Response to EMCa Report

1. Introduction

TransGrid submitted its revenue proposal for the 2014/15 to 2018/19 regulatory control period to the AER on 2 June 2014. The revenue proposal sets out the revenue and expenditure TransGrid requires to provide transmission services for an upcoming period.

As part of the AER's review of TransGrid's revenue proposal, the AER engaged EMCa as technical consultants to provide advice on TransGrid's proposed replacement capital expenditure. EMCa has provided its advice in a report, *Review of Proposed Replacement Capex in TransGrid Revenue Proposal 2014-2019*, October 2014 (EMCa report).

This response by TransGrid, which is provided as an appendix to the revised revenue proposal, is the first opportunity TransGrid has had to comment on the EMCa report.

TransGrid has reviewed EMCa's report and considers that, while some of EMCa's observations are fair, others reflect errors of fact and insufficient regard to the information TransGrid provided to the AER accompanying the revenue proposal.

Further, EMCa has selectively referenced the information available to it and drawn inferences in the absence of information in a way that does not provide a balanced view.

Finally, the observations made by EMCa do not support its conclusions, and EMCa has also not provided any analysis to support its conclusions.

The occurrences in the EMCa report that demonstrate these issues are shown in Table 1.

Table 1
Issues with EMCa's Review

Issue	Paragraphs in EMCa Report
Errors of fact	32, 50, 52, 57, 64, 77, 114, 133, 134, 135
Misrepresentation of TransGrid's comments or data	32, 57, 134, 158
Insufficient regard to the information TransGrid provided to EMCa or the AER accompanying the revenue proposal	35, 40, 45, 57, 58, 80, 86, 113, 114, 115, 124-126, 131, 134, 135
Selective references to the information available to EMCa	38, 101, 113
Inferences in the absence of information	56, 116, 129
Conclusions that are not supported by the observations or analysis	36, 39, 57, 58, 69, 80, 102, 109, 120, 141, 154, 163, 169

TransGrid considers that these issues with EMCa's review are both prevalent and systemic.

TransGrid also engaged Asset Management Consulting Limited (AMCL), global asset management experts, to review the EMCa report. The AMCL review is attached to TransGrid's revised revenue proposal as Appendix E. AMCL found that in the EMCa report:

- there is a disconnect between the observations made and conclusions drawn;
- there is a lack of evidence and analysis to justify the proposed percentage reductions in funding;
- EMCa appears to apply distribution-focused management strategies that are generally unsuitable to TransGrid's transmission business and assets; and
- there is a misunderstanding of TransGrid's application of its risk assessment processes.

Both TransGrid and AMCL consider that the observations in the EMCa report (whether TransGrid considers them to be fair or otherwise) do not support the substitute expenditure forecasts EMCa has proposed.

TransGrid's response to the specific matters raised in each section of the EMCa report is set out as follows.

2. Summary of Response

The review undertaken by EMCa comprised three components:

1. an assessment of TransGrid's governance and management framework;
2. an assessment of TransGrid's forecasting methods; and
3. an assessment of TransGrid's proposed expenditure.

This response addresses each of these components in turn. While they are addressed in the order in which they are presented in the EMCa report, TransGrid notes that many of EMCa's observations in its assessment of proposed expenditure are used to support conclusions in the earlier sections of its report. Many of these observations appear to exhibit the issues listed in Table 1, and therefore TransGrid considers that many of EMCa's conclusions are poorly justified. TransGrid has cross-referenced observations between the three components to demonstrate this in the discussions below.

A summary of TransGrid's response to EMCa's background statements and assessment of its governance and management framework is set out in Table 2.

Table 2
Response to Background and Assessment of Governance and Management Framework

Subsection	Summary of Response	Detailed Response to Specific Paragraphs Below
Background	When observing actual replacement expenditure in 2009/10 to 2013/14 above the forecast in the revenue proposal, EMCa has misunderstood the interrelationship between augmentation and replacement expenditure	22, 32
General observations	EMCa's comments on the rigour of TransGrid's project justifications conflict with those of GHD following its more comprehensive review TransGrid has taken account of interrelationships and synergies between projects through optimisation at all stages of its bottom-up process	35, 36, 38, 39
Network investment risk assessment methodology	EMCa has misunderstood TransGrid's application of risk TransGrid already uses one of the risk value summation approaches EMCa espouses (summation on a logarithmic scale) TransGrid has done a sensitivity check using the other approach EMCa espouses (maximum single risk), and noted that all projects in the portfolio are still justified	40, 43, 45, 46, 50, 52, 53, 55, 56, 57, 77
Investment planning and portfolio governance	TransGrid considers that EMCa's advocacy of separate governance for discrete capital expenditure drivers rather than as a combined optimised portfolio would not be prudent TransGrid has provided additional evidence of its prioritisation process and the project deferral that has been taken into account in the forecasts in the revenue proposal	59, 64
Performance drivers and outcomes	TransGrid has adopted a more targeted option for two projects in its revised proposal based on EMCa's observation	69
Long term capital expenditure planning	TransGrid has considered life cycle through economic evaluation of the options for each investment TransGrid has a Network Vision and Network Development Strategy which consider the future long term development of its network TransGrid has also provided a top-down assessment of its proposed replacement expenditure in the revised revenue proposal, indicating that it would maintain the current level of network performance and is no higher than the sustainable level in the long term	70, 71, 72, 75

A summary of TransGrid's response to EMCa's assessment of its forecasting methods is set out in Table 3.

Table 3
Response to Assessment of Forecasting Methods

Subsection	Response	Detailed Response to Specific Paragraphs Below
Findings	TransGrid rejects EMCa's assertion of an overforecasting bias, and does not consider that EMCa has demonstrated its assertion TransGrid considers that EMCa has misrepresented information it has used to support its conclusions	80, 100, 101
General observations	In response to EMCa's claim that TransGrid has not demonstrated prudent deferral of projects, TransGrid has provided a list of needs that were considered for the 2014/15 to 2017/18 regulatory control period but deferred	84
Needs analysis	TransGrid rejects EMCa's assertion that options analysis was limited to "large discrete options" TransGrid has considered minimum replacement options	86, 87
Cost estimating	TransGrid has clarified its use of insourcing and outsourcing	94
Options analysis	For needs where the 'do nothing' option is viable, TransGrid has not proposed a project	95, 96

A summary of TransGrid's response to EMCa's assessment of its proposed expenditure is set out in Table 4.

Table 4
Response to Assessment of Proposed Expenditure

Subsection	Response	Detailed Response to Specific Paragraphs Below
Findings	TransGrid rejects EMCa's assertion of an overforecasting bias, and has provided further information to support this position	102, 105
Substation Renewal	TransGrid rejects EMCa's proposed reductions to substation renewal expenditure because they are premised on errors of fact, have insufficient regard to the information accompanying the revenue proposal and lack evidence	109, 110, 113, 114, 115, 116, 117, 118, 119, 120
Secondary Systems Renewal	TransGrid rejects EMCa's proposed reductions to secondary systems renewal expenditure because they are premised on errors of fact, have insufficient regard to the information accompanying the revenue proposal and lack evidence TransGrid has reduced the scope of secondary systems renewal at one substation in consultation with the one customer supplied by that substation, who indicated a willingness to accept an increasing level of risk at that substation above that of the rest of TransGrid's network	123, 124, 126, 129, 131, 132, 133, 134, 135, 136, 137, 138, 139, 141, 142
Communications upgrades	EMCa's suggestion of deferring some of these works ignores the context of TransGrid's 15 year strategy and would hinder the establishment of fault tolerant rings, which is a key outcome of this work	148, 149, 152, 153, 154
Transmission line rebuilds	TransGrid has accepted EMCa's suggestion of pole reinforcement and targeted replacement in lieu of two projects to replace wood poles	158, 159, 160, 161, 162, 163
Other repex	TransGrid considers that EMCa's conclusions would not similarly apply to all other types of replacement projects	166, 167, 168, 169

On the basis of the detailed responses below, TransGrid does not consider the reductions to replacement expenditure proposed by EMCa to be justified or in the long-term interest of consumers.

TransGrid has also set out its concerns with the review process undertaken by the AER and EMCa.

3. Response to Specific Statements

3.1 Background

22. We sought[3] a disaggregation of the prior RCP planned expenditure from TransGrid into the project groupings that it used to propose expenditure for the forthcoming RCP (as shown in Table 1). At the time of drafting, this information had not been provided in a form that is readily adaptable to the project groupings under review. However, from the information that was supplied, it appears that actual expenditure exceeded both the AER allowance and planned levels of expenditure in each category.[4]

[3] We requested repex and total capex on a common basis (i.e., real $2013/14), including breakdown into project groupings / categories under review for the AER Allowance 2009-14 (planned), Capital Expenditure 2009-14 (actual) and Forecast CAPEX 2015-19

[4] 2014-08-29 EMCa information 2

TransGrid provided this information to EMCa in the format and categories it had understood EMCa had required. TransGrid invited EMCa to raise any concerns it had with the information provided to it at the time. EMCa did not raise any concerns.

32. TransGrid advised[5] that they reallocated capital from augmentation to replacement. They explained that, provided the total capital expenditure was less than the AER allowance, this was a satisfactory management approach. However, this approach fails to recognise that augmentation capex is required to increase services whereas replacement capital is required to maintain existing services. To reallocate funding between the two categories reflects a substantial change in asset management strategy from that proposed by TransGrid at the time of its prior RCP determination. While it is prudent to reduce augmentation expenditure in response to declining demand growth (or, more so, declining demand), it is only prudent to increase repex above what was previously planned to the extent that there is an unanticipated increase in some program driver or a realisation of additional unanticipated asset risk.

[5] AER/EMCa/TransGrid Meeting, 25 August 2014.

EMCa's comment misrepresents TransGrid's statements. TransGrid did not state that it reallocated capital from augmentation to replacement, but that some projects that were classified as augmentation projects in the 2009/10 to 2013/14 proposal had both augmentation and replacement drivers. The two types of expenditure are not, as EMCa has suggested, mutually exclusive.

In New South Wales and the Australian Capital Territory, TransGrid is the Jurisdictional Planning Body for all expenditure. This enables it to optimise its investment portfolio across all types of expenditure in a way that is not possible under some other jurisdictional arrangements. Section 4.3 of the revenue proposal explains how TransGrid achieves this across all stages of its network investment process, including:

- identification of related, pre-requisite and dependent needs across all categories of capital expenditure, including augmentation and replacement; and
- identification and evaluation of options across the whole portfolio, such as options that may satisfy multiple needs (including across augmentation and replacement).

It is not unusual to have some projects that satisfy both augmentation and replacement needs. In TransGrid's 2009/10 to 2013/14 portfolio, projects that satisfied both replacement and augmentation needs included:

- augmentation of substation capacity by replacing existing transformers with larger transformers, where the existing transformers were nearing end of life and not suitable for reuse;
- upgrades to substation fault levels by replacing switchgear that was also nearing end of life based on condition;
- augmentation of transmission capacity by construction of a new 330kV transmission line, which would then allow for the decommissioning rather than replacement of a parallel 132kV transmission line; and
- communications upgrades, which include the replacement of some existing communications systems.

In such cases, where there are both augmentation and replacement drivers, TransGrid typically categorises the projects as augmentation. However, if the augmentation driver disappears, the replacement still needs to be undertaken. Some of the augmentation projects in the 2009/10 to 2013/14 portfolio were still required in a modified form to ensure that the replacement need was addressed, and were classified as replacement projects in actual expenditure.

This is reflected in the higher actual replacement expenditure than forecast for that category over 2009/10 to 2013/14. The higher actual replacement expenditure does not reflect a change in TransGrid's asset management strategy.

TransGrid understands that at least one of the personnel from EMCa that prepared the report has experience in a different jurisdictional arrangement, in which separate bodies are responsible for augmentation and replacement planning. However, this jurisdictional arrangement is not relevant to TransGrid and should not be used to simplistically disregard the interactions between augmentation and replacement expenditure in the assessment of TransGrid's revenue proposal.

3.2 Assessment of Governance and Management Framework

35. We found exceptions that indicate TransGrid's application of the asset management framework for the purpose of including repex projects in the Revenue Proposal was not sufficiently rigorous. This has led to the inclusion of some items of expenditure that lack sufficient justification. We consider also that TransGrid has focussed overly at the individual project and program level and has paid less attention to the strategic scope, timing and risk / benefit of the aggregate portfolio of projects and programs that it has proposed. Given TransGrid's considerable increase in replacement capital expenditure during the last RCP, and substantial further increase proposed for the next RCP, we consider this to be a significant

weakness in the proposed submission which has led to over-forecasting expenditure needs for the next RCP.

EMCa has not clearly identified the exceptions it found or the extent of those exceptions. However, TransGrid's response to the observations on specific projects is provided in detail below in the responses to paragraphs 105 to 169. In response to the observations on specific projects, TransGrid considers that EMCa's observations and conclusions suffer from errors of fact, insufficient regard to the information that was available and misunderstanding of TransGrid's application of its processes.

In November 2014, TransGrid achieved full certification to ISO 55001 following a comprehensive audit of its governance, asset management and decision making processes. This demonstrates the suitability of TransGrid's asset management approach with reference to an internationally recognised standard.

EMCa's comments also conflict with the findings of GHD, which TransGrid engaged to review its capital investment documentation to provide internal assurance of the prudence and efficiency of its capital portfolio before submission to the AER. GHD found that:

> The suite of investment planning documents for asset replacement projects examined demonstrate that TransGrid has a robust process for assessing the condition of network assets, underpinned by thorough and detailed condition assessment reports. As a result GHD is satisfied that the available condition information presents TransGrid with adequate evidence to base the determination of an investment trigger within the 2014-2019 regulatory period. The information reviewed demonstrates that TransGrid's replacement plans comply with the relevant Asset Management Strategies and the replacement capex proposed is reasonably required to address the asset condition needs identified in condition reports and strategies. The documents examined demonstrated that appropriate internal processes and governance procedures are in place.[1]

Given that GHD undertook a comprehensive review of a significant sample of TransGrid's capital expenditure supporting documentation, in contrast to EMCa's apparently superficial review of a limited sample of documentation, TransGrid recommends that the AER place more weight on GHD's findings than EMCa's.

On this basis, TransGrid considers that EMCa's conclusions in this paragraph are unsupported by evidence.

36. We find that key elements of the replacement capex proposed by TransGrid are not reasonable in terms of the NER requirements and result from an overestimation of risk, as evidenced by:

- development and application of the Network Investment Risk Assessment (NIRA) Methodology was rudimentary and immature. We did not find evidence of individual project based pre- and post-investment risk assessments being used to assist the review of risk at an asset class or corporate level by the responsible governance bodies;

[1] TransGrid, *Revenue Proposal 2014/15 – 2018/19: Appendix K*, 2 June 2014, p2.

TransGrid's response to EMCa's comments on its risk methodology are discussed in detail in the responses to paragraphs 43 to 58 below.

TransGrid's Executive Network Investment Committee (ENIC) reviews pre and post investment risks at a project level, and uses these to understand the level of risk of TransGrid's portfolio. The Operations and Maintenance Steering Committee monitors key indicators of network performance by asset class, including outages, malfunctions and equipment failures. This provides an overall view of the effectiveness of TransGrid's asset management strategies and plans. TransGrid's asset manager is a member of these asset management committees and so has visibility of both key project risks and network performance indicators, as well as responsibility for TransGrid's asset management strategies and plans. In this way, risk assessments are incorporated into TransGrid's investment decision making and considered at an asset class and portfolio level.

- management of the replacement expenditure at a portfolio level and governance of prioritisation across project groupings was not evident;

TransGrid's Portfolio Management Office is responsible for prioritisation of all investments to address network needs including augmentations, asset renewals and asset refurbishments. Projects are prioritised by evaluating customer impacts (for example, energy not served), compliance requirements (for example, environmental drivers) and reputation (for example, community and stakeholder preferences). The prioritisation process informs decisions about project deferral and resolution of resource constraints.

EMCa did not request evidence of prioritisation of the portfolio as an item of information to be provided after the one-day meeting. TransGrid has included its prioritisation analysis in the information it has provided to the AER with the revised revenue proposal.

- performance outcomes including asset health and risk, both as drivers of the need for expenditure and as impacted by the proposed expenditure levels were not defined or well understood; and

TransGrid monitors the performance of its network using key indicators such as outages and energy not supplied events, tracking these indicators over time. The indicators are similar to those used in the AER's Service Target Performance Incentive Scheme (STPIS) for electricity transmission.

While TransGrid uses asset condition as the driver for replacement expenditure, it does not at this time track asset condition at an aggregate, overall network level. TransGrid understands that its approach differs from EMCa's preferred approach, but does not consider that this implies inadequate understanding of the condition of its assets, or that TransGrid's approach is not fit for purpose. In fact, TransGrid has a thorough understanding of its asset related risks. Each driver/project/network need is thoroughly documented and replacement based expenditure is justified through detailed condition assessments. These were provided to the AER with the revenue proposal.

EMCa's preferred approach is to use well understood asset condition thresholds to establish asset health indices, derive failure curves and calibrate these curves over time using network performance indicators. This

approach is typically used in distribution networks, and is best suited to managing a large number of assets with low consequences and high probabilities of failure.

Conversely, transmission networks have a small number of assets with high consequences resulting from failure. The small number of assets allows TransGrid to closely monitor the condition of individual assets or classes of assets and plan renewal projects to maximise the life of the assets while minimising high consequence failures. TransGrid's approach is to use asset condition thresholds to trigger action such as a change in maintenance regime, refurbishment or replacement and evaluate the outcomes of these actions using network performance indicators.

In both cases, asset condition is used to trigger actions and the effectiveness of the actions is reviewed through the use of network performance indicators, which provide feedback to influence asset management strategies and plans.

TransGrid considered and trialled the use of health indices and failure curves in 2008. TransGrid found the results of the indices to be similar to those obtained using its own approach and thresholds. Therefore, given the cost incurred to update, populate, verify and maintain the model TransGrid did not consider at the time that its use presented value for money. TransGrid may consider the use of the technique again in the future, if it can be demonstrated to provide value.

- there was no evidence of long term (>=10 years) strategic capital expenditure planning analysis, or management of a pipeline of asset replacement and refurbishment plans based on risk.

TransGrid prepares two long term strategic planning documents, which it provided as appendices to its revenue proposal:

- a Network Vision, which sets out the context of the electricity industry environment and TransGrid's vision for the NSW electricity transmission network of the future; and
- a Network Development Strategy, which sets out expected trends and possible developments over the long term and provides a guiding direction for the long term development of the network.

TransGrid considers specific replacement plans over a five to 10 year period in the context of these long term strategies. In TransGrid's view, planning further than 10 years ahead has a high level of uncertainty at this point in time, as recent volatile energy demand has shown. The value of long term strategic planning at present is in understanding the industry environment and considering replacement plans within the range of possible future directions of the industry.

In its review of the EMCa report, AMCL states that:

1. While the lack of long term capital expenditure plans may be an indicator that TransGrid does not fully understand its future financial sustainability, it does not provide any justification for a reduction of expenditure

during the next regulatory period as the projects within the next RCP are largely individual projects with their own justification.

