Attachment 1.16

Jacobs - System Capex and Maintenance Prudency Assessment

January 2015

Ausgrid revised regulatory proposal attachment

Networks NSW - Draft Determination Review

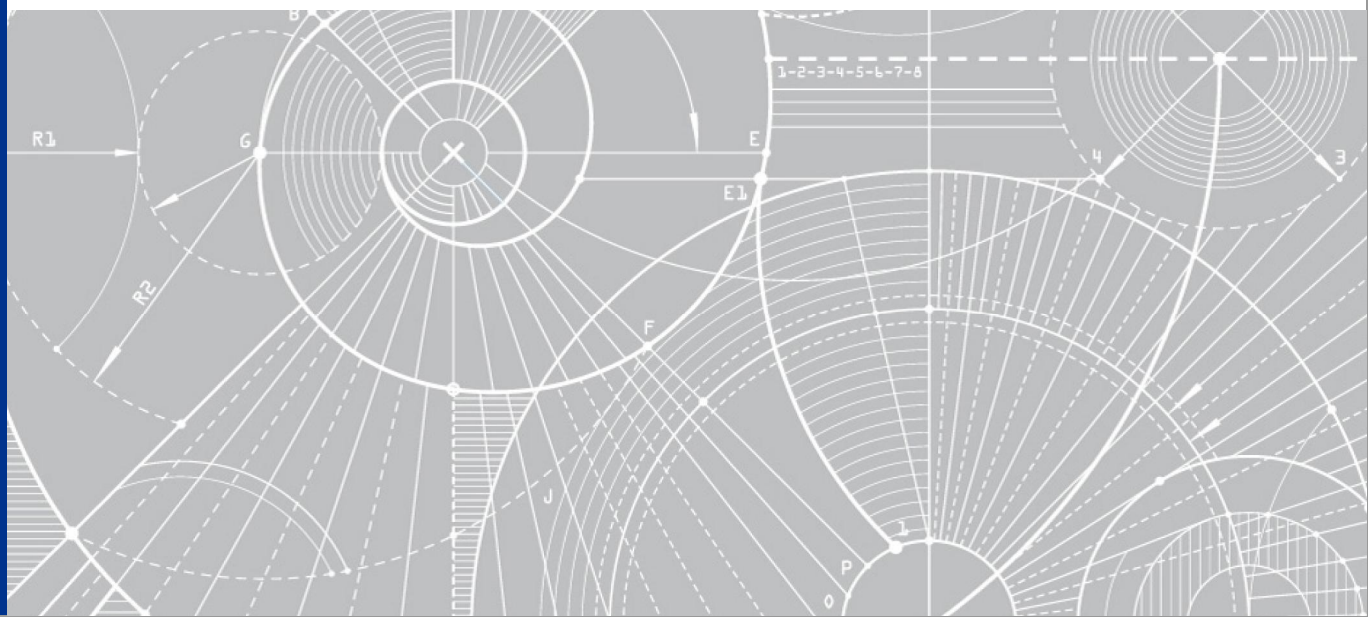
NETWORKS NSW

System Capex & Maintenance Prudency Assessment

Document No. 1 | Version No. 1

PO 4500919182

15 January 2015



JACOBS®

JACOBS

Networks NSW - Draft Determination Review

Project no:	RO008300
Document title:	System Capex & Maintenance Prudency Assessment
Document no:	Document No. 1
Revision:	Version No. 1
Date:	15 January 2015
Client name:	Networks NSW
Client no:	PO 4500919182
Project manager:	Adam Homan
Author:	Adam Homan, Andreas Laubi & Marnix Schrijner
File name:	C:\\RO008300_Networks NSW_System Capex & Maintenance Prudency Assessment_Version 1.docx

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
100 Christie Street
St Leonards NSW 2065 Australia
PO Box 164 St Leonards NSW 2065 Australia
T +61 2 9928 2100
F +61 2 9928 2500
www.jacobs.com

Document history and status

Revision	Date	Description	By	Review	Approved
Version No. 1	15/1/2015	Initial Issue	Adam Homan, Andreas Laubi & Marnix Schrijner	Mike Tamp	Ryan Dudley

Contents

Executive Summary

Networks NSW (NNSW) refers to a cooperative operating model across Ausgrid, Endeavour Energy and Essential Energy (collectively referred to as "the NSW DNSPs"). The objective of NNSW is to contain the costs of building, maintaining and operating the NSW electricity networks in a safe, reliable and sustainable manner.

The economic regulator for the NSW DNSPs that operate under the NNSW model, the Australian Energy Regulator (AER) has proposed a significant reduction in the expenditure of the NSW DNSPs in its Draft Determinations. As the businesses are allowed a regulated return on their investment, reductions in expenditure result in a corresponding reduction in revenue. The expenditure reductions indicated in the Draft Determinations apply to the upcoming regulatory period commencing 2015-19, as well as retrospectively to the 2014/15 transitional regulatory period. The reductions are compounded by expenditure already committed in 2014/15, where reductions applicable to 2014/15 would need to be achieved within 2015-19 in addition to reductions associated with the 2015-19 period.

NNSW has engaged Jacobs to carry out a prudency assessment on the system capital expenditure (capex) and maintenance operational expenditure (opex) of the three electricity Distribution Network Service Providers (DNSP) in NSW ("the NSW DNSPs").

The prudency assessment has been carried out in the context of the Draft Determinations handed down by the Australian Energy Regulator (AER) on 27th November 2014.

The AER's Draft Determinations have identified significant reductions are across both opex and capex, amounting to 35% and 37% of the combined expenditure proposed by the NSW DNSPs. Jacobs understands that, broadly speaking, the AER's reasoning for imposing these reductions is that they consider the Expenditure Proposals to be inefficient and overly risk averse.

The purpose of this prudency assessment is to objectively consider the constructs of the NSW DNSP's Expenditure Proposals against the findings of the Draft Determinations. The assessment focusses on the significant reductions that have been identified in the Draft Determinations. It highlights whether Jacobs considers the AER's approach and assessment to:

- Be reasonable and appropriate;
- Demonstrate apposite rigour and consistency; and
- Appropriately considers the robustness of the NSW DNSP's approach.

Jacobs has also sought to indicate any areas where it appears that the AER would not have been aware of the validity of the approach applied by the NSW DNSPs based on the information provided, and where Jacobs considers that the NSW DNSPs should provide more robust information to support the revised Expenditure Proposals. Following on from the specific prudency assessment items the review also provides commentary on the potential impacts if the expenditure reductions indicated within the Draft Determinations were to be imposed.

The key findings of the system capex and maintenance prudency assessment are summarised below.

1. The Draft Determinations misrepresent the approach taken by the NSW DNSPs to forecast expenditure

The AER has discounted the capex forecasts methodologies from the NSW DNSPs on the basis that the expenditure has been prepared from a bottom up methodology only and does not include a top-down assessment. However, a top down assessment has been undertaken by the NSW DNSPs in conjunction with Networks NSW that takes a strategic view of the risk versus expenditure profile of the capital programme.

The AER requires a top down assessment to:

- Evidence a holistic and strategic consideration or assessment of the entire forecast capex program at a portfolio level;

- Demonstrate how the forecast capex proposal has been subject to governance and risk management arrangements;
- Demonstrate how the timing and prioritisation of certain capital projects or programs has been determined over both the short and the long-term;
- Demonstrate that the capex drivers, such as asset health and risk levels, are well defined and justified. In particular, [the AER consider that] asset health and risk level metrics are key elements of capex drivers.

Whilst we acknowledge that there can always be improvements made to a system or process, it is Jacobs' view that the top down assessment being applied to the overall capital programme by Networks NSW in conjunction with the NSW DNSPs better reflects these requirements than the AER's own top-down assessment.

In addition, in developing the bottom-up forecasts, Jacobs notes that a number of top-down approaches are used for different expenditure categories as part of the individual DNSP's expenditure projection development process. Jacobs observes that this has been undertaken in order to do the very thing the AER claims is absent from the DNSP's forecasting processes, and appears to have been overlooked by the AER in its draft determination.

Furthermore, the AER uses the term "top-down" modelling to suggest a variety of analysis techniques aimed at identifying or framing an appropriate level of expenditure. Jacobs is of the view that the AER both inadequately define what is meant by this term, and themselves misunderstand the term and the various techniques associated with it. This in turn leads the AER to a view regarding the proposed expenditure that is ill-informed.

2. The Draft Determinations do not appropriately consider the spectrum of the Expenditure Proposal risk evaluation processes

The AER considers that the risk assessments applied by the NSW DNSPs are overly conservative and do not adequately justify:

- the timing; and
- the priority of its proposed expenditure forecast; and

The AER also consider that Ausgrid & Essential Energy lack a clear capex delivery strategy.

In our opinion, the risk assessments used in the development of the bottom up programmes appear to be broadly consistent with AS/NZS ISO 31000:2009 Risk management – Principles and guidelines. The risk assessment process appears to have been applied methodically across the projects and programmes in the capital forecast.

Networks NSW in conjunction with the NSW DNSPs apply the CASH/PIP risk prioritisation tool over the entire NSW DNSP capital programme. This tool provides a mechanism for regulating the risk assessments used by the three NSW DNSPs and for providing a prioritised capital programme.

In Jacobs' view it appears that the AER has reached a position on the risk adversity of the Expenditure Proposals based on isolated NSW DNSP risk assessment elements; without giving due consideration to the full spectrum of risk evaluation processes in effect to produce the final Expenditure Proposals. Also, in our opinion the AER does not appear to have apposite consideration of the impact that the revised expenditure levels have on the risk exposure of the NSW DNSPs.

3. The Draft Determination reductions to augmentation expenditure lack rigour

The AER has reduced the forecast augmentation expenditure for the NSW DNSPs based on two findings, a change to the demand forecast and a change to the DNSP Licence Conditions.

We consider the AER's reduction to augmentation expenditure based on a linear relationship between augex and demand growth to be reasonable for the purpose of forecasting expenditure where the

augmentation is driven only by underlying demand growth. That is, we consider it reasonable to assume for the purposes of forecasting expenditure at the distribution wide level, that the relationship between cost and demand (i.e. $/kVA) tends toward a linear relationship. However, in cases where augmentation expenditure is driven by new developments, the application of a linear relationship will misrepresent the cost of constructing the assets required. In these cases, the augex will be substantially higher than the forecast demand growth (i.e. a large capex requirement for a relatively small demand) as a base level of infrastructure does not exist.

The AER's finding and subsequent reductions relating to the changes to the Design, Reliability and Performance Licence Conditions rely on a consultant report which identifies a range of potential augex reductions of between 10 to 20%. The AER has subsequently applied reductions of 15%, 15% and 20% to Ausgrid, Endeavour Energy and Essential Energy. In our opinion, there appears to be a lack of analysis from which the basis for the application of 15% and 20% are made. Further, there is a lack of analysis from which the initial 10 to 20% value has been determined, other than "it would be reasonable to expect". Additionally, the identified range is only discussed with respect to Endeavour Energy whereas the comments for Ausgrid and Essential only indicate reductions "may be possible". The consultant report does not indicate any rationale as to why the reductions for Ausgrid and Essential Energy would be in the order of that expected for Endeavour Energy.

We understand that the NSW DNSP's reduced the augex requirements by $214M following a detailed review of the new Licence Conditions and consideration of cost-benefit factors. This amount was subsequently reflected in the revenue proposal augex forecasts; however, it is not clear from the consultant's report or the AER's draft determination whether this was taken into consideration before applying a further 15% and 20% reduction to the DNSPs proposed augex. Jacobs notes that the reduction of $214M represents 13% of the proposed augex which is within the consultant's "reasonable to expect" range.

In any case, it is our opinion that given the reductions made by the NSW DNSP's themselves are the result of a detailed assessment process, it is imprudent to simply speculate on a percentage reduction based on arguable reasonableness (as the AER and its consultants have appeared to have done). Instead, given the significance and the complexity of the drivers for network investment and the detailed modelling that is undertaken in order to derive the DNSP's expenditure projections, it is not unreasonable to expect that the potential for any additional reductions could only be assessed through the undertaking of further detailed analysis. To do otherwise demonstrates a shortcoming of due process in the review undertaken by the AER.

4. The Draft Determination reductions to replacement expenditure lack rigour

The AER's approach to replacement expenditure modelling uses a range of techniques to present supporting arguments. However, the decision on the majority of repex is ultimately made based on their Repex Model. The Repex Model is executed under multiple scenarios through the calibration of two variables – unit costs and replacement lives.

The AER has modelled multiple scenarios after which it has identified a "reasonable range" for the repex forecasts. However, Jacobs was not able to observe consistent criteria or discussion to substantiate the identified reasonable range. Notwithstanding the modelling of several scenarios, it appears that the AER has used the "Calibrated Forecast' to determine the figure for each DNSP's revised repex forecast. The Calibrated Forecast essentially accepts the unit costs proposed by the NSW DNSPs but substitutes the replacement lives of the assets with "calibrated" replacement lives which the AER has calculated.

Using this approach the asset lives appear to be calculated based on a number of variables including the previous regulatory period expenditure for the particular asset category, average age and a number of other factors. The approach is not transparent and we have not been able to replicate the calculation. A comparison of the "calibrated" replacement lives within the models shows that they have produced perverse outcomes with asset replacement lives being significantly higher in some cases and lower in others, than those that Jacobs' would typically expect to be realised by network businesses in any jurisdiction.

In summary, the draft determination for repex has been based on the output of non-transparent scenario modelling where the fundamental basis for the reductions appear to be a difference in the replacement lives provided by the distribution businesses to that which the AER has used in the modelling. Jacobs' review of the models made available by the AER shows that there are:

- A significant number of anomalies with the calculated replacement lives, which are observably illogical/erroneous upon visual inspection; and
- Material inconsistencies between the replacement lives applied to each DNSP.

Jacobs notes that it is also likely that the application of the model in the same manner in future years has the potential to produce perverse outcomes.

In any case, the repex forecasts produced by the NSW DNSPs were based on the sound application of asset condition assessments. In previous regulatory determinations, the AER has endorsed the approach of a bottom-up build based on actual condition and has been critical of only using age based modelling to forecast expenditure. In our opinion, the use of both bottom-up and top-down assessment are critical to determine a prudent level of replacement expenditure.

In Jacobs' view the analysis presented by the AER to discount the approaches applied by the NSW DNSPs does not robustly support its conclusions. Furthermore, the AER's substituted repex modelling approach:

- Does not apply the same rigour as the repex forecasts produces by the NSW DNSPs;
- Is poorly substantiated at key decision making points, such as the definition of a "reasonable expenditure range" and why the "calibrated forecast" repex model is most appropriate; and
- Reaches a repex forecast by adjusting the replacement lives of assets without justification as to why the replacement lives proposed by the NSW DNSPs are unreasonable, or why the AER's substituted replacement lives are more appropriate.

5. Opex maintenance determinations are likely to increase risk profiles above the "efficient frontier"

The AER has not accepted the opex proposals and has substituted their own forecast which is derived from modelling techniques using industry benchmarks. Based on the material presented, Jacobs is of the view that the AER has adequately demonstrated there is scope for efficiency gains within the NSW DNSP's opex categories. However, in carrying out its benchmarking process it does not appear that the AER has robustly substantiated a position on whether the asset age profiles (and asset health by proxy) of the 'efficient frontier' organisations are comparable or appropriate for benchmarking the NSW DNSPs.

Moreover, implicit in the benchmarking process is that the risk profiles of the 'efficient frontier' organisations are considered acceptable. Additionally, Jacobs notes that if an equivalent step-change in efficiencies cannot be found elsewhere in the NSW DNSP's opex programmes the maintenance programmes may be disproportionately affected. This would increase the risk profiles of the NSW DNSP's above that of the 'efficient frontier'.

Jacobs does not consider that the AER has effectively substantiated a position on the proportion of expenditure reductions which are expected to be absorbed through efficiency gains and the proportion absorbed through an increased risk profile.

Additionally, in substituting its approach Jacobs considers that due regard for areas of strong performance have been overlooked. This is particularly apparent with respect to the Failure Mode, Effects and Criticality Analysis / Reliability Centred Maintenance (FMECA/RCM) tool used by the NSW DNSPs to determine asset inspection frequencies.

The FMECA/RCM approach has a long development history, is supported by solid data and Jacobs considers its risk assessment approach among the industry leaders. Jacobs understands that the tool has received recognition from the asset management community as well as the AER in previous regulatory submissions.

Jacobs is of the view that a step change of opex reductions in the magnitude indicated by the Draft Determinations will inevitably lead to a reduction in asset maintenance, a significant proportion of which has been optimised using the FMECA/RCM approach. This situation would lead to a demonstrably increased risk profile and inefficient outcomes in the medium to longer term.

6. STPIS determinations are inconsistent with expenditure determinations

Ausgrid and Endeavour Energy have included reliability capex in their expenditure proposals. The AER has disallowed all proposed expenditure on the grounds that it has not been adequately justified. We consider this position to be reasonable and would expect that the DNSPs would demonstrate a robust business case in their revised expenditure proposals to justify this expenditure, especially in terms of their compliance with Schedules 2 & 3 of the NSW Design and Reliability Performance Licence Conditions.

Notwithstanding this, Jacobs has reviewed the performance target (STPIS) Draft Determinations and is of the view the AER's position relating to the STPIS targets does not take into account the effects of deteriorating asset health. Furthermore, we consider that a lack of rigour has been applied by extrapolating its conclusions relating to Ausgrid to the other NSW DNSPs.

Jacobs notes that in the Draft Determinations the AER has significantly reduced expenditure across both capex and opex. Jacobs considers that the NSW DNSPs cannot reasonably be expected to absorb the magnitude of expenditure reductions through efficiency gains alone. That is, Jacobs expects that the reductions will not be achieved without significantly reducing the number and size of projects and programmes. In Jacobs' opinion it is likely that large reduction to opex and capex programmes can be expected to have a negative impact on performance metrics.

It is Jacobs' view that the AER has not given due regard to the overall reductions in expenditure which will likely result in poorer reliability performance and difficulty to meet higher targets. In this scenario the NSW DNSPs are likely to be further penalised under STPIS for not meeting the performance targets.

Jacobs acknowledges that the AER's intent in imposing these reductions is to align the proposed expenditure levels with those that, in the AER's view, a prudent service provider would require. However, in making its draft determination we consider that the AER has not duly considered the associated risk profiles of the businesses. We consider that the AER's Draft Determinations could potentially lead to a situation where the businesses are unable to effectively mitigate the risks associated with their network assets. Critically, in our review of the AER's discussions supporting the Draft Determination expenditure reductions we were unable to observe robust consideration of critical risk factors such as bushfires and public safety; where, in Jacobs' opinion the overarching thread focuses on costs versus reliability of supply.

Our review of the Draft Determinations highlights a number of issues with respect to the AER's approach. Jacobs observed in the AER's expenditure reduction decisions apparent flaws in reasoning, poorly substantiated decisions, and an over-reliance on speculation and subjective reasoning in order to discount the NSW DNSP's Expenditure Proposals.

