratios have been adjusted to reflect proposed changes to the maintenance regimen. These defect ratios have been calculated using the historical data contained in Figure 4-5 and Figure 4-6, relating to the raw data for defect and routine related maintenance, respectively.

Figure 4-5 – Historical defect maintenance hours

Defect Maintenance Hours

Workstream	2004-05	2005-06	2006-07
Lines	13,022	11,673	18,035
Substations	28,815	60,924	55,790
Communications	20,973	16,715	16,515
Secondary Systems	9,405	4,686	5,309
Land and Easements	29,674	15,910	10,072

Figure 4-6 – Historical routine maintenance hours

Routine Maintenance Hours

Workstream	2004-05	2005-06	2006-07
Lines	11,911	16,224	19,358
Substations	84,018	53,552	48,138
Communications	9,071	7,203	8,427
Secondary Systems	19,143	16,840	18,031
Land and Easements	4,056	9,481	20,862

PB notes that the substation, secondary system and communication defect ratio's used in the TransGrid opex modelling appear to align reasonably well with the those calculated using historical costs after the adjustments to remove the impact of the Haymarket Substation defects are made, refer to Figure 4-3. It is noted that the defect ratios for land and easements have been reduced to reflect the proposed changes in land and easement maintenance procedures.

Given this additional level of insight into the defect ratio calculations, PB continues to maintain that the forecast expenditures based on the defect ratios TransGrid incorporated in its opex modelling are reasonable provided our recommended adjustments are incorporated into the total opex projections.

4.4 NEW EQUIPMENT WARRANTY

PB has considered the warranty periods included in the TransGrid purchase specifications, and which have been reproduced in Figure 4-7 from Appendix L of the TransGrid Revised Revenue Application.

Figure 4-7 – Warranty periods for equipment

Equipment	Normal warranty period	Equipment	Normal warranty period
CB	2	Shunt reactor	2
CT	2	Series reactor	2
MVT	2	SVC	4
CVT	2	GIS	2
Disconnectors	2	Batteries	10
Earthswitch	2	Battery charges	2
Surge Arrestor	2	Distance relays	1
Line Trap	2	Transformer protection relays	1
Capacitor Bank	5	132 kV concrete pole	1
Transformer	2	Steel tower lines	2

PB is of the view that these warranty periods should be sufficient to identify and/or detect any burn-in, material, workmanship, design or construction issues during the warranty period and have then rectified at the manufacturer's or supplier's expense.

In relation to TransGrid's conditions of contract, SKM state in Appendix L:

> *"The equipment supplier is not responsible for any defects or damage arising out of faulty materials, workmanship or design provided by the TransGrid or arising out of improper usage by TransGrid. In these cases, TransGrid would be responsible for the full cost of repair / replacement.*
>
> *In cases where the defect is shown to be the supplier's responsibility, TransGrid requires the supplier to either repair or replace the damaged / defective equipment. Details as to the coverage and extent of the warranty are not explicitly referenced in documentation other than in the standard conditions of order or conditions of contract prepared by Supply Management."*

PB believes that these contract conditions are relatively standard and accept they could involve TransGrid in supplying some labour to remove and replace the faulty equipment. However, we also consider this would involve only minor expenditure as much of the secondary equipment and communication equipment is now plugged in rather than hard wired and sub assemblies are replaced on a unit basis rather than a component basis. In our experience, heavy electrical plant such as transformers, switchgear and isolators, etc generally have fewer defects in the first three years of service following commissioning compared with secondary equipment. Burn-in type defects are usually associated with

equipment containing electronic components such as protection relays, communications, SCADA and alarm equipment.