2. EMCa seems to be inferring that if TransGrid had a better estimate of its longer term risk and renewal expenditure profile then it would be able to delay projects into the following RCP period but there is no justification for this being the case.[2]

Therefore, TransGrid does not consider that EMCa's conclusion is supported by its observations.

3.2.1 General Observations

38. TransGrid advised in our onsite meeting that processes were recently updated and subsequently referred to a review of investment plans and supporting document by GHD. We note that the included analysis showed the average quality score at stage 1 of the review was around 40% and at stage 2 this had increased to just under 70% following changes from TransGrid.

This is a selective reference to the review by GHD, and ignores the changes TransGrid made to its supporting documents following the Stage 2 review. Had EMCa had proper regard to the information before it, it would have noted and taken into account GHD's conclusion that:

> The suite of investment planning documents for asset replacement projects examined demonstrate that TransGrid has a robust process for assessing the condition of network assets, underpinned by thorough and detailed condition assessment reports. As a result GHD is satisfied that the available condition information presents TransGrid with adequate evidence to base the determination of an investment trigger within the 2014-2019 regulatory period. The information reviewed demonstrates that TransGrid's replacement plans comply with the relevant Asset Management Strategies and the replacement capex proposed is reasonably required to address the asset condition needs identified in condition reports and strategies. The documents examined demonstrated that appropriate internal processes and governance procedures are in place.[3]

Given that GHD undertook a comprehensive and challenging review of a significant sample of TransGrid's capital expenditure supporting documentation, in contrast to EMCa's apparently superficial review of a limited sample, TransGrid recommends that the AER place more weight on GHD's findings than those in the EMCa report.

39. Our review identified substantial gaps in the analysis of the need for a project including the identification and assessment of option, risks, costs and benefits. We did not find sufficient evidence of review and analysis of the overall portfolio to ensure an efficient level of expenditure. Further, we found that investment decisions can be based more on an overarching technology-driven strategy and implementation goals rather than a disciplined investment decision.

[2] AMCL, *AMCL Review of EMCa's Report to the Australian Energy Regulator*, 23 December 2014, p16.

[3] TransGrid, *Revenue Proposal 2014/15 – 2018/19: Appendix K*, 2 June 2014, p2.

EMCa's view was similarly expressed by the AER in its draft decision:

> In our view, applying a top-down assessment is a critical part of the process in deriving a forecast capex allowance. It indicates that some level of overall restraint has been brought to bear. This is an important factor for us to consider in deciding whether we are satisfied that a proposed forecast capex allowance reasonably reflects the capex criteria. In particular, to derive an estimate of capex by solely applying a bottom-up assessment does not itself provide any evidence that the estimate is efficient. Bottom-up assessments have a tendency to overstate required allowances as they do not adequately account for inter-relationships and synergies between projects or areas of work which are more readily identified at a portfolio level.[4]

TransGrid accepts that ideally, a bottom-up build up of a portfolio should be accompanied by a top-down assessment. However, TransGrid does not accept that the absence of a top-down assessment indicates that forecasts are overstated. It simply indicates that forecasts have not been comprehensively tested using top-down techniques.

In response to the AER's concern that bottom-up assessments do not adequately account for interrelationships and synergies, TransGrid notes that its network investment process does account for these interrelationships and synergies through optimisation at all stages of the process. In its revenue proposal, TransGrid explained the ways in which its practices optimise the capital portfolio:

- identification of related, pre-requisite and dependent needs, across all expenditure categories including augmentation and replacement, from the earliest stage of identifying needs;
- identification and evaluation of options across the whole portfolio, such as options that may satisfy multiple needs;
- selection of the most appropriate sourcing and delivery strategy for each project; and
- post-project review of each project's outcome against the original need and identification of key learnings.

These optimisation practices have been applied to TransGrid's forecast portfolio in its revenue proposal, and are evidenced in the supporting documentation provided to the AER with the revenue proposal.

Further, TransGrid's bottom-up process allows for the deferral of projects in its assessment of needs and annual planning review cycles. A list of needs that were considered for the 2014/15 to 2017/18 period then deferred to subsequent revenue control periods are shown in Table 5. These needs were assessed as:

- not being required within the regulatory control period;
- the asset condition is such it can be managed by normal maintenance action within the regulatory control period; or
- the asset condition issue can be addressed through a low cost operational action.

[4] AER, *Draft Decision: TransGrid Transmission Determination 2015-16 to 2017-18 – Attachment 6: Capital Expenditure*, November 2014, p6-18.

TransGrid notes that usual practice for identifying needs is to start with an initial list, undertake detailed reviews to prioritise the list, determine the timeframes in which they need to be addressed and identify any that can be deferred. TransGrid has included the list in Table 5 for clarity.

Table 5
Needs Deferred or Otherwise Descoped in Preparation of Portfolio

Need	Comment
Kemps Creek SVC Control System Condition	Project need made redundant by decision to retire SVC
Mt Piper 330kV Secondary System Condition	Changed to individual item replacements
Molong Secondary System Condition	Need substantially descoped to defer expenditure
Line 96H Clarence River Crossing Conductor Height	Placed on hold until Roads & Maritime Services make decision on bridge proposal that may remove the need for the works
Condition of Line 968 (Narrabri to Tamworth)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Condition of Line 964 (Port Macquarie to Taree)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Condition of Line 96F (Tomago to Stroud)	Condition assessment prepared but economic assessment found targeted replacement is the preferred solution
Condition of Line 973 (Yass to Cowra)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Condition of Line 99A (Finley to Uranquinty)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Condition of Line 9R3 (Deniliquin to Finley)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Condition of line 94X (Wallerawang 132 to Panorama)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Condition of line 948 (Panorama to Orange)	Condition assessment prepared but decision made that existing maintenance regime is adequate
Wood Pole Condition - 9U3 Line – Gunnedah to Narrabri	Condition assessment prepared but decision made that existing maintenance regime is adequate
Sydney North No.3 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace

Need	Comment
Newcastle No.1 Capacitor Condition	Condition reviewed and decision made not to proceed with replacement in this regulatory control period
Kempsey 33-66kV Transformer Condition	Condition reviewed and economic evaluation found option to implement alternative network solution and retire both transformers was the preferred option
Armidale No.2 Reactor Condition	Condition reviewed but decision made that no additional action required within RCP
Narrabri No.1 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Taree No.3 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Gunnedah No.2 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Port Macquarie No.3 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Taree No.4 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Darlington Point No.1 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Jindera No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Yanco No.2 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Wellington No.1 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Panorama No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace

Need	Comment
Marulan No.4 Transformer Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Sydney North No.4 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Sydney North No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Sydney North No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Newcastle No.2 Capacitor Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Panorama No.2 132-66kV Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Jindera No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Dapto No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Dapto No.3 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Dapto No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Tenterfield No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Tenterfield No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Newcastle No. 3 Capacitor Condition	Condition reviewed but decision made that no additional action required within regulatory control period
Muswellbrook No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Muswellbrook No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace

Need	Comment
Eraring Substation No.2 Tie Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Beryl No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Beryl No.3 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Mount Piper No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Mount Piper No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Broken Hill No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Broken Hill No.2 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace
Murrumburrah No.1 Transformer Condition	Condition reviewed and decision made to refurbish transformer rather than replace

Further, TransGrid has provided a top-down assessment of its capital portfolio in Section 5.5.2 of the revised revenue proposal. The top-down assessment indicates that TransGrid's forecast replacement expenditure addresses a similar threshold of risk to its historical replacement expenditure, thereby satisfying the capital expenditure objectives to maintain quality, reliability, security and safety. It also indicates that TransGrid's forecast capital expenditure is reasonable in the context of the long-term sustainability of its network, and at a level commensurate with replacement rates of other Australian and international networks of similar age and technology.

TransGrid considers that its portfolio optimisation practices and the top-down assessment provided in this revised revenue proposal support its forecast replacement expenditure as being prudent and efficient.

40. Investment decision documentation was found to contain considerable duplication. Further, in many cases, only very broad, high level options and analysis was presented. We found that consideration of broad options resulted in a very high level risk assessment for the investment, and which was often dominated by a single risk. It is our view that the determination of a prospective treatment for a dominant risk might prudently include additional options and risk analysis. We found that these factors were either not considered or not adequately represented in the options analysis.

TransGrid has prepared a detailed condition assessment to underpin each replacement need. The condition assessments set out the full range of asset condition issues that are required to be addressed. The extent to which EMCa has had regard to these detailed condition assessments is unclear. However, TransGrid has noted that in EMCa's specific project reviews, it has misconstrued the risks set out in TransGrid's supporting documentation (for example, as discussed in the responses to paragraphs 115 and 135 below).

TransGrid also notes that some projects are the consolidation of a number of drivers. For example, whole substation and secondary systems renewals have been developed by consolidating a range of replacement plans that apply to specific families of equipment, for example, of the same make, model and type. The need statements and option evaluations for these have been provided to the AER in the supporting documentation for asset strategy programs. TransGrid seeks clarification as to whether EMCa has had regard to the documentation for these asset strategy programs in forming its view.

3.2.2 Network Investment Risk Methodology

43. The network "observable failure risk" is reported at the corporate level and has been assessed as 'Medium' with a stable trend. Whilst this risk is not identified as a driver of expenditure by TransGrid, we would have expected to see a greater correlation between asset class risks and project level risks to this corporate risk. We also note that the network performance metrics of system minutes, line outages, transformer outages and reactive plant outages have been relatively stable or improving since 2009. The risk and performance trends do not independently signal the need for a major change in asset management focus.

EMCa appears to have not understood the purpose and meaning of "observable asset failure risk" reporting at the corporate level. The inherent risk of observable failure risk is rightly listed as extreme. The process of assurance at the Executive and Board level is to evaluate the risk following the applications of the controls that are in place.

As outlined in the revenue proposal and presentations during the on site visit, these controls include the Asset Management System, the Network Investment Process, the Capital Governance Process and the Network Investment Risk Assessment Process. The assessment of Medium of this risk indicates a view that these controls and specifically, in this context, the process of identifying asset related network risks and developing appropriate and timely investment, is effectively managing reliability risk.

In terms of high level risk and performance measures, the following measures are considered the most appropriate indicators of performance over the long term:

- energy not supplied (ENS) event numbers; and
- key hazards analysis (such as explosive substation equipment failures, conductor drops, structure failures and fire starts). These hazards have been identified as indicators of events with a significant risk

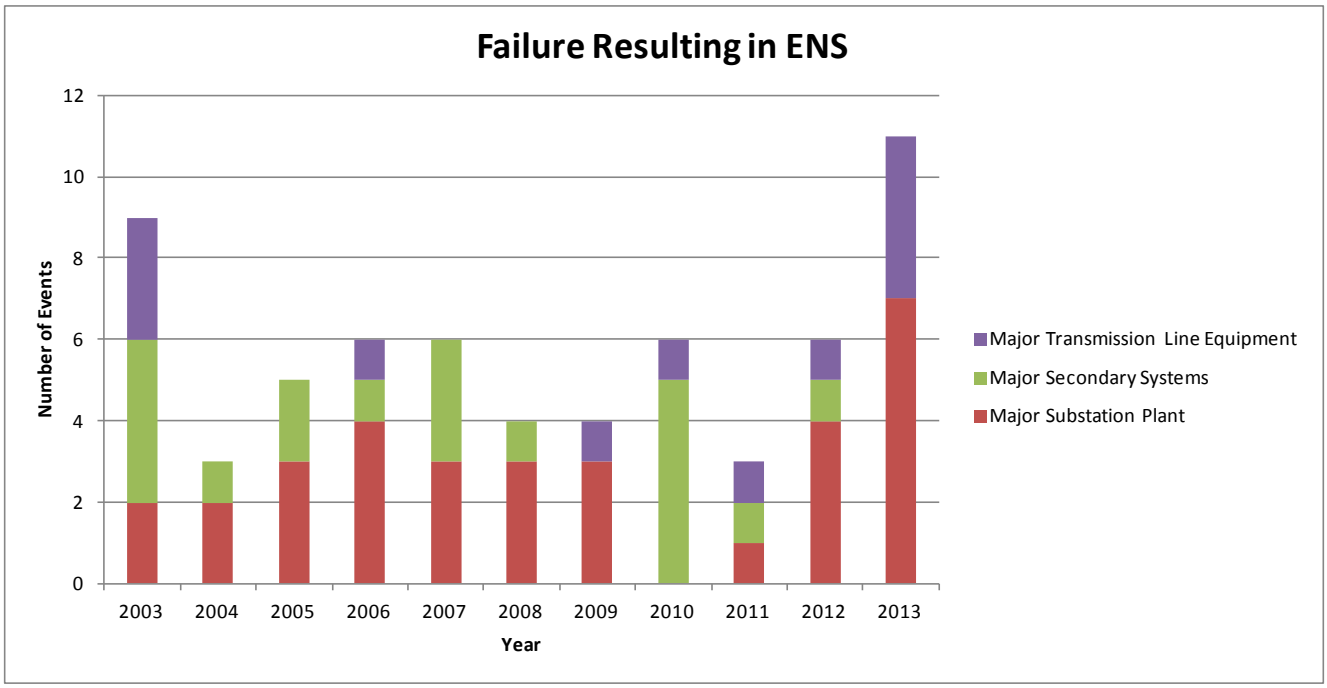
to TransGrid of not meeting its safety, environmental and reliability corporate and asset management objectives.

TransGrid regularly tracks these indicators to understand the effectiveness of its asset management strategies and plans, ascertain trends of concern in the performance of the network and initiate appropriate actions to address these. As lagging indicators, they are suitable for this purpose. However, they are not used for forecasting expenditure, nor are they suitable for doing so. The appropriate indicators to use for forecasting expenditure are the leading indicators of condition that are referred to in the condition assessments that establish the need for each replacement project. These condition assessments have been provided to the AER as part of the supporting documentation to TransGrid's revenue proposal.

With regard to the network performance metrics, the performance of TransGrid's network has been stable over time, as evidenced by its network performance indicators. TransGrid disagrees with EMCa's assertion that some of its network performance indicators have been improving over time,[5] noting that the trends cited by EMCa are only over a short period of time and do not exhibit statistically significant variance.

The trend of failures resulting in energy not supplied is shown in Figure 1.

Figure 1
Failure Resulting in Energy Not Supplied



The trends of outages of transmission lines, transformers and reactive plant that were in the information provided to EMCa are shown in Figures 2, 3 and 4. These indicators align with the definitions in the AER's

[5] EMCa, *Review of Proposed Replacement Capex in TransGrid Revenue Proposal 2014-2019*, October 2014, p12.

STPIS for transmission networks, and have been backcast to 2009 in order to respond to the AER's recent regulatory information notices.