In Jacobs' view the magnitude of the reductions cannot be absorbed by efficiencies alone. The AER does not appear to have adopted a position on the proportion of expenditure that it expects the NSW DNSPs to absorb through efficiency improvements and the proportion absorbed though increasing the risk profile of their businesses. The capacity with which the NSW DNSPs have to absorb the reductions though efficiency gains is further compounded by the fact that the AER's determinations will apply retrospectively, which means that the first year of expenditure will be predominantly "locked in". This will have the effect of increasing the opex and capex reductions from 35% and 37% over 5 years to 44% and 46% over 4 years.

In Jacobs view it is not reasonable to expect the NSW DNSPs to achieve a step change in efficiency of this magnitude. This means that the majority of this expenditure reduction will translate into an increased risk profile rather than increased efficiency; at least within the short to medium term. If expenditure levels are reduced to the extent proposed, Jacobs is if the view that the benefits can be expected to be overwhelmed by risk costs in the longer term.

Additionally, the AER does not appear to have given due consideration to the trade-offs between different expenditure categories, for example a reduction in repex is likely to lead to an increase in the opex required to maintain the aging assets. Also, the AER does not appear to have considered the future impacts of the deferred expenditure. In Jacobs' view there is significant potential for this to lead to unmanageable capex programmes in future, particularly in the case of Ausgrid and Essential Energy's future repex requirements.

Analysis of the capex programme at risk due to the Draft Determination reductions shows that the largest proportion of projects at risk are for asset renewals, mandatory programs to meet minimum regulatory requirements, and strategic projects to meet short term needs. This suggests that the networks are likely to:

- Have difficulty meeting their regulatory, customer and other stakeholder obligations; and
- Begin showing signs of decreasing reliability and increasing risks to public safety within the 2014-19 regulatory period.

Preliminary analysis on the effects of the opex reductions suggests that there will be an associated increase in overall business costs that will outweigh the reductions by approximately 56% over the long term.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to assess the prudency of the NSW DNSPs system capex and maintenance (opex) Expenditure Proposals in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

The prudency assessment has been carried out based on information provided by NNSW, the NSW DNSPs, and other information made publicly available by the AER.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

1.1 Preamble

Networks NSW (NNSW) refers to a cooperative operating model across Ausgrid, Endeavour Energy and Essential Energy (collectively referred to as "the NSW DNSPs"). The objective of NNSW is to contain the costs of building, maintaining and operating the NSW electricity networks in a safe, reliable and sustainable manner.

The economic regulator for the NSW DNSPs that operate under the NNSW model, the Australian Energy Regulator (AER) has proposed a significant reduction in the expenditure of the NSW DNSPs in its Draft Determinations. As the businesses are allowed a regulated return on their investment, reductions in expenditure result in a corresponding reduction in revenue. The expenditure reductions indicated in the Draft Determinations apply to the upcoming regulatory period commencing 2015-19, as well as retrospectively to the 2014/15 transitional regulatory period. The reductions are compounded by expenditure already committed in 2014/15, where reductions applicable to 2014/15 would need to be achieved within 2015-19 in addition to reductions associated with the 2015-19 period.

NNSW has engaged Jacobs to carry out a prudency assessment on the system capital expenditure (capex) and maintenance operational expenditure (opex) of the three electricity Distribution Network Service Providers (DNSP) in NSW ("the NSW DNSPs").

The prudency assessment has been carried out in the context of the Draft Determinations handed down by the Australian Energy Regulator (AER) on 27th November 2014. The Draft Determinations detail the AER's preliminary rulings on the Expenditure Proposals submitted by each of the NSW DNSPs for the 2014-19 regulatory price control period. Jacobs understands that the NSW DNSPs are required to respond to the AER's Draft Determinations with revised Expenditure Proposals by 13th January 2015. The AER's Final Determinations will define the levels of expenditure for which the NSW DNSPs are permitted to pass costs on to consumers and derive a return on investment.

In the Draft Determinations the AER has identified significant reductions to the proposed expenditure of the NSW DNSPs. The reductions are across both opex and capex and amount to, respectively 35% and 37% of the combined expenditure proposed by the NSW DNSPs. Reductions of this magnitude would have substantial impacts on their business operations. Jacobs understands that, broadly speaking, the AER's reasoning for imposing these reductions is that, in their view, the Expenditure Proposals are considered to be inefficient and overly risk averse.

1.2 Purpose

The purpose of this prudency assessment is to objectively consider the constructs of the NSW DNSP's Expenditure Proposals against the findings of the Draft Determinations. The assessment focusses on the significant reductions that have been identified in the Draft Determinations. It discusses and provides professional opinion on whether the AER's approach and resulting assessments are:

- Reasonable and appropriate;
- Demonstrate sufficient rigour and consistency; and
- Appropriately consider the robustness of the NSW DNSP's approach.

Jacobs has also sought to indicate areas where it appears that the AER may not have been aware of the validity of the approach applied by the NSW DNSPs based on the information provided, and where Jacobs considers that the NSW DNSPs should provide more robust information to support the revised Expenditure Proposals.

Jacobs notes that each of the DNSPs will be carrying out internal bodies of work to demonstrate the prudency and efficiency of their Expenditure Proposals. This document is intended to be an overarching review that objectively considers the Expenditure Proposals from a higher level across the NSW DNSPs as a collective. It is

anticipated that this prudency assessment will accompany the submission of the revised Expenditure Proposals along more with the detailed supporting information developed by each of the NSW DNSPs.

Following on from the specific prudency assessment items the review also provides commentary on the potential impacts if the expenditure reductions indicated within the Draft Determinations were to be imposed.

1.3 Assurance statement

Jacobs affirms that the review documented in this report has been conducted to achieve the purpose outlined above in Section 1.2 and within the confines of the scope which is outlined later in Section 1.5.

Jacobs understands that all information and data relied upon to form our professional opinions expressed within this report can be made reasonably available to the AER or others (including foot-noted items) upon request to NNSW and the relevant NSW DNSP(s).

In forming our professional opinion with have relied upon:

- Information and data provided by NNSW and the NSW DNSPs.
- Information and data that is publicly available on the AER's website at the time of the review.
- Other information publicly available at the time of the review.

The key references relevant to the review are outlined in Section 1.5 and specific referencing is also provided as appropriate throughout the report. In addition to the review of information and data outlined above Jacobs has also interviewed NNSW and NSW DNSP personnel as appropriate to forming our professional opinion.

Jacobs assumes that all information and data, and responses provided by NNSW and the NSW DNSPs that we have relied upon for this review is complete and accurate. In forming our expressed opinions we have applied professional judgement to test the integrity of the presented material as appropriate.

Jacobs affirms that we have made all the inquiries that we believe are desirable and appropriate in producing the report and that no matters of significance that we regard as relevant have, to our knowledge, been withheld from the report. This affirmation is made in the context of the purpose outlined above in Section 1.2 and within the confines of the scope which is outlined later in Section 1.5.

The curricula vitae (CVs) of the Jacobs team members involved in producing this report are provided in Appendix E. The CVs are provided to give assurance on the qualification of the document authors – in terms of their education, training and experience in relation to the subject matter of the report – to provide the professional opinions expressed within this report.

1.4 Background

1.4.1 Networks NSW Context

The NNSW companies (the NSW DNSPs) are responsible for providing electricity services across the State of NSW and parts of southern Queensland. In FY12 they had annual revenue of $2.45 billion and 12,700 employees. The objective of NNSW is to contain the future costs of building, maintaining and operating the electricity network in a safe, reliable and sustainable manner. The combined network has over 800 major substations, 2.2 million poles and 190,000 smaller substations bound together by 279,000 kilometres of underground or overhead cable.

- Ausgrid supplies electricity to more than 1.6 million customers in Sydney, the Central Coast and the Hunter Region in New South Wales. In FY12 this network generated revenue of $1.12 billion and had 5,900 employees.
- Endeavour Energy manages an electricity distribution network for 950,000 customers or 2.1 million people across a network spanning Sydney's Greater West, the Illawarra and South Coast, the Blue Mountains and the Southern Highlands. In FY12 this network generated revenue of $0.76 billion and had 2,800 employees.

- Essential Energy is responsible for building, operating and maintaining Australia's largest electricity network delivering essential services to more than 860,000 homes and businesses across 95 per cent of NSW and parts of southern Queensland. It also has water services with its Essential Water business which delivers water services to around 20,000 people in Broken Hill, Menindee, Sunset Strip and Silverton, and sewerage services to Broken Hill.

1.4.2 AER Determination Background

The AER regulates the revenues of the DNSPs in eastern and southern Australia under the National Electricity Law (NEL) and National Electricity Rules (NER). The AER is required to determine the revenue allowance for the distribution network service providers under the National Electricity Rules (NER). The regulatory period for NSW is 5 years, from 1 July 2014 to 30 June 2019.

The AER's draft determinations for the 5 year period were published on 27 November 2014 for the NSW DNSPs. Networks NSW must submit a revised proposal by 13 January 2015 responding to issues raised in the AER's Draft Determination. The AER will take submissions from stakeholders and make a final determination by 30 April 2015.

The AER's draft determination impacts the revenue allowable by the businesses, including significant reductions to proposed opex and capex programs (including previously approved limits for 2014/15). The NSW DNSPs are permitted to recover revenue approved through prices for direct control services.

1.5 Scope

The scope of work includes a prudency assessment with respect to specific items of the NSW DNSP's Expenditure Proposals and the AER's Draft Determinations. It also extends to the provision of high-level commentary on the potential impacts associated with implementing the expenditure reductions outlined within the Draft Determinations. The scope of the prudency assessment is outlined with respect to the Expenditure proposals and Draft Determinations below.

1.5.1 Expenditure Proposals

The preparation of the Expenditure Proposals for the three NSW DNSPs; including the internal processes of each NSW DNSP and the overarching governance processes of NNSW. The expenditure categories and other areas of focus are outlined in Table 1-1 below.

Table 1-1: Scope of Work – Expenditure Proposals

Expenditure category	Areas of focus
Capex	• Overall programme preparation. • Risk assessments and prioritisation. • Replacement expenditure (repex). • Augmentation expenditure (augex). • Reliability expenditure, Service Targets Performance Incentive Scheme (STPIS), and interaction with other expenditure categories.
Opex	• Maintenance; with a specific focus on the application of the FMECA/RCM[1] tool used for maintenance scheduling.

Key References

The key reference documents relating to the Expenditure Proposals are as follows:

- Ausgrid – Regulatory Proposal 1 July 2014 to 30 June 2019, 30 May 2014
- Endeavour Energy – Regulatory Proposal to the Australian Energy Regulator, Delivering Better Value, 1 July 2015 to 30 June 2019, 30 May 2014

[1] FMECA/RCM = Failure Mode, Effects and Criticality Analysis / Reliability Centred Maintenance

- Essential Energy – Regulatory Proposal, 1 July 2014 to 30 June 2019, 30 May 2014

1.5.2 Draft Determinations

The AER's Draft Determinations for the NSW DNSPs and other associated material are made publicly available by the AER. The relevant "Draft Determination" documents with respect to each NSW DNSP and the Expenditure Proposal scope of work and other key references relating to the scope outlined above are identified in Table 1-2 below.

Table 1-2: Scope of Work – Draft Determinations

DNSP	Relevant Draft Determination Documents
Ausgrid	• AER – Draft decision Ausgrid distribution determination – Attachment 6 – Capital expenditure – November 2014 • AER – Draft decision Ausgrid distribution determination – Attachment 7 – Operating expenditure – November 2014 • AER – Draft decision Ausgrid distribution determination – Attachment 11 – Service target performance incentive Scheme – November 2014
Endeavour Energy	• AER – Draft decision Endeavour Energy distribution determination – Attachment 6 – Capital expenditure – November 2014 • AER – Draft decision Endeavour Energy distribution determination – Attachment 7 – Operating expenditure – November 2014 • AER – Draft decision Endeavour Energy distribution determination – Attachment 11 – Service target performance incentive Scheme – November 2014
Essential Energy	• AER – Draft decision Essential Energy distribution determination – Attachment 6 – Capital expenditure – November 2014 • AER – Draft decision Essential Energy distribution determination – Attachment 7 – Operating expenditure – November 2014 • AER – Draft decision Essential Energy distribution determination – Attachment 11 – Service target performance incentive Scheme – November 2014

Other Key References

The other key reference documents and files relating to the Draft Determinations are as follows:

- AER 2014 Annual distribution benchmarking report - November 2014_0
- Worley Parsons, Review of Proposed Augmentation capex in NSW DNSP Regulatory Proposals 2014-19, 17 November 2014
- EMCa – Technical Review of Regulatory Proposals, Review of Proposed Replacement capex in Ausgrid's Regulatory Proposal 2014-2019, October 2014
- EMCa – Technical Review of Regulatory Proposals, Review of Proposed Replacement capex in Endeavour Energy's Regulatory Proposal 2014-2019, October 2014
- EMCa – Technical Review of Regulatory Proposals, Review of Proposed Replacement capex in Essential Energy's Regulatory Proposal 2014-2019, October 2014
- AER Draft decision Ausgrid distribution determination - Ausgrid 2014 - repex model (calibrated - forecast) - November 2014
- AER Draft decision Endeavour Energy distribution determination - Ausgrid 2014 - repex model (calibrated - forecast) - November 2014
- AER Draft decision Essential Energy distribution determination - Ausgrid 2014 - repex model (calibrated - forecast) - November 2014

2. Draft Determination Overview

In the Draft Determinations the AER has identified significant reductions to the proposed expenditure of the NSW DNSPs. The reductions are across both opex and capex and amount to 35% and 37% of the combined expenditure proposed by the NSW DNSPs. Reductions of this magnitude would have significant impacts on their business operations. Jacobs understands that, broadly speaking, the AER's reasoning for imposing these reductions is that, in the AER's view, the Expenditure Proposals are considered to be inefficient and overly risk averse.

Table 2-1 and Table 2-2 below provide a summary of the NSW DNSP capex and opex proposals and the AER's corresponding Draft Determinations with respect to each.

Table 2-1: Summary of NSW DNSP capex Proposals and AER Draft Determinations

	Proposed Expenditure ($ M)	AER Draft Determination ($ M)	Difference ($ M)	Difference (%)
Ausgrid	$4,421	$2,256	-$1,875	-42%
Endeavour Energy	$1,746	$1,070	-$676	-39%
Essential Energy	$2,619	$1,934	-$684	-26%
Total	$8,786	$5,551	-$3,235	-37%

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

Table 2-2: Summary of NSW DNSP opex Proposals and AER Draft Determinations

	Proposed Expenditure ($ M)	AER Draft Determination ($ M)	Difference ($ M)	Difference (%)
Ausgrid	$2,888	$1,759	-$1,130	-39%
Endeavour Energy	$1,381	$1,068	-$313	-23%
Essential Energy	$2,332	$1,437	-$895	-38%
Total	$6,601	$4,263	-$2,338	-35%

(Source: Ausgrid Draft Determination, Attachment 7; Endeavour Energy Draft Determination, Attachment 7; Essential Energy Draft Determination, Attachment 7)

3. System Capex & Maintenance Prudency Assessment

3.1 Capex Forecasting Methodology

Overview

A key aspect of the NSW DNSP's capex forecasts is the methodology and governance processes which steer their preparation and refinement. These processes are the mechanisms used by the NSW DNSPs and NNSW to ensure the prudent development and prioritisation of capex programs in accordance with the requirements for 'Forecast Capital Expenditure' as defined by the National Electricity Rules (NER), clause 6.5.7.

The NER states that:

"the AER must accept the forecast of required capital expenditure … if it reasonably reflects … each of the following capital expenditure criteria:

1) *The efficient costs of achieving the capital expenditure objectives;*
2) *The costs that a prudent operator would require to achieve the capital expenditure objectives; and*
3) *A realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.*

(Source: National Electricity Rules, Version 66, clause 6.5.7 c – p. 664)

The AER has not accepted the capex forecasts of each of the NSW DNSPs and has subsequently revised them using its own methodology. The revisions result in significant reductions to the capex forecasts as shown previously in Table 2-1.

The Draft Determinations identify two common issues which are presented as reasons and findings for substituting the NSW DNSPs capex forecast methodologies with their own approaches.

The reasons and findings given within the AER's Draft Determinations are paraphrased as follows:

1) A bottom-up assessment but not a top-down assessment.

2) Overly conservative risk assessments which do not adequately justify:

- **a) The timing;**
- **b) Priority of its proposed expenditure forecast; and**
- **c) In the cases of Ausgrid & Essential Energy, lacks a clear capex delivery strategy.**

(Source: Ausgrid Draft Determination, Attachment 6 – p. 10; Endeavour Energy Draft Determination, Attachment 6 – p. 9; Essential Energy Draft Determination, Attachment 6 – p. 10)

The AER has stated that these issues are *"material to [the AER's] view that [it] is not satisfied that [the] proposed total forecast capex reasonably reflects the capex criteria"* (Source: Ausgrid Draft Determination, Attachment 6 – p. 10; Endeavour Energy Draft Determination, Attachment 6 – p. 9; Essential Energy Draft Determination, Attachment 6 – p. 10)

Prudency Assessment

Jacobs has reviewed the capex forecasting methodologies used by NNSW and the NSW DNSPs. Their approaches are discussed here with respect to the two common issues identified within the AER's Draft Determinations noted above, and the reasons and findings for not accepting the NSW DNSP's capex forecasting methodologies but instead revising them using its own methodology.

1) AER finding: *A bottom-up assessment but not a top-down assessment*

Jacobs has reviewed the approaches used by the NSW DNSPs and has found that at a high level the capex forecast methodology is consistent between all three businesses. **The review shows that, contrary to the**

AER's finding, the NSW DNSPs have used a two-layered iterative approach that employs both a bottom-up and a top-down assessment to develop the capex forecasts. This approach is intended to ensure that each of the NSW DNSPs propose a capex forecast that is both prudent and efficient.

Jacobs understands that the approach can be broadly outlined as follows:

- A bottom-up baseline capex forecast is first established by each DNSP based upon an aggregation of the preferred investment options. Where the preferred options themselves are established based upon a refinement process which is intended to identify the most prudent and efficient option; in consideration of the range of credible options and non-network solutions, and other proposed expenditures.

  Jacobs notes that while a bottom-up approach is used to develop the majority of the baseline capex forecasts a top-down approach is also used to establish a baseline for certain expenditure categories where that is considered a more appropriate approach (e.g. network connections).

- A top-down assessment is then made on the baseline capex forecasts, using an iterative approach involving NNSW and the NSW DNSPs. The top-down assessment is intended to refine the capex forecasts based on a strategic view of overall risk profile and expenditure objectives; to ensure an optimisation of prudency and efficiency.

In Jacobs' view it appears that that AER, in reaching its finding that the NSW DNSPs have applied a bottom-up assessment but not a top-down assessment, has overlooked the following:

- **The iterative top-down assessments between NNSW and the NSW DNSPs; and**
- **The development of the baseline capex forecasts for specific expenditure elements using a top-down approach.**

Jacobs has observed that this iterative assessment between NNSW and the NSW DNSPs is outlined in each of the NSW DNSP's Expenditure Proposals. Relevant extracts are provided below – refer to the identified documents for further detail.

- Ausgrid:

  "A key aspect of our forecasting method was to apply the outcomes of a prioritisation process that was centrally coordinated across the 3 NSW DNSPs [through NNSW]. The objective of the process was to identify prudent opportunities to defer or avoid capital expenditure based on an assessment of relative risk such that we could minimise our requirement for investment funding and better meet our goal of customer affordability."