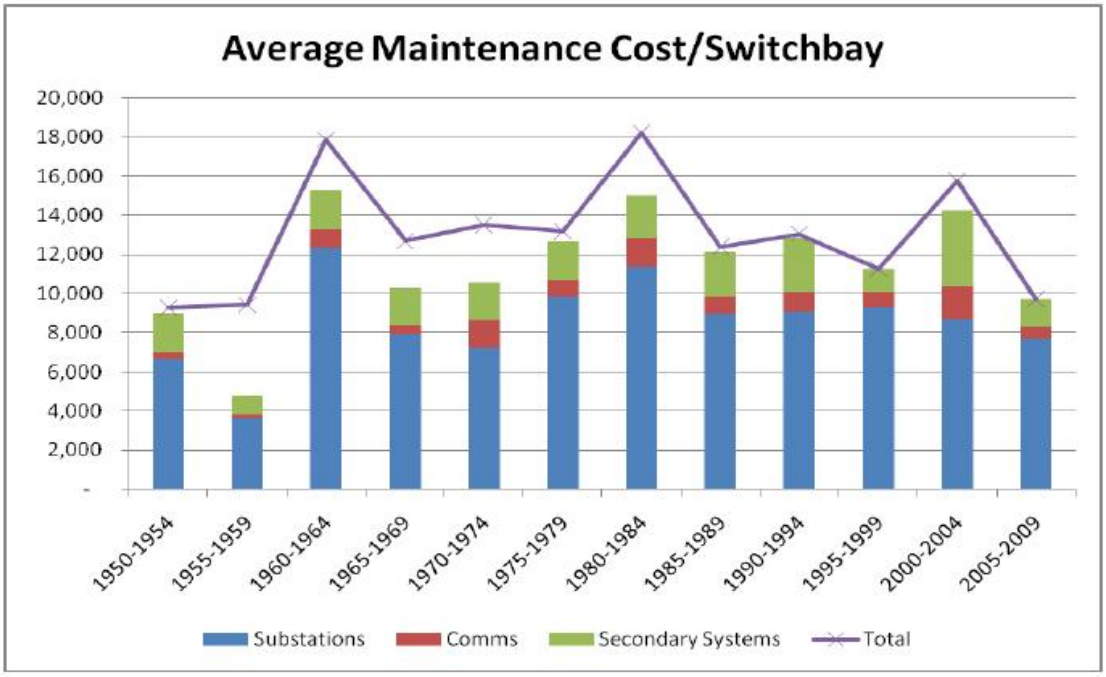
PB acknowledges that some of these minor costs would not be recoverable from manufacturers and has included a revision to its original recommended adjustment to compensate for such costs.

4.4.1 Average maintenance costs

In its response to the AER's questions on defect maintenance, TransGrid included the following statement relating to Figure 4-8:

> *"The figure below shows the average maintenance cost per switchbay based on the same data used to calculate the defect ratio."*

Figure 4-8 – Average maintenance cost / switchbay



Note: *The columns on the above graph relate to the average total maintenance cost for each workstream working within substations. This includes only defect and routine maintenance, excluding major operating projects (MOPs) costs. The Total Cost Line above the stacked columns includes the MOPS cost for completeness.*

PB has reviewed this data and makes the following observations:

- the highest proportion of switchbay maintenance costs are substation costs
- for assets installed over the last 14 years, average substation maintenance costs have been consistently falling
- communications costs have generally fallen for assets installed over the same period, if the higher average costs in the period 2000 – 2004 are ignored
- there was an abnormally high spend on Secondary System costs on assets installed in the period 2000-2004 which was unexplained.

TransGrid noted in its response to the AER that the higher communication costs were due to a number of one-off control schemes commissioned during this period and that it has responded to these concerns by limiting specifications of control equipment to pre-qualified suppliers and configurations.

Figure 4-8 clearly shows that that the average maintenance costs per switchbay is lower for newly commissioned assets than for assets commissioned during previous regulatory periods over the sampled period of 2006/07 to 2007/08. In addition, the average maintenance costs for switchbays displays a reducing trend for assets commissioned over the last thirty years during the review period.

PB requested TransGrid to rework the data used to develop Figure 4-8 to exclude the costs associated with the MetroGrid project. As discussed previously, TransGrid also filtered out several substation line items so as to align the cost categories with those used to develop the opex model. The results of this exercise are shown below in Figure 4-9.

Figure 4-9 – Average maintenance cost / switchbay (ex HYM)