Figure 2
Transmission Line Outages

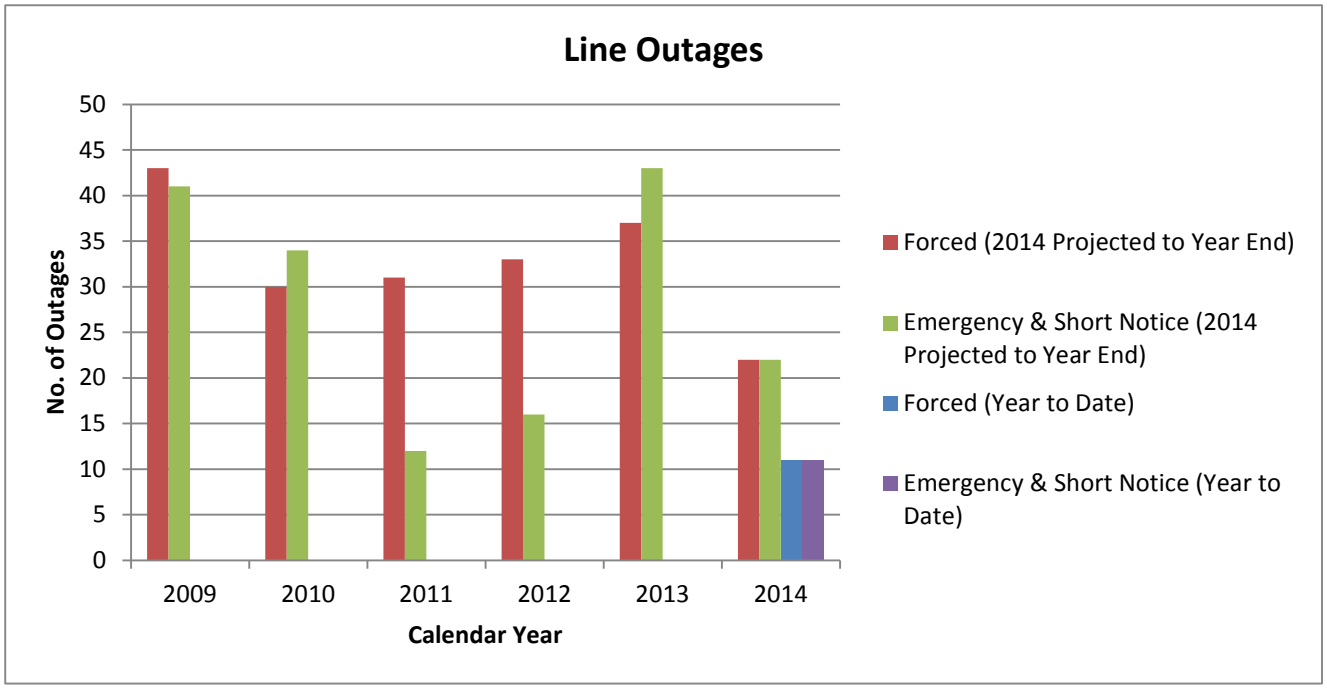


Figure 3
Transformer Outages

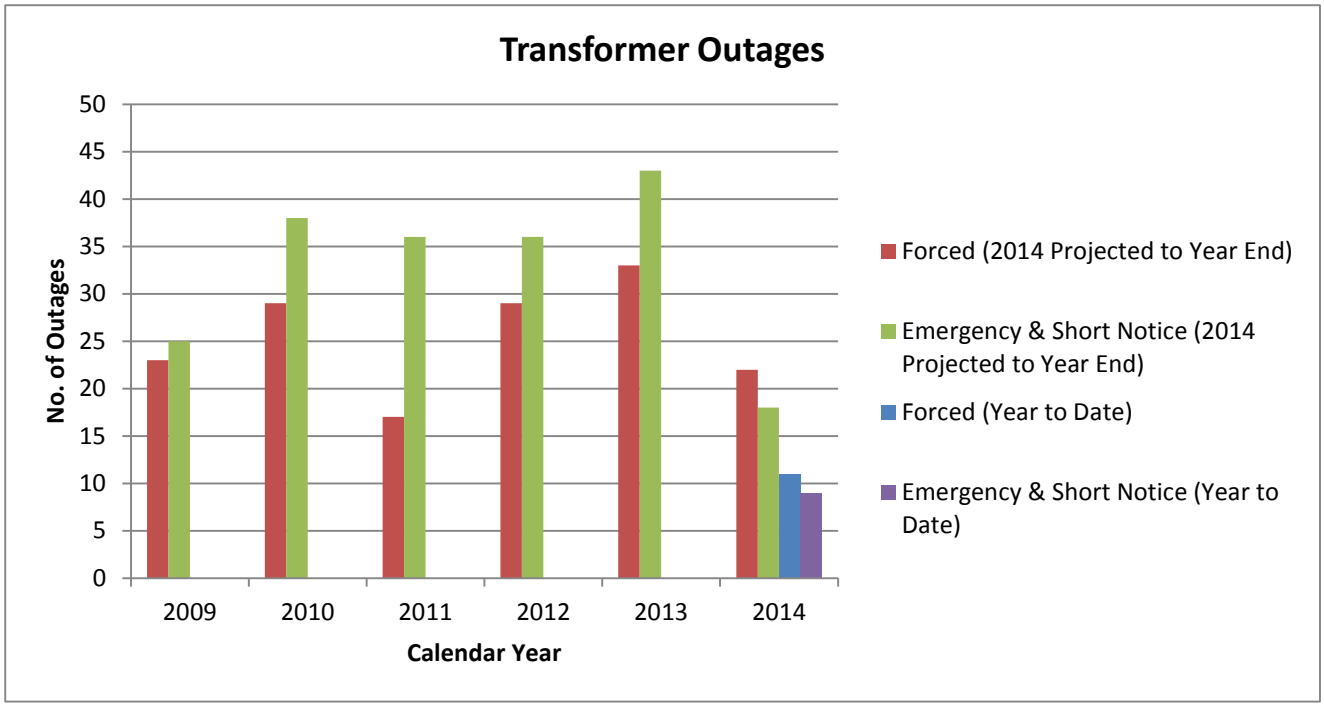
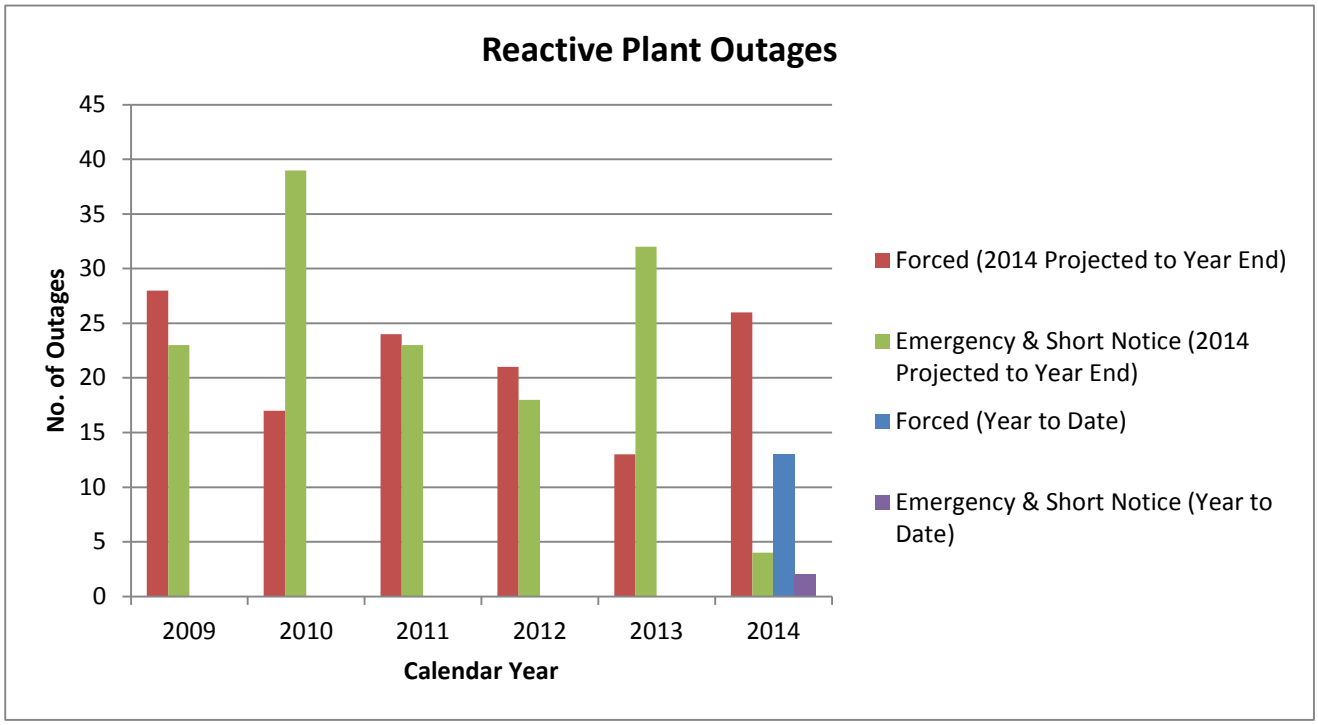


Figure 4
Reactive Plant Outages



Prior to the use of these specific performance indicators adopted in line with the most recent STPIS, TransGrid tracked slightly different performance indicators, which have also shown a stable trend over a long time period. These are shown in Figures 5, 6 and 7.

Figure 5
Previous Indicator of Substation Outages

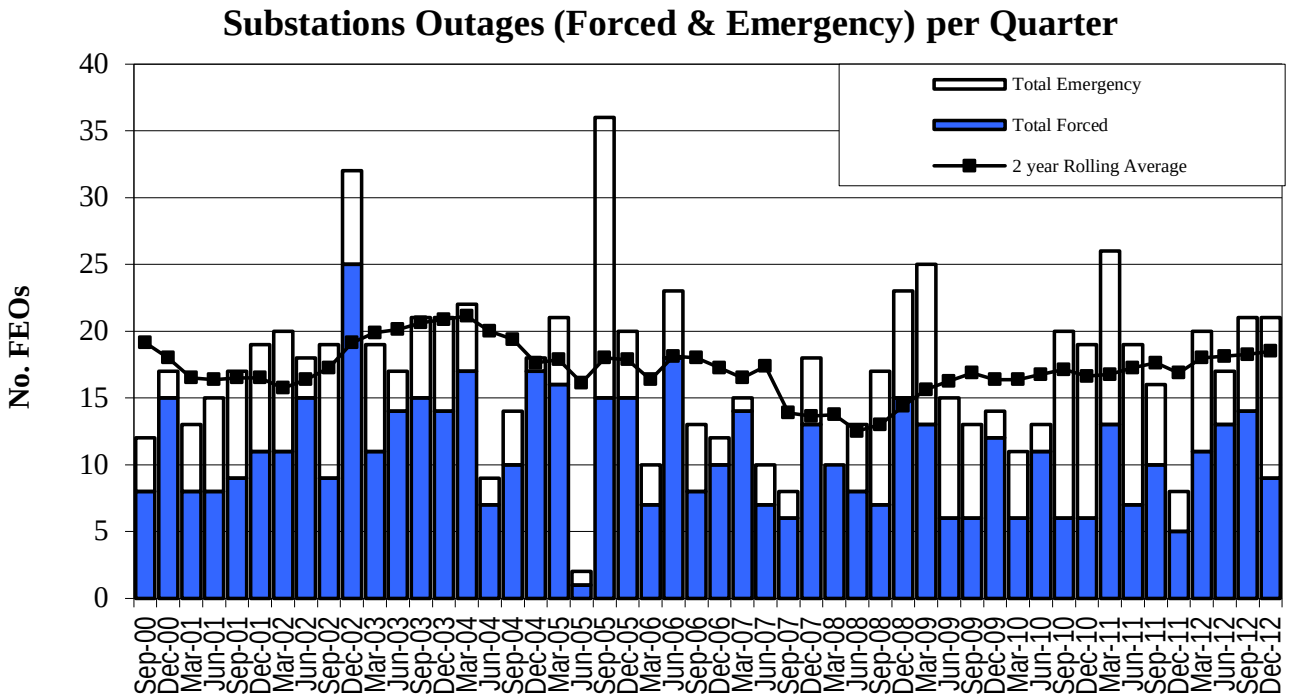


Figure 6
Previous Indicator of Transmission Line Outages

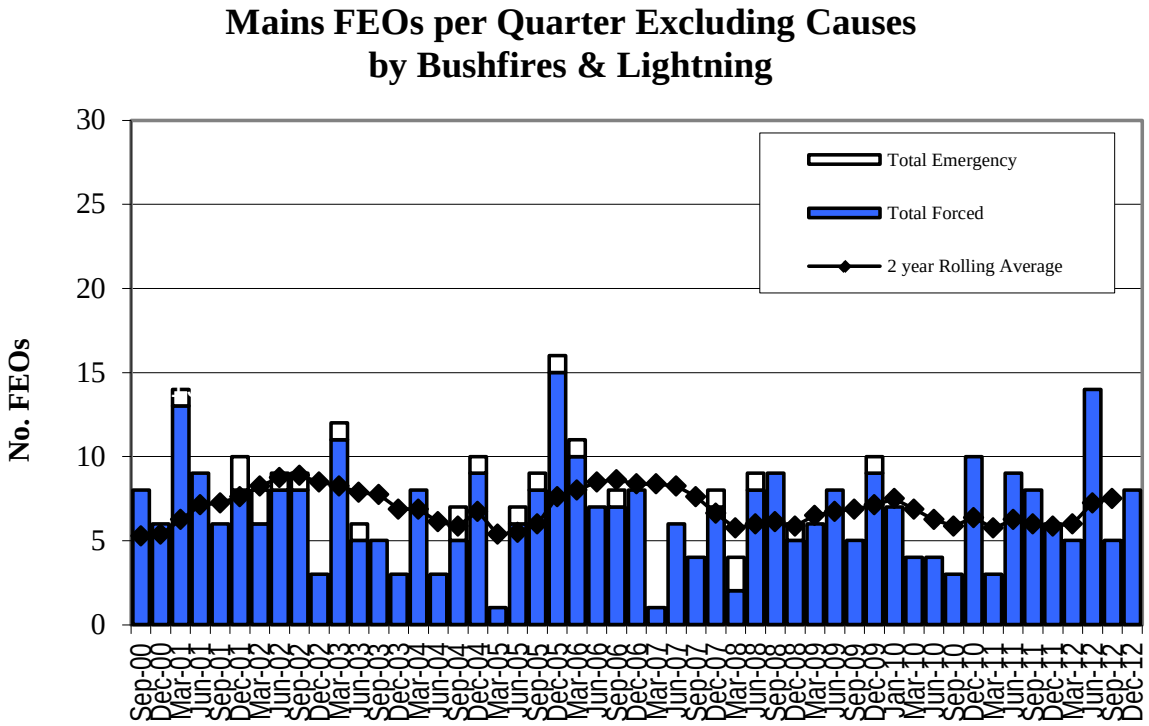
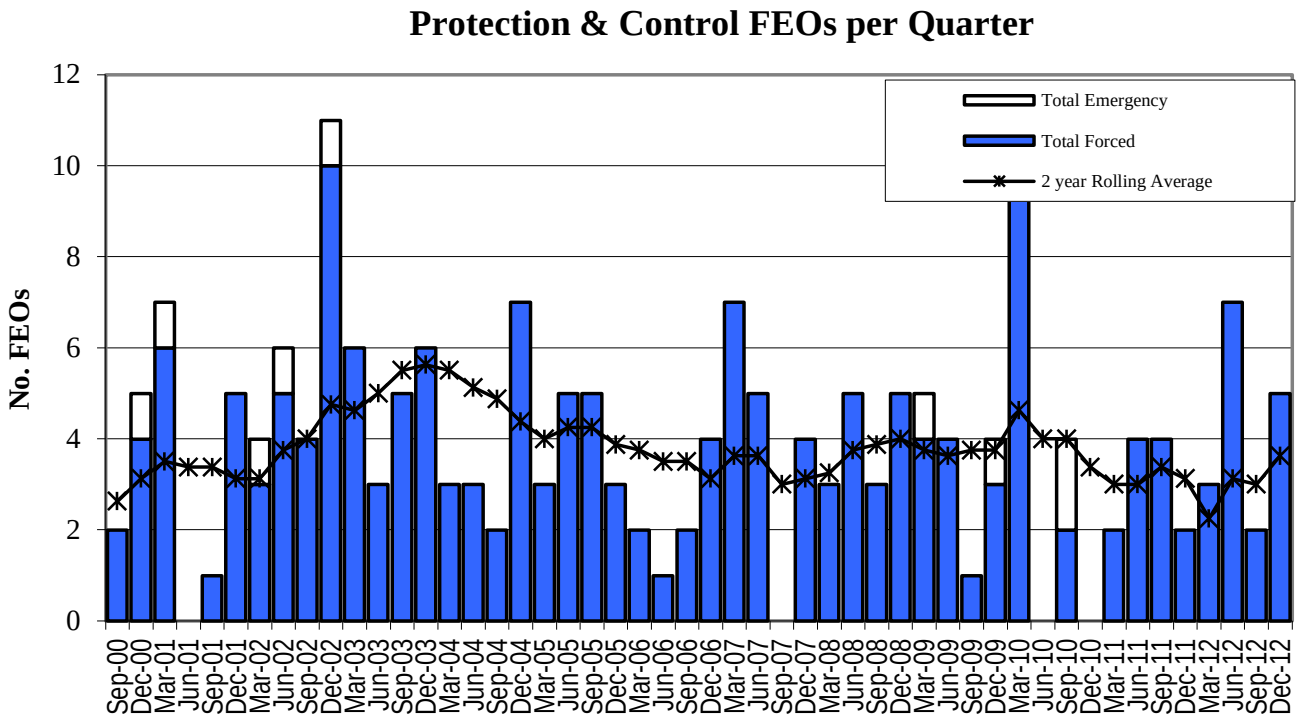


Figure 7
Previous Indicator of Protection and Control Systems Outages



These long term trends in performance indicators show that:

- the additional replacement expenditure in the 2009/10 to 2013/14 period compared with the 2004/05 to 2008/09 period was prudent and appropriate to effectively control the key risks and hazards associated with the assets;
- the long term trend due to the condition of the assets (as set out the condition assessments presented as part of the revenue reset and comparison of the values of risk of the portfolio in Section 5.5.2 of the revised revenue proposal) indicates that additional expenditure is required in the 2014/15 to 2017/18 period; and
- the expenditure for the next period has been estimated using the similar principles, and approaches to risk and condition assessment methodologies as the last period. The trends above show that TransGrid has been prudently spending to effectively manage its key performance indicators and risks over the last two regulatory control periods.

45. We requested a copy of the decision approval for the selection of risk cost, being the unit of risk in dollars per year. TransGrid provided a copy of the approval for the Corporate Risk Management framework and a document that had been generated to show how network events are aligned to financial risk levels. However, no documentation was provided to describe how this risk is to be assessed at a project level or

evidence of the calculations used to determine the consequence cost level.

This information is in the Network Investment Risk Assessment Methodology (NIRAM), which was provided to EMCa.

46. TransGrid advised that they have migrated from using a total risk score to a total risk cost in their project assessments, such that the risk score was no longer used. We were also advised that the unit of risk cost had been approved internally and was subject to ongoing review. In the absence of the requested information, we were not able to draw meaningful conclusions on the implied cost of risk selected by TransGrid.

The NIRAM documents how the Corporate Risk Management Framework is applied at the project level. It takes the levels of the consequence cost defined by the Corporate Risk Management Framework and maps them to the values used to assess project risk (see table 4 on page 9 of the NIRAM). This table takes the range of outcomes defined in the Corporate Risk Management Framework and takes a geometric mean dollar value for each likelihood and consequence combination.

Evidence that the reliability risk scores map to the Value of Consumer Reliability has been provided. Other values have been determined through Board workshops and Corporate Governance reviews and are consistent with the organisation's view of obligations under its enabling legislation, Work Health and Safety legislation, environmental legislation and the financial capacity of the organisation. Good practice asset management requires risk assessment practices across the organisation to be consistent with the Corporate Risk Management Framework.

50. We requested a copy of a similar representation of project risks for other asset classes. However, it became evident that this information was prepared in response to our request only. We believe this further reinforces our view that such representations of risk at an asset class level are not currently used within TransGrid to understand current and forecast risk levels.

The graphical representation of the substation project pre and post investment risk assessments was prepared for the purposes of the presentation to EMCa based on the risk scores in the substation project documents. These risk scores are all available to EMCa in the investment documentation submitted to the AER accompanying the revenue proposal and are the basis used by TransGrid to understand the current risk levels and justify the expenditure for each individual project.

It is incorrect to state that risk at an asset class level is not used to understand current and forecast risk levels on the basis that a specific presentation of the figures was not available. These risks are known and understood by TransGrid at an asset class level, noting that the project view of risk is different to the asset view of risk (as a project comprises different types of assets).

52. Figure 5 below shows the risk assessment from the Needs Statement of the Yanco substation renewal project. While this risk template has been used in all of the reviewed substation renewal projects, there is no mention in the Network Investment Risk Assessment Methodology documentation for how a risk is mapped from this risk assessment template to the single risk rating shown in Figure 4.

EMCa have stated that the NIRAM does not describe how the risk is mapped from this risk assessment template to the single risk rating. This is not correct, as the risk values for each square in the 5x5 matrix are clearly defined in table 4 of the NIRAM. The template takes the value of each square based on the assessed likelihood, for example rare + moderate safety impact maps to risk value of $0.24 million per annum. A simple arithmetic sum is used to combine the risks. This was clearly presented to EMCa during the onsite visit.

TransGrid invited EMCa to raise any concerns it had with the information provided to it at the time. EMCa did not raise any concerns.

53. Figure 5 shows that the highest assessed risk for all risk categories (shown by an 'x') is Medium (yellow). Yet, when aggregated to the single risk rating as shown in Figure 4, we found that the risk was elevated from Medium to High. We selected a further example to determine if this was an isolated case. The Needs Statement risk assessment for the Orange substation renewal project was similarly found to have increased from High to Extreme when aggregated.

As EMCa has noted, the aggregation method used has the potential to move the risk from one level to another, in this case from High to Extreme. This appropriately reflects the coincident risk event rating. It does not follow that the calculated values are therefore not a prudent means of identifying initial needs for further review.

55. TransGrid advised that 'a cost of risk (in dollars) enables the evaluation of cost effectiveness of control measures'. The Network Investment Risk Assessment procedure also states that 'the cost savings (per annum) from remediation can be compared with the one-off cost of remediation'. However, while the risk cost was included in many of the substation projects there was no cost effectiveness evaluation or discussion in the options analysis. Also the project justification documentation for Tamworth substation renewal provided to the Executive and Board did not contain a reference to the risk assessment and risk cost.

The Tamworth 132 substation need and project were developed under a previous process, which used a risk score rather than a value of risk. TransGrid has further developed its risk assessment process in the interim.

The project is now committed, and was accepted by the AER in the capital portfolio in the 2009/10 to 2013/14 revenue determination. TransGrid is not aware of any requirement to revisit the prudence of projects which were previously approved under a framework in place at the time.

TransGrid reassesses investment needs annually or whenever new information emerges that may affect the need. Based on all the information available to it, TransGrid considers that the Tamworth 132 renewal is still required.

56. No evidence was provided on its use in evaluating projects in project justification documentation. Also, the Network Investment Risk Assessment Methodology documentation was first approved on 21st May 2014, so it is unclear the extent to which this assessment was used to determine the projects included in TransGrid's revenue submission in June 2014.

TransGrid can confirm that the NIRAM methodology was used on all pre-DG3 projects in the forecast capital expenditure in the revenue proposal. Evidence of this is readily available as each individual project document provided contains the risk template as specified in the NIRAM and therefore risk has been calculated consistently across the portfolio.