  "A Board level review of the overall risk profile and the relationship between risk and different scenarios of expenditure identified the prudent level of capital investment which forms the basis of our expenditure forecast."

  (Source: Ausgrid – Regulatory Proposal 1 July 2014 to 30 June 2019, 30 May 2014 – p. 40)

- Endeavour Energy:

  "As part of the Networks NSW reform program, we have instituted a new Investment Governance Framework to review and rationalise our forecast capital program."

  "The Investment Governance Framework… provides a framework within which the Board [i.e. NNSW]… provides an independent and peer-review process to further test the proposed expenditure."

  "The ability to prioritise planned investments within Endeavour Energy is an important component of the governance framework."

  "[The prioritisation model] provide[s] the maximum flexibility to the Board and management to balance financial risks and prioritise investments that most effectively mitigate network risks."

  (Source: Endeavour Energy – Regulatory Proposal to the Australian Energy Regulator, Delivering Better Value, 1 July 2015 to 30 June 2019, 30 May 2014 – p. 53)

- Essential Energy:

> *"A new investment governance process has been implemented to review and rationalise our forecast program [through NNSW]. A prioritisation model is being used for all network projects and programs. This model uses an algorithm based on an assessment of risks and provides a ranking outcome for the proposed capital expenditure projects. This prioritisation is used to finalise the capital works program for each year based on an acceptable level of risk. This process ensures that the capital expenditure program is efficient and prudent, and meets our objective of keeping charges as low as possible."*
>
> (Source: Essential Energy – Regulatory Proposal, 1 July 2014 to 30 June 2019, 30 May 2014 – p. 54)

The top-down assessment is concisely illustrated by the following figures which Jacobs understands accompanied the NSW DNSP's Expenditure Proposal Submissions to the AER. Jacobs understands that the assessment involved multiple workshops over an extended period of time, and ultimately resulted in reductions to the combined capex forecast for the NSW DNSPs, based on a top-down strategic view of overall expenditure and risk (i.e. cost vs. benefit) profiles. The programme cut-off was applied across the NSW DNSPs based on the Weighted Risk Ranking. Jacobs understands that the corresponding capex reductions from initial proposals for each business were 24% (Ausgrid), 15% (Endeavour Energy) and 16% (Essential Energy). The overall reduction due to risk prioritisation across NSW was 20.4%. (Source: Advice from NNSW – email – Steve Buncombe, Confirmation of EMCa PIP cutoff quotes, 06/01/2015 9:31am)Whilst there would be internal process variances within the NSW DNSPs, Ausgrid have advised that their process can be summarised as follows:

- *"High level [Statement of Corporate Intent] SCI numbers were prepared based upon historical trend numbers. These numbers formed the starting point for the CASH list and prioritisation process.*
- *The high level CASH project List allowed for project comparison , reassessment, regrouping and re-evaluation of risk within the businesses*
- *Based on the revised cash list Ausgrid proposed a program representing 80% of the [Statement of Corporate Intent] SCI capex for the board based on potentially acceptable risk levels and revised demand forecasts. Information was presented to the board in a way that allowed the development of a mutually agreed outcome. The board decreased proposed capex a further 4% based on both an understanding of risk and recognition of capex opex trade-offs particularly around maintenance opex and replacement capex.*
- *The revised capex numbers formed the basis for the capex proposal in the May 2014 regulatory proposal.*
- *The process reflects a governance process that incorporates Board level, executive management and officer level involvement in risk evaluation and program prioritisation."*

(Source: Advice from NNSW – email – Robert Smith, Ausgrid Feedback on Report, 05/01/2015 5:58 pm)

Figure 3-1 below shows the combined baseline capex expenditure forecast for the NSW DNSPs and highlights the NNSW Board's strategic consideration of the overall risk versus expenditure profile; where the area under consideration is between the high to medium risk categorisation at 70-80% expenditure profile compared to the baseline capex forecast. Jacobs understands that NNSW undertook extensive workshops with the NSW DNSPs to assess the project/programs that would potentially be excluded or deferred to meet the strategic risk versus expenditure profile for the NSW DNSPs. Jacobs understands that the NNSW Board were informed of the process parameters and outcomes.

Also indicated in Figure 3-1 is the implied expenditure/risk profile with the combined capex forecast reduced to $5.55 billion in accordance with the AER's Draft Determinations. **Jacobs has not observed a robust discussion in Draft Determination documents that gives due consideration to this potential change to the combined risk profile of the NSW DNSPs should the indicated capex reductions be adopted.**

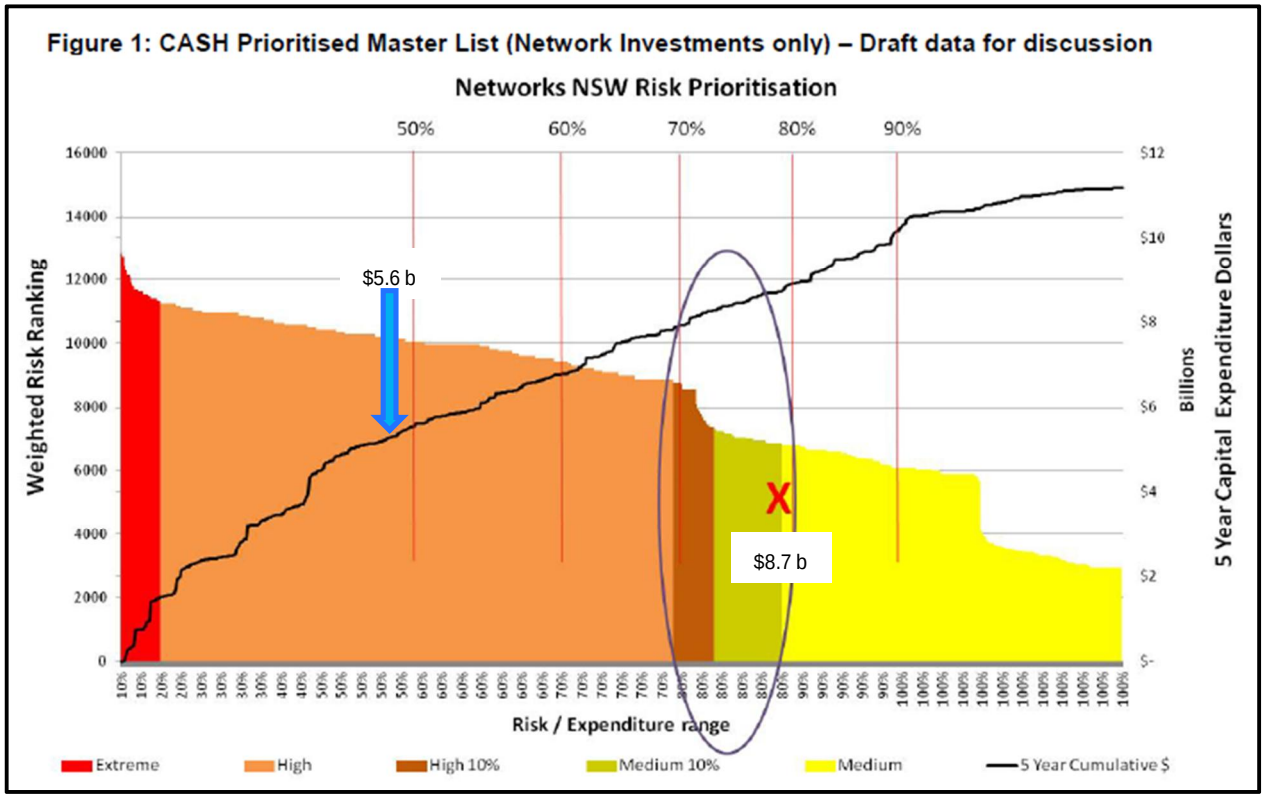
The Draft Determinations state that *"We are not approving a particular category of capex or a particular project, but rather and overall amount"* (Source: Ausgrid Draft Determination, Attachment 6 – p. 10; Endeavour Energy Draft Determination, Attachment 6 – p. 9; Essential Energy Draft Determination, Attachment 6 – p. 10). However, in Jacobs' view the two are inextricably linked and it would be imprudent to significantly reduce expenditures without giving due consideration to the impacts on the overall risk profile, and given that the programs have been subject to the risk prioritisation process noted above. Jacobs recognises that there would be potential to reduce expenditures

while maintaining a prudent overall risk profile through improving efficiencies. However, the figure below illustrates the magnitude of indicated reduction against the overall risk profile; and Jacobs considers it unlikely that it would be possible for the NSW DNSPs to absorb the indicated expenditure reductions purely through increased efficiency, especially given that the programs for the first year of the 2014-19 period are largely locked in.

Jacobs acknowledges that the AER does not wish to make rulings at the individual project and programme level. However, we consider that it would be prudent to adopt a position based on understanding of costs versus benefits, especially given the magnitude of the reductions proposed by the AER. **In Jacobs' view this means that, in order to take a position on overall expenditure, a position should also be adopted on the overall risk profiles associated with that expenditure.**

A common thread throughout the determinations is that the AER believes the capex forecasts of NSW DNSPs are inefficient and overly risk averse. However, **the AER does not appear to have a demonstrable position on the proportions of the expenditure reductions that it expects can be absorbed through efficiencies and the proportion to be absorbed by increasing the overall risk profiles of the businesses** (through cutting or deferring projects and programs).

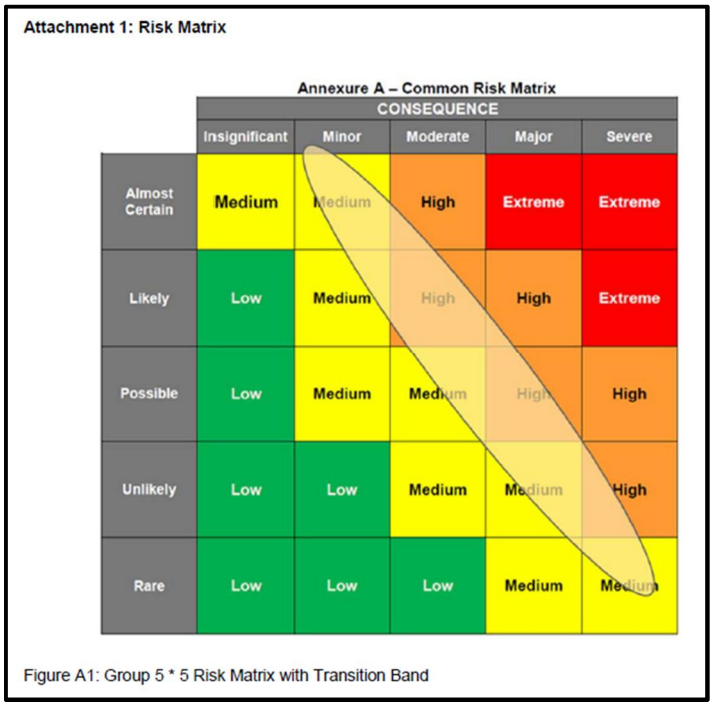
Figure 3-1: Combined baseline capex forecast for the NSW DNSPs – strategic risk/expenditure profile highlighted at high-medium / 70-80% and implied risk / expenditure profile with expenditure reduced to $5.5 b



(Source: Networks NSW – BOARD PAPER FOR MEETING ON 30 OCTOBER 2013, ITEM 4.2: Five Year (15-19) Investment Plan Scenarios, DATE: 14 October 2013 – p. 2)

Figure 3-2 below illustrates the risk profile of the projects and programs that were given consideration for by NNSW and the NSW DNSP's for exclusion or deferral to meet various strategic risk/expenditure profiles (high-medium and 70-80%). Jacobs understands that extensive analysis was undertaken to determine an appropriate cut-off point that would ensure a prudent and efficient overall capex forecast for the NSW DNSPs. The complete Risk Matrix is provided in Appendix A.

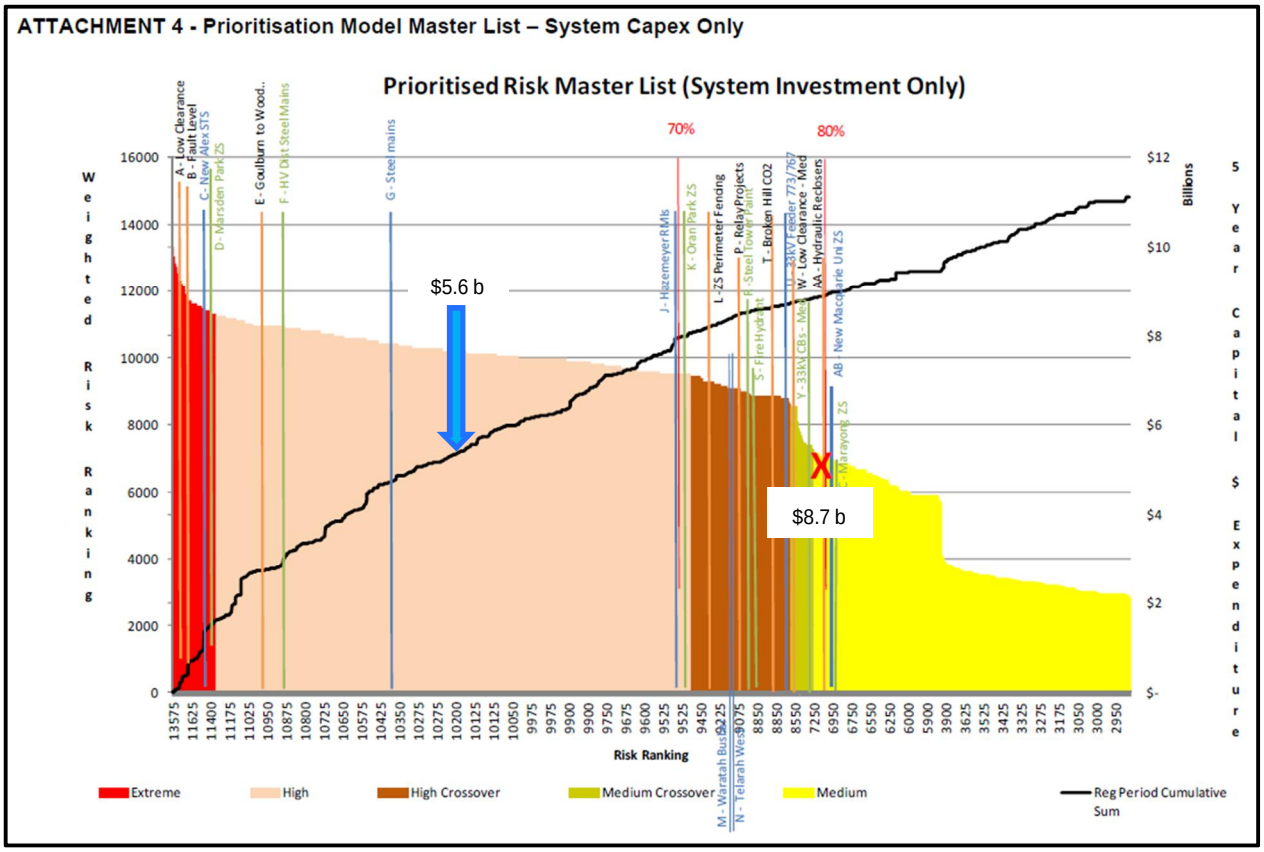
Figure 3-2: Common risk matrix – highlighting the strategic risk/expenditure profile highlighted at high-medium/70-80%



(Source: Networks NSW – BOARD PAPER FOR MEETING ON 30 OCTOBER 2013, ITEM 4.2: Five Year (15-19) Investment Plan Scenarios, DATE: 14 October 2013 – p. 6)

Figure 3-3 below provides an illustration of the analysis undertaken to determine the appropriate cut-off point to meet the top-down strategic position on risk versus expenditure. It indicates the individual projects and programs that would be excluded or deferred based on the expenditure cut-off point.

Figure 3-3: Combined baseline capex forecast for the NSW DNSPs – strategic risk/expenditure profile identified at 80%



(Source: Networks NSW – BOARD PAPER FOR MEETING ON 27 NOVEMBER 2013, ITEM 3.2: Five Year (15-19) Investment Plan Approval DATE: 20 October 2013 – p. 14)

The process resulted in a cut-off point of 79.61% and a reduction to the baseline capex forecasts of approximately $2.2 billion. (Source: Networks NSW – BOARD PAPER FOR MEETING ON 27 NOVEMBER 2013, ITEM 3.2: Five Year (15-19) Investment Plan Approval DATE: 20 October 2013 – p. 14)

This strategic position on risk versus expenditure was taken at the NNSW Board level with respect to the combined capex forecasts of the three NSW DNSPs. Jacobs understands that the application of a cut-off point with a consistent Weighted Risk Ranking across the NSW DNSPs resulted in the following outcomes once applied to the DNSPs programmes individually:

- Ausgrid: 24% reduction to baseline capex forecast.

  (Source: Advice from NNSW – email – Steve Buncombe, Confirmation of EMCa PIP cutoff quotes, 06/01/2015 9:31 am)

- Endeavour Energy: 15% reduction to baseline capex forecast.

  (Source: Advice from NNSW – email – Steve Buncombe, Confirmation of EMCa PIP cutoff quotes, 06/01/2015 9:31 am)

- Essential Energy: 16% reduction to baseline capex forecast.

  (Source: Advice from NNSW – email – Steve Buncombe, Confirmation of EMCa PIP cutoff quotes, 06/01/2015 9:31 am)

In addition to the top-down assessments applied to the overall capex forecasts as a key element of the NSW DNSPs methodology, Jacobs also notes that each DNSP has also forecast specific capex categories using a top-down approach to formulate the baseline forecasts – which have also then been subject to the top-down assessment from the total capex program level. These capex categories include areas such as customer connections, reliability investments and distribution capacity planning.

2) ***AER finding:*** *Overly conservative risk assessments which do not adequately justify:*

a) *The timing; and*

b) *Priority of its proposed expenditure forecast.*

c) *And lacks a clear deliver strategy (the capex delivery issue is specific to Ausgrid only).*

The AER's findings on the "overly conservative risk assessments" appear to be primarily based upon the technical consultant's review of the replacement expenditure (repex) proposals of each of the NSW DNSPs. Jacobs has reviewed the consultant reports relating to the three DNSPs as well as a sample of projects included in the capex programme.

All of the NSW DNSPs have methods for applying risk assessments as they develop their bottom up programmes. In our opinion, the risk assessments used in the development of the bottom up programmes appear to be broadly consistent with *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*. The risk assessment process appears to have been applied methodically across the projects and programmes in the capital forecast.

However, Jacobs notes that the consultant's report has highlighted some inconsistencies evident with the application of Ausgrid's risk assessment matrix. Jacobs understands that Ausgrid has applied its "operational risk matrix" consistently to all "planned replacement programs". Reactive programs were viewed as unavoidable costs and therefore did not have risk assessments undertaken. It is understood that a portion of planned projects were not assessed using the operational risk matrix – including switchgear and underground cable projects which were included in "area plans" (for project coordination purposes). In its revised Expenditure Proposal submission Jacobs observes that there may be opportunities for Ausgrid to better support the exclusion of some projects from the application of the risk assessment matrix. Further, in Jacobs' view it would be beneficial to demonstrate the alignment between any varying risk assessment techniques and the NNSW ("corporate") risk matrix which overarches all three NSW DNSPs.