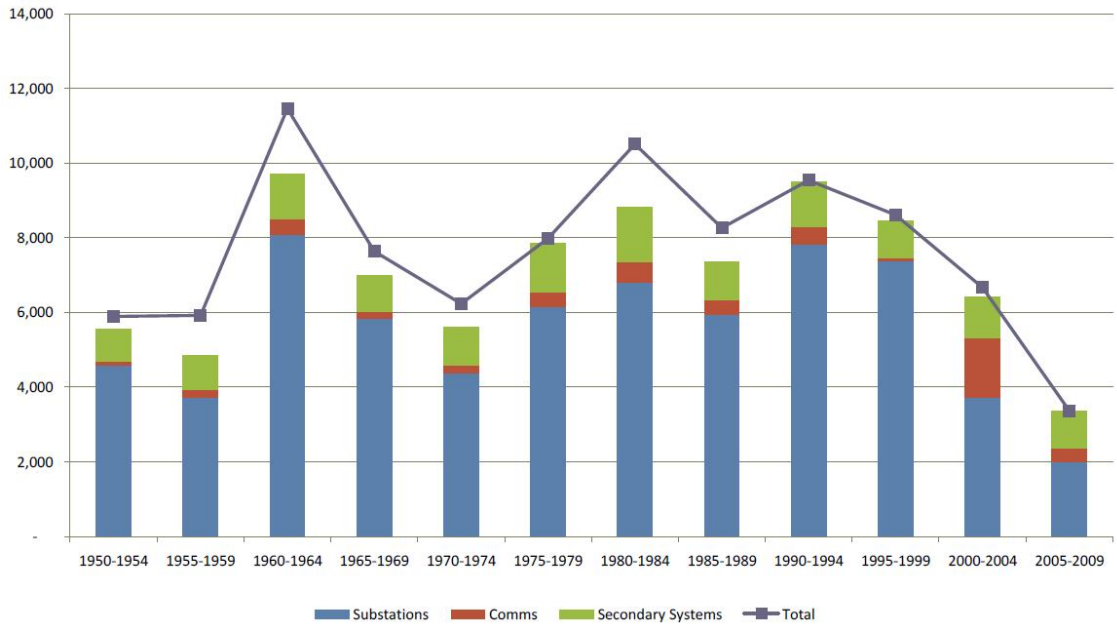


Figure 4-9 clearly shows the trend of falling average maintenance costs per switchbay for assets commissioned since 1990 and the significantly lower average substation maintenance costs for assets commissioned during the current regulatory period when the impact of the MetroGrid project is removed.

PB considers this result further supports our assertion that newly commissioned assets have lower average maintenance costs than older assets, implying also lower defect rectification costs than older assets.

For example, the average maintenance cost per switchbay for assets commissioned during the current regulatory period is approximately $3,000 lower than for assets commissioned during the period 2000 to 2004, excluding the MetroGrid project. PB contends that this supports our position that newly commissioned assets experience lower maintenance costs than older assets, implying lower defect rectification costs as routine maintenance costs should be relatively stable across asset classes irrespective of their commissioning date.

4.4.2 Non-recoverable costs

With specific reference to the nature of non-recoverable costs associated with defect experience by new assets, SKM outlined in Appendix L of the revised proposal that:

> *"SKM has investigated the typical costs associated with defect rectification on new assets. The costs can be divided into several discrete components as follows:*
> - *Call-out and defect identification;*

- *Contingency measures to mitigate the loss (or potential loss) of supply, damage to other network elements and HSEC (Health Safety Environment and Community);*
- *Customer interruptions and impacts on service standards obligations;*
- *Liaison with the manufacturer to determine an effective solution the rectify defective equipment;*
- *Material to rectify the defective equipment;*
- *Labour associated with the rectification of the defective equipment;*
- *Labour associated with the support / supervision of the manufacturer while undertaking the corrective measures; and*
- *Network outage planning, management and switching associated with the rectification."*

PB has reviewed this listing of costs SKM describe as non-recoverable costs associated with warranty work and we consider that:

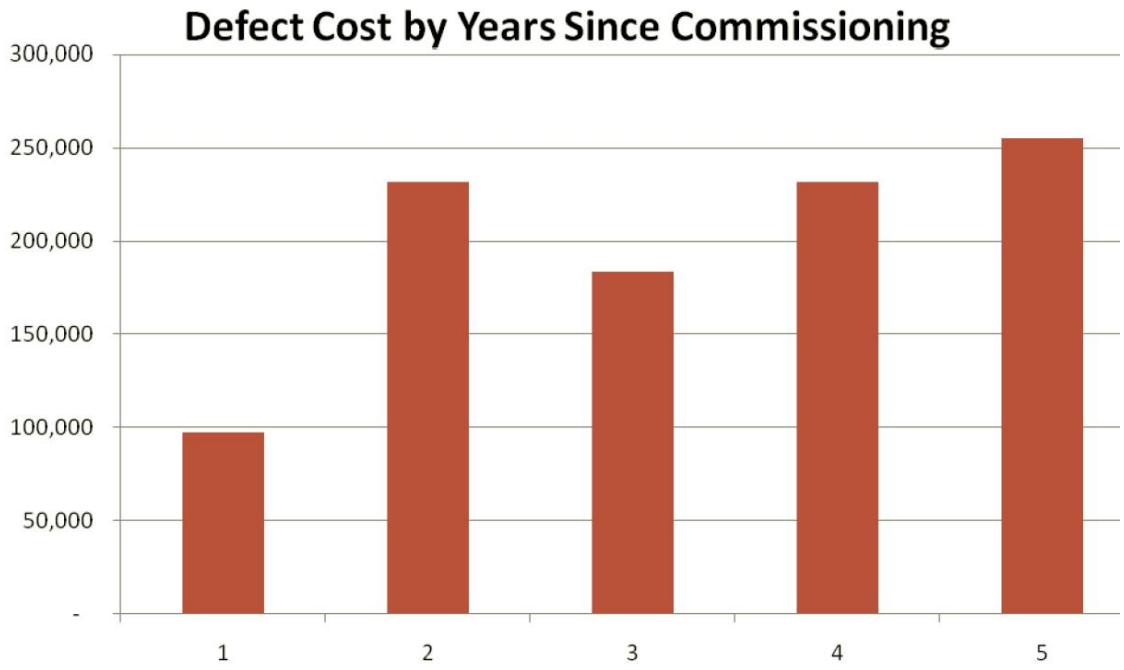
- some of these costs should be covered by TransGrid's technical overheads such as the liaison with manufactures to determine effective solutions
- other costs should be covered by allowances made for system operation, such as outage planning, management and control-room switching costs
- some costs should be only incremental and therefore not significant (such as customer interruptions and impacts on service standards)
- supervision and support costs should also be relatively minor.

To gain further insight into TransGrid's position, PB requested TransGrid provide some quantified assessment of its annual historical costs, which were non-recoverable from manufacturers, and that were associated with the defect rectification of newly commissioned assets within stated warranty periods.

TransGrid responded by indicating that this specific data was unavailable, but supplied defect costs it incurred over the first five years after the commissioning of all (five) new substations (excluding the MetroGrid project and the Coffs Harbour 330/132 kV substation[101]), over the most recent five year period. This resulted in annual defect costs per annum as shown in Figure 4-10.

101 As this substation was built on an existing 132 kV site.

Figure 4-10 defect cost by years since commissioning



TransGrid also indicated in its response that:

> *"The average defect cost per switchbay is calculated to be $6,230 per annum for these substations over the survey period, compared to $4,390 calculated for the network".*

PB has reviewed this information on the assumption that it is based on full year results and the same burden factors have been used, and makes the following observations:

- in PB's view the defect costs incurred by TransGrid in the second year of operation for these five substations appears relatively high compared to the previous year, given that all the equipment (with the exception of relays) would still be covered by warranty. The reason for these higher defect costs in year two is not apparent.
- that even after expiry of warranty periods (i.e. generally the final three years) the average defect cost per switchbay for these new substations is considerably higher (by approximately 40%) than the network average, which implies that newly commissioned equipment either has more defects on average (or more costly defects) than older equipment
- the average annual burdened costs associated with defects for the sample was approximately $40,000 (equivalent to direct costs of approximately $16,000 per substation per annum).

This data is not consistent with PB's experience as generally after the initial warranty period, the number of defects for newly commissioned equipment is lower than the average for the network. PB believes the data needs to be considered together with TransGrid data which indicates that average maintenance costs for newly commissioned switch-bays are substantially lower than for switch-bays commissioned during previous regulatory periods over the two year sample period.

TransGrid also indicated that the average defect cost per switchbay is $6,230 per annum (for the sample which excludes Haymarket Substation), compared to $4,390 calculated for the network, suggesting approximately 40% higher defect costs per switchbay. This information also appears disparate compared with the average maintenance costs for switch-bays commissioned during the current period (excluding Haymarket substation) of approximately

$3500 over the two year sample period 2006 to 2008. PB has assumed that average maintenance costs include both routine and defect maintenance costs.

PB believes that this defect data raises issues which require further investigation prior to forming any opinion since the defect costs appear higher than the average maintenance costs.