EMCa did not request TransGrid to confirm whether the NIRAM was used to determine the projects in the revenue submission. Had it made this request, TransGrid could have responded and clarified this matter prior to the publication of the EMCa report.

57. The application of the risk assessment tools by TransGrid exhibits a strong bias to overestimation of the risk. Our review identified that the:

    - summation of five risk costs disproportionally represents the cost of the risk. Our review of available literature on this topic supports the selection of the single largest risk and corresponding risk cost, or the aggregation on a logarithmic scale to avoid the disproportionate effect. The risk cost values for projects proposed in the RCP existed in a very wide range from $4.13 to $399.61 million per year for individual sites. The corresponding risk-cost to project-cost ratio ranged from 19% to 3,000%, where values of around 10% were expected.

The risk assessment methodology, while producing relatively high numbers, is effective in identifying risks that require an assessment of possible control measures. The Network Investment Process is then employed to ensure that the most effective network or non network solution is employed.

TransGrid's risk assessment methodology currently uses a logarithmic scale, which is one of the methods suggested by EMCa in this paragraph.

To further demonstrate the fit for purpose nature of its risk assessment process, TransGrid has recast the values of risk for the portfolio of pre DG3 projects using a conservative application of the alternative method proposed as good practice by EMCa. TransGrid used the single value of the maximum of the safety, reliability or environmental risk only. Following this recast, all projects proposed in the portfolio are still required.

TransGrid notes that in a presentation on its 2014/15 to 2016/17 revenue proposal, AusNet Services (then SP AusNet) provided examples of the values of risk it assessed for two substation renewal projects:

- West Melbourne Terminal Station, with a project value of approximately $163 million and pre-investment risk value of $114 million (risk-cost to project-cost ratio of 70%); and
- Richmond Terminal Station, with a project value of approximately $87 million and pre-investment risk value of $14 million (risk-cost to project-cost ratio of 16%).[6]

Therefore, EMCa's expectation of a risk-cost to project-cost ratio of 10% appears to be below that observed in industry experience. EMCa has not established a case that TransGrid's risk values have been overestimated.

- assessment was undertaken at too high a level to identify meaningful risk mitigation actions, which resulted in unnecessarily large investment projects. In the extreme case, the OPGW strategy, which is the collection of 9 projects at a proposed expenditure of $112.5m, has a single risk assessment applied. We observe that the review of network investment plans by GHD commissioned by TransGrid notes that "Following the workshop [between GHD and TransGrid] TransGrid revised the investment planning documentation for the 10 projects [under review]." The revisions included "… expand the OER where appropriate to include a staged risk based option for asset replacement projects". We consider that this and other revisions relating to improving the justification for the need and proposed timing should have been addressed.

TransGrid has prepared a detailed condition assessment to underpin each replacement need. The condition assessments set out the full range of asset condition issues that are required to be addressed. The extent to which EMCa has had regard to these detailed condition assessments is unclear. However, TransGrid has noted that in EMCa's specific project reviews, it has misconstrued the risks set out in TransGrid's supporting documentation (for example, as discussed in the responses to paragraphs 115 and 135 below).

TransGrid also notes that some projects are the consolidation of a number of drivers. For example, whole substation and secondary systems renewals have been developed by consolidating a range of replacement plans that apply to specific families of equipment, for example, of the same make, model and type. The need statements and option evaluations for these have been provided to the AER in the supporting documentation for asset strategy programs. TransGrid seeks clarification as to whether EMCa has had regard to the documentation for these asset strategy programs in forming its view.

In the case of the OPGW strategy, EMCa has not demonstrated that the risk assessment presented is not reasonable or a true statement of the associated risks, but rather that is has been done in a single matrix. This is not sufficient grounds to draw conclusions around the effectiveness of TransGrid's risk management processes. As noted in the response to paragraph 119 below, one of the key outcomes of the communications strategy is to establish fault tolerant communications rings, which cannot be established by individual projects in isolation. TransGrid does not consider it unreasonable to consider the risks and benefits of a strategy as a whole, particularly for communications networks which are heavily interconnected services over a large number of paths and links.

[6] AusNet Services, *Presentation Slides at AER Public Forum*, 24 April 2013.

- existence and effectiveness of current risk mitigation controls and management measures was not included in the risk assessment. In our meeting with TransGrid, a risk was identified in the secondary systems cabling of older substations whereby the 415V supply cable was allocated with the other protection and control cabling. In the event of the failure of the 415V cable, and subsequent fire in the cable pit, the secondary system cabling would be disabled which would cause loss of control of that station. TransGrid advised that this risk was mitigated through use of fire retardant coating on the cable pit. Our review has identified that the risk assessment of a number of the secondary systems renewal projects appear to be based on the un-mitigated (inherent risk), without consideration of the current controls (residual risk). Where other risks and/or mitigation measures were also present at the site, these were not detailed in the risk assessment.

The current risk mitigation controls and management measures have been taken into account in the detailed condition assessments for each need. Further, TransGrid has provided specific condition assessments for all projects involving cable replacement. The extent to which EMCa has had regard to these detailed condition assessments is unclear.

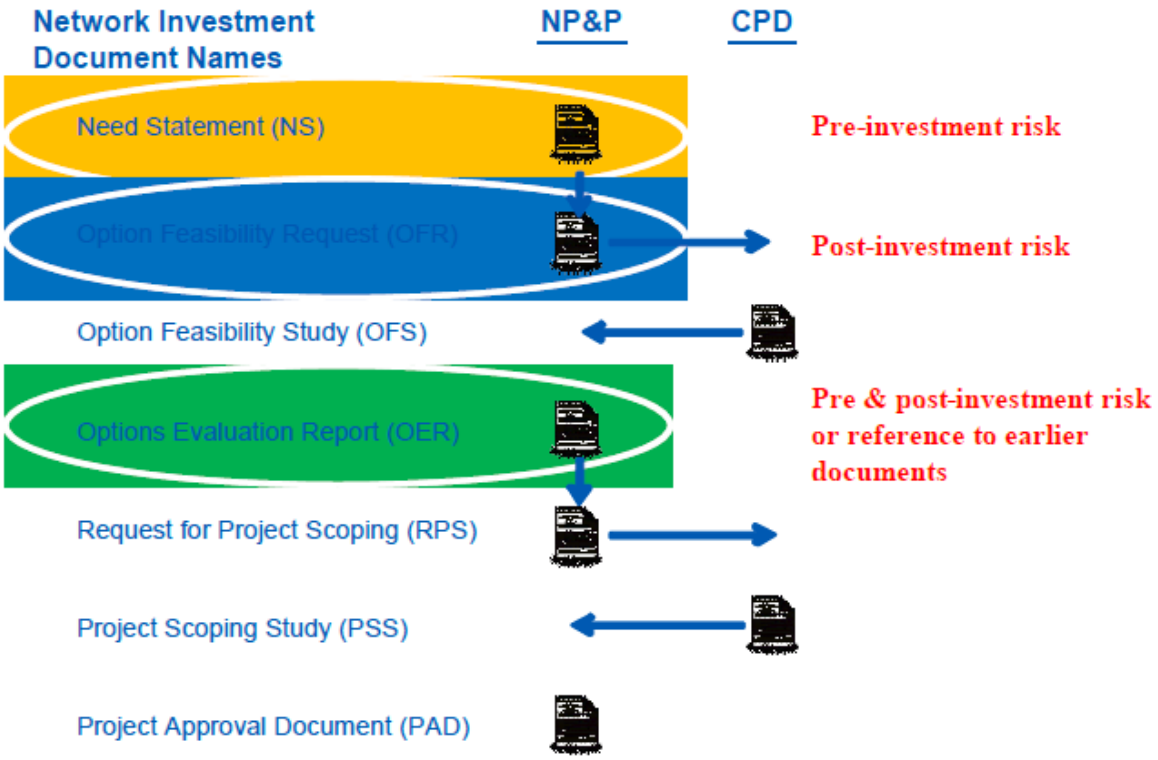
In its responses to specific projects below, TransGrid has noted examples in which EMCa has disregarded or misrepresented the full range of risks TransGrid has identified (for example, as discussed in the response to paragraphs 115 and 135 below).

58. TransGrid stated that they have recently updated their investment planning process and capital project documentation, including options analysis. We nevertheless found insufficient examples of sub-option investigation, feasibility or development to mitigate identified risks. Rather, we found that the selected options were very broad in nature and sought to lower the identified risk to “green” rather than to an acceptable level with consideration of the economic cost as required by the TransGrid risk management framework. Figure 4 shows the residual risk after the completion of the projects with 50% being Low and 50% at the Medium level. However, in the project documentation provided for substation renewal projects, we found no assessments of the residual risk costs in the options. It is not clear how or when these residual risks were determined.

EMCa has contradicted itself in this paragraph. As it has noted, Figure 4 in its report shows that only half of the projects have their residual risk moved to the green (low risk) level. Those projects remaining in the yellow (medium risk) range can still have significant risk costs associated with them. It is unclear how EMCa have formed the opinion that the selected options are biased towards moving the risk to the green level.

TransGrid dispute EMCa’s assertions that there is no residual risk determined for each option and that it is not clear how the residual risks are determined. Residual risk is determined using the same methodology as highlighted in the NIRAM and documented in the relevant network investment document, as shown in Figure 8.

Figure 8
Network Investment Documentation



Further, TransGrid considers that the majority of alternative options proposed in EMCa's review of specific projects (section 5.2 of EMCa report) are not feasible, do not address key safety and environmental risks or have been demonstrated not to be the most economic option. TransGrid would be willing to discuss these on a case by case basis with the AER and its advisors.

3.2.3 Investment Planning and Portfolio Governance

59. The revised investment planning process noted earlier includes clear guidance for decision gates, required procedures and allocated accountabilities across TransGrid. The framework includes establishment of the Network Investment Committee to review the progress of delivery of TransGrid's capital portfolio. TransGrid was requested to provide copies of the reporting to the Executive and Board of the capital portfolio which occurs on a monthly and quarterly basis. The only information received was a chart showing the total capital expenditure against budget and the AER allowance. The expenditure is not split into augmentation and renewal categories and therefore, with the evidence provided, the capital portfolio is managed at an aggregated level and the need to justify transferring funds into either expenditure category does not appear to have occurred.

As noted in the response to paragraph 32 above, there are interrelationships between augmentation and replacement expenditure, and individual projects may address several types of needs. Therefore, TransGrid considers that separate governance for augmentation and replacement projects is unnecessary and that it would not be prudent to govern the two categories in isolation. TransGrid's governance is appropriately applied within the overall management of the portfolio by the Portfolio Management Office under the governance of the Executive Network Investment Committee.

Further, TransGrid contends that the concept of a funds "transfer" between categories is inconsistent with the AER's understanding of its role in setting a capital expenditure allowance. The AER has made this abundantly clear in its draft decision:

> Importantly, our assessment is about the total forecast capex and not about particular categories or projects in the capex forecast. The AEMC has expressed our role in these terms:
>
> > It should be noted here that what the AER approves in this context is expenditure allowances, not projects.
>
> …
>
> Importantly, the techniques that focus on sub-categories are not conducted for the purpose of determining at a detailed level what projects or programs of work the service provider should or should not undertake. They are but one means of assessing the overall total forecast capex required by the service provider. This is consistent with the regulatory framework and the AEMC's statement that we do not approve projects. Once we approve total revenue, which will be determined by reference to our analysis of the proposed capex, the service provider will have to prioritise its capex program given the prevailing circumstances at the time (such as demand and economic conditions that impact during the regulatory period). Most likely, some projects or programs of work that were not anticipated will be required. Equally likely, some of the projects or programs of work that the service provider has proposed for the regulatory control period will not be required. We consider that acting prudently and efficiently, the service provider will consider the changing environment throughout the regulatory period and make sound decisions taking into account their individual circumstances.[7]

Therefore, TransGrid disputes that a prudent service provider would apply governance to replacement expenditure in isolation from the rest of its capital portfolio, as EMCa appears to be advocating.

64. We have reviewed a sample of needs statements, governance documents, committee terms of reference and meeting minutes to form a view of the investment governance and consider that:

- The capital portfolio is developed from an aggregation of needs statements (with corresponding expenditure forecasts) and once approved by TransGrid, remain unchallenged. The identified projects

[7] AER, *Draft Decision: TransGrid Transmission Determination 2015-16 to 2017-18 – Attachment 6: Capital Expenditure*, November 2014, pp6-13 – 6-15.

are required to be addressed within the RCP. Our review did not find evidence of a prioritisation process or framework that considered all business needs and ranked or prioritised these needs based on risk, cost or other criteria, and which may have also considered deferring projects into a subsequent RCP. TransGrid advised that the portfolio was prioritised. However this prioritisation was largely based on delivery date determined by the project feasibility and scoping stages.

- There is no objective criteria used to identify the economic cut-off for the portfolio of work, or where the prudent risk outcome is achieved for a level of expenditure.
- The capital portfolio has had limited review at a whole of portfolio level or across project groupings to satisfy the requirement of prudence and efficiency. We requested records of the decision approval process undertaken over this period to ascertain the management of the pipeline of works into the capital portfolio. We conclude that the process was largely reactionary to the availability of additional resources through declining demand and associated reductions in augmentation expenditure.

It is incorrect to suggest that the capital portfolio remains unchallenged after it is approved. TransGrid reviews the need for each project at each of the decision gates in its network investment process, and has removed projects from the portfolio in the last regulatory control period even after they have been committed and tenders for delivery have closed. These are included in the list in Table 5 above.

With regard to prioritisation, as discussed in the response to paragraph 36 above, the Portfolio Management Office is responsible for prioritisation of all investments to address network needs including augmentations, asset renewals and asset refurbishments. This informs decisions about project deferral and resolution of resource constraints. Projects are prioritised by evaluating customer impacts (for example, energy not served), compliance requirements (for example, environmental drivers) and reputation (for example, community and stakeholder preferences).

Evidence of prioritisation of the portfolio and the decision approval process to manage the pipeline of works were not items of information to be provided on the list identified by TransGrid and EMCa after the one-day meeting. TransGrid has included its prioritisation analysis in the information it has provided to the AER with the revised revenue proposal.

TransGrid disputes that the process to ascertain the pipeline of works was reactionary to the availability of additional resources and associated reductions in augmentation expenditure. The process of considering needs and initiating investments is set out in the network investment process and undertaken on a regular basis as part of TransGrid's annual planning review.

3.2.4 Performance Drivers and Outcomes

69. The individual needs statements were derived from the condition assessment information provided, rather than in response to a business performance target. However, the condition information in most cases was more representative of an aggregate health and condition for the asset group, rather than at an individual asset level. The resulting condition improvement, and corresponding improvement to business outcomes

was not evident at a project or portfolio level. For example:

- for Line 22 – Sydney North to Vales Point, the structure condition assessment included a range of conditions along the line and formed conclusions for the best option for treatment of tension towers only without justifying the difference in condition within the supplied documentation;
- similarly for Line 99F Uranquinty to Yanco, the replacement of wood poles appeared to be based primarily on a structural defect rate higher than the TransGrid average and supposition of declining wood pole condition and increasing failure rate, where individual pole data was not provided as a basis for analysis; and
- at a portfolio level, the impact of the delay of substation rebuilds and transmission lines from the previous RCP was not readily identifiable which further challenges the link to performance outcomes and bias to over-forecasting.

As TransGrid advised EMCa, data informing the condition of structures such as maintenance and defects records, condition data and photographic records are kept on a tower/pole basis. The investment process documentation is prepared on a per line (or relevant line section) basis, informed by the condition data. The consideration of treatment of tension towers only was an economic decision in regard to the lowest cost option, and not a decision based on a difference in condition between tension and suspension towers.

As set out in response to paragraph 160 below, following the draft decision, TransGrid has reviewed its approach for two of its four lines proposed for wood pole replacements and agrees that a more targeted option as suggested by EMCa may be suitable for Lines 99F and 99J. TransGrid has removed the capital expenditure for Lines 99F and 99J in the revised revenue proposal, and included operating expenditure for this more targeted option.

TransGrid assesses the impact of delays to the delivery of capital projects on a case by case basis, and takes appropriate action specific to the assets affected by the delay. TransGrid does not consider that this indicates a bias to over-forecasting, or that EMCa has substantiated its assertion.

3.2.5 Long Term Capital Expenditure Planning

70. The TransGrid investment planning process described earlier promotes the identification of the lowest cost option through a process of needs identification, options analysis and evaluation. Options considered for replacement and renewal consider variations of rebuilding the asset or replacement of the asset, often where there may have been some form of asset replacement undertaken previously.

71. We understand that the scope of the partial replacement option includes those assets identified from the asset condition reports for replacement, whereas the rebuild option replaces all associated assets. The value of past investments, however, does not appear to have been included in the analysis where the rebuild options is applied. This indicates to us that improvements may be required to the management of full life cycle analysis. TransGrid advised that assets considered to have residual life were considered for

return to its stores.

As described in the response to paragraph 116 below, if there has been asset replacement undertaken previously at a site proposed for renewal, assets with remaining life are reused. This is not necessarily via return to stores, but may be in the staging of a renewal project or in other asset replacement projects. In response to an item of information requested by EMCa, TransGrid has provided reference to investment documentation in which the reuse of equipment in the staging of a renewal project is explicitly stated.

72. Our review identified references to long term capital expenditure plans of at least 10 years. However, no long-term capital expenditure plans was made available to us for this review. Further, no explanation was provided as to whether (or if so, how) the proposed allowance for the forthcoming RCP fits into this long term capital plan. The management of expenditure over the life of the asset requires a long term outlook of capital expenditure requirements as part of the life cycle analysis. The absence of an available long term capital expenditure plan suggests that capital requirements of the asset are not optimised over the life of the asset.

TransGrid's economic evaluation for each investment takes into account the installation, maintenance and disposal costs for the investment. In this way, TransGrid takes into account the life cycle costs of each option when evaluating the most economic option for each investment.

TransGrid also prepares long term strategic planning documents, which it provided as appendices to its revenue proposal:

- a Network Vision, which sets out the context of the electricity industry environment and TransGrid's vision for the NSW electricity transmission network of the future; and
- a Network Development Strategy, which sets out expected trends and possible developments over the long term and provides a guiding direction for the long term development of the network.

In the context of these long term strategies, TransGrid considers specific replacement plans over a five to 10 year period. In TransGrid's view, as recent volatile energy demand has shown, planning further than 10 years ahead has a high level of uncertainty at this point in time. The value of long term strategic planning is in understanding the industry environment and considering replacement plans within the range of possible future directions.

Further, the top-down assessment in Section 5.5.2 of the revised revenue proposal indicates that TransGrid's forecast capital expenditure is reasonable in the context of the long-term sustainability of its network.

75. The increased level of replacement capex has not been adequately linked to a prudent and efficient portfolio of capital expenditure to meet the needs of TransGrid's assets in the long term. TransGrid advised that the proposed increase corresponds with maintaining the current risk level. However, they have neither advised the method used to assess the current level of risk, nor shown evidence of

increasing risk or the desired level of risk in order to measure the effectiveness of the proposed program.