Jacobs notes that the risk assessment and prioritisation process occurs at two levels; both within the DNSPs and also an overarching process applied iteratively with NNSW. In Jacobs' view it appears that the consultant's conclusions, and subsequently the AER's conclusions, are based predominantly upon an isolated review of the internal processes within the DNSPs. That is, it appears that **the AER has formed an overall opinion on the risk-averseness of the capex programmes based on the review of isolated elements of the process rather than consideration of the capex programme risk assessment and prioritisation process in its entirety.**

Critically, the conclusions do not appear to have been formed with appropriate consideration given to the CASH/PIP risk prioritisation tool applied in conjunction with NNSW over the entire NSW DNSP capital programme. This tool is independent of the NSW DNSP's internal risk assessments. It provides the calibrating mechanism for regulating the risk assessments used by the three NSW DNSPs and for providing a prioritised capex programme.

Jacobs understands that the CASH/PIP process uses the NNSW corporate risk assessment criteria which overarch the NSW DNSPs (noting that legacy and other situation-specific risk assessments are also used internally). Jacobs notes that the minimum probability / consequence criteria (for environmental and safety only) that would lead to a "high" risk rating are as shown in Table 3-1 below. In Jacobs' opinion these would be reasonable situations for a network business to categorise as high risk. However, implicit in the AER's conclusion that the NSW DNSP's are overly risk averse is that the below scenarios should be categorised as lower risk. Jacobs notes that with capex programme cut-off point set at the high-medium interface (as illustrated in Figure 3-2), it can be inferred that the AER considers it acceptable for these known situations to remain unaddressed. The complete Risk Matrix is provided in Appendix A.

Table 3-1: Minimum 'high risk' scenarios – NNSW Risk Matrix

Probability	Consequence	
	Safety	Environmental
Unlikely: The event has occurred less than once every ten years, but more than once every thirty years.	Severe: One or more fatalities, or significant irreversible injuries to multiple persons	Severe: Very serious long term, wide spread impairment of ecosystem function or localised damage to endangered or heritage item beyond recovery.
Possible: The event has occurred less than once a year, but more than once every ten years.	Major: Significant irreversible injuries to one or more persons	Major: Serious widespread, long term damage to ecosystem requiring significant rectification.
Likely: The event has occurred more than once a year, but less than several times.	Moderate: Moderate irreversible injuries to one or more persons	Moderate: Measurable, medium term damage over a large area but not affecting ecosystem function.

(Source: Networks NSW – Risk Matrix)

The AER has used the CASH/PIP process to conclude that the capex programmes are overly risk averse, rather than considering its key role of ensuring that *"restraint is brought to bear"*; which is one of the criteria identified by the AER as reflective of a robust top-down assessment. This is evident in Figure 3-4 below, which has been extracted from the consultant's report on Endeavour Energy. While the consultant and AER's opinion may or may not be valid with respect to the baseline capex programmes, in Jacobs' view this cannot be extended to the final capex forecasts which are produced following the completion of the entire risk assessment and prioritisation process.

In Jacobs' view the technical consultant's comments in Figure 3-4 demonstrate that the consultant's opinion is expressed in relation to their views of the on the risk averseness of the baseline capex programme (i.e. prior to the application of the top-down assessment) rather than the final Expenditure Proposal. And, contrary to the consultant's assertion that the cuts to the baseline programmes were then made "without material impact on the network risk profile", Figure 3-1, Figure 3-3, and Figure 3-6 clearly demonstrate the impacts of the cuts on the risk profile. In Jacobs' opinion a conclusion on the risk-averseness of an overall capex programme should be formed based upon consideration of the entire risk assessment process that has resulted in the formation of the final programme rather than on individual components alone i.e. based on the risk profile of the final Expenditure Proposal as illustrated in Figure 3-1, Figure 3-3, and Figure 3-6.

Figure 3-4: Consultant Report Extract – conclusion on Endeavour Energy's *"overly-risk averse"* capex programme

> We believe that the apparently variable quality of Endeavour's defect information and analysis is a potential cause of what appears to be a conservative approach to risk assessment which ultimately resulted in NNSW cutting 15% of its total expenditure portfolio without a material impact on the network risk profile.

(Source: EMCa – Technical Review of Regulatory Proposals, Review of Proposed Replacement capex in Endeavour Energy's Regulatory Proposal 2014-2019, October 2014 – p. 17)

Jacobs has reviewed the CASH/PIP process and considers it to demonstrate a consistent and methodical process for defining and prioritising the capex programmes of the NSW DNSPs. An overview of this process was illustrated and discussed earlier in this report with respect to Figure 3-1, Figure 3-2 and Figure 3-3.

The CASH/PIP process provides a risk score for each project which allows sufficient granularity to prioritise projects; rather than simply giving ratings as low, medium, high extreme etc. The process assigns a priority score based on the following formula:

$$Priority = Project\ Type\ Risk\ Weighting \times \sum (Risk\ Category\ Ratings\ (CASH) \times Risk\ Assessment\ Scores)$$

(Source: Prioritisation Process Slides - provided to Chairman 131126 – p. 16)

The "Risk Assessment Scores" in the above equation are based on responses to a number of targeted questions relating to the five risk category areas identified in Table 3-2 – for further detail on the risk assessment questions refer to the presentation referenced above with respect to the prioritisation equation. Table 3-2 and Table 3-3 show the risk weightings for the different risk categories and project types.

Table 3-2: CASH/PIP Tool – Risk Category Weightings

Risk Category[2]	Risk Weighting
Network Reliability Improvement	10
Public Safety, Environmental or Regulatory Impact	10
Network Initiated Fire	10
OH&S (Employee)	10
Network Capacity Improvement	20[3]

(Source: Prioritisation Process Slides - provided to Chairman 131126 – p. 18)

Table 3-3: CASH/PIP Tool – Project Type Risk Weightings

Project Type	Risk Weighting
Committed Project	15
Major Project – New	10
Major Project – New (Optional)	5
Mandatory Program - Minimum Requirement	15
Mandatory Program - Medium Term	10
Mandatory Program - Long Term	5
Strategic Program - Short Term Need	15
Strategic Program - Medium Term Need	10
Strategic Program - Longer Term Need	5

(Source: Prioritisation Process Slides - provided to Chairman 131126 – p. 17)

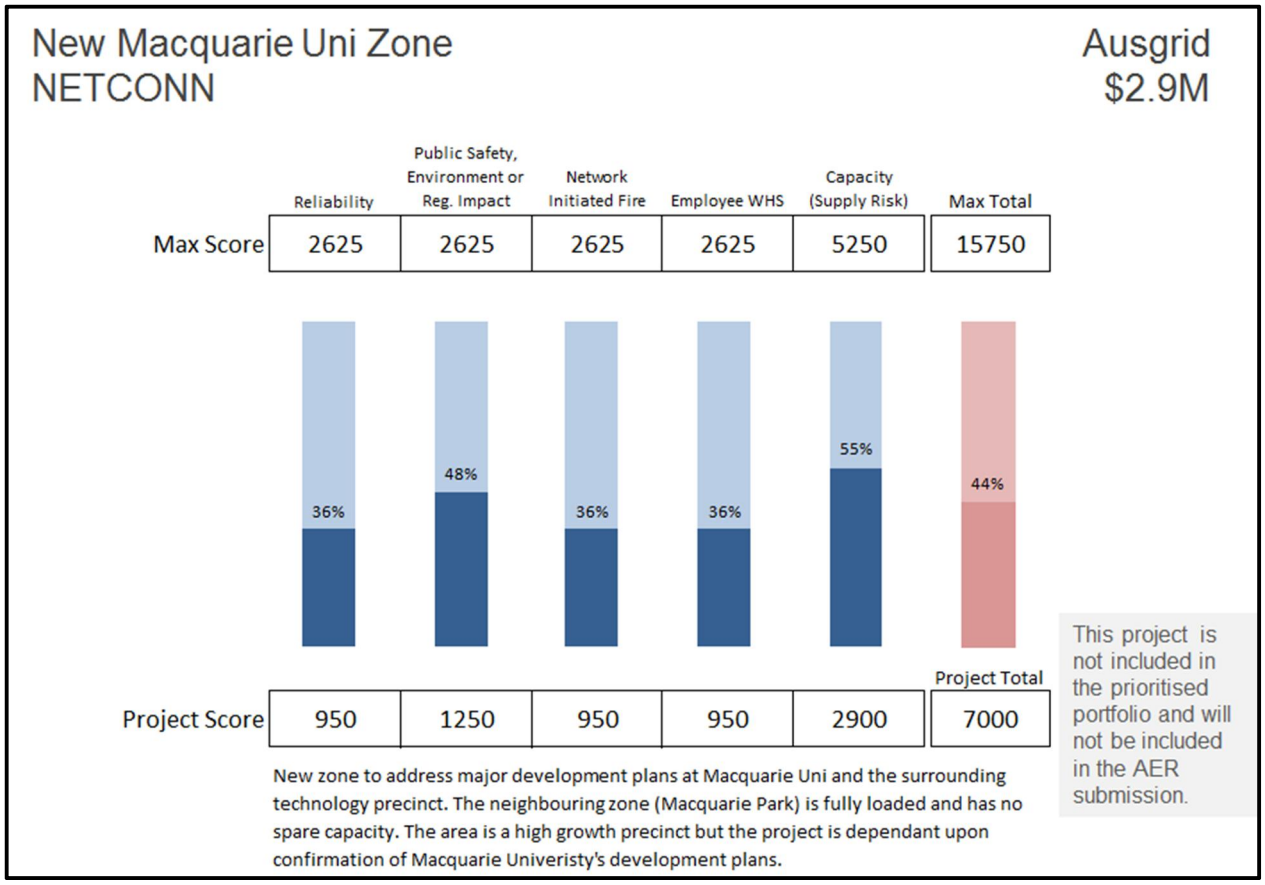
A typical output from the CASH/PIP process is shown in Figure 3-5 below. This demonstrates a project that was removed from Ausgrid's capex programme based upon the CASH/PIP tool. In Jacobs' view it evidences the refinement of the overall capex programme based upon an understanding of the risks associated with each project and programme.

Jacobs notes that the consultant reports state that *"we have not seen compelling evidence … that the Board was provided with information of sufficient quality to make a fully informed decision"* (Source: EMCa – Technical Review of Regulatory Proposals, Review of Proposed Replacement capex in Endeavour Energy's Regulatory Proposal 2014-2019, October 2014 – p. 11). **In Jacobs' view this statement upon which the AER has reached its conclusions demonstrates a fundamental misunderstanding on how the CASH/PIP process works.** It implies that the baseline capex programmes are handed over to NNSW with supporting information, and then NNSW "imposes" a decision over the NSW DNSPs. However, Jacobs understands that the refinement of the overall capex programme is an iterative process that involved detailed consultation and workshops between NNSW and the NSW DNSPs.

[2] Jacobs understands that the NSW DNSPs have included an additional risk category for 'reputation' in their revised Expenditure Proposal submissions.

[3] Jacobs understands that the NSW DNSPs have revised the network capacity improvement risk weighting down from 20 to 10 in their revised Expenditure Proposal submissions. This would mean that all 'risk categories' are now treated equally.

Figure 3-5: Extract from CASH/PIP tool presentation showing a typical output for an individual project



(Source: Risk Presentation 20131216 v1.6 - December 13 Board – p. 12)

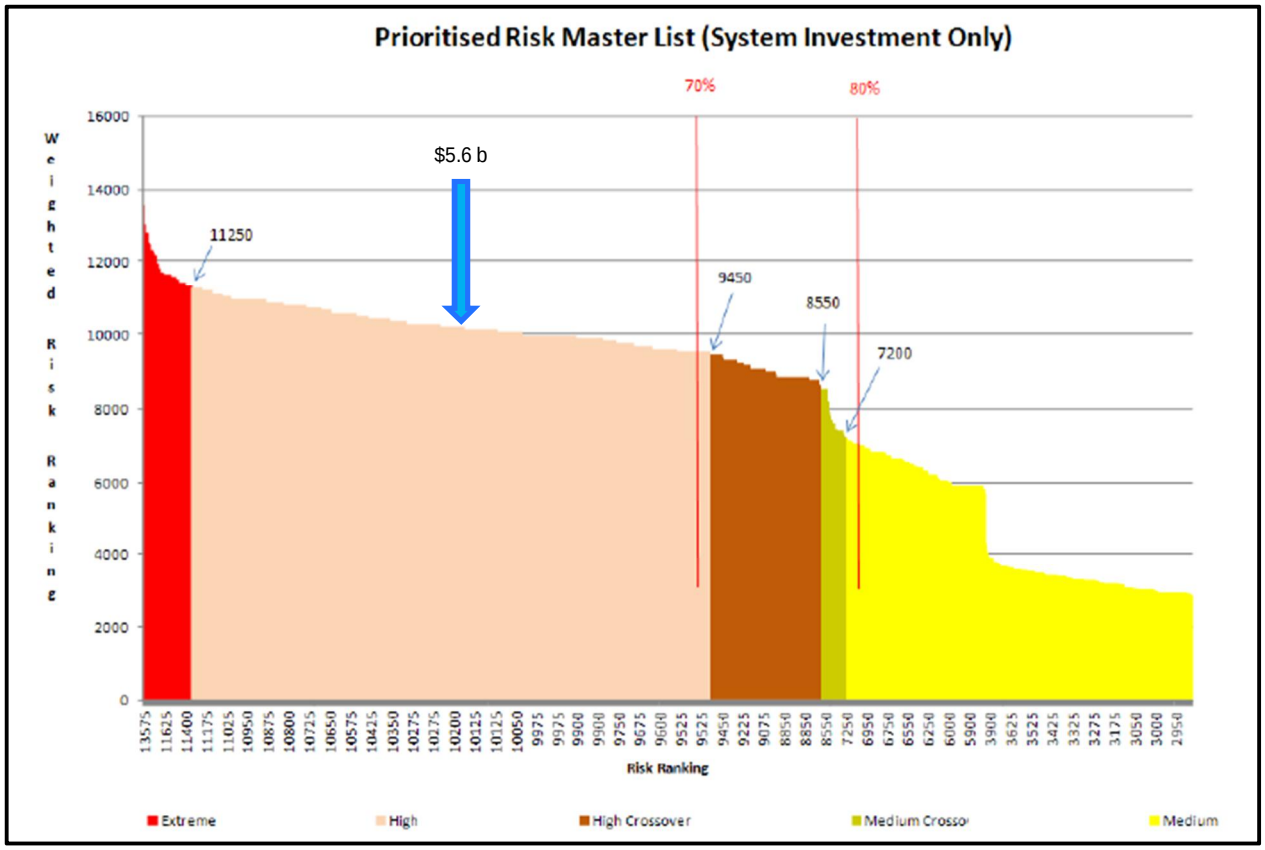
Once all projects and programmes have been assessed using the CASH/PIP process they are compiled to gain an overall view of the risk profile associated with each project and programme. An overall position on risk versus expenditure is then taken as illustrated and discussed earlier in this report with respect to Figure 3-1, Figure 3-2 and Figure 3-3. This decision is made based upon detailed consideration of the individual projects surrounding the potential programme cut-off points.

Figure 3-6 below illustrates how the granularity of the CASH/PIP scores:

- Allow a macro view of the risk profile of the proposed expenditure; and
- Inform the prioritisation of projects and programmes within the capex programme.

In our opinion, the AER does not appear to have apposite consideration of the impact that the revised expenditure levels have on the risk exposure of the NSW DNSPs. Notwithstanding potential efficiency – driven savings, the expenditure reductions within the Draft Determinations would introduce a risk score cut-off point of approximately 10,125 rather than the 7,000 on the basis of which the NSW DNSP's Expenditure Proposals are formed.

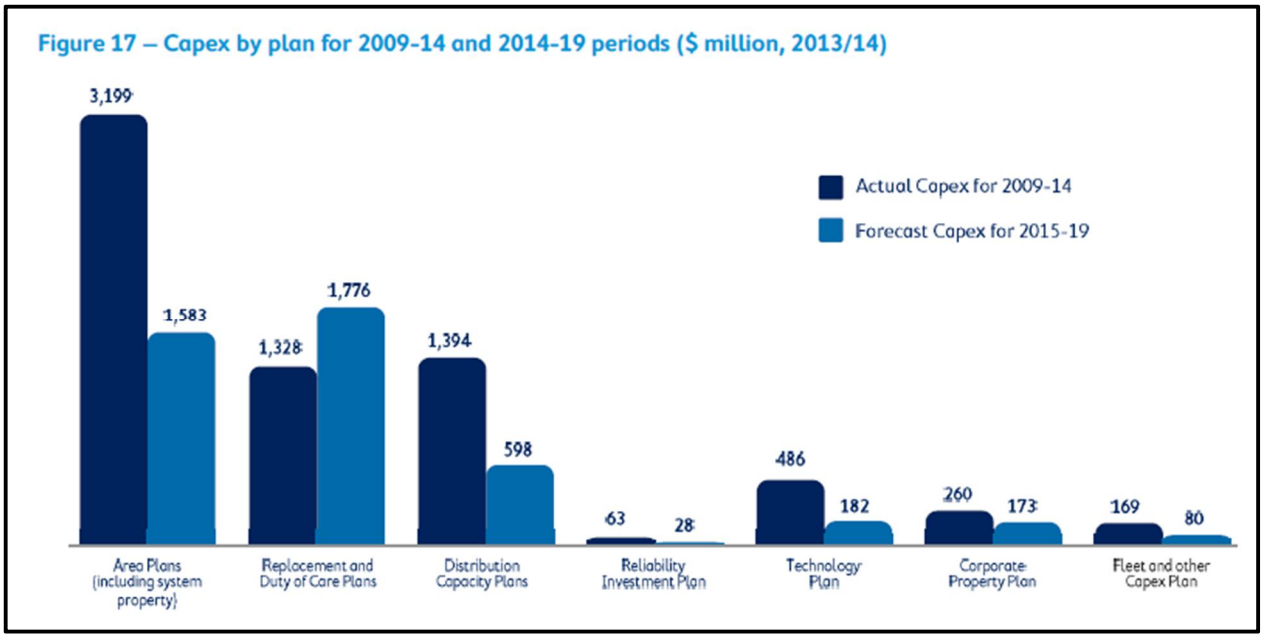
Figure 3-6: Extract from CASH/PIP tool presentation showing how the granularity of scores informs prioritisation



(Source: Prioritisation Process Slides - provided to Chairman 131126 – p. 17)

The AER has also expressed concerns regarding Ausgrid's and Essential Energy's capacity to deliver their proposed capex programmes after they encountered deliverability issues throughout the 2009-14 period and fell significantly short of delivering on the approved capex programmes. However, Jacobs notes that the proposed capex programmes for the 2014-19 period are significant reductions on the previous period. Importantly, the proposed capex program for the 20014-19 period is significantly reduced from the actual capex works delivered during the 2009-14 period for all NSW DNSPs. Figure 3-7 below illustrates how the proposed 2014-19 capex for Ausgrid is significantly lower than the actual capex delivered in 2009-14.