PB considers that the vast majority of material manufacturing defects associated with new equipment and all design and installation errors should be either rectified during commissioning or within the warranty periods. The defect costs for the sample of substations presented by TransGrid do not align with our expectations as they appear to remain relatively constant and show no signs of reducing after the expiration of the warranty period.

Given this data in isolation and without further explanation, PB is not prepared to alter its view in relation to the maintenance costs associated with newly commissioned assets..

4.5 CONCLUSIONS

Following PB's detailed review into the historical and projected operational and maintenance expenditure presented by TransGrid, we believe that TransGrid is a competent transmission service provider and experienced in specifying, designing, constructing, maintaining and operating transmission networks. There is evidence that TransGrid adopts a 'whole-of-life' and integrated approach to its asset management process, and this includes its design and equipment procurement processes.

Further, PB believes TransGrid relies upon its own experience, and that of other transmission service providers, to remain up-to-date and current with new technologies, design principles and maintenance and operating techniques.

Our view is reinforced by the data presented by TransGrid - including the data showing that the average switchbay maintenance costs for newly commissioned assets is lower than for assets commissioned during previous regulatory periods over the two year sample period. Transgrid has also reduced the land and easement defect ratio incorporated into the opex modelling based on proposed changes to land and easement maintenance procedures. PB considers TransGrid capable of designing and constructing new transmission assets that should not require any (or at least minimal) defect rectifications for the first few years of their operation after the expiration of typical warranty periods.

Whilst TransGrid is proposing a substantial increase in capital works during the next regulatory period, PB has not identified any individual project which is utilising any new or novel technologies such that it will pose significant construction, commissioning or abnormal maintenance risks to the organisation. PB notes that TransGrid has included some projects that include GIS switchgear and 330 kV cable, but we consider that TransGrid has had experience in specifying, designing and commissioning this type of equipment such that these projects do not pose any significant construction or maintenance risks to the organisation.

PB contends that new assets tend to have a lower maintenance costs than older assets during the regulatory period in which they are commissioned. In reviewing the information provided by TransGrid (including the independent advice presented by SKM), PB has not identified any basis to alter our initial view in relation to the impact of newly commissioned assets on forecast opex expenditures other than to adjust our recommendation to compensate for the fact that the TransGrid model includes some regular maintenance costs when forecasting defect rectification costs and for the small costs associated with managing and organising warranty works. We continue to believe that the overwhelming majority of the new assets scheduled for commissioning during the next regulatory period should not require any significant defect rectification expenditures during that period other than those identified and rectified during commissioning and the ensuing warranty period.

Recommendation

The additional information provided by TransGrid, including the SKM report in Appendix L of the revised proposal, has not altered PB's original view in relation to the maintenance costs associated with assets proposed to be commissioned during the next regulatory period. The additional information:

- indicates a reasonable warranty period for all asset classes
- indicates TransGrid is experiencing lower average switchbay maintenance costs for newly commissioned assets compared to assets commissioned during previous regulatory periods (over a two year sample period 2006 to 2008)
- indicates a reduction in defect ratios across the major categories during the current regulatory period (notwithstanding issues associated with some recent major and complex projects).

PB recommends to the AER that it maintain its position as detailed in Section 5.6.5 of its draft determination, namely to reduce the total costs forecast by TransGrid's opex model to reflect the impact of the expected lower maintenance costs associated with new assets proposed in the significant capital works program. PB continues to recommend quantifying these cost reductions by calculating the defect rectification costs for growth related assets using the TransGrid opex model, but subsequently we recommend reducing these total defect rectification costs by a reasonable and moderate amount to compensate for the non-routine, but regular maintenance works included by definition in these defect rectification forecasts and also to compensate TransGrid for some minor non-recoverable costs associated with organising and managing works under manufacturer's or construction warranties.

In the absence of specific data to support the magnitude of these subsequent adjustments, PB believes that $300k per annum would be a reasonable estimation of the sum of the non-routine maintenance costs included in the total defect rectification costs associated with the assets proposed to be commissioned during the next regulatory period, as well as the non-recoverable costs associated with managing and organising warranty works over the same period. This recommendation translates into a total reduction of $1.5m over the five year regulatory period.

The calculated defect rectification costs using the TransGrid opex model for the assets proposed to be commissioned during the next regulatory period is $15m, therefore PB's recommended adjustment to TransGrid's total forecast opex expenditures to allow for the expected lower maintenance costs associated with new assets is a net reduction of $13.5m.