TransGrid has undertaken a relative comparison of the levels of risk addressed by the capital portfolios in 2009/10 to 2013/14 and 2014/15 to 2018/19 in Section 5.5.2 of the revised revenue proposal. The comparison shows that the level of risk addressed by the forecast replacement expenditure in TransGrid's revenue proposal is consistent with that addressed by the forecast replacement expenditure in the 2009/10 to 2013/14 revenue proposal, and therefore that the current level of risk would be maintained by the proposed forecast replacement projects.

76. Justification for the programs that have increased significantly has not been adequately supported. There is insufficient evidence that the increased level of expenditure reflects an efficient means of managing the identified risks.

The background and context of the change in expenditure from 2009-2014 to 2014-2019 for each asset category is set out below. TransGrid has provided extensive documentation along with the revenue proposal to establish the efficiency of managing individual asset risks. This documentation clearly identifies the risk(s), the options considered to address the risk(s) and selection of the most cost-effective solution over the asset life.

Substations

In the 2009-2014 period TransGrid commissioned 6 substation renewal projects, and in the 2014-2019 period it proposes to commission 7 substation renewal projects. There are also a number of programs of work to replace families of make/model/type of substation equipment that have been assessed as having specific issues.

TransGrid aims to extract the most life from its assets, by seeking to retain assets in service for as long as possible, and selecting the lowest cost option for their replacement. To date, TransGrid has mainly undertaken replacement and refurbishment of individual items of equipment to keep existing substations operational at the lowest cost. This has been an appropriate strategy in the current and previous regulatory control periods.

For example:

- TransGrid retains equipment in operation past its nominal technical life, where its condition indicates that it is still fit for service. In the 2009-2014 period TransGrid replaced Queanbeyan substation after 50 years' service and Wallerawang 132 substation after over 60 years' service. Almost 20% of TransGrid's equipment by replacement value (across all asset classes) has exceeded its nominal technical life, and TransGrid will retain this equipment in service as long as it is in serviceable condition.
- TransGrid has previously undertaken bolt replacement in steelwork at Vales Point substation in order to retain the steelwork rather than replace it. The steelwork is now reaching a stage where broader condition issues require its replacement.

Substations constructed during the early years of establishment of the transmission network in the 1950s and 1960s are reaching a condition that reflects the end of their serviceable lives. Given the significant number of

assets constructed when the transmission network was first developed, this has led to an increase in the number of assets requiring replacement over the next five years.

Transmission Lines

The proposal for tower life extension on 13 coastal steel tower lines for the first time is due to the towers on these lines exhibiting corrosion, due to their proximity to the ocean and in some cases polluted environments. The towers are currently at a stage where the corrosion can be treated by removal and the application of high load zinc coating to replace lost galvanising. If this option is not pursued, the towers would continue to corrode to a stage where this is no longer an option and they must be replaced. The life extension is a more economic option.

In the 2009-2014 period TransGrid undertook wood pole replacement projects on 4 lines and a trial of tower life extension on a small number of steel towers. In the 2014-2019 period it proposes to undertake wood pole replacement projects on 3 lines, rebuild 1 line and undertake tower life extension on 13 coastal steel tower lines.

Notably, expenditure on repex for transmission lines in the 2004-2009 period was approximately $70 million (in 2013/14 dollars). While the expenditure in the 2009-2014 period has been lower, this simply reflects that capital expenditure is built up as projects to address individual needs, and that within a category there can be some variation in the extent and nature of these needs over time.

Secondary Systems

Modern microprocessor based secondary systems have a much shorter support cycle and life cycle to obsolescence than traditional electromechanical or solid state systems. As the population of microprocessor based secondary systems has grown over the last 25 years, the rate of replacement has increased commensurate with the shorter equipment life cycle. This has resulted in increasing replacement expenditure on secondary system replacements over the last 10 years and into the 2014-2019 period.

Further, at some sites TransGrid has experienced reliability issues over the last 10 years due to extensive vermin damage to cabling. At sites where the cabling has been assessed as in poor condition, it is proposed to replace the cabling as part of the secondary system replacements.

In the 2009-2014 period TransGrid undertook 1 trial of a secondary systems replacement by installing a SSB (demountable secondary systems building), 1 trial of a secondary systems renewal at a tunnel board site, and the predominant method for secondary systems renewal was programs of work of individual panel replacements.

In the 2014-2019 period it is proposed to undertake secondary system replacements predominantly by site, to achieve efficiencies through the consolidation of work at a site and take advantage of functionality benefits of having the same generation of secondary systems technology throughout a site.

The condition of the secondary systems at each site has been assessed on a site specific basis, and the most economic option selected for each site.

Communications

The proposed expenditure in 2014-2019 reflects the continuation of communications replacement through the use of optical fibre to improve bandwidth on trunk services and create proper fault tolerant rings. While this has previously developed through a strategy of organic growth of optical fibre, it is now proposed to develop it through a retrofit strategy, as organic growth opportunities do not exist in the areas in which communications is required to increase bandwidth and complete fault tolerant rings.

The historical approach of using microwave for trunk services has proved insufficient to cater for the full range of operational technology solutions TransGrid currently uses or plans to use in the near future.

Table 6
Communications Network Overview

	As at 30 June 2014	Proposed for 30 June 2019
Sites serviced by optical fibre	41	72
Sites serviced by microwave spur	11	12
Sites serviced by other (trunk microwave, satellite, DPLC)	45	13

77. In many cases, the identified risks are: (i) described only at a high level, without supporting detail; and (ii) significantly over-estimated, the effect of which is to elevate projects into the 'High' or 'Extreme' risk level where TransGrid has determined that a plan must be put in place to reduce the risk. This risk over-estimation bias contributes to an increase in the number of projects included in the RCP.

This is incorrect. TransGrid has prepared a detailed condition assessment to underpin each replacement need. The condition assessments set out the full range of asset condition issues that are required to be addressed. The extent to which EMCa has had regard to these detailed condition assessments is unclear. However, TransGrid has noted that in EMCa's specific project reviews, it has misconstrued the risks set out in TransGrid's supporting documentation (for example, as discussed in the responses to paragraphs 115 and 135 below).

As discussed in the response to paragraph 57 above, following a recast of the values of risk using the single value of the maximum risk, all projects proposed in the portfolio are still required.

3.3 Assessment of Forecasting Methods

80. We find that key elements of the replacement capex proposed by TransGrid are not reasonable in terms of the NER requirements and are the result of an over-forecasting bias, as evidenced by:

- comparisons of expenditure in previous RCP identify a forecasting bias to advance projects;

EMCa has made the assertion of a forecasting bias to advance projects. However, TransGrid does not consider that EMCa's observation about its expenditure in the previous regulatory control period supports it assertion. There are several other equally reasonable scenarios that may explain comparisons of expenditure in the previous regulatory control period that EMCa appears to have not considered:

- interaction between augmentation and replacement expenditure (as discussed in the response to paragraph 32 above);
- replacement needs that arise within the regulatory control period that were not included in forecast capital expenditure (which the AER has acknowledged are likely to arise);[8] and
- an underforecast allowance.

EMCa's assertion is also inconsistent with TransGrid's observed behaviour that has been characterised by deferring capital expenditure from the 2009/10 to 2013/14 regulatory control period where possible.

- options generated for review at the needs analysis stage are biased towards major asset renewal projects and do not consider sub-options. There was also no evidence of sub-options being generated during the option detailed study phase; and

For all major asset renewal projects, TransGrid considers a "piecemeal replacement" or "selected plant replacement" option that comprises the replacement of the minimum equipment needed to address the condition risks that have been identified. This is explained further in the response to paragraph 86 below.

- there was no evidence of assessment of the prudent timing for a project and the prospective impacts that delaying the project may have on the risk and costs.

TransGrid has considered projects that could reasonably be deferred beyond the 2014/15 to 2017/18 regulatory control period, and deferred them where possible, as listed in Table 5.

[8] AER, *Draft Decision: TransGrid Transmission Determination 2015-16 to 2017-18 – Attachment 6: Capital Expenditure*, November 2014, p6-15.

3.3.1 General Observations

84. TransGrid provided examples of projects deferred, but these were largely augmentation projects in response to changes in demand. There has been deferral of some secondary systems replacement work in order to align this work with the replacement of the primary assets (which provides efficiency gains). However, the main deferrals of work are due to external factors such as delays in gaining a site for a rebuild. Whilst prudent in their own right, the examples TransGrid provided do not demonstrate the consistent application of prudent deferral of replacement projects based on risk-based prioritisation, as claimed by TransGrid.

TransGrid considers the need for each project when initiating the project, and reviews the needs in annual planning reviews and at decision gates in the network investment process. As EMCa has rightly pointed out, TransGrid responds to changes in the drivers of needs and will defer or bring forward projects on a case by case basis if drivers change.

In the 2009/10 to 2013/14 regulatory control period, much of the change in drivers was due to changes in demand, and therefore many of the project deferrals in this period were augmentation projects that were driven by demand.

TransGrid would be concerned about the credibility of its replacement planning if it found that it could consistently defer replacement projects from their original need date. This is because projects are only initiated in response to needs driven by condition, and once initiated, it is unlikely that the condition-based risks would improve over time. That is, TransGrid considers equipment condition against acceptable condition thresholds *before* compiling its portfolio, and not after an initial portfolio has been compiled.

In the planning process in the lead up to submission of the revenue proposal, TransGrid assessed the condition of a range of transmission lines and substations, some of which were not included in its capital portfolio for the revenue proposal, and in that sense were "deferred" by being prioritised beyond the upcoming regulatory control period as there was no immediate condition driver to act within the next five years. These are listed in Table 5.

Further, TransGrid has set out in its revenue proposal examples of needs it has addressed by low cost options to defer a higher cost solution, which are reflected in forecast expenditure. These include:

- the deferral of Wagga 132 substation renewal (as discussed in the response to paragraph 113 below);
- the deferral of capacitor bank replacements at Narrabri by de-rating the capacitor banks to be able to operate them with a lower number of individual capacitor cans;[9] and
- the selection of selected plant replacement options, rather than full rebuilds, for substation renewals unless there is a more economic option.[10]

Therefore, TransGrid considers that EMCa's observation is not justified.

[9] TransGrid, *Revenue Proposal 2014/15 to 2018/19*, 2 June 2014, p167.
[10] TransGrid, *Revenue Proposal 2014/15 to 2018/19*, 2 June 2014, p73.

3.3.2 Needs Analysis

86. Options analysis was limited to large discrete options. TransGrid has, in some instances, included assessment of additional options through the investment planning process of a discrete project. However, options are often rejected without sufficient analysis within the Options Evaluation Report. For example:

- Wagga 132kV substation upgrade - an option presented is to defer the major rebuild project by replacing one transformer that can later be used as system spare, and a few circuit breakers;
- Cooma rebuild - a deferral option is the replacement of one of the regulators and disconnector refurbishments; and
- Communications OPGW work - the delayed installation of the OPGW over two RCP periods instead was not evaluated.

In most cases, the "large discrete options" to which EMCa refers were developed by consolidating a range of replacement plans that apply to specific families of equipment, for example, of the same make, model and type. The need statements and option evaluations for these have been provided to the AER in the supporting documentation for asset strategy programs. TransGrid seeks clarification as to whether EMCa has had regard to the documentation for these asset strategy programs in forming its view.

In considering the most economically efficient option to meet each need, TransGrid has considered "piecemeal replacement" or "selected plant replacement" options that comprise the replacement of the minimum equipment needed to address the condition risks that have been identified. These options comprise an initial program of works to address immediate asset condition, and consider the later costs of works to address the remaining asset replacements as they arise.

Where a particular site has a clear majority of equipment due to be replaced under asset strategy programs, a more efficient way to handle these programs in a consolidated manner is through a substation renewal. A substation renewal also considers the condition of key infrastructure in the substation, such as civil works and steelwork. The most economically efficient option across the whole site is then selected, as presented in the revenue proposal.[11]

Where TransGrid has selected an option other than a "piecemeal replacement" option, it is because that option has been demonstrated to be more economically efficient. For example, an adjacent rebuild can be more cost effective than selected plant replacement where the significant majority of equipment and infrastructure at site requires some works. This is because extensive brownfield works are generally more expensive due to the need for staging and to work incrementally in a live substation.

Therefore, TransGrid does not consider that options analysis was limited to "large discrete options", as EMCa have suggested.

In relation to EMCa's specific examples:

[11] TransGrid, *Revenue Proposal 2014/15 to 2018/19*, 2 June 2014, pp73-74.

- TransGrid has already considered the option EMCa has suggested for the Wagga 132 substation renewal (as discussed in the response to paragraph 113 below);
- the option EMCa has suggested for Cooma would not address all of the risks requiring action at the site (as discussed in the response to paragraph 115 below); and
- one of the key outcomes of the communications OPGW work is to establish fault tolerant communications rings, which would be hindered if some of the works proposed for 2014/15 to 2017/18 were deferred. This is explained further in the response to paragraphs 148 and 149 below.

87. We observe that expenditure incurred during the "identify needs" phase is expected by TransGrid to be operating expenditure and included in the operating budget approval process. Review of the nature of this expenditure and treatment was not within our review, however, we note that pre-planning expenditure is more typically capitalised against projects or programs within the capital expenditure portfolio.

Accounting standards allow expenditure to be capitalised from the time a project has been defined. TransGrid's need identification and option evaluation stages are before a preferred option has been selected, and therefore before a project has been defined. Accordingly, under accounting standards, expenditure at these stages of the network investment process is treated as operating expenditure.

3.3.3 Cost Estimating

94. Based on the information provided, we do not consider TransGrid's cost estimates to be uncompetitive. However, we do believe there may be an opportunity to reduce costs further by outsourcing more of the design, site supervision and secondary construction work.

TransGrid has considered the difference between outsourced and insourced costs and found that in general, insourcing is more cost effective for design, site supervision and secondary construction work. Outsourcing is used for tasks where it is more cost effective, or for workload peaks that are unlikely to be sustained.

3.3.4 Options Analysis

95. The evaluation of the options identified in the Needs Statement occurs in an Options Evaluation Report. This report discusses each option, but in all cases the 'Do Nothing' option is dismissed as non-viable. Accordingly, there is no base case evaluation to judge the value gained by the investment options. The assessment of the base case is done using the risk score or risk cost in the Needs Statement.

TransGrid considers that it is to be expected that in all of the documentation EMCa reviewed, the 'do nothing' option would not be viable. For needs where the 'do nothing' option is viable, a project has not been included in TransGrid's capital portfolio to address the need and therefore, the documentation would not be in the sets of documentation provided to EMCa.

Table 5 above demonstrates a range of projects where the 'do nothing' option was, in fact, the preferred option.

As set out in the response to paragraph 84, TransGrid has set out in its revenue proposal examples of needs it has addressed by low cost options to defer a higher cost solution, which are reflected in forecast expenditure.

96. The options evaluation does not include an assessment of how the annual risk cost or maintenance costs vary over time, except in some cases where maintenance costs were assumed to be constant in all options. The evaluation refers to an NPV for each project option, but is only an assessment of the present value of the capital costs for each option.

Where there are specific needs that can be met by discrete trade-offs between capital and operating expenditure, TransGrid considers options across capital and operating expenditure in its economic evaluation. For example, in TransGrid's forecast expenditure for 2014/15 to 2017/18, it has included the dismantling of a 132kV transmission line between Wallerawang and Orange North (which is operating expenditure) and replacement of the lower level of capacity that is still required by installing substation equipment elsewhere to optimise other flow paths on the network (which is capital expenditure). In such situations, the operating expenditure is proposed in TransGrid's bottom-up forecast of major operating projects.

100. TransGrid stated that it has applied only a bottom-up forecasting method, in which it has aggregated the expenditure implied by the projects and programs that it has identified. We found that the identification of these projects and programs has not been adequately supported. There is insufficient evidence that the increased level of expenditure reflects an efficient and effective means of managing the identified risk.

TransGrid has addressed EMCa's concerns as to whether identification of projects and programs has been adequately supported in the response to paragraph 105 below.

101. Our review identified issues that are consistent with a review commissioned by TransGrid in 2004 (prior to the last revenue reset), specifically:

- insufficient correlation between projects, strategies and future capital needs; and
- the cost-benefit analyses are brief and largely qualitative, and the risk assessment is descriptive.

EMCa has referred to a review undertaken around 10 years ago as supporting justification for its observations. This review was commissioned by the ACCC as part of the revenue determination process, and not TransGrid. TransGrid is disappointed that EMCa has quoted in an unbalanced way from this review. In regard to replacement capital expenditure, the review found that:

> The Network 30 Year Plan, the Network Management Plan and the Asset Management Strategies together provide a coherent and justifiable basis for proposed maintenance and refurbishment projects.[12]

[12] GHD, *TransGrid Regulatory Review*, April 2004, p i.

In further detail:

> The strategy documents summarise the approach for each asset type and demonstrate that extensive review and evaluation of maintenance and renewal practices has taken place to arrive at the preferred technical solution.
>
> An extensive range of Asset Management Manuals are referenced, indicating that the maintenance and renewal process is mature.
>
> The evaluation process for maintenance or renewal projects covers:
>
> - Demonstrate the need
> - Cost-benefit analysis
> - Risk assessment
> - Quantities and costs
> - Method proposed
> - Time factor
> - Priority rating
>
> From the supporting information provided, the technical review of options and selection of the preferred solution is appropriate.[13]

These findings are quite different to the perception created by EMCa's unbalanced regard to this review. That is, while the 2004 review identified some improvement opportunities to TransGrid's processes, its findings are not, when taking a balanced view, consistent with the EMCa report.

In its specific assessments of TransGrid's proposed substation and secondary system renewal projects for 2004/05 to 2008/09, the review found that:

> There is a high level of confidence in the most appropriate solution applied to the improvement need.[14]

In its specific assessment of TransGrid's proposed transmission line renewal projects for 2004/05 to 2008/09, it found that:

> In summary, the proposal for transmission lines is considered justified and efficient.[15]

These findings are also not consistent with the EMCa report.

TransGrid considers that EMCa has misrepresented the findings of this review and, in doing so, cast aspersions on the suitability of TransGrid's forecast capital expenditure.

[13] GHD, *TransGrid Regulatory Review*, April 2004, p12.
[14] GHD, *TransGrid Regulatory Review*, April 2004, p47-48.
[15] GHD, *TransGrid Regulatory Review*, April 2004, p48.

Further, EMCa appears not to have had regard to the more recent (and therefore, more relevant) review of TransGrid's capital investment plans conducted in 2014 by the same consultant, GHD. In the 2014 review, in relation to asset replacement, GHD found that:

> The suite of investment planning documents for asset replacement projects examined demonstrate that TransGrid has a robust process for assessing the condition of network assets, underpinned by thorough and detailed condition assessment reports. As a result GHD is satisfied that the available condition information presents TransGrid with adequate evidence to base the determination of an investment trigger within the 2014-2019 regulatory period. The information reviewed demonstrates that TransGrid's replacement plans comply with the relevant Asset Management Strategies and the replacement capex proposed is reasonably required to address the asset condition needs identified in condition reports and strategies. The documents examined demonstrated that appropriate internal processes and governance procedures are in place.[16]

Given that GHD undertook a comprehensive and challenging review of a significant sample of TransGrid's capital expenditure supporting documentation, in contrast to EMCa's brief and superficial review, TransGrid recommends that the AER place more weight on GHD's findings than those in the EMCa report.