Figure 3-7: Ausgrid – Actual capex in 2009-14 compared to 2014-19 capex Forecast



(Source: Ausgrid – Regulatory Proposal 1 July 2014 to 30 June 2019, 30 may 2014 – p. 42)

- Ausgrid: The actual capex delivered during 2009-14 was $6.9 b and the capex forecast for the 20014-19 period is $4.4 b. This is a reduction of approx. $2.5 b and a capex programme of approx. 64% of the actual capex delivered over 2009-14.

  (Source: Ausgrid – Regulatory Proposal 1 July 2014 to 30 June 2019, 30 May 2014 – p. 42)

Jacobs also notes that the forecast capex in the Expenditure Proposals for Endeavour Energy and Essential Energy are lower than the actual capex delivered during the 20019-14 period.

- Endeavour Energy: The actual capex delivered during 2009-14 was $2.6 b and the capex forecast for the 20014-19 period is $1.7 b. This is a reduction of approx. $900 M and a capex programme of approx. 66% of the actual capex delivered over 2009-14.

  (Source: Endeavour Energy – Regulatory Proposal to the Australian Energy Regulator, Delivering Better Value, 1 July 2015 to 30 June 2019, 30 May 2014 – p. 3, 48)

- Essential Energy: The actual capex delivered during 2009-14 was $3.4 b and the capex forecast for the 20014-19 period is $2.6 b. This is a reduction of approx. $800 M and a capex programme of approx. 76% of the actual capex delivered over 2009-14.

  (Source: Essential Energy – Regulatory Proposal, 1 July 2014 to 30 June 2019, 30 May 2014 – p. 29)

In Jacobs' view the significantly reduced capex forecasts for the 2014-19 periods compared to the actual capex delivered over the 2009-14 period provides an indication that the NSW DNSPs should be capable of delivering the proposed capex programmes for the 2014-19 period.

Draft Determination Anomalies

Jacobs' review of the NSW DNSPs capex forecasting methodologies has uncovered a number of anomalies between the expenditure proposals and the AER's Draft Determinations. These are summarised below.

1) AER finding: *A bottom-up assessment but not a top-down assessment*

The Draft Determinations provide considerable discussion stating that the NSW DNSPs capex forecasting methodology *"does not involve applying a top-down assessment"* (Source: Ausgrid Draft Determination, Attachment

6 – pp. 20-22; Endeavour Energy Draft Determination, Attachment 6 – pp. 18-20; Essential Energy Draft Determination, Attachment 6 – pp. 19-21). This is then identified as a key reason to discount the NSW DNSP's capex forecast methodologies and substitute them with the AER's methodology.

However, based on the review Jacobs considers the AER's position to be inaccurate. Jacobs considers the NSW DNSP's approach clearly demonstrates a considered top-down assessment of their capex forecasts in reaching their final expenditure proposal. As such, the AER's findings would not appear to justify discounting the capex forecasting methodologies of the NSW DNSPs and substituting them with the AER's methodology.

The AER's discussion states that "*A top-down assessment should also clearly evidence a holistic and strategic consideration or assessment of the entire forecast capex program at a portfolio level. It should also demonstrate how the forecast capex proposal has been subject to governance and risk management arrangements. In turn, these arrangements should demonstrate how the timing and prioritisation of certain capital projects or programs has been determined over both the short and the long-term. It should also demonstrate that the capex drivers, such as asset health and risk levels, are well defined and justified. In particular, asset health and risk level metrics are key elements of capex drivers."* (Source: Ausgrid Draft Determination, Attachment 6 – pp. 20-22; Endeavour Energy Draft Determination, Attachment 6 – pp. 18-20; Essential Energy Draft Determination, Attachment 6 – pp. 19-21)

Jacobs considers that the processes employed by the NSW DNSPs broadly address these criteria. Conversely, Jacobs notes that the approach substituted by the AER does not meet its own stated criteria for what a top-down assessment *"should"* include. Specifically, the capex forecasting methodologies substituted by the AER do not appear to:

- "*Clearly evidence a holistic and strategic consideration or assessment of the entire forecast capex program at a portfolio level.*
- *Demonstrate how the forecast capex proposal has been subject to governance and risk management arrangements.*
- *Demonstrate how the timing and prioritisation of certain capital projects or programs has been determined over both the short and the long-term.*
- *Demonstrate that the capex drivers, such as asset health and risk levels, are well defined and justified. In particular, asset health and risk level metrics are key elements of capex drivers."*

(Source: Ausgrid Draft Determination, Attachment 6 – p. 21; Endeavour Energy Draft Determination, Attachment 6 – p. 19; Essential Energy Draft Determination, Attachment 6 – p. 20)

Jacobs considers the AER's position of largely discounting the bottom-up assessments is ill-founded and appears to demonstrate a poor understanding of a prudently constructed capex forecast. It is Jacobs' view that such an approach, particularly one taken without due consideration given to risk profiles, could be potentially negligent. In Jacobs' review of the Draft Determinations we were unable to observe robust consideration of critical risk factors such as bushfires and public safety; where, in Jacobs opinion the overarching thread focuses on costs versus reliability of supply.

Jacobs has noted contradictions between the AER's overall findings on the capex forecast methodology and its detailed discussions relating to repex. The Draft Determinations state that:

"EMCa [the AER's consultant] notes the Networks NSW Board reduced the overall expenditure forecast originally developed within [the NSW DNSPs] by [15 to 24] per cent. This decision was in response to the Board's objective of reducing expenditure, but only to the extent that a prudent risk level would be maintained. … EMCa considers this portfolio adjustment indicates that the process used within [the NSW DNSPs] was inadequate, either in terms of the prudency of the repex work proposed (volume and timing) or the cost of the work. Further, EMCa is of the view that the methodology used is a useful decision support tool, but on its own will not necessarily lead to an optimal portfolio.

(Source: Ausgrid Draft Determination, Attachment 6 – p. 62; Endeavour Energy Draft Determination, Attachment 6 – p. 58; Essential Energy Draft Determination, Attachment 6 – pp. 19-21)

Jacobs considers that these findings, which are used to support the AER's position on repex, seem to contradict its position with respect to the overall capex forecasting methodology. Whereby it is previously stated that:

"In [the AER's] 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."

(Source: Ausgrid Draft Determination, Attachment 6 – p. 20; Endeavour Energy Draft Determination, Attachment 6 – p. 18; Essential Energy Draft Determination, Attachment 6 – p. 19)

In Jacobs view it appears contradictory to initially state that *"applying a top down assessment is a critical part of the process [which] indicates that some level of overall restraint has been brought to bear",* and to then cite that *"the process used within [the NSW DNSPs] was inadequate"* because the top-down assessment '*brought restraints to bear*' in the order of 15 to 24%.

Furthermore, the AER uses the term "top-down" modelling to suggest a variety of analysis techniques aimed at identifying or framing an appropriate level of expenditure. Jacobs is of the view that the AER both inadequately define what is meant by this term, and themselves misunderstand the term and the various techniques associated with it. This in turn leads the AER to a view regarding the proposed expenditure that is ill-informed.

Top-down modelling is not trending, benchmarking or other comparative assessments. These techniques do not have as a prime input parameter the actual features of the asset base that is being assessed, which is a key requirement. Modelling that is applied to features of the asset base from a high-level (or from the "top") are analyses such as replacement expenditure modelling and asset replacement cost depreciation analysis.

Notwithstanding this, Jacobs notes that trending and benchmark data can provide useful contextual insights into the appropriateness of a total investment proposal. However we are of the opinion that the AER has used this reference data inappropriately in order to support its views that the NNSW DNSPs replacement expenditure projections are overstated.

***2) AER finding:** Overly conservative risk assessments which do not adequately justify:*

- *d) The timing; and*
- *e) Priority of its proposed expenditure forecast.*
- *f) And lacks a clear deliver strategy (the capex delivery issue is specific to Ausgrid only).*

The Draft Determinations provide considerable discussion stating that the NSW DNSPs capex forecasting methodology *"incorporates overly conservative risk assessments"* (Source: Ausgrid – pp. 20-22; Endeavour Energy – pp. 18-20; Essential Energy – pp. 19-21). This is then identified as a key reason to discount the NSW DNSP's capex forecast methodologies and substitute them with the AER's methodology.

The AER's conclusions in this regard appear to predominantly rely on the outcomes of the review by the AER's appointed technical consultant who reviewed the repex programmes of the three NSW DNSPs individually. However, in Jacobs' view it appears that the consultant's conclusion is primarily based on an assessment of the internal risk assessment mechanisms of the DNSPs and doesn't appositely consider the top-down risk prioritisation process carried out in conjunction with NNSW. In short, **the AER's conclusion seems to be predominantly based on the risk assessment mechanisms used to produce each DNSP's baseline capex programme rather than the final capex forecasts which comprise the NSW DNSP's Expenditure Proposals.**

While the consultant's report does discuss the CASH/PIP prioritisation process, it only does so in relation to the efficiency of the baseline capex forecasts. It does not appear that the consultant has carried out a detailed

review of the CASH/PIP process to gain an appropriate understanding of its rigour. This is apparent in statements that they had *"not seen compelling evidence … that the Board was provided with information of sufficient quality to make a fully informed decision"* (Source: EMCa – Technical Review of Regulatory Proposals, Review of Proposed Replacement capex in Endeavour Energy's Regulatory Proposal 2014-2019, October 2014 – p. 11). In Jacobs' view this conclusion demonstrates a misunderstanding of how the process works, where NNSW is not presented with information to decide on individual projects, but rather works iteratively through consultations and workshops to refine the capex programmes.

The consultant found that the top-down assessment resulted in reductions to the baseline capex programmes. In Jacobs view this evidences *"that some level of overall restraint that has been brought to bear [in the capex forecasts which comprise the NSW DNSP's Expenditure Proposals]. [Which the AER notes] is an important factor for [them] to consider in deciding whether we are satisfied that a proposed forecast capex allowance reasonably reflects the capex criteria."* (Source: Ausgrid Draft Determination, Attachment 6 – p. 20; Endeavour Energy Draft Determination, Attachment 6 – p. 18; Essential Energy Draft Determination, Attachment 6 – p. 19)

The AER has also concluded that the risk assessments do not adequately justify the priority and timing of the capex forecasts. However, it appears that this conclusion has been reached because the CASH/PIP process was not properly understood. In Jacobs' view the CASH/PIP top down assessment clearly provides adequate granularity to inform the prioritisation and scheduling of the associated capital works programmes.

Jacobs also notes that while the AER has discounted the NSW DNSP capex forecasts because it considers them to be based on overly conservative risk assessments, it does not appear to have carried out any form of risk assessment in its substituted capex forecast approach. The AER appears to be taking a position on expenditure without apposite consideration of the risk profiles associated with the varying levels of expenditure. In particular, the AER's approach does not appear to consider "*risk level metrics [as] key elements of capex drivers"* within its substituted capex forecast approach.

The consideration of risk level metrics is one of the AER's stated criteria for what a top-down assessment 'should' include.

(Source: Ausgrid Draft Determination, Attachment 6 – p. 21; Endeavour Energy Draft Determination, Attachment 6 – p. 19; Essential Energy Draft Determination, Attachment 6 – p. 20)

3.1.1 Augmentation Expenditure (Augex)

Overview

Network Augmentation Expenditure (augex) is a significant element of the capex program and is required to provide capacity to cater for increasing network demand at a given level of supply security. The combined augex forecast for the NSW DNSPs has reduced by 68% between the 2009-14 and 2014-19 regulatory periods. This reduction is due to significantly reduced demand forecasts across NSW, as well as a change to the Design, Reliability and Performance Licence Conditions imposed on DNSPs by the Minister for Energy.

Notwithstanding the significant reductions in proposed augex, the AER has not accepted the augex forecasts of each of the NSW DNSPs and has subsequently revised them downwards. The revisions result in significant reductions to the augex forecasts as shown in Table 3-4 below.

Table 3-4: Summary of NSW DNSP augex Proposals and AER Draft Determinations

	Proposed Expenditure ($ M)	AER Draft Determination ($ M)	Difference ($ M)	Difference (%)
Ausgrid	$ 509	$ 376	-$ 133	-26%
Endeavour Energy	$ 426	$ 352	-$ 74	-17%

	Proposed Expenditure ($ M)	AER Draft Determination ($ M)	Difference ($ M)	Difference (%)
Essential Energy	$ 745	$ 475	-$ 270	-36%
Total	$ 1,680	$ 1,203	-$ 477	-28%

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

The Draft Determinations identify two common issues which are presented as reasons and findings for reducing the NSW DNSPs augex forecasts.

These reasons and findings given within the AER's Draft Determinations for the indicated augex reductions are paraphrased as follows:

1) A reduction to account for updated spatial demand forecasts – totalling:

a) Ausgrid: 12% augex reduction

b) Endeavour Energy: 3% augex reduction

c) Essential Energy: 20% augex reduction

2) A reduction for not applying a risk-based cost benefit technique – totalling:

a) Ausgrid: 15% augex reduction

b) Endeavour Energy: 15% augex reduction

c) Essential Energy: 20% augex reduction

(Source: Ausgrid Draft Determination, Attachment 6 – p. 10; Endeavour Energy Draft Determination, Attachment 6 – p. 9; Essential Energy Draft Determination, Attachment 6 – p. 10)

Prudency Assessment

Jacobs has reviewed the augex forecasting methodologies used by NNSW and the NSW DNSPs. The approaches adopted by the DNSPs are discussed here with respect to the two common issues identified within the AER's Draft Determinations as the reasons and findings for reducing the augex forecasts.

1) AER finding: *Basing the augex programmes on 2013 demand forecasts rather than the updated 2014 forecasts.*

The AER has relied on a consultant's report and concluded that expenditure will follow a linear trend with demand forecasts. Hence, a reduced demand forecast will result in a proportionate expenditure reduction. Jacobs' understands that the AER has subsequently recalculated the expenditure required on the HV network downstream from the Zone Substations. Jacobs understands that downward revisions have not been made for the Zone Substations and upstream sub-transmission network or the LV network. However, it should be noted that Jacobs' has not reviewed the calculation or verified to which parts of the network they have been applied.

Notwithstanding, we consider the AER's reduction to augmentation expenditure based on a linear relationship between augex and demand growth to be reasonable for the purpose of forecasting expenditure where the augmentation is driven only by underlying demand growth. That is, we consider it reasonable to assume for the purposes of forecasting expenditure at the distribution wide level, that the relationship between cost and demand (i.e. $/kVA) tends toward a linear relationship for each individual distributor, reflecting their own unit rates, scale, network topology and topography.

However, in cases where augmentation expenditure is driven by step changes of base infrastructure, as is required for new developments, the application of a linear relationship will misrepresent the cost of constructing the assets required. In these cases, the augex will be substantially higher than the forecast

demand growth (i.e. a large capex requirement for a relatively small demand) as a base level of infrastructure does not exist.

Jacobs understands that the proportions of the NSW DNSP's augex forecasts that are comprised of step changes to base infrastructure are as follows (including connections capex):

- Ausgrid: $577 M totalling 67% of Ausgrid's augex forecast.
- Endeavour Energy: $343 M totalling 61% of Endeavour Energy's augex forecast.
- Essential Energy: $579 M totalling 52% of Essential Energy's augex forecast.

(Source: Advice from NNSW – email – Matthew Webb, Consolidated on Draft Prudency Report, 05/01/2015 4:12 pm)

This suggests that the AER's assumption of a linear relationship between demand and expenditure has been inappropriately applied to approximately 60% of the NSW DNSP's proposed augex. In Jacobs' view the reductions to augex based on the linear relationship between expenditure and demand should be adjusted to factor in step changes to base infrastructure.

2) ***AER finding:*** *Not applying a cost-benefit analysis assessment techniques following changes to the NSW licence conditions design standards that took effect on 1 July 2014.*

The AER's finding and subsequent reductions relating to the changed Design, Reliability and Performance Licence Conditions rely on a consultant report which identifies a reasonable range of potential augex reductions of between 10 to 20% - where the AER has then applied reductions of 15, 15 and 20% to the NSW DNSPs. **However, in Jacobs' view the consultant's conclusions do not directly align with the AER's finding; in particular:**

- **The AER's consultant's identified range of 10-20% is a speculation that is not robustly substantiated and is discussed only with respect to Endeavour Energy. Also, it seems to relate to a number of variable factors than specifically to the licence e condition changes. The AER has then applied the 10-20% speculation to all NSW DNSPs.**
- **It does not appear that specific augex program reductions made by the DNSPs to their baseline augex forecasts have been considered. These reductions occurred prior to the CASH/PIP process.**

These shortcomings are apparent in the relevant section of the report from which the AER has drawn its findings, which is provided in Figure 3-8 below.

Figure 3-8: Extract from consultant report identifying potential reductions of 10-20% through application of risk assessment techniques

2.5.1 The business forecast is reasonable and unbiased

Whilst there is some evidence of bias in the decisions made in the 2009-14 regulatory period with respect to load forecasting and possible over commitment to the licence compliance works impacting on early expenditure in the current period, there is clear evidence that Endeavour has improved its business forecasting processes for the 2014-19 period and that it is applying more prudent techniques to the forecasting of augmentation expenditure and its timing. The expenditure forecasts are likely to be biased given that that more detailed reviews and cost-benefit analysis of options is being carried out as part of the Gate 3 approval process during the regulatory control period and that savings that can be realised are not reflected in the Regulatory Proposal.

There is also evidence that further reductions in projected expenditure may be possible through the application of risk assessment techniques to all projected programs of work. The application of these techniques and the consideration of non-augmentation options has resulted in a reduction of 38% to the projected expenditure for the Distribution Works Program and reductions to projected expenditure in other programs would be expected when they are subjected to a similar analysis. It is not anticipated that the reductions would be at the same level as for the Distribution Works Program given the nature of projects involved and that they have already been subject to reductions through the Networks NSW Network Investment Prioritisation process, however, it would be reasonable to expect reductions in the order of 10 to 20%.

(Source: Worley Parsons, Review of Proposed Augmentation capex in NSW DNSP Regulatory Proposals 2014-19, 17 November 2014 – p. 8)

Table 3-5 below identifies $214 M of project expenditure that was removed from the NSW DNSP's baseline augex programs based on engineering reviews that considered cost-benefit factors in light of the changes to the Design, Reliability and Performance Licence Conditions. **It demonstrates that the NSW DNSPs:**

- **Have carried out a cost-benefits review in relation to the changes to the Licence Conditions; and**
- **Through this review a reduction was achieved equivalent to 13% of the combined augex forecast. Incidentally, this sits within the speculated 10-20% "reasonable range' identified in the report.**

Table 3-5: Summary of Reductions in capex Due to Removal of NSW Design Reliability and Performance Licence Conditions - Schedule 1

Project Name	$ Million
Ausgrid	
Reduction in 11kV distribution feeder reinforcement (10% of previous $450 million estimate)	$ 45.0
Dee Why West to Beacon Hill 11kV load transfer	$ 2.3
Drummoyne to Croydon 11kV load transfer	$ 2.2
Macquarie Park to Top Ryde 11kV load transfer (St2)	$ 8.4
Miranda to Kirrawee 11kV load transfer	$ 1.6
New Anna Bay STS with 132kV and 33kV Mains	$ 50.6
Port Botany to Matraville 11kV load transfer	$ 0.3
Rutherford 33kV feeder KU8 & KU13 upgrade	$ 11.0
St Ives to Lindfield 11kV load transfer	$ 1.8
Telarah to Rutherford 33kV OH feeder 30028 upgrade	$ 4.4

Project Name	$ Million
Ausgrid Total	**$ 127.5**
Endeavour Energy	
West Epping ZS	$ 24.8
Feeder 450 Newton 33kV feeder upgrade	$ 1.7
Reduction in overloaded 11kV distribution feeder reinforcement	$ 14.7
Endeavour Energy Total	**$ 41.2**
Essential Energy	
TG Port Macquarie to Rocks Ferry - reconductor 33kV conductor	$ 2.4
Tamworth to Quirindi (Werris Ck) - construct 132kV feeder and 132/66kV substation	$ 23.0
Orange Industrial ZS - upgrade 66/11 kV transformer	$ 1.1
Griffith West - new dual 132kV feeder (operate 33kV)	$ 7.3
Bourkelands ZS - upgrade 2 x 66/11 kV transformers	$ 2.9
Bourkelands to Uranqunity - construct new 66kV feeder	$ 5.0
Reduction in overloaded 11kV distribution feeder reinforcement	$ 3.4
Essential Energy Total	**$ 45.2**
NETWORKS NSW TOTAL	***$ 213.8***

(Source: Networks NSW – Attachment 2 – NNSW Licence Conditions Adjustments.xlsx – Worksheet: Schedule 1 Impacted Projects)

Jacobs notes that there is a lack of analysis from which the initial 10 to 20% value has been determined, beyond the consultant's assertion that "it would be reasonable to expect" that reductions of this magnitude may be possible. Additionally, the identified range is only discussed with respect to Endeavour Energy whereas the comments in the report relating to Ausgrid and Essential only indicate reductions "may be possible". The consultant report does not indicate any basis for their conclusion that the reductions for Ausgrid and Essential Energy would be in the order expected for Endeavour Energy.

Jacobs also notes that while the consultant's report acknowledges that further augex reductions would have been achieved through the CASH/PIP process, it does not appear that the magnitude of these reductions have been taken into account in establishing the speculated "reasonable range". The further reductions to the augex programme achieved through the CASH/PIP process are as follows:

- Ausgrid: $293 M totalling 25% of Ausgrid's baseline augex forecast.
- Endeavour Energy: $170 M totalling 23% of Endeavour Energy's baseline augex forecast.
- Essential Energy: $323 M totalling 23% of Essential Energy's baseline augex forecast.

(Source: Advice from NNSW – email – Matthew Webb, Consolidated on Draft Prudency Report, 05/01/2015 4:12 pm)

It is noted that the $214 M reduction made by the NSW DNSPs is an outcome of a detailed technical assessment process. Given this, it is our opinion that it is imprudent to simply speculate on a percentage reduction based on arguable reasonableness (as the AER appears to have done). Rather, it is necessary to apply further detailed analysis to determine the potential for any additional reductions beyond that which the DNSP's have already identified through detailed analysis.

Additionally, the Draft Determinations explain that the possible reductions of 15% for Ausgrid and Endeavour Energy and 20% for Essential Energy are based on the overall proposed reductions to augex. This in noted against Ausgrid already proposing a 76% reduction compared to the actual spend in the 2009-14 period, Endeavour Energy proposing a 61% reduction, but Essential Energy "only" proposing a 44% reduction. The AER has levered Essential Energy's reduction up from 15% to 20% based on the lower augex reduction between 2009-14 and 2014-19 as compared to the other NSW DNSPs. **Again, in our opinion it would be**

prudent to apply further detailed analysis rather than relying on a subjective assessment that does not consider Essential Energy's actual augex requirements for the 2014-19 period.

(Source: Ausgrid Draft Determination, Attachment 6 – p. 34; Endeavour Energy Draft Determination, Attachment 6 – p. 32; Essential Energy Draft Determination, Attachment 6 – p. 33)

The AER has sought to support its proposed generic reductions in augex by looking at utilisation trends, which show an approximate decrease in average utilisation in the order of 5-15% for each of the networks. However, the AER does not appear to have discussed how this would be impacted by the proposed reductions of augex expenditure incurred through 2009-14 of between 44-76%.

(Source: Ausgrid Draft Determination, Attachment 6 – p. 34; Endeavour Energy Draft Determination, Attachment 6 – p. 32; Essential Energy Draft Determination, Attachment 6 – p. 33)

In Jacobs view it seems likely that the proposed augex reductions of this magnitude would increase utilisation rates. Thus, it would be imprudent to further reduce expenditure without giving due consideration to the impact of the reductions currently proposed by the NSW DNSPs on increasing the utilisation rates.

Draft Determination Anomalies

Jacobs' review of the NSW DNSPs augex forecasting methodologies has uncovered a number of anomalies between the expenditure proposals and the AER's Draft Determinations. These are summarised below.

1) ***AER finding:*** *Basing the augex programmes on 2013 demand forecasts rather than the updated 2014 forecasts.*

Jacobs considers that the reductions that the AER has indicated to reflect updated demand forecasts using a linear demand versus expenditure relationship for HV feeders appear reasonable where the demand is due to underlying growth or reduction in demand. However, in cases where step changes are required to provide new base infrastructure (as required for new developments) the expenditure will significantly exceed the underlying growth in demand. **In Jacobs' view it would be appropriate to moderate the indicated reduction to reflect the proportion of proposed expenditure that is associated with step changes to base infrastructure such as for new development areas.**

2) ***AER finding:*** *Not applying a cost-benefit analysis assessment techniques following changes to the NSW licence conditions design standards that took effect on 1 July 2014.*

Jacobs considers that the changes to Licence Conditions should result in associated reductions to augex. However, it appears that the AER has not considered the $214 M of projects that were removed from the baseline augex forecast following a detailed engineering review undertaken by the NSW DNSPs that considered cost versus benefit factors. Jacobs notes that the $214 M reduction made by the NSW DNSPs was the outcome of a detailed assessment process, and yielded reductions within the speculated "reasonable range".

The AER has indicated further reductions of 15% to 20% for the NSW DNSPs. In Jacobs' view these figures are based upon speculations with respect to Endeavour Energy that are not robustly substantiated. This has then been extrapolated to Ausgrid and Essential Energy using blunt mechanisms, and further supported with narrow reasoning. Furthermore, that speculated range has not considered the magnitude of reductions achieved through the CASH/PIP process.

In our opinion, it would be prudent to apply further detailed analysis to determine whether there is potential for any additional reductions rather than simply speculating on a percentage reduction based on arguable reasonableness.

3.1.2 Replacement Expenditure (Repex)

Overview

Replacement expenditure (repex) forms a significant part of the total capex forecasts of the NSW DNSP's Expenditure Proposals. Due to the decreasing need for augmentation the relative significance of repex in the total capex has increased. In addition, the forecast repex requirements for the 2014-19 period have significantly increased with respect to historical values.

The AER has not accepted the repex forecasts of each of the NSW DNSPs and has subsequently revised them downwards. The revisions result in significant reductions to the repex forecasts as shown in Table 3-6 below.

Table 3-6: Summary of NSW DNSP Repex Proposals and AER Draft Determinations

	Proposed Repex ($ M)	AER Draft Determination ($ M)	Difference ($ M)	Difference (%)
Ausgrid	$3,226	$1,769	-$1,457	-45%
Endeavour Energy	$740	$661	-$79	-11%
Essential Energy	$856	$675	-$181	-21%
Total	$4,822	$3,105	-$1,717	-36%

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

The AER has used a variety of techniques and identified several reasons for not accepting the repex forecasts. The techniques and findings (reasons for not accepting the repex forecasts) are paraphrased in Table 3-7 below.

Following its decision not to accept the Expenditure Proposals of the NSW DNSPs the AER has determined revised repex forecasts through predictive modelling using its own *Repex Model*.

Table 3-7: AER's repex analysis techniques and corresponding findings (reasons for not accepting expenditure proposals)

Review Technique	Findings **(reasons for not accepting expenditure proposals)**
Trend analysis of historical actual and expected repex	1) Significant increases of approx. 40% to 60% in forecast repex compared to historical trends.
Benchmarking at the expenditure category	2) Unfavourable comparisons with benchmarked DNSPs 3) Network health indicators not supporting the relative increase in repex requirements
Engineering review	4) Overly conservative risk assessments 5) Deliverability issues faced by Ausgrid and Essential Energy during the 2009-14 period

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

Prudency Assessment

Jacobs has reviewed the repex forecasting methodologies used by NNSW and the NSW DNSPs. The approaches adopted by the NSW DNSPs are discussed here with respect to the five common issues identified within the AER's Draft Determinations as the reasons and findings for reducing the repex forecasts.

AER reasons for discounting NSW DNSP repex forecasts

This section discusses the five reasons presented by the AER for discounting the repex forecasts proposed by the NSW DNSPs.

Trend Analysis

1) AER finding: *Significant increases of approx. 40% to 60% in forecast repex compared to historical trends.*

The AER has used historical repex trend as the starting point for their analysis and concluded that all of the distribution businesses are above the long term average and in excess of the expenditures in the 2009-14 period. The results of the assessment are shown in Table 3-8 below.

Table 3-8: AER's Repex Trend Analysis

	Increase: long term	Increase: 2009-14
Ausgrid	41 %	56 %*
Essential Energy	59 %	11 %
Endeavour Energy	55 %	22 %

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

* Jacobs notes that, in the case of Ausgrid, there appears to be some errors within the data used to compile Table 3-8. This is supported by the AER's consultant EMCa, who state that *"a better characterisation of Ausgrid's repex is that it is essentially flat, with the proposed allowance being similar to actual repex in the prior RCP"* (Source: EMCa, Review of proposed replacement capex in Ausgrid's regulatory proposal 2014-2019, October 2014, p8). This suggests that the calculated 2009-14 increase of 56% for Ausgrid may be incorrect, potentially undermining the AER's conclusions that flow from it.

Jacobs notes the AER's high-level conclusion that the proposed level of repex appears to be significantly higher than the historical trends. **However, Jacobs is of the view that historical trend projections are useful only for the purposes of providing a context for the future projections rather than being a predictor of future need.** This is because assets deteriorate with use over time. The younger the asset base, the lower the level of expenditure expected to be required to renew or replace assets. It would normally be expected that asset replacement driven expenditure would increase (in real terms) with the passage of time due to the asset base being utilised. It is to be expected that from one regulatory period to another, replacement expenditure should increase in real terms as assets deteriorate and replacement needs emerge, subject of course to the amount of recent historical investment in new assets (driven by either growth or renewal needs).

This changing asset-renewal investment driver from one period to another means that the past is unlikely to be a good predictor of the future. From a statistical viewpoint, using trend analysis to ascertain future demand for expenditure is predicated on the underlying assumption that the historical drivers of investment need will be identical in the future. This is clearly not the case with an ageing asset base.

Further, historically low-levels of replacement expenditure do not establish the benchmark for future asset replacement expenditure requirements. As greater asset needs emerge, and as the basis for replacement programs is based on the understanding of actual asset condition and performance data, the need for asset replacement expenditure increases. This may occur within a regulatory period or across several periods as the timing of these periods is arbitrary relative to the actual replacement needs of the asset base. This is indeed the case for the NSW DNSPs.

Jacobs notes that all of the DNSPs have asset management frameworks and planning processes in place to identify actual, ground-up asset replacement needs, which have been used to develop their respective replacement expenditure proposals. **Jacobs therefore expects that in their revised Expenditure Proposals**

the NSW DNSPs would provide robust justification that demonstrates the reasons for why the increased levels of repex are warranted. Ideally, this would also demonstrate why the magnitudes of approx. 40% to 60% are appropriate.

Benchmarking

2) **AER Finding:** *Unfavourable comparisons with benchmarked DNSPs.*

The AER has carried out benchmarking analyses across a number of categories. These are discussed below.

- NEM Repex

  Benchmarking is done across the NEM normalising for capacity density, customer density and asset base. For each of the benchmarking assessments it is assumed a linear relation exists between the repex and customer density, capacity density and asset base. For both density measures this relationship is negative (higher density = lower repex), but for the asset base the relation is positive (larger asset base = higher repex).

  On the basis of their benchmarking results the AER conclude that all NSW businesses compare unfavourably with most of the other businesses in the NEM. In Ausgrid's case the analysis shows particularly large deviations.

Jacobs notes the AER's conclusion that the NSW DNSPs appear to compare unfavourably with other NEM DNSPs, based on these measures. However, Jacobs notes that:

- **The analysis has been carried out using data over a specific window of time (2008 to 2013). The AER does not appear to substantiate why this is an appropriate window.**
- **The AER has not provided trend comparisons of asset age profiles or repex expenditure for the benchmarked DNSPs. If the DNSPs on the "efficient frontier" have aging assets during the period this may simply demonstrate a riskier profile rather than greater repex efficiency. In Jacobs view it would be imprudent to draw conclusions on this analysis without an understanding of the age profiles (and risk profiles by proxy) and the asset failure performance of the benchmarked DNSPs.**
- **The relationship between repex and customer/ capacity density may not be linear, and as such Essential Energy's position may not be as unfavourable as observed. There has been limited consideration for the fact that Ergon Energy (with a similar density) has an even higher repex. Also, Jacobs understands that Essential Energy's forecast repex spend is below 1% of the total replacement cost of its asset which would place it among the more efficient in the NEM.**
- **Also, Jacobs understands that more detailed analysis has been undertaken which highlights significant flaws in the benchmarking approach and the understanding of differences in these measures.**

It should be noted that Jacobs has not carried out a detailed review of the validity and rigour of the AER's repex benchmarking – primarily because the AER has used this as a supporting argument rather than using it to make adjustments to the proposed repex Expenditure.

3) ***AER Finding:*** *Network health indicators not supporting the relative increase in repex requirements*

- Asset Age Profile

  The AER has carried out two types of comparative age profiling analyses for different populations of asset classes:

  - A comparison of replacement cost of assets commissioned in each year against the average repex proposed by the DNSPs; and
  - A comparison of historic average residual service lives against projected average residual service lives.

From both of these the AER had drawn the following conclusions with respect to each of the NSW DNSPs:

- Ausgrid: The AER concludes that the above information suggests that *"Ausgrid would require less repex to maintain its network now than it has in the previous regulatory period"*, and the numbers also suggest that Ausgrid "significantly overestimates the stock of old assets in the network that needs to be replaced".

  (Source: p6-56-57, attachment 6: Capital expenditure, Ausgrid draft decision)

- Endeavour Energy: The AER established that a relatively similar level of repex to historical values should be sufficient to maintain Endeavour Energy's network.

  (Source: p6-53, attachment 6: Capital expenditure, Endeavour Energy draft decision)

- Essential Energy: The AER states that Essential Energy are forecasting higher residual lives at the end of the 2014-19 period, suggesting that they are seeking more repex than is necessary for some asset classes to maintain their function compared to the past.

  (Source: p6-56, attachment 6: Capital expenditure, Essential Energy draft decision)

Jacobs does not agree that these conclusions can be drawn from the analysis that has been presented by the AER. This is because the AER's analysis does not appear to consider the actual quantum of assets that are reaching the end of their serviceable lives. For example:

- The replacement cost versus average proposed repex analysis is discussed in the context of the entire age profile and the number of years across where the annual replacement value exceeds the average proposed repex. In Jacobs' view this is not relevant to forming an opinion on the amount of repex required through the 2014-19 period. That is, this discussion should focus on whether the total proposed repex exceeds the total replacement cost of assets reaching the end of their serviceable life.

  From Jacobs' high level observation of the Draft Determination documents it appears that in general the proposed repex is less that the total cost of replacing the assets approaching / exceeding the end of their serviceable life.

- The average residual life analysis discusses whether the proposed expenditure would increase the average residual life of the assets above the historical trend (2006 –2013). Again, this analysis does not consider the actual assets reaching the end of their serviceable life. In Jacobs' view it would be inappropriate to draw short-term conclusions based on average residual lives for asset populations unless the population had an evenly distributed age profile. Jacobs also notes that the significant augex in prior years would push the average age of asset populations downwards without necessarily replacing aging assets (although, a proportion would have been replaced incidentally).

  From Jacobs' observation of the Draft Determination documents it appears that in general the age profiles of the NSW DNSPs are skewed towards newer assets; with a large proportion of new assets and a smaller hump of aging assets. Such an age profile would produce a lower average age and potentially mask the smaller hump of assets that are reaching the end of their serviceable life.

Further detail from Jacobs' review of the AER's age profiling analysis is provided in Appendix B.

- <u>Asset Utilisation</u>

  The AER's utilisation analysis for the NSW DNSPs states that all have benefited from *"significant spare capacity ... based on past investment to meet expected demand that did not eventuate",* as a *"positive correlation between asset condition and utilisation"* is assumed, and therefore should result in *"reduced repex compared to the past"*.

  (Source: attachment 6: Capital expenditure for all businesses, p. 59)

  The AER also notes that because of lower expected demand and lower value of customer reliability the cost of service in asset failure is reduced compared to past periods, effectively increasing deferral potential, reducing replacement cost relative to the past. The AER has not quantified the potential size of the repex reduction, based on decreased utilisation.

Jacobs has reviewed the AER's asset utilisation analysis which shows an approximate decrease in average utilisation in the order of 5-15% for each of the networks. However, the AER does not appear to have discussed how this would be impacted by the proposed reductions in augex expenditure of between 44-76%.

In Jacobs view it seems likely that the proposed augex reductions of this would increase utilisation rates. Thus, it would be imprudent to further reduce expenditure without giving due consideration to the impact of the reductions currently proposed by the NSW DNSPs on increasing the utilisation rates.

Jacobs also notes that the assumed "positive correlation between asset condition and utilisation" is largely a long term trend (unless the assets would otherwise have been subject to duty above capacity without the decrease in utilisation), which for the most part would be unlikely manifest in material reductions to repex requirements over the 2014-19 period.

An additional concern here is that geographical areas with spare capacity due to decreased utilisation not necessarily need to align with areas containing assets that need to be replaced.

Also noted is that utilisation will have limited, if any, effect on deteriorating asset condition due to environmental factors, such as corrosion, termites and other decay. Degradation due to environmental factors is a significant contributor to the replacement requirements for outdoor assets, particularly those in coastal regions.

Engineering Review

4) AER Finding: *Overly conservative risk assessments*

The AER's findings regarding overly conservative risk assessments and deliverability issues are predominantly based upon consultant's reports which looked at the NSW DNSPs individually. These reviews aimed to test whether the repex forecasts are reasonable and unbiased, and costs, work practices and risk management are prudent and efficient.

The reports identify a variety of issues as would typically be expected of any review of this nature. Jacobs notes that all issues presented lead to the headline finding that the risk assessments are too conservative within the network businesses, and therefore positively biases the forecasted expenditures, impeding efficiency.

The AER has used this finding to support not only discounting the repex forecasts of the NSW DNSPs, but also to discount the capex forecast as a whole. Jacobs has reviewed the risk assessment processes in their entirety and our findings are detailed in Section 3.1 with respect to the overall capex forecasting methodology of NNSW and the NSW DNSPs.