102. In addition, the existence of such issues is of concern to the reasonableness of the proposed expenditure in the RCP and indicate an over-forecasting bias due to:

- inadequate assessment of prudent timing of projects;
- focus on adherence to large replacement options, and insufficient options analysis; and
- inadequate consideration of risk mitigation options associated with the 'do nothing' option, reflective of the issues discussed in section 3.

EMCa's claim of inadequate assessment of prudent timing of projects is contradicted by GHD's comment from its 2014 review, that:

> … GHD is satisfied that the available condition information presents TransGrid with adequate evidence to base the determination of an investment trigger within the 2014-2019 regulatory period.[17]

Further, even if there was inadequate assessment of prudent timing of projects, this does not necessarily indicate overforecasting but may equally indicate underforecasting.

TransGrid has addressed EMCa's concerns of adherence to large replacement options and insufficient options analysis in the response to paragraph 86, above.

TransGrid has addressed EMCa's concerns of inadequate consideration of risk mitigation options associated with the 'do nothing' option in the response to paragraph 95, above.

[16] TransGrid, *Revenue Proposal 2014/15 – 2018/19: Appendix K*, 2 June 2014, p2.
[17] TransGrid, *Revenue Proposal 2014/15 – 2018/19: Appendix K*, 2 June 2014, p2.

Therefore, TransGrid rejects EMCa's allegation of overforecasting and the supposed implications for proposed replacement expenditure it asserts in paragraphs 100-102.

3.4 Assessment of Proposed Expenditure

The assessment of proposed expenditure is set out in Section 5 of the EMCa report. EMCa has assessed expenditure for four types of works: substation renewal, secondary systems renewal, communications upgrades and transmission line renewal.

105. From our examination of a sample of projects, we consider that the issues identified in sections 3 and 4 relating to the over-estimation of risk and over-forecasting bias are evident in the proposed forecast expenditures. This is evidenced by:

- risk assessments that in many cases are at an aggregated level and do not enable the assessment of sub-options that may address the major risks at a much lower cost and will reduce the risk to an acceptable level;
- excessive scope - where we believe it is possible to defer some of the work from this RCP without changing the selected option or by undertaking interim measures to achieve an acceptable level of risk until the major renewal takes place. In some projects, we have identified opportunities that should have been considered to reduce the scope of work;
- replacement of relatively new assets as part of the major substation and secondary renewal projects - there has been insufficient consideration of reusing these assets either in-situ or to extend the life of other assets; and
- an over-reliance on technology driven strategies to drive asset replacement in the secondary systems and communications areas where the benefits of the use of new technology is not recognised in the economic analysis, not justified and/or where other lower-cost options may be adequate to address the identified risk.

TransGrid does not accept EMCa's assertions, and has set out:

- the response to EMCa's assertion regarding its risk assessments in the response to paragraph 57 above;
- the response to scope with reference to the minimum "piecemeal replacement" or "selected plant replacement" option in the response to paragraph 86 above;
- reuse of assets in acceptable condition, as discussed in the response to paragraph 116 below; and
- the basis for secondary systems renewal projects in the response to paragraph 126 below.

3.4.1 Substation Renewal

EMCa reviewed five substation renewal projects, comprising two committed projects (Tamworth 132 and Cooma) and three future projects (Canberra, Vales Point and Wagga 132).

109. We consider that it is highly likely that some projects will "slip" from the forthcoming period, which would result in a reduction to the proposed expenditure. For example, if the projects at the end of the RCP being Wagga, Munmorah and Newcastle were deferred by only one year, the proposed substation renewal expenditure would be reduced by $39.5m. Considering the increase in the number of substation renewal projects, combined with the lack of an assessment of how the risk might change due to deferral, it is reasonable to assume that this could occur.

TransGrid rejects EMCa's assertion of a high likelihood that some projects will slip, and considers its assumption that this "could" occur to be hypothetical and unfounded. TransGrid does not consider it likely that projects will be systematically deferred, having already established their need.

Firstly, in terms of deliverability, the total forecast capital expenditure proposed by TransGrid in the revenue proposal is 28% lower in real terms than historical capital expenditure. This means that TransGrid has a demonstrated track record of ability to deliver a capital portfolio of at least the size it is proposing in the revenue proposal.

Secondly, the substation renewal projects that have slipped beyond the 2009/10 to 2013/14 regulatory control period are Tamworth 132 and Cooma. In both cases, the delays were due to the availability of property for an adjacent or nearby rebuild. At Tamworth 132, the most economic option was delayed pending the rebuild of an adjacent depot. At Cooma, an alternative option was pursued due to an Aboriginal land claim over the site for the original preferred option. However, all other forecast substation renewal projects are either rebuilds in-situ or selected plant replacements,[18] which do not have the same potential for delays due to the availability of property.

Thirdly, under TransGrid's project scoping processes, its forecast project delivery times are routinely updated to reflect the times it has actually achieved in practice. Therefore, while individual projects may be delivered slightly earlier or later than the standard times, this should not result in a net deferral across the whole portfolio.

On this basis, TransGrid rejects EMCa's assertion that there is a high likelihood that projects would slip and this would result in a reduction to proposed expenditure.

110. We reviewed a number of risk assessments and found evidence of expenditure linked to what we consider to reflect a systemic over-estimation of risk. For example, the risk assessment for the Newcastle substation renewal project as shown in Figure 4 is 'Medium'. According to TransGrid's corporate risk framework, a 'Medium' risk only requires treatment based on a cost-benefit assessment. This assessment has not been adequately demonstrated to us. We consider that, in this example, the project could be deferred.

As discussed in the response to paragraph 57 above, with a recast of the values of risk using a conservative application of the alternative method proposed as good practice by EMCa, all projects proposed in the portfolio

[18] TransGrid, *Revenue Proposal 2014/15 to 2018/19*, 2 June 2014, p73.

are still required. This includes the Newcastle substation renewal project. TransGrid also notes that a full cost/benefit assessment has been provided to the AER for every project.

113. Of the five projects reviewed, we consider that, on a reasonable interpretation of the documentation provided, prudent executive management and/or Board consideration of reasonable alternatives would result in deferral of the Wagga and Tamworth projects (in spite of Tamworth being a committed project). For example:

- Wagga may be deferred if some temporary works are undertaken and a less expensive option implemented at a later date if further use is made of the assets already replaced. For example, all the 132kV circuit breakers are relatively new.
- The Tamworth project did not consider the option of undertaking temporary works and purchasing a spare transformer in order to defer the station renewal; this alternative may be more economical, especially if the spare is purchased so that it can be used at a number of sites.

TransGrid considers that EMCa has had selective and insufficient regard to the information provided to it in forming its view.

For Wagga 132, TransGrid has previously deferred the substation renewal by replacing the 132kV circuit breakers. The options analysis considered targeted component "piecemeal" replacement against full asset replacement, and found that the piecemeal replacement strategy was not the most economic in this case. This is evident from the information TransGrid provided as part of its revenue proposal submission.

For Tamworth 132, TransGrid's investment documentation for the project has already addressed the matter EMCa has raised.

Firstly, the investment documentation already included explicit consideration of an option to undertake the minimum works to address individual asset condition issues, as an alternative to a full renewal (Option F).[19] This option was not the lowest cost option, and so was not recommended.

Secondly, the investment documentation also considered alternative options to address the condition of the transformers:

- scrapping of the three 60MVA transformers, which implies the use of new transformers in lieu of reuse of existing transformers ($2.2 million);
- factory refurbishment of two of the existing 60MVA transformers for reuse ($1.4 million), and replacement with two new 120MVA transformers at Tamworth 132; and
- on site refurbishment of two of the existing 60MVA transformers for reuse ($1.1 million).

[19] Refer to OFR 4010F, OFS 4010F and OER 4010 in TransGrid, *Document Set: Tamworth 132kV Substation Rebuild*, 30 May 2014.

The pre-investment risk cost was assessed at $120 million, which is around 55 times higher than the most expensive option. Even under alternative methods of assessing risk, such as taking the cost of the single largest risk rather than the summation of all risks, there is still a clear justification to act. Taking into consideration the different risks of undertaking each option, a decision tree analysis was carried out to determine the preferred option to address the need. The analysis determined that the preferred option is to scrap the three transformers.

TransGrid already holds a minimum number of spare transformers for use across its network. Therefore, it already holds a spare transformer that could replace one of the transformers at Tamworth 132 Substation in the event of failure. However, the holding of spares is not intended to facilitate a deliberate "run to failure" asset management regime for large power transformers. TransGrid does not consider that such a regime, which is more commonly used for smaller distribution network equipment, constitutes good electricity industry practice for transmission level equipment or would be appropriate. This view is supported by AMCL:

> An N-1 approach is used to ensure redundancy in the system in the event of failures or outages. N-1 should not be used as an excuse to push the assets to a point where failure is likely, especially for transmission assets where consequence of failure are typically very high.[20]

Therefore, as clearly justified in its investment documentation that was provided to the AER with the revenue proposal, TransGrid has already considered options of minimum works and alternative options to address the condition of the transformers, and does not consider these options to be economic.

114. In the reviewed projects there was also significant work in secondary replacements and civil works. For example:

- Approximately $35m or 60% of the expenditure for the Canberra project is secondary equipment and control cable replacement. The Vales Point project proposes to replace all 330kV and 220kV secondary systems, yet there is not a compelling reason to undertake the 132kV replacements at the same time. The Wagga project also proposes to replace all 330kV and 132kV secondary systems and cables. There should be opportunities to reduce the scope of this secondary work.
- In all of the substation renewal projects, there is considerable expenditure for replacement or augmentation work in areas such as fencing, drainage, oil containment, auxiliary services and other general civil works. From the documentation provided, no compelling reasons were provided to explain why some of this work could not reasonably be deferred.

EMCa correctly notes that substation renewals include work to renew secondary systems and civil works. As for high voltage electrical equipment, these types of equipment also require renewal. TransGrid provides further information on the rationale for these works below.

[20] AMCL, *Review of Proposed Replacement Capex in TransGrid Revenue Proposal 2014 – 2019*, 23 December 2014, p17.

However, some of EMCa's statements in this paragraph are factually incorrect, as identified below. TransGrid contends that the prevalence of factual errors in the EMCa report casts significant doubt on the veracity of its conclusions.

3.4.2 Secondary Systems Replacements

EMCa has, without any demonstrated analysis, incorrectly claimed that there is scope to reduce the secondary systems work at substations such as Canberra, Vales Point and Wagga 132. EMCa has had insufficient regard to the information provided by TransGrid that showed that:

- the expected works will replace systems that are effectively at end of life;
- the expected works will not include replacement of systems that can be retained, such as the Substation Data Concentrator and telecommunications assets at Canberra;[21] and
- the control cables are in poor condition and experience earth faults in wet weather and the cable trenches need urgent remedial works (see detailed discussion below).

Canberra

At Canberra, the average expired percentage service life per device at the stated need date for the renewal of protection and metering systems is 93%. The control system panels at Canberra substation consist of push buttons and visual only meters, and would require extensive upgrade work to suit modern control systems under a piecemeal replacement approach.

The scope of secondary systems work at Canberra involves the retention of the Substation Data Concentrator and Human-Machine Interface (HMI), which is to be interfaced with the new bay control equipment. The current telecommunications systems are being retained and will not form part of the secondary systems replacement works. All NEM metering installations have exceeded their economic service life and have been identified for replacement.

Canberra substation was commissioned in 1967. The condition assessment (NACA-9002A) notes that the control cables have been subject to substantial damage due to rodent activity, causing a number of faults. The condition assessment also notes that the state of the substation bench and drainage issues have resulted in the collapse of cable trenches in a number of places.

A civil condition assessment conducted by Parsons Brinkerhoff in May 2012 made the following observations:

> The substation has some major problems which need addressing. The major problems identified are as follows:
>
> 1. Maintenance vehicles regularly get bogged after consecutive days of rain when they drive off-road.
> 2. Cable trenches frequently collapse, particularly after heavy rain and/or when maintenance vehicles drive close to them.

[21] Refer to OFS 9002F Sections 1.2 and 2.7.3.

3. Earth leakage alarms sound during wet weather requiring maintenance due to rabbits nibbling at cable trench wiring.[22]

The report goes on to discuss at length remedial actions necessary to prevent maintenance vehicles being bogged when traversing the switchyard following heavy rain. The surface condition and drainage problems also contribute to the collapse of cable trenches when maintenance vehicles pass near or cross them. The report attributes both vehicle loading due to switchyard surface construction techniques and hydraulic pressure on the cable trench walls due to poor drainage as contributing to the cable trench failure modes.

The report also discusses the rabbit infestation:

> The use of a grass surface rather than a gravel surface at Canberra substation allows for a habitable environment for rabbits.

The report further notes that the rabbits tend to gnaw at the cables in the trenches, damaging them. When it rains, these damaged cables activate earth leakage alarms. As well as the maintenance issues associated with earth faults, the rabbit infestation represents a safety issue, as TransGrid staff have twisted their ankles whilst walking on site when the ground collapsed into a rabbit warren.

The extensive control cable works required for a Secondary Systems Building (SSB) secondary systems replacement solution become economic when the extensive rectification works to address the substation bench drainage, the general condition of the cable trenches, rabbit-proofing the cable trenches and replacing rodent-damaged cabling are considered.

The use of SSB techniques offers considerable benefits for future secondary systems replacement works, in that the demountable SSB may be constructed and tested in a factory before being transported by road to the site. The actual replacement of the existing system then consists of unloading the new SSB, connecting to the switchyard cable marshalling points, cutting over and commissioning the new systems and recovering the existing SSB for removal, generally by the same heavy vehicle that delivered the new SSB.

Wagga 132

The EMCa report suggests that TransGrid is planning to address 330kV secondary systems work at Wagga in its forecast expenditure, which is incorrect. Wagga 132 substation does not have 330kV equipment. While there is a separate 330kV substation in the Wagga area, it does not have major works proposed in the upcoming regulatory control period.

The EMCa report has stated that, “there should be opportunities to reduce the scope of this secondary work,” referring in part to Wagga 132 substation.

[22] Parsons Brinckerhoff, *Canberra 330/132kV Substation Civil Condition Assessment Report*, May 2012, p16.

At Wagga 132, the average expired percentage service life per device at the stated need date for the renewal of protection and metering systems is 94%.

Similarly to Canberra, the Wagga 132 Substation control panels would require extensive upgrade work to suit modern control systems under a piecemeal replacement approach. Therefore, a complete replacement of the existing electromechanical control system was intended under TransGrid's proposal.

While the telecommunications systems at Wagga 132 have some remaining life, the need for a complete secondary systems replacement will require new telecommunications terminal equipment to be installed. The telecommunications systems that have remaining life will be retained as spares to assist in managing TransGrid's fleet of telecommunications systems across its network.

Vales Point

EMCa's statement of the scope of secondary systems replacement at Vales Point is incorrect, demonstrating that EMCa has again had insufficient regard to the information provided to it. In particular:

- Vales Point does not have 220kV equipment, to which EMCa has referred; and
- TransGrid is, in fact, proposing to replace both 330kV and 132kV secondary systems at Vales Point at the same time. The current scope of works for Vales Point is set out in the investment documentation that was provided to the AER.[23]

The 132kV secondary systems replacements were originally packaged with a separate demand-based need to establish a 132kV busbar at Vales Point. The busbar project has now been deferred due to a decline in demand in the area. The decision to defer the busbar project was made after the option feasibility study (OFS) stage of the substation renewal project.

In OER 8006 TransGrid stated:

> Since the issue of the OFR, the establishment of a 132 kV busbar has been deferred due to revised distributor load forecasts. In light of this new information, the replacement of the 132 kV secondary systems would be completed simultaneously with the substation rebuild (refer to section 2.2). The 132 kV secondary system replacement cost is not included in OFS 8006A.[24]

The 132kV secondary systems replacements were subsequently included in this project at the Project Scoping Study (PSS) stage. The scope of works includes:

[23] Refer to RPS 8006, PSS 8006 and DG2 0231 in TransGrid, *Document Set: Vales Point Sub Rebuild*, 12 May 2014.
[24] TransGrid, *OER 8006*, 10 April 2014, pp9-10 in TransGrid, *Document Set: Vales Point Sub Rebuild*, 12 May 2014.

1.2 c) Replacement of the following items in the 132 kV switchyard:

1. Secondary systems;
2. Individual plant items as per condition assessment[25]

The Project Scoping Study was included in the supporting documentation provided with TransGrid's revenue proposal. Therefore, this information was available to EMCa when preparing the report.

3.4.3 Civil Works

For each of the substation renewal projects in TransGrid's revenue proposal, detailed condition assessments were prepared to review and document the site condition. In each case, the condition assessments led to the preparation of needs statements to identify site issues that should be addressed for ongoing reliable and safe operation of the substations.

Issues that should be addressed if feasible in the course of addressing the other issues were separately listed, and could be deferred if not economically justified to address.

The sites under consideration have had minimal maintenance of civil components since their construction and have been in service for between 47 years to 60 years. It is to be expected that deterioration requiring action will occur over these timeframes, and the process outlined above is intended to identify this deterioration and act in a reasonable way to economically manage the issues found.

The EMCa report suggests that reasons have not been given to not defer some of this work. TransGrid has, however, provided reasons for why the work should be done. No sound reasons have been provided by EMCa for why any of the work should be deferred.

Some additional background to the main areas of concern is as follows.

Oil Containment Systems

There is an issue with the fixed bund type transformer bunding systems used at some TransGrid sites. They are of brick construction and will not hold the oil from the transformer enclosed if there is fire involved, as evidenced by previous failures and leakages. In addition, fire fighting would require the addition of water that will overtop the bund (oil and fire first).

An alternative type of oil containment system is the draining bund type, which has proven to successfully retain released and burning oil and not impede fire fighting. These oil containment systems are based on a bund that is drained through flame traps, with piping leading to an "underflow drainage" type of flow through (underground) oil containment tank.

[25] TransGrid, *PSS 8006*, 20 February 2014, p5 in TransGrid, *Document Set: Vales Point Sub Rebuild*, 12 May 2014.

A recent review of sites has identified that the design of oil containment at Canberra is likely to be ineffective, and modification would be required to ensure that the containment system operates as required. This has been included in the project cost of the piecemeal option to address site issues.

In the case of Vales Point, no major oil containment works are proposed.

For Wagga 132 and Tamworth 132 substations, fixed bunds are used around the transformers and installation of containment tanks is necessary to properly contain oil in the case of a transformer fire.

At Cooma, transformer bunds are drained to a single spill oil tank. However, this tank is also used to process the water collected from the total site and in the event of rain in connection with a transformer failure, the effectiveness of oil retention will be compromised making it possible for oil to migrate through the containment system to reach the environment.

Auxiliary Services – 415V Supplies

The legacy 415V systems installed in TransGrid substations are based on a central main switchboard with smaller sub-boards distributed through the substation and connected by cables in the cable trenches, mixed in with control cabling. The 415V cabling has been fuse protected in all older substations and for large supply cables in particular, was often run as single core cables.

The cable trenches provided in the older substation sites were constructed to provide a dual function. The trenches were built of brick with a drain at the bottom, which was separated from the cable trench on top using concrete slabs (separated by narrow gaps) to support the cables.

Unfortunately, in areas affected by large numbers of rabbits, the cable trenches are attractive to the rabbits as a ready made system of tunnels. As rabbits can access the drains at the bottom of the trenches or in the cable trench compartment itself, they chew on the cable sheaths, creating potential faults.

The fault that results may be of high impedance, as the cables are surrounded by the sheaths of other cables. When this high impedance fault is on a 415V cable, large amounts of heat can be released, without reaching the rupture current of the protective fuse.

In the last 10 years, TransGrid has had two occasions of cable trench fires with major impact on critical substations. At Kemps Creek in 2004, all of the cables in a cable trench were destroyed when an uncleared fault on a 415V supply continued to supply heat into the area of the fault. Major outage was avoided by the quick actions of staff on site and the fortunate timing of the event.

At Sydney North in 2010, a similar fire led to a large scale blackout in the north of the Sydney supply area.

In both of these cases, some weeks of work were required to return the two sites to normal operation.

At Jindera in 2003, a smaller but similar fire caused loss of services including protection to three 132kV switchbays and 18 cables in the trench required replacement.

Following the investigation of the Sydney North fire, sites were ranked based on available cable defect data, information on rabbit baiting requirements and site criticality to rank sites by risk. Canberra is considered a very high risk site due to the large number of cable faults found, known rabbit problem and its role in the supply of Canberra.

Apart from the risk to reliability, serious safety concerns can arise. There are cases of electric shock through working in cable trenches with damaged cables. There has been a recent case where a field worker stepped on a copper compressed air line and caused a 415V arc when the pipe contacted exposed cable wiring.

In the smaller sub-boards installed in the older sites, bakelite or fibreboard is used to mount fuses and links forming the board. This material deteriorates with time and becomes faulty. There is an instance of a fire in sub-board in a major site built in the 1960s. There have been cases of electric shock from faulty older type fuse carrier type links mounted at other similar locations.

The main distribution boards at these sites are built to old standards and do not have modern standards of isolation. There are some cases where asbestos has been used in the main circuit breakers and the relays on the boards are electro-mechanical, are at end of life and not easily replaced.

For the projects covered under the EMCa review, action related to the 415V systems is as follows:

- Canberra: This site has extensive damage to cabling caused by rabbits and there are five defects that have been reported in the defect system since 2010 that were serious enough to require a large repair. It is expected that there are other unreported defects. This problem is compounded with damage to cable trenches that has occurred due to the poor stability of the soil on the substation bench, resulting in cable trench wall collapse. The 415V distribution board may contain asbestos and does not provide adequate partitioning for modern requirements. Without action, it is almost certain that a serious cable trench fire will occur on the site in the next 5-10 years that will threaten the ability to keep the substation in operation.
- Wagga 132: Secondary system replacement is in the scope of this project, including replacement of cabling. This will require removal of 415V cabling and hence renewal of the 415V system at the same time is appropriate. The 415V system is not a driver for the work, but it is efficient to address the 415V supplies at this time. Although considered a lower risk overall risk at this site, the work will eliminate the possibility of a cable trench fire that might cripple the substation.
- Tamworth 132: The option selected for this site is an adjacent rebuild. There is consideration of cable trench condition although renewal of the 415V system is not a driver in the decision to rebuild the substation entirely. However, it is efficient to address the 415V supplies in conjunction with the other rebuild works.
- Vales Point: Targeted replacement of 415V components is included in the scope of the selected option. 415V cabling and the switchfuse boards on the auxiliary transformers are to be replaced. The remaining main boards are to be retained.

- Cooma: The selected option for this site is not affected by the condition of 415V systems, but the option selected results in a new installation (in a new site) as it is efficient to address the 415V supplies in conjunction with the other rebuild works.

Other Civil

The other key civil issues being addressed in the projects EMCa has reviewed are:

- Canberra: Apart from an identified problem with the design and installation of the oil containment system that could limit its holding ability, the main civil issue associated with this site is the condition of the bench. Drainage is inadequate and has contributed to damage to cable trenches. There are a small number of switchgear footings that have tilted. Access to equipment using mobile plant is affected in wet weather. The bench is grassed and this provides support for a rabbit population within the substation and requires that grass-cutting contractors be given admission to the substation to maintain the grassed area. Gravel has an advantage over grass for earthing performance in a substation. A targeted amount of work is included to replace grass with gravel and to improve access in selected areas for plant.
- Wagga 132: Civil consultants indicate that 40% of the substation steelwork has 5-10 years remaining life with 5% requiring immediate attention.
- Tamworth 132 and Cooma: The most economic option to address the range of risks and issues at these sites is to rebuild the sites. Civil components of work were not significant components of the decision to rebuild, but will be addressed as part of the most economic option.
- Vales Point: At Vales Point, the condition of steelwork is an important issue for the site. A metallurgist's report has been obtained that give a finite life to the steelwork on site, and the proposed scope at the site is directed at dealing with two portions of the switchyard which were installed at different times – with appropriate strategies for each. The remaining civil works on the site is mainly focussed around dealing with problems with drainage in the 'A' portion of the site.

115. The Cooma substation is listed with the most extreme risk, with a risk cost of $246.5m per annum. Yet, the major risks are associated with the condition of the 11kV regulators and an assumption that it will take up to a year to replace a failed unit if a transformer fails. It is unlikely that this situation would be allowed to occur. (We note that the station also has existing redundancy.) Based on an assessment of extreme risk, we consider that a new regulator should have been installed and the removed regulator kept as a spare. Also, a spare transformer should be available to cover Cooma and other substations.

TransGrid considers that EMCa has misconstrued the risks associated with Cooma substation, in particular that the major risks are associated with the condition of the 11kV regulators. The need statement for Cooma substation lists 15 risks to be addressed at the site, only one of which is the condition of the 11kV regulators.[26]

[26] Refer to NS 6025 in TransGrid, *Document Set: Cooma 132kV Substation Rebuild*, 8 May 2014.

The other 14 risks comprise condition, operational, safety and environmental issues relating to other equipment at the site.

Since the identification of the need to renew Cooma substation, one of the transformers failed at the site. Fortunately, the failure did not result in fire and was managed by replacement with a spare transformer.

The EMCa report suggests that action should have been taken to procure a new regulator to manage this risk at the site. As noted in the EMCa report, there is a long lead time for supply of a replacement regulator, and the risk exposure would remain while the new regulator is manufactured delivered and installed. Further, the cost of the regulator would be wasted following the rebuild of the site, as TransGrid has no other use for such a device and their use by the distribution authorities is limited. As a rebuild of the site is required to address the full breadth of risks that have been identified with the site, this is not considered economic.

Other options to manage the additional risk arising from the implementation delay have included consideration of borrowing or hiring a regulator, and operating the existing regulators on fixed or restricted tap. However, no suitable spare regulators could be located and it has been found that the management of voltage at Cooma would become an issue in the downstream distribution network with restricted tapping on the 11kV regulators.

A spare transformer is already held to cover TransGrid's standard 132kV 60MVA transformers, which would be used in the event of a transformer failure. However, the tertiary winding on the available spare at the time is unlikely to be rated to supply the 10 MVA load of a regulator. Again, transformers with tertiary windings of this rating are not used elsewhere in TransGrid's network, and a spare transformer with this rating would be unique and unnecessary following the rebuild of the site.

Further, the holding of spares is not intended to facilitate a deliberate "run to failure" asset management regime for large power transformers. TransGrid does not consider that such a regime, which is more commonly used for smaller distribution network equipment, constitutes good electricity industry practice for transmission level equipment or would be appropriate. This view is supported by AMCL:

> An N-1 approach is used to ensure redundancy in the system in the event of failures or outages. N-1 should not be used as an excuse to push the assets to a point where failure is likely, especially for transmission assets where consequence of failure are typically very high.[27]

The proposal from EMCa to purchase a spare and defer the site renewal suggests a narrow focus of risk on supply reliability issues only. While this aspect of risk is important, TransGrid is also required to manage other risks such as safety, environmental and operational risks to effectively manage risk for the site.

116. Many of the substation circuit breakers at Cooma have previously been replaced, resulting in 65% of the fleet being less than 20 years old. Many of the projects are now being driven by the replacement of other equipment at the substations such as disconnectors, instrument transformers, power transformers and

[27] AMCL, *Review of Proposed Replacement Capex in TransGrid Revenue Proposal 2014 – 2019*, 23 December 2014, p17.

> secondary systems. However, there is a concern that relatively new circuit breakers will be replaced as part of a substation renewal project; this issue was observed in some of the project documents reviewed. For example, the Wagga project includes the complete demolition and rebuild of the 132kV switch bays despite nine of the ten existing circuit breakers being relatively new SF6 units. There was no mention of the option to reuse these in situ.

As stated above, EMCa has expressed concern that relatively new circuit breakers might be replaced as part of a substation renewal project, not just at Cooma but also at other sites such as Wagga 132.

TransGrid therefore seeks to clarify its practices on the reuse of equipment during renewal projects at Cooma, Wagga 132 and in general.

Cooma

TransGrid plans to retain the equipment from the existing Cooma substation that has useful remaining life. It is unlikely to be feasible to reuse the equipment in the rebuilt substation at Cooma due to the work staging at that site. However, the equipment will be used for replacements elsewhere in TransGrid's network where possible. The intention to retain equipment is clearly stated in the Joint Planning Project Report for Cooma Substation:

> TransGrid will provide a list of plant and equipment that Essential Energy will recover on behalf of TransGrid, when they become operationally available and within an agreed timeframe. The identified items for recovery will remain the property of TransGrid upon site transfer. Essential Energy will provide two high capacity 66kV circuits to supply the reconstructed Cooma Substation which will be tail-ended via 66kV switchbays to the 132/66kV transformers at the new TransGrid Cooma 132/66kV Substation.
>
> …
>
> Essential Energy responsibilities are to:
>
> - Recover salvageable equipment for TransGrid as agreed by both parties (Cl 2.2);[28]

TransGrid trusts that this intention alleviates EMCa's concern that relatively new circuit breakers will be replaced as part of the rebuild of Cooma substation.

Wagga 132

TransGrid accepts that the scope of works for the original Option Feasibility Studies for Wagga 132 substation did not explicitly address the reuse of relatively new equipment such as circuit breakers. However, TransGrid intends to retain the new circuit breakers at Wagga 132 for reuse.

Reuse of Equipment in General

[28] TransGrid, *Joint Planning Report for Cooma Substation*, pp4-5.

In response to a question from EMCa on reuse of equipment at the one day meeting, TransGrid advised EMCa that it reuses equipment in acceptable condition in three ways:

1. For significant items of plant, such as transformers, reuse is assessed and an approach decided during option evaluation (prior to DG1). For example:

    - In the last five years, TransGrid replaced 132kV transformers at Coffs Harbour substation with larger transformers and reused the transformers at Narrabri substation to replace transformers reaching the end of their serviceable lives.

    - In the proposed substation renewals at Vales Point, Munmorah and Canberra, transformers that were added after the original substation construction are being retained in service in their existing locations, as they have not reached the end of their serviceable lives.

    - For the replacement of transformers at Forbes, an assessment was undertaken of the suitability of refurbishing and then reusing the transformers released during the renewal of Tamworth 132 Substation, compared to the acquisition of new transformers.

    - For replacement of transformers at Beaconsfield West, various refurbishment and reuse options were considered.

2. For substation renewals, reuse of equipment is considered when scoping the staging of a rebuild during option evaluation (prior to DG1). For example, the Option Feasibility Study for Munmorah Substation renewal specifically identifies equipment to be retained and reused during staging.

3. The remaining substation plant and equipment is assessed during the project scoping phase (post DG1 but pre DG2) for its suitability for recovery, either as spare item, parts recovery, or use in an asset replacement program.

    Secondary systems equipment has a much shorter life. It is normally assessed later in the project schedule (post DG3) whether they are suitable for reuse or spares.

Therefore, TransGrid considers that EMCa has had selective and insufficient regard to the information before it regarding TransGrid's reuse of equipment in acceptable condition, and has drawn erroneous and misleading conclusions that are not based on evidence.

117. From the review of a sample of projects we found evidence of inadequate risk assessment, forecasting and scope bias, including:

    - excessive assessment of risk costs;
    - areas of excessive scope;
    - insufficient consideration of the option to defer the major renewals by undertaking interim work and the use of spares; and

- insufficient consideration of the retained use of relatively new assets.

118. By examining this sample of expenditure, it is evident that the biases described above have consistently led to an over-estimate of the proposed expenditure. We consider that these biases reflect a systemic issue and are likely to reasonably exist in the remainder of this expenditure category.

119. Based on our analysis of this sample, and the impact of systemic issues found, we consider that the level of expenditure during the last RCP is a better indicator of a prudent level of expenditure. We remain unconvinced of the need for an increase.

120. It is our view that the over-estimation of required expenditure is in the order of 10% to 20% within this project category. We consider that a corresponding adjustment to the replacement capital expenditure that TransGrid has proposed for this project category would more reasonably reflect a prudent and efficient level of expenditure.

Based on the responses to the preceding paragraphs, TransGrid rejects EMCa's findings related to substation renewals, as it considers them to be unfounded and unreasonable.

EMCa has not provided any analysis to support its recommended reductions. Given this lack of justification, and the issues TransGrid has found with EMCa's observations above, TransGrid does not consider that EMCa's reductions are justified.

3.4.4 Secondary Systems Renewal

123. Total expenditure in the current period is forecast to be $79m and is forecast to increase by 240% to $191.2m. There were six projects over $1m in the last RCP, whereas this has increased to 17 projects in the 2015-19 period. This is a substantial increase. We expect that TransGrid will encounter significant challenges to implement all of these projects in the period, while also undertaking the secondary system renewal component of works included in the substation renewal projects.

TransGrid notes that it has installed and commissioned a similar number of secondary systems in the previous regulatory control period, many as part of augmentation projects. Therefore, TransGrid considers that the deliverability of its proposed portfolio is feasible.

124. The secondary system renewal work is being driven by the strategies adopted in the Network Renewal, Maintenance & Disposal Strategy and Objectives – Substation Automation Systems issued on 20 May 2014, specifically:

- Protection – to have the majority of electromagnetic relays replaced by 2030 and the discrete component and early microprocessor protection by 2025;
- Control systems - replace all discrete component control assemblies as a matter of urgency and all early microprocessor type control systems by 2024; and

- Meters - replacement of the remaining electromechanical, solid state and early microprocessor meters by the end of the RCP.

…

126. This strategy results in an aggressive technology driven replacement program. The strategy does not take into account the specific risks associated with each site and instead focusses on target replacement quantities.

The EMCa report has incorrectly claimed that the secondary systems asset replacement program, which includes protection devices, is "an aggressive technology driven replacement program", when in fact TransGrid has put forward a condition and compliance based replacement program.

TransGrid notes that secondary systems renewal projects have been developed by consolidating a range of replacement plans that apply to specific families of equipment, for example, of the same make, model and type. The need statements and option evaluations for these have been provided to the AER in the supporting documentation for asset strategy programs. TransGrid seeks clarification as to whether EMCa has had regard to the documentation for these asset strategy programs in forming its view.

The EMCa report appears to have not had regard to the information provided by TransGrid in the condition assessments and asset management strategy that demonstrated the condition and compliance drivers for the program.

129. The substation and secondary renewal programs will result in the replacement of some of the more modern systems at the site. Therefore, the number of scheme replacements will be more than those shown in Table 5. For example, in the substation renewal project secondary assessments there may be 75% of schemes that are targeted for replacement, thus the actual number retired will be 25% higher. The extent of the renewals programs will also potentially generate many spares.

EMCa's figure of 75% of schemes that are targeted for replacement is purely hypothetical. TransGrid can demonstrate, if consulted, that the average expired percentage service life per device at the stated need date for each project is generally around 90% or higher. Therefore, TransGrid rejects EMCa's hypothesis that the extent of the renewals programs will generate many spares, and notes that it is made without regard to the evidence and without requesting information on which to base analysis.

131. Project-specific documentation to describe asset condition, options and any options evaluation was sparse. There were no details of specific performance issues associated with the secondary equipment at each site. The assessed number of secondary assets to be replaced at each site was based on TransGrid's technology replacement strategies.

As discussed in the response to paragraph 126 above, secondary systems renewal projects have been developed by consolidating a range of replacement plans that apply to specific families of equipment, for

example, of the same make, model and type. The need statements and option evaluations for these have been provided to the AER in the supporting documentation for asset strategy programs. TransGrid seeks clarification as to whether EMCa has had regard to the documentation for these asset strategy programs in forming its view.

132. The ANN 132kV substation was commissioned in 1981. The control cables are in good condition and the secondary systems condition assessment report states that approximately half the protection relays are targeted for replacement. However, the only option considered is a full secondary system replacement. The two options considered only relate to the delivery method. Other options should have been considered, including: (i) interim works to enable the deferral of the project; and (ii) an option for more targeted replacements. The age of this station should not warrant a complete secondary systems replacement as proposed. We consider that, on a reasonable interpretation of the documentation provided, prudent executive management or Board review would seriously consider implementation of alternate options or deferral of this work.

The EMCa report has stated that, “The age of this station should not warrant a complete secondary systems replacement as proposed”. However, all metering systems have exceeded their economic service life, the telecommunications infrastructure is no longer fit for purpose, the control systems are original as installed in 1981, all feeder protection schemes require substantial modification due to a requirement for protection intertripping to meet current critical clearance times, and the 50V DC power supplies need to be duplicated.

TransGrid can demonstrate, if consulted, that the average expired percentage service life per device at the stated Need Date of 2017 for this project, for protection and metering systems, is 90%.

As ANM substation supplies only one customer, TransGrid has sought and gained agreement from that customer to undertake only minimum secondary system replacements, on the understanding that the site will carry increasing risks compared to the remainder of TransGrid’s network.

133. The Beryl 132kV substation was commissioned in 1976. It is similar to ANN as the secondary cables are satisfactory. In this case, 74% of the protection relays and 30% of the metering relays and the control system are targeted for replacement. However, only the complete replacement option was considered.

EMCa stated that for Beryl, only a complete replacement option was considered. This is incorrect. TransGrid considered two options for the secondary systems replacement at Beryl and selected the option that retains the use of existing low voltage cabling. Further, all metering systems were specifically excluded from both options that were considered.

The average expired percentage service life per device at the stated Need Date of 2020 for this project is 89%.

The EMCa report has stated that that 30% of the metering relays have been targeted for replacement. This is incorrect. In fact, the existing metering systems have 50% remaining economic service life and TransGrid's proposal was to exclude the metering from the secondary systems replacement works and retain all existing panels (refer OFS-6013E Section 2.6.2).

134. The Liddell 330kV substation was commissioned in 1970. The secondary cables are in good condition and the condition assessment reported that approximately 75% of the secondary systems are targeted for replacement. Again, only the complete replacement option was considered. The Options Evaluation Report stated that the project can be delayed by two years (i.e., defer to 2020) provided a maintenance cycle is carried out. However, in TransGrid's proposal, the project was only delayed by one year to 2019.

EMCa claimed a discrepancy in the need date for Liddell secondary systems replacement between the investment documentation (2020) and revenue proposal (2019). TransGrid has not been able to find this discrepancy, and observes that the investment documentation and revenue proposal are aligned with the date of 2020.