Our key finding in this area is that the consultant reports took an isolated view of the processes in effect by looking individually at each DNSP. In doing so they did not give apposite consideration to the entire risk evaluation process. In particular, the validity of the strategic top-down assessment of the overall capex programme was largely overlooked. **This led to the AER reaching its conclusion primarily based on the processes used to establish baseline repex forecasts rather than full consideration of the entire risk evaluation process that was applied to refine the final repex forecasts that comprise the NSW DNSPs Expenditure Proposals.**

Critically, Jacobs has noted that while the AER has discounted the NSW DNSP repex forecasts because it considers them to be based on overly conservative risk assessments, it does not appear to have carried out any form of risk assessment in its substituted repex forecast approach. The AER appears to be taking a position on expenditure without apposite consideration of the risk profiles associated with the varying levels of expenditure. In particular, the AER's approach does not appear to consider "*risk level metrics [as] key elements of capex drivers*" within its substituted capex forecast approach.

The consideration of risk level metrics is one of the AER's stated criteria for what a top-down assessment 'should' include.

(Source: Ausgrid Draft Determination, Attachment 6 – p. 21; Endeavour Energy Draft Determination, Attachment 6 – p. 19; Essential Energy Draft Determination, Attachment 6 – p. 20)

5) AER Finding: *Deliverability issues faced by Ausgrid and Essential Energy during the 2009-14 period*

The AER has also potential deliverability issues with respect to the proposed repex programmes. Again, the AER has used this finding to support not only discounting the repex forecasts of the NSW DNSPs, but also to discount the capex forecast as a whole. Jacobs' has reviewed this issue and has found that the proposed capex programmes amount to approx. 65% to 75% of the actual capex programmes delivered during the 2009-14 period.

Jacobs' considers this to demonstrate the NSW DNSPs capability to deliver their proposed expenditure forecasts. For further details refer to Section 3.1, page 24.

AER's Substitute Repex Forecasts

This section discusses the AER's repex forecasting approach that has been used to replace the repex forecasts of the NSW DNSPs. The repex Draft Determination is predominantly based upon predictive modelling using the AER's *Repex Model*. The repex Model has been used to assess 84% of Ausgrid's repex, 70% of Endeavour Energy's repex and 90% of Essential Energy's repex. The other areas were deemed unsuitable for modelling and these were assessed based upon trend analysis and engineering review only.

Table 3-9 below shows the NSW DNSP's proposed repex and how it has been assessed by the AER in their substituted approach. (Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

Table 3-10 shows the AER's determinations with respect to each approach.

Table 3-9: Proportions of proposed repex modelled versus un-modelled in the AER's substitute repex forecasts

	Proposed Repex ($ M)	Modelled Component ($ M)	Un-modelled Component ($ M)
Ausgrid	$3,226	$2,767[4]	$459
Endeavour Energy	$740	$515	$225
Essential Energy	$856	$770	$86
Total	$4,822	$4,052	$770

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

Table 3-10: AER determinations

	Modelled Component ($ M)	Un-modelled Component ($ M)	Total ($ M)
Ausgrid	$1,430	$366	$1,769[5]
Endeavour Energy	$519	$142	$661
Essential Energy	$590	$86	$675

[4] Jacobs notes that Ausgrid's Draft Determination states that $2.6 b has been modelled which is equivalent to 84% of Ausgrid's proposed repex. However, 84% of $3.23 b is $2.7 b, not $2.6 b. Subtracting the un-modelled amount of $459 M from $3,226 M gives $2,767 M.

[5] Jacobs notes that the sum of the modelled and un-modelled component equals $1,796, which is $27 M more than the $1,769 allowed in the Draft Determination.

Total	$2,539	$594	$3,105

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

Predictive Modelling

The data used to populate the repex models is acquired from the Regulatory Information Notice (RIN). Jacobs understands that the NSW DNSPs have significant concerns relating to the suitability of this data to be applied as the AER have used it in their modelling. These issues are thought to be particularly acute in Essential Energy's case. Jacobs would expect the DNSPs to demonstrate the issues with the AER's application of the RIN data in their revise expenditure proposals.

The predictive modelling is a two-step process:

- First, the AER models a range of scenarios using the base data, historical performance data of the DNSP being modelled, and benchmark data for all DNSPs in the NEM.
- The AER uses the multiple scenarios to establish a "reasonable range", and then selects an outcome within that range.

The AER has developed several scenarios and reported the outcomes of these scenarios accordingly. The scenarios use a combination of changes to the following two input variables:

- The asset replacement lives (lifespan of assets or standard asset lives).
- The unit costs for asset replacement.

Jacobs' notes that for all three NSW DNSPs the modelled scenarios that has been selected from the "reasonable range" to determine the revised repex forecast is the "Calibrated Forecast". This scenario replaces the asset replacement lives proposed by the DNSPs with figures calculated by the AER i.e. the unit costs proposed by the DNSPs have been accepted but the replacement lives has essentially been extended to achieve reductions in forecast repex over the 2014-19 period.

The process for "calibrating" the replacement lives of the assets is not transparent and Jacobs has not been able to replicate the calculations. However, Jacobs understands that the calculations use historical data where the replacement lives are established based upon each DNSP's own repex spending and replacement volumes over the 2009-14 period.

While the Draft Determinations provide significant discussion, in Jacobs' view the AER does not robustly substantiate the key decision points in this process i.e. The AER does not appear to substantiate:

- How the "reasonable expenditure range" is determined;
- Why the "calibrated forecast" model is the most suitable.
- Why the replacement lives proposed by the NSW DNSPs are inappropriate.
- Why the replacement lives calculated by the AER are most suitable.

Table 3-11 below summarises the outcome of the AER's predictive modelling showing the base case produced by the repex model, the reasonable range determined by the AER and the Draft Determinations based upon the "calibrated forecasts".

Table 3-11: Predictive modelling outcome – Draft Determination based on "Calibrated Forecast"

	Modelled Repex ($ M)	Base Model Outcome ($ M)	"Reasonable Range" ($ M)	"Calibrated Forecast" ($ M)
Ausgrid	$2,767[6]	$3,734	$1,360 to $1,430	$1,430
Endeavour Energy	$515	$575	$519	$519
Essential Energy	$770	$4,363	$590 to $682	$590
Total	$4,052	$8,672	N/A	$2,539

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

Although, "reasonable ranges" were identified for the DNSPs based on a number of scenarios the AER does not appear to have substantiated these ranges. In any case, these ranges were not relevant for the final outcome process because in all cases the output value of the calibrated model was selected for the determination (although, it is noted that this is not categorically stated by the AER; Jacobs ascertained this outcome through subtracting the allowed un-modelled repex from the total allowed repex).

Jacobs has analysed the calibrations that were made on asset replacement lives for the calibrated forecast model. Table 3-12 below shows the average increase or decrease to asset replacement lives for each DNSP – it should be noted that this is not weighted by expenditure so should only be considered as an indicative outcome for each DNSP.

Notwithstanding, it shows that on average the replacement life calibration process:

- Extended Ausgrid's asset replacement lives by 41%
- Reduced Endeavour Energy's asset replacement lives by 8%
- Extended Essential Energy's asset replacement lives by 10%

In Jacobs view it is difficult to understand how "calibration" changes of this nature can be representative of the asset aging process and accurately forecast asset replacement needs.

Table 3-12: Predictive modelling – Average reduction / increase in replacement life from "calibration" process

Asset Category	Ausgrid	Endeavour Energy	Essential Energy
Poles	30%	-25%	-7%
Overhead Conductors	47%	9%	52%
Underground Cables	35%	-28%	5%
Service Lines	32%	11%	1%
Transformers	28%	-1%	12%
Switchgear	73%	-15%	-2%
AVERAGE	41%	-8%	10%

(Sources: Derived from the Base Forecast Models[7] and Calibrated Forecast Models[8] for each DNSP available on the AER's website – www.aer.gov.au)

[6] Jacobs notes that Ausgrid's Draft Determination states that $2.6 b has been modelled which is equivalent to 84% of Ausgrid's proposed repex. However, 84% of $3.23 b is $2.7 b, not $2.6 b. Subtracting the un-modelled amount of $459 M from $3,226 M gives $2,767 M.

[7] • AER Draft decision Ausgrid distribution determination - Ausgrid 2014 - repex model (base - forecast) - November 2014
• AER Draft decision Endeavour Energy distribution determination - Ausgrid 2014 - repex model (base - forecast) - November 2014

Un-modelled repex

The un-modelled repex categories have been considered independently using trend analysis and engineering reviews. These categories include SCADA/Protection/Control, Pole-Top Structures and Other. Essentially, expenditure categories with a significant increase that have not been adequately justified have been reduced to the expenditure allowed in the previous period.

Jacobs considers the AER's approach to be reasonable and expects that the DNSPs will provide sufficient evidence to justify any step increases to expenditure within the un-modelled categories in their revised expenditure proposal submissions.

Table 3-13 below summarises the AER's determination on the un-modelled portion of the repex determination.

Table 3-13: AER's Draft Determination on the un-modelled repex

	Un-modelled Repex ($ M)	AER Determination ($ M)
Ausgrid	$459	$366
Endeavour Energy	$225	$142
Essential Energy	$86	$86
Total	$770	$594

(Source: Ausgrid Draft Determination, Attachment 6; Endeavour Energy Draft Determination, Attachment 6; Essential Energy Draft Determination, Attachment 6)

The key findings with respect to the un-modelled repex are summarised below.

Ausgrid

- Ausgrid has proposed $252 M for SCADA/Protection/Control which the AER has reduced to $160 M, which is a step increase of 58% from the previous period. The AER considers that Ausgrid have not provided sufficient evidence to support this increase. Hence they have reduced the amount to $160 M which is equivalent to the 2009-14 allowance.
- Ausgrid has proposed $68 M for pole-top structures which the AER has accepted, although noting that it is at the higher end of their 'reasonable range'.
- Ausgrid has proposed $130 M for 'Other' repex which the AER has accepted. The majority of this relates to buildings ($111 M). The AER have accepted this repex on the grounds that it is 32% lower than the 2009-14 period.

(Source: Ausgrid Draft Determination, Attachment 6 – pp. 72-74)

Endeavour Energy

- Endeavour Energy has proposed $108 M for SCADA/Protection/Control which the AER has reduced to $25 M. Endeavour Energy's proposal contains a step increase for this category in 2013-14. The AER considers that Endeavour Energy have not provided sufficient evidence to support this increase. Hence they have reduced the amount to the expenditure equivalent to the first four years of the 2009-14 period (prior to the step increase).

[8] • AER Draft decision Essential Energy distribution determination - Ausgrid 2014 - repex model (base - forecast) - November 2014
• AER Draft decision Ausgrid distribution determination - Ausgrid 2014 - repex model (calibrated - forecast) - November 2014
• AER Draft decision Endeavour Energy distribution determination - Ausgrid 2014 - repex model (calibrated - forecast) - November 2014
• AER Draft decision Essential Energy distribution determination - Ausgrid 2014 - repex model (calibrated - forecast) - November 2014

- Endeavour Energy has proposed $117 M for 'Other' repex. The AER have accepted this on the grounds that it is a $230 M decrease from the expenditure for these items during previous period.

(Source: Endeavour Energy Draft Determination, Attachment 6 – pp. 64-65)

Essential Energy

- Essential Energy has proposed $28 M for SCADA/Protection/Control which the AER has accepted. The AER considers the increase of $9 M from the previous period as immaterial and has not investigated further.
- Essential Energy has proposed $59 M for pole-top structures which the AER has accepted. Although this is a significant increase from $32 M in the previous period Essential Energy have demonstrated an increasing failure rate of these assets to justify the expenditure.

(Source: Essential Energy Draft Determination, Attachment 6 – pp. 63, 71-72)

Draft Determination Anomalies

General Approach for the NSW DNSPs

The general approach taken by the NSW DNSPs in preparing their repex forecasts is summarised as follows:

- Bottom up approach based on risk analysis of the different businesses, using an element of top down forecasting for validation.
- Each of the businesses carries out operational risk analyses to identify the different projects/programs.
- Risk analysis is predominantly based on a qualitative analysis, although between businesses there are differences in the way they structure this risk analysis and what tools they use.
- When a complete list of projects/programs is identified the CASH/PIP model is used by all businesses to:
  - Refine the baseline forecasts; and
  - Prioritise the projects/programs.
- An overview of the projects/programs and associated risk levels is established in collaboration with NNSW, and the repex programme is then based on a strategic position on overall expenditure and risk profiles.

Overall Assessment of the AER's Approach

The predictive modelling done by the AER is the most crucial step in the determination process of the AER. All other steps are used as supporting evidence to the AER's decision; which is to use the *Calibrated Forecast* Repex Model output to determine the repex allowance.

The AER has presented five key reasons for discounting the approach of the NSW DNSPs and substituting their repex forecasts with the output from the Calibrated Forecast model.

In Jacobs view the reasons to discount the approach of the DNSPs are either flawed or poorly substantiated. These are summarised as follows:

1) AER finding: *Significant increases of approx. 40% to 60% in forecast repex compared to historical trends.*

Jacobs notes the AER's high-level conclusion that the proposed level of repex appears to be significantly higher that the historical trends. **However, as noted above, Jacobs is of the view that historical trend projections are useful only for the purposes of providing a context for the future projections rather than being a predictor of future need.**

It would normally be expected that asset replacement driven expenditure would increase (in real terms) with the passage of time due to the asset base being utilised. It is to be expected therefore that from one regulatory period to another, replacement expenditure should increase in real terms as assets deteriorate and new replacement needs emerge as identified through asset management planning processes.

The changing asset-renewal investment driver from one period to another means that the past is unlikely to be a good predictor of the future. From a statistical viewpoint, using trend analysis to ascertain future demand for expenditure is predicated upon the underlying assumption that the historical drivers of investment need will be identical in the future. This is clearly not the case with an ageing asset base.

Critically, these factors mean that basing the repex forecast on the "calibrated forecast" which calculates replacement lives based on repex spending over the 2009-14 period would be inappropriate.

2) AER Finding*: *Unfavourable comparisons with benchmarked DNSPs.

Jacobs notes the AER's conclusion that the NSW DNSPs compare unfavourably with other NEM DNSPs based on these measures. However, Jacobs notes that:

- The analysis has been carried out using data over a specific window of time (2008 to 2013). The AER does not appear to substantiate why this is an appropriate window.
- The AER has not provided trend comparisons of asset age profiles or repex expenditure for the benchmarked DNSPs. If the DNSPs on the "efficient frontier" have aging assets during the period this may simply demonstrate a riskier profile rather than greater repex efficiency. In Jacobs view it would be imprudent to draw conclusions on this analysis without an understanding of the age profiles (and risk profiles by proxy) and the asset failure performance of the benchmarked DNSPs.
- Also if the DNSPs on the "efficient frontier" have made significant repex investments prior to 2008 this would distort the benchmarking.

***3) AER Finding:** Network health indicators not supporting the relative increase in repex requirements*

- The estimated residual service life analysis is not considered in the context of the age profiles of the assets and draws flawed conclusions as a result. Specifically it is based on averages and assumed an even distribution of assets. It does not consider how the proportions of new and aging assets affect the average residual life analysis. Hence, conclusions are not based on the actual proportion of assets reaching the end of the serviceable life that will require replacement.
- The asset utilisation analysis does not take into account the effects of reduced augex.

***4) AER Finding:** Overly conservative risk assessments*

- The AER's conclusion is primarily based on the processes used to establish baseline repex forecasts rather than full consideration of the entire risk evaluation process that was applied to refine the final repex forecasts that comprise the NSW DNSPs Expenditure Proposals.
- Critically, Jacobs has noted that although the AER has discounted the NSW DNSP repex forecasts because it considers them to be based on overly conservative risk assessments, it does not appear that the AER has carried out any form of risk assessment in its substituted repex forecast approach. The AER appears to be taking a position on expenditure without apposite consideration of the risk profiles associated with the varying levels of expenditure. In particular, the AER's approach does not appear to consider "*risk level metrics [as] key elements of capex drivers"* within its substituted capex forecast approach.

  The consideration of risk level metrics is one of the AER's stated criteria for what a top-down assessment 'should' include. (Source: Ausgrid Draft Determination, Attachment 6 – p. 21; Endeavour Energy Draft Determination, Attachment 6 – p. 19; Essential Energy Draft Determination, Attachment 6 – p. 20)

***5) AER Finding:** Deliverability issues faced by Ausgrid and Essential Energy during the 2009-14 period*

- Jacobs' has reviewed the issue of capex deliverability and has found that the proposed capex programmes amount to approx. 65% to 75% of the actual capex programmes delivered during the 2009-14 period.

- Jacobs' considers this demonstrates the NSW DNSP's capability to deliver their proposed expenditure forecasts. For further details refer to Section 3.1, page 24.

The AER has used the above reasons to discount the approach of the DNSPs. However, the critical elements that determine the repex outcome lack rigour, are poorly substantiated, and appear to be based on illogical "calibrations" to asset replacement lives.

The key anomalies identified with the repex modelling approach are as follows:

- A number of scenarios are used to establish a "reasonable range". However, the AER has not substantiated how it arrived at this range, which appears to be inconsistent with respect to each of the DNSPs. There is no robust argument provided as to why these ranges have been picked from the modelled scenarios, and therefore they appear to be randomly chosen.
- For all businesses the chosen final repex value is based on the output of the "Calibrated Forecast" model (with calculated replacement lives and forecasted unit rates), and neither a robust justification nor quantification is provided to substantiate this.
- In short, although a number of supporting arguments for the repex Determination have been provided these do not appear to have been applied robustly to determine prudent repex levels. For example, the five key reasons for discounting the approaches of the DNSPs are not weighted and ranked in any meaningful way, and no discussion is provided as to how they influence the Draft Determination.

Furthermore, the largely unsubstantiated use of the "Calibrated Forecast" repex Model means the implicit area of difference is that the AER considers the NSW DNSP's assets to have longer replacement lives than advised by the DNSPs.

It should be noted that the replacement life calibration is not transparent and Jacobs has not been able to replicate the calculations. Notwithstanding, **Jacobs' has carried out analysis of the Calibrated Replacement Lives and has found anomalies with several observably illogical replacement lives applied to some asset categories, and significant inconsistencies between the DNSPs.** For example, based on the calibrated replacement lives:

- The AER considers that Essential Energy's steel poles under 1 kV will have a 72 year lifespan whereas Endeavour Energy's equivalent poles will have only a 23 year lifespan.
- At the same time, it considers that Essential Energy's 22-66 kV steel poles will have only a 9 year lifespan whereas Endeavour Energy's equivalent poles will last 58 years.

In the above example the inconsistencies in the AER's calibrated asset lives are clearly evident both between different asset groups within each DNSP and between comparable asset groups across the NSW DNSPs. These anomalies are evident in Table 3-14 below, which compares a selection of the replacement lives advised by the DNSPs to those used in the Calibrated Forecast Models where there is a variation greater than 50%. It should be noted that this table shows only a sample. The complete table is provided in Appendix A.

The table demonstrates several of the illogical and inconsistent calibrated asset lives. In Jacobs' view this brings into question the robustness of the calibration process.

Jacobs' understanding is that the remaining lives of the assets is "calibrated" based upon the repex activities over the 2009-14 period. In Jacobs view this is unlikely to accurately capture realistic repex requirements for the reasons given above. The AER has not substantiated why it considers this window to accurately reflect ongoing repex requirements.