The average expired percentage service life per device for the control, protection and metering at the original need date of 2018 for this project is 94%.

135. The Sydney West 330kV substation was commissioned in 1965. It is a major hub in the network. The condition assessment stated that 70% of the secondary systems at the site are targeted for replacement. The site inspection report states that the secondary cables can last for one more secondary system cycle. However, the options chosen assume complete replacement of the cables. This is not in keeping with the TransGrid secondary systems strategy and cables of this age should be in reasonable condition. The complete secondary systems replacement was the only option considered and there is no risk assessment. Considering the age and technology of some of the secondary systems, coupled with the criticality of the station, some replacements are appropriate. However, the evaluations are insufficient to justify the total work scope and cost.

The EMCa report has ignored the substantial amount of coordinated high voltage construction works carried out in and around Sydney West substation, both within Endeavour Energy's 132kV network and within TransGrid's own 330kV network, during the previous regulatory control period and the early part of 2014. Much of this work commenced during the 2009-14 regulatory control period and has a construction program spanning a number of years.

The timing for secondary systems works has been driven by obsolescence and the HV augmentation programs driving use of new technology such as differential protection schemes. Savings have been realised by commissioning to new systems and carrying out an orderly cut-over from the old to the new substation automation systems. The original Feasibility Study (refer FS PSR 309 Section 1.2) for works at Sydney West notes that:

> The program for MCB installation proposed in this feasibility study is structured to enable these bays to be commissioned directly into the new 330kV modular building. This will remove the requirement for the significant re-work were these secondary system changes made in the existing control room and replaced a short time later.

The EMCa report has suggested that 70% of the systems are were targeted for replacement. TransGrid can demonstrate that the average expired percentage service life per device at the stated Need Date of 2016 for this project was 85%.

Supporting Evidence for Decision

The Sydney West Secondary Systems Replacement was part of a suite of projects associated within the Western Sydney Supply Project (WSSP), which commenced in 2010 and was largely completed in the last regulatory control period. Need ID 64 was presented as a Continuing Need, to ensure that works on the Sydney West SSR continued in the 2014-19 regulatory control period.

A number of incidents have occurred over the last few years that support the continuation of works at Sydney West. Table 7 lists reliability incidents that have occurred at Sydney West due to faulty secondary systems devices or cabling issues.

Table 7
Incidents at Sydney West

Incident	Date	Load Lost
132kV A2 Bus tripped. No protection flags.	9 December 2014	50MW
No.2 330/132kV Transformer tripped. No protection flags.	16 August 2014	
No.5 330/132kV Transformer tripped. Faulty instantaneous overcurrent relay.	18 December 2012	33MW
No.5 330/132kV Transformer tripped. Spurious “Low SF6 alarm” on CB4452. Rodent damage to cable.	2 July 2012	

As can be seen, Sydney West is experiencing load interruptions due to spurious trips with no protection flags recording an event, faulty relays, and due to rodent damage to control cables.

Secondary Systems Condition

A great deal of high voltage augmentation work was being carried out as part of the Western Sydney Supply Program, which has resulted in numerous changes in the 330kV switchyard at Sydney West. The existing control room is very crowded and the moves and changes associated with the WSSP HV construction works have been considerably simplified by being able to be commissioned onto new control systems rather than attempting to create space for an orderly cut-over in the existing crowded control room.

Sydney West does not have a unified substation automation system and relies on several different systems spanning several generations of technology. The Toshiba and MD1000 have exceeded their economic service life and are no longer supported. The current hardware spans 4 generations of equipment installed from the 1960's to present day. The Condition Assessment NACA-3003 notes that at the completion of the approved 330kV and 132kV yard projects all control equipment will have been replaced or upgraded.

TransGrid's telecommunications systems are not included in the replacement works.

Control Cables

Sydney West substation is similar in age and condition to Canberra substation, equipment date and overall condition.

The EMCa report includes the following statement:

> The site inspection report states that the secondary cables can last for one more secondary systems cycle. However the options chosen assumed complete replacement of the cables. This is not in keeping with the TransGrid secondary systems strategy and cables of this age should be in reasonable condition. The complete secondary systems replacement was the only option considered

TransGrid cannot locate the reference within Condition Assessment NACA 3003 Rev 0 that supports this statement. The Condition Assessment notes that the cables were 47 years old in 2012 (refer NACA-3003 Section 1.1) and that they have been heavily damaged by rabbit and other rodent activity. It estimates that the cables have about 10% of remaining service life, due to accumulated damage (ibid Section 1.1). The Condition Assessment further notes the deteriorating condition of the cable trenches (ibid Section 1.2).

Given that the project evaluation studies expected a 5 year project period, the control cables will reach the end of their service life when they are being replaced in 2016.

Condition Assessment NACA-3003 notes that the existing control cabling is at capacity, and no additional control or indication functions can be provided. Establishment of a modern control system able to extend control and indication of all feeder bay elements including earth switches will require new control cabling (ibid Section 4.7).

Therefore, TransGrid rejects EMCa's comments on the Sydney West secondary system renewal.

136. For all of the above major projects, there was no consideration of alternatives to complete replacement - or options to delay the delivery timing. For example, there will be many opportunities to use some of the assets being replaced as spares in order to extend the life of schemes at other stations. There was no mention of reusing spares, or of a life extension option, in any of the strategy documents reviewed.

137. We find that the substantial increase in the complete replacement of secondary systems is not well justified. The proposed repex allowance should be reduced in order to encourage the efficient consideration of partial replacements at some sites and the selection of life extension options through the reuse of replaced equipment.

All reviewed projects that were subject to the current Corporate Governance Process included a discussion of the "Do Nothing" option – relying solely on maintenance replacement of irreparably damaged devices – in the Option Evaluation Report.

For secondary systems replacement projects, need dates have generally been selected where the average expired age of equipment is approximately 90% or higher.

With regard to the reuse of spares, the EMCa report portrays that up to 30% of removed devices can then be used as spares. However, TransGrid has noted that significantly lower amounts of spares can be retained for future use when taking into account the effective age at time of removal. TransGrid has been using swapped out units as emergency spares, and had already factored this practice into its replacement forecasts. However, TransGrid has found that this practice has not generated the quantity of spares suggested by EMCa. Further, the spares taken from substations cannot be expected to be used in new designs as they do not integrate with the new technologies and as such can only be used for emergency situations before they become ineffective. The cost implied in reuse of spares does not take into account the design, panel, and installation costs associated with reusing old technology.

138. From the review of the project information, we found evidence of systemic forecasting and scope bias, including:

- projects that could be reasonably deferred; and
- projects that could reasonably be reduced in scope.

139. By examining this sample of expenditure, it is evident that the biases in terms of scope and risk have led to an overestimate of the proposed expenditure. We consider that these biases reflect systemic issues and are likely to reasonably exist in the remainder of this replacement capital expenditure category.

140. Based on our analysis of this sample and the impact of systemic issues that we found, we consider that a reduced level of expenditure is a more reasonable indicator of a prudent level of expenditure. We do however find that there is sufficient basis for increasing the level of total expenditure from the level of the last RCP.

Based on the responses to the preceding paragraphs, TransGrid rejects EMCa's findings relating to secondary system renewals, and considers that EMCa has made many of its assertions with incomplete, inaccurate or misleading regard to the information TransGrid provided the AER accompanying its revenue proposal.

141. It is our view that the over-estimation of required expenditure is in the order of 20% to 30% within this project category. We consider that a corresponding adjustment to the replacement capital expenditure that TransGrid has proposed for this project category would more reasonably reflect a prudent and efficient level of expenditure.

142. We consider that TransGrid can make reasonable use of life extension strategies and consideration of alternatives to the complete renewal of all secondary systems at the sites.

EMCa has not provided any analysis to support its recommended reductions. Aside from the change to the scope at ANM, which has been incorporated into the forecasts in the revised revenue proposal, TransGrid does

not consider that EMCa has justified a reduction in secondary systems renewal expenditure and considers that the forecast expenditure in its revised revenue proposal is a suitable forecast.

3.4.5 Communications Upgrades

EMCa reviewed two optical ground wire (OPGW) projects, one protection and communication replacement project and one spur microwave system replacement project.

148. We consider that the proposed work has been aggregated at too high a level with a single risk assessment and options analysis, rather than considering the justification of individual projects and associated expenditure. The risks specific to supply reliability as a result of congestion and capacity constraints of the existing microwave bearer are not detailed for each project. A single option to implement the OPGW strategy is presented. Benefits and significance of timing of the expenditure were not adequately justified.

149. We consider that options to defer some of this work into subsequent regulatory periods were not adequately considered. We found insufficient evidence to support the justification of an increase in proposed expenditure for OPGW projects.

TransGrid notes that one of the key outcomes of this work is to establish fault tolerant communications rings, which cannot be established by individual projects, thus its consideration as a strategy as a whole. The establishment of fault tolerant communications rings would be hindered if some of the works proposed for 2014/15 to 2017/18 were deferred.

Further, the *Infrastructure Development and Renewal, Strategy and Objectives – Telecommunications* provided as part of the investment documentation clearly places the proposed expenditure in the next five years in the context of a 15 year strategy that has been considered for each area of the state. Deferral of some of this work out of the 2014/15 to 2017/18 period would have flow-on effects to TransGrid's ability to deliver its strategy over the next 15 years.

Therefore, TransGrid does not consider that EMCa's conclusions on communications projects are reasonable.

152. By examining this sample of expenditure, we found that there are biases evident in terms of scope and risk that have led to an over-estimate of expenditure. We consider that these biases reflect a systemic issue and are likely to reasonably exist in the remainder of this expenditure category.

153. Based on our analysis of this sample, and the impact of systemic issues found, we consider that the level of expenditure during the last RCP is a better indicator of a prudent level of expenditure. We remain unconvinced of the need for an increase.

154. It is our view that the over-estimation of required expenditure in the forthcoming RCP is in the order of 50% to 60% within this project category. We consider that a corresponding adjustment to the replacement capital expenditure that TransGrid has proposed for this project category would more reasonably reflect a

prudent and efficient level of expenditure.

EMCa has not provided any analysis to support its recommended reductions. Given this lack of justification, and the issues TransGrid has found with EMCa's observations above, TransGrid does not consider that EMCa's reductions are justified.

3.4.6 Transmission Line Rebuilds

EMCa reviewed two wood pole replacement projects (Lines 99F and 96H), one steel tower line life extension project (Line 22) and one partial rebuild project (Line 99J).

TransGrid notes that EMCa has referred in its report to transmission line projects as rebuild projects. However, TransGrid does not consider that this is an appropriate description of these projects, as TransGrid has considered and in many cases proposed low cost options to avoid rebuilds where there is a prudent and lower cost option.

158. The information provided indicated that TransGrid spent less than half of its previously proposed expenditure on lines and lines related projects in the previous RCP.

This observation is incorrect in relation to transmission line rebuilds, which is within the scope of this review.

It is correct in relation to total expenditure on transmission lines including augmentation projects, due to the deferral of a number of augmentation projects in response to the change in peak demand.

By quoting figures that are beyond the scope of its review, EMCa is creating and perpetuating misperceptions that it has taken into account when drawing conclusions.

159. We find that the need for proposed refurbishment of the steel tower lines is prudent. However, we consider that aspects of the scope of a sample of the projects have been engineered conservatively at this initial scoping stage and that the risk assessments should be expanded to include:

- consideration of specific tower conditions;
- improved justification of the approach to only treat tension towers and prioritisation across the nominated lines; and
- consideration of a risk based approach to tower treatment across the network.

TransGrid advises that its estimates have been prepared to ±25% accuracy and reflect the most likely cost of the works. Further, the risk assessments reflect the consideration of the condition of individual towers, as EMCa has already been advised.

160. Whilst we support the need for transmission line wood pole replacement projects, we consider that:

- the case to rebuild entire lines is not compelling and leads to a high estimate where this is

proposed. We consider that greater consideration of targeted replacement of individual poles or poles within line sections of the line may lead to a more efficient estimate;

- the information provided was insufficient to conclude that there was a reasonable expectation of increasing levels of pole defects and an increased risk to reliability of supply, as stated by TransGrid. This is further evidenced by TransGrid's view that, for some projects, the defect rate is manageable;
- other risk mitigation options - such as pole reinforcement (or nailing) - could be considered for application to some lines and line sections as undertaken by other TNSPs at 132kV; and
- whilst it may be efficient to package requirements together within a single project, components to address a low span / clearance requirement and opportunities to install OPGW should be, where included, justified separately.

TransGrid had proposed four lines for wood pole replacements and upon review after the draft decision, considers that a more targeted option as suggested by EMCa may be suitable for two of the four lines, 99F and 99J. TransGrid has therefore removed the pole replacement expenditure for those two lines from the capital expenditure forecasts, and added operating expenditure for targeted treatments in this revised proposal.

TransGrid notes that pole reinforcement or nailing is carried out in distribution networks. However, as the failure of a transmission structure has a more significant impact than failure of a distribution structure, nailing is not considered to be the best option for poles of suspect condition.

The main TNSP of which TransGrid is aware that reinforces 132kV poles is Western Power. TransGrid notes that the Western Australian Auditor General, in a recent report, has found that:

> Western Power's management of its wood pole network has been subject to seven inquiries and assessments by regulators in the last five years (Figure 1 overleaf). A significant recent inquiry, completed in 2012, by the Public Administration Committee found:
>
> > "…Western Power has clearly failed to adequately manage its wooden pole asset base to an acceptable level. This is most obviously demonstrated by its 'worst-in-class' status throughout Australia."

TransGrid is concerned that EMCa is recommending a practice that is mainly used by a "worst-in-class" performer. TransGrid has some concerns that pole reinforcement is unproven for wood poles at transmission voltages such as 132kV as a routine asset management approach. However, as it is used in a limited number of circumstances, TransGrid is willing to accept an expenditure forecast that reflects the use of pole reinforcement in some circumstances.

TransGrid has justified low spans and opportunities to install OPGW separately, and consolidated needs that can be delivered together into optimised projects for delivery.

161. By examining this sample of expenditure, it is evident that the biases in terms of scope and risk have led to an overestimate of expenditure. We consider that these biases reflect a systemic issue and are likely to

reasonably exist in the remainder of this expenditure category.

162. Based on our analysis of this sample and the impact of systemic issues that we found, we consider that a reduced level of expenditure is a more reasonable indicator of a prudent level of expenditure. We do, however, find that there is sufficient basis for increasing the level of expenditure from the level of the last RCP.

163. It is our view that the over-estimation of required expenditure in the forthcoming RCP is in the order of 10% to 20% within this project category. We consider that a corresponding adjustment to the replacement capital expenditure that TransGrid has proposed for this project category would more reasonably reflect a prudent and efficient level of expenditure.

Having adopted EMCa's recommendation for targeted options for two of the transmission lines proposed for wood pole replacement, TransGrid considers that the forecast expenditure in its revised proposal is a suitable forecast without further reduction. EMCa has not provided any analysis to justify its proposed reductions in expenditure.

3.4.7 Other Replacement Expenditure

166. Based on our review of a sample of expenditure from the four major project groupings proposed, we consider that the remainder of the proposed replacement capital expenditure is likely to be subject to the same issues and bias that has led to an over estimate of proposed expenditure.

167. Accordingly, to reflect a prudent level of expenditure, we consider that it would be reasonable to make a pro rata adjustment to the 'other' replacement expenditure category. Any such adjustment should be applied at an aggregate level without change to any specific project or program.

168. Our review of the four samples of expenditure has identified evidence of issues and biases that contribute to an overestimate of expenditure within each of the four expenditure categories reviewed. Although we assessed each of the four project categories separately, we consider that the biases evident in the sample of projects reviewed reflect systemic issues. As such, it is reasonable to conclude that similar issues and biases are likely to exist in the remainder of the proposed replacement capital expenditure.

169. We estimate that these biases result in an over-estimate of the proposed level of expenditure, in aggregate across the four project expenditure categories reviewed. It is our view that this over-estimation, when considered in aggregate across the forecast replacement capital expenditure, is in the order of 20% to 30%. We consider that a corresponding adjustment to the replacement capital expenditure that TransGrid has proposed would more reasonably reflect a prudent and efficient level of expenditure.

TransGrid also notes that other categories of proposed replacement capital expenditure are different in nature to the categories reviewed by EMCa. For example, asset strategy programs relate to individual items of equipment, rather than aggregated renewals by location. Therefore, EMCa's assertion that options analysis was

limited to large, discrete options discussed above is not relevant to these types of projects. While TransGrid disagrees with EMCa's conclusions on its four main categories of review, even if there was merit in EMCa's conclusions, they would not similarly apply to all other categories of replacement expenditure.

4. Procedural Fairness

Further to the observations above, TransGrid has significant concerns with the process used by the AER and EMCa to undertake this review. TransGrid's specific concerns are that:

1. The AER had led TransGrid to understand that a more comprehensive review of the capital and operating expenditure in its revenue proposal would be undertaken. In particular, the AER provided an indication to TransGrid on 30 May 2014 that it would be given face to face meetings over four weeks for 2-3 days per week. On 18 July 2014 the AER advised TransGrid that the indicative dates for these meetings would be delayed by two weeks. On 13 August 2014 the AER advised TransGrid that it would be given only one day to meet with the AER and EMCa to discuss its replacement capital expenditure. This meeting took place on 25 August 2014.
2. TransGrid was not provided with the terms of reference from the AER to EMCa in advance of EMCa's review, despite requesting it. TransGrid has been provided with the terms of reference following publication of the draft decision. However, references to the terms of reference in the EMCa report do not always align with the terms of reference provided by the AER to TransGrid.
3. Section 2.4 of the EMCa report states the list of projects and programs that were identified for review. This list was provided by the AER to TransGrid after close of business on Friday 22 August 2014 for the meeting on Monday 25 August 2014, the next business day. This hindered discussion of these projects and programs in the one day meeting. Further, TransGrid did not receive any clarification questions from EMCa relating to any of the identified projects or programs subsequent to the meeting.
4. TransGrid identified 13 items of information to be provided to EMCa following the meeting. TransGrid provided this list to EMCa on 27 August 2014, and EMCa advised TransGrid on 28 August 2014 of 9 additional items of information to be provided. TransGrid provided all requested information to EMCa incrementally by 3 September 2014, 7 business days after the one-day meeting. With each set of information provided, TransGrid invited EMCa or the AER to respond with any further questions or follow-up clarifications.
5. TransGrid received no further questions or follow-up clarifications regarding its presentations on 25 August 2014 or any of the 22 items of information it subsequently provided. Further, EMCa and the AER did not raise with TransGrid any concerns regarding the adequacy of the information it provided or make requests for further information.
6. TransGrid requested several times to be able to discuss EMCa's findings with them. TransGrid was particularly concerned that as it had submitted 35,000 pages of documentation to the AER with the revenue proposal, to meet the requirements of the Regulatory Information Notice, it is possible that information EMCa would like would be within the documents but EMCa may need assistance to find it.

TransGrid considers that these concerns have led to an inadequate and ill-informed review by EMCa, on which the AER has placed significant weight in making its draft decision on capital expenditure.[29]

[29] AER, *Draft Decision: TransGrid Transmission Determination 2015-16 to 2017-18 – Attachment 6: Capital Expenditure*, November 2014, p6-28.