It seems that if the AER considers the replacement lives advised by the DNSPs to be incorrect it would be more reasonable to state more appropriate replacement lives (adjusted for environmental factors such as coastal / inland etc.) rather than a poorly substantiated calibration technique that produces observable anomalies.

In addition:

- The AER has not provided any discussion on the increased risk profiles that are likely to result due to the deferred asset replacements.
- The AER has expressed concerns with respect to the deliverability of repex programmes. However, in Jacobs' view the NSW DNSPs appear to have proposed achievable repex programmes that can be expected to be sustainable over the longer term. With large scale deferral of asset replacements it seems likely that this would lead to potentially unachievable programmes in future regulatory periods.
- There is significant concern on behalf of the NSW DNSPs relating to the suitability of the underlying RIN data to be applied in the manner in which the AER has relied upon it for the repex modelling.

Table 3-14: Predictive modelling – "Calibrated Forecast" analysis of asset replacement lives – selection of assets with > 50% change to lives advised by DNSPs

		Ausgrid			Endeavour Energy			Essential Energy		
Asset category	**Asset ID**	Base-Forecast (years)	Calibrated Forecast (years)	% Reduction / increase	Base-Forecast (years)	Calibrated Forecast (years)	% Reduction / increase	Base-Forecast (years)	Calibrated Forecast (years)	% Reduction / increase
POLES	STAKING OF A WOODEN POLE	6.77	12.56	86%	15.00	13.21	-12%	53.80	23.38	-57%
	> 66 kV & < = 132 kV; WOOD	40.61	60.42	49%	58.00	62.05	7%	54.90	87.02	59%
	< = 1 kV; CONCRETE	27.63	48.11	74%	58.00	21.25	-63%	53.80	42.98	-20%
	> 1 kV & < = 11 kV; CONCRETE	27.63	26.76	-3%	58.00	17.25	-70%	53.80	45.30	-16%
	> 66 kV & < = 132 kV; CONCRETE	27.63	41.03	48%	58.00	24.20	-58%	54.90	38.68	-30%
	< = 1 kV; STEEL	38.19	55.51	45%	58.00	23.01	-60%	53.80	72.04	34%
	> 1 kV & < = 11 kV; STEEL	38.19	48.39	27%	58.00	22.73	-61%	53.80	29.87	-44%
	> 11 kV & < = 22 kV; STEEL	38.19	16.66	-56%	58.00	4.63	-92%	54.90	9.09	-83%
	> 22 kV & < = 66 kV; STEEL	38.19	11.46	-70%	58.00	58.00	0%	54.90	9.16	-83%
OVERHEAD CONDUCTORS	< = 1 kV	40.61	67.22	66%	50.00	67.92	36%	53.80	76.12	41%
	> 11 kV & < = 22 kV ; SWER	40.61	87.95	117%	50.00	87.57	75%	53.80	93.91	75%
	> 11 kV & < = 22 kV ; MULTIPLE-PHASE	40.61	75.62	86%	50.00	50.00	0%	53.80	86.33	60%
	> 22 kV & < = 66 kV	40.61	54.79	35%	55.00	55.00	0%	54.90	102.74	87%
	> 66 kV & < = 132 kV	40.61	63.75	57%	55.00	55.00	0%	54.90	80.22	46%
UNDERGROUND CABLES	< = 1 kV	42.49	66.20	56%	60.00	44.11	-26%	53.80	73.82	37%
	> 1 kV & < = 11 kV	45.67	70.60	55%	60.00	39.25	-35%	53.80	61.26	14%
	> 11 kV & < = 22 kV	45.67	66.51	46%	60.00	15.75	-74%	53.80	45.49	-15%
	> 22 kV & < = 33 kV	46.66	77.08	65%	45.00	45.80	2%	54.90	63.85	16%
TRANSFORMERS	POLE MOUNTED ; < = 22kV ; < = 60 kVA	32.33	79.96	147%	51.00	57.29	12%	45.80	70.12	53%
	POLE MOUNTED ; < = 22kV ; > 60 kVA	36.51	54.35	49%	51.00	48.69	-5%	45.80	66.84	46%
	POLE MOUNTED ; < = 22kV ; < = 60 kVA	32.98	59.65	81%	51.00	57.42	13%	45.80	70.19	53%
	POLE MOUNTED ; < = 22kV ; > 60 kVA	36.51	58.47	60%	51.00	53.35	5%	45.80	60.31	32%
	KIOSK MOUNTED ; < = 22kV ; > 60 kVA	36.29	55.36	53%	51.00	39.97	-22%	45.80	45.14	-1%
	GROUND OUTDOOR / INDOOR CHAMBER	36.63	62.43	70%	51.00	46.97	-8%	45.80	68.39	49%
SWITCHGEAR	< = 11 kV ; FUSE	24.85	134.32	440%	35.00	36.26	4%	53.80	68.24	27%
	> 11 kV & < = 22 kV ; CIRCUIT BREAKER	41.80	41.80	0%	51.00	14.37	-72%	53.80	50.07	-7%
	> 33 kV & < = 66 kV ; SWITCH	30.92	99.40	222%	NA	NA		54.90	41.77	-24%

(Sources: Derived from the Base Forecast Models and Calibrated Forecast Models for each DNSP available on the AER's website – www.aer.gov.au – refer to footnotes on page 40)

3.2 Operating Expenditure (Opex)

Overview

A key aspect of the NSW DNSP's Operating Expenditure (opex) proposal is the expenditure forecast methods. Various methods have been identified by the NSW DNSPs and are applied to individual cost categories. The varying methodologies are intended to ensure a prudent forecast of the spending to establish a safe and reliable network supply.

The NSW DNSPs have used varying approaches to produce their opex forecasts. The AER has not accepted the opex forecasts and has instead substituted their forecasts with their own approach. The AER's approach uses various benchmarking techniques to identify an overall level of "efficient expenditure for a prudent service provider" – it does not make assessments on individual projects and programmes.

For Ausgrid, the AER states the following (for Endeavour Energy and Essential the wording is similar):

"The main difference between our forecast and Ausgrid's forecast is the base amount of opex used to form the opex forecast (known as the 'base year'). […]Ausgrid based its opex forecast primarily on the actual opex it incurred in 2012–13. However, while Ausgrid acknowledged that it is currently incurring costs above efficient levels it has […] proposed similar levels of opex to the previous period. […] Ausgrid spends opex about half as efficiently as the most efficient service providers in the NEM […]."

(Source: Ausgrid Overview– p. 54)

As a result, the AER has applied a substantial efficiency adjustment to each of the NSW DNSPs (and other changes, including a service classification change, price change and output change). Based on the reasons outlined above, and the AER's subsequent revision to the proposed expenditure, the draft determinations make reductions to the proposed opex as outlined in Table 3-15 below.

Table 3-15: Summary of NSW DNSP opex Proposals and AER Draft Determinations

	Proposed Expenditure ($ M)	AER Draft Determination ($ M)	Difference ($ M)	Difference (%)
Ausgrid	$2,888	$1,759	-$1,130	-39%
Endeavour	$1,381	$1,068	-$313	-23%
Essential	$2,332	$1,437	-$895	-38%
Total	**$6,601**	**$4,263**	**-$2,338**	**-35%**

(Source: Ausgrid Draft Determination, Attachment 7; Endeavour Energy Draft Determination, Attachment 7; Essential Energy Draft Determination, Attachment 7)

Prudency Assessment

Benchmarking

Jacobs has carried out a high level review of the opex Draft Determinations and considers that it demonstrates that other DNSPs within the NEM are operating at lower opex levels than the NSW DNSPs. However, it should be noted that Jacobs has not carried out a detailed review of the validity and rigour of the AER's benchmarking approach.

Notwithstanding, Jacobs notes two key elements of the approach:

- The AER has benchmarked the NSW DNSPs against an "efficient frontier" of DNSPs – citing Citipower as the frontier business under their preferred benchmarking technique with an efficiency score of 0.95 and using the top quartile of businesses to set an average efficient level from which to calibrate reductions.

(AER draft decisions, attachment 7: Ausgrid – p. 28, Endeavour Energy – p. 27, Essential Energy – p. 28)

- The AER is not required to (and has not) consider(ed) the circumstances of the [individual] service provider.

  (AER draft decisions, attachment 7: Ausgrid – p. 54, Endeavour Energy – p. 53, Essential Energy – p. 54)

Jacobs considers that system expenditure and risk profiles are directly linked. In view of this, and in consideration of the above points, Jacobs notes the following implications of the overall opex rulings:

- **By benchmarking the opex allowances of the NSW DNSPs against an "efficient frontier" it is implied that the AER considers the risk profile of the efficient frontier to be acceptable, or that the risk profiles of distributors being compared are similar.**
- **If the individual circumstances of the NSW DNSPs do not enable them to gain the same efficiencies as the efficient frontier elsewhere in their opex programme, system opex will be disproportionately affected. This would result in the NSW DNSPs having a greater risk profile than the efficient frontier for the same opex levels.**

Also, Jacobs also notes that it does not appear that the AER has robustly substantiated a position on whether the asset age profiles (and asset health by proxy) of the "efficient frontier" are appropriate for benchmarking the NSW DNSPs. The AER categorically states that:

"We are satisfied that it is not necessary to provide an operating environment factor for differences in asset age between the NSW service providers and the comparison service providers."

(AER draft decisions, attachment 7: Ausgrid – p. 128, Endeavour Energy – p. 127, Essential Energy – p. 128)

FMECA/ RCM Approach

In addition to the above benchmarking issues, it appears that the AER has discounted the opex based on the overall level of expenditure without giving due regard to the underlying approaches of the DNSPs.

One particular approach used by the NSW DNSPs is the use of its FMECA/RCM tool (Failure Modes, Effects & Criticality Analysis / Risk Centred Maintenance). This tool is widely used to determine the periods for asset inspections and associated reactive maintenance. Jacobs considers the FMECA/RCM tool to use robust techniques to interpret and quantify risks and optimise schedules accordingly. Jacobs understands that the tool has received recognition from the asset management community, in industries such as aviation, mining, oil & gas and the military, as well as the AER in previous regulatory submissions.

Jacobs notes that limited reference to the FMECA/RCM approach was made in the NSW DNSP Expenditure Proposals, which means that the AER may not have appropriately considered the rigour of the approach. Jacobs considers that due to its risk analysis strengths it provides significant insights into the risk profiles of the NSW DNSPs. **In their revised Expenditure Proposal submissions, Jacobs would expect the NSW DNSPs to present the benefits of the FMECA/RCM approach and demonstrate the potential risks and increased overall costs burden that would eventuate due to the disruption of the optimised schedules.**

The NSW DNSPs apply this tool to support the forecast of planned inspections (excl. vegetation), which is a sub category of Network Maintenance. In doing so it regulates reactive maintenance and associated asset failures. Jacobs understands that its application can be summarised as follows:

- The FMECA/RCM methodology is used to determine optimised maintenance/inspection cycles (excl. vegetation) on the basis of failure modes effects criticality analysis (FMECA). It has been used by Ausgrid since the year 2000.
- A comprehensive database for some 99% of Ausgrid's assets has been built up over the years. Both Endeavour and Essential have progressively adapted the tool as well and built up their own databases.
- The tool and its suitability were acknowledged by the regulator in Ausgrid's previous proposal for the 09/14 regulatory period. It has also received recognition from the broader asset management community.

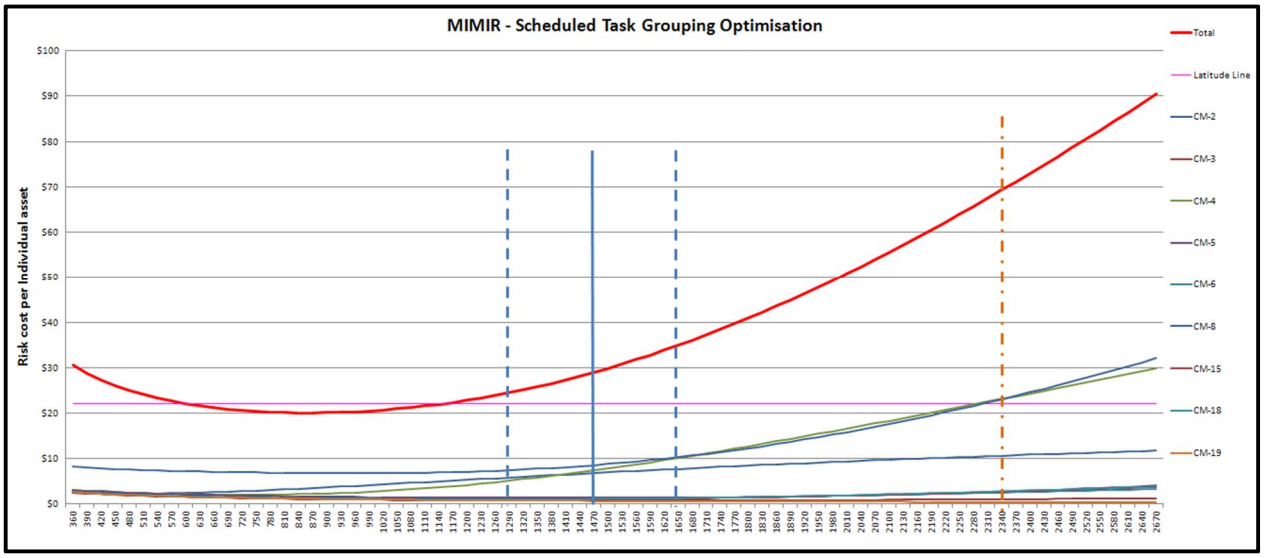
The FMECA/RCM method analyses a variety of factors to provide a transparent view of the risks associated with different scenarios. As a result, informed decisions can be made as to the optimised inspection and maintenance regimes, considering cost, safety and reliability. In quantifying risk the tool analyses a breadth of direct and indirect costs in conjunction with probabilities and consequence costs. In Jacobs view significant reductions to system opex would disrupt the optimised programmes, which, while potentially reducing opex in the short term, would lead to higher overall costs over the medium to longer term. This would not be a prudent outcome for the NSW DNSPs.

Figure 1 below shows an example of the output from the FMECA/RCM data analysis. This output shows analysis on the optimised inspection regimes for a small number of failure modes for Essential Energy's cross-arm population. It is summarised as follows:

- The red curve is the sum of the individual condition monitoring task curves for the selected failure modes.
- Each individual condition monitoring task curve represents the direct and indirect maintenance costs, and risk costs of the failure mode; where risk costs are determined by the consequence costs multiplied by the probability of occurrence.
- The blue vertical line shows the current task scheduling period for the group of tasks. It should be noted that the period can vary around the absolute minimum overall cost (i.e. lowest point on the red curve) because it needs to be considered and aligned with other pole and overhead line tasks which have different optimum periods but are undertaken at the same time for reasons of task delivery economy.
- The orange vertical line indicates how the task schedule for Essential Energy's cross-arms would be affected if the opex were to be reduced by 38% - as indicated in Essential Energy's opex Draft Determination, and the period for maintenance correspondingly increased by 1/(100-38%).
- The schedule delay, represented by the gap between the blue and orange vertical lines, will result in an approximate maintenance increase of 140% for the selected failure modes.

Figure 3-9 clearly demonstrates how the effects of reducing opex in the short term would result in significantly increased costs associated with managing the asset population over the long term.

Figure 3-9: FMECA/RCM output – Essential Energy Cross-arms



(Source: AER OPEX Reduction Implications Rev04)

Draft Determination Anomalies

The AER has not accepted the opex proposals and substituted these with modelling techniques using industry benchmarks which they have compiled. Based on the material presented Jacobs is of the view that the AER has demonstrated there is scope for efficiency gains within the NSW DNSP's opex categories. However, in carrying out its benchmarking process it does not appear that the AER has robustly substantiated a position on whether the asset age profiles (and asset health by proxy) of the "efficient frontier" are appropriate for benchmarking the NSW DNSPs.

Moreover, implicit in the benchmarking process is that the risk profiles of the 'efficient frontier' are considered acceptable. Jacobs does not consider that the AER has effectively substantiated a position on the proportion of expenditure reductions are expected to be absorbed through efficiency gains and the proportion absorbed through an increased risk profile.

Additionally, in substituting its approach Jacobs considers that due regard for areas of strong performance have been overlooked. This is particularly apparent with respect to the FMECA/RCM tool used by the NSW DNSPs to schedule asset inspection frequencies.

The FMECA/RCM approach has a long development history and is supported by solid data and Jacobs considers its risk assessment approach among the industry leaders. Jacobs understands that the tool has received recognition from the asset management community as well as the AER in previous regulatory submissions.

Jacobs is of the view that a step change of opex reductions in the magnitude indicated by the Draft Determinations will inevitably lead to a reduction in asset maintenance, a significant proportion of which has been optimised using the FMECA/RCM approach. This situation would lead to a demonstrably increased risk profile.

3.3 Performance Targets and Related Expenditure

Overview

The AER outlines performance targets for each of the NSW DNSPs through the Service Target Performance Incentive Scheme (STPIS) determinations[9]. The STPIS scheme provides the DNSPs with financial incentives or penalties based upon whether they achieve the targets determined by the AER. However, the DNSP's ability to achieve their performance targets is clearly linked to their overall allowable levels of expenditure.

Prudency Assessment

Reliability Expenditure

Both Ausgrid and Endeavour Energy have proposed additional capex (outside the other capex categories such as capex and augex etc.) specifically to meet performance standards and customer expectations under their respective reliability investment plans of $28.3 M and $65.3 M. **However, the AER has disallowed all proposed expenditure on the grounds that it has not been adequately justified. We consider this position to be reasonable and would expect that the DNSPs would demonstrate a robust business case in the revised Expenditure Proposals to justify this expenditure.**

The AER has not approved Ausgrid's reliability improvement capex because:

"we consider that Ausgrid's proposed methodology is sound. However, we have not accepted this amount for the purpose of the draft decision on the basis that Ausgrid has not identified what component of this proposed capex is augex and repex related. This information is necessary to ensure we do not double count this expenditure (e.g. if this expenditure is mainly repex related we have already taken this into account in our

[9] • AER – Draft decision Ausgrid distribution determination – Attachment 11 – Service target performance incentive Scheme – Nov 2014
• AER – Draft decision Endeavour Energy distribution determination – Attachment 11 – Service target performance incentive scheme – Nov 2014
• AER – Draft decision Essential Energy distribution determination – Attachment 11 – Service target performance incentive scheme – Nov 2014

alternative estimate of repex. It is also not clear to us the extent to which Ausgrid's proposal is related to its proposed improvement in SAIDI during the 2014–2019 period. To this end it also remains unclear whether this expenditure should form part of Ausgrid's total forecast capex, given any improvements that are valued by customers should be funded through the STPIS. Accordingly, we expect Ausgrid to provide further information in its revised regulatory proposal regarding the portion of this forecast that is considered to be augex and repex. We also expect Ausgrid to provide analysis that supports the additional expenditure that is not related to its Schedule 3 licence obligations."

(Source: AER Ausgrid draft decision, attachment 6, p 74)

Jacobs considers this assessment to be reasonable and would expect Ausgrid to specifically address these concerns within its revised Expenditure Proposal.

The AER has also not accepted Endeavour Energy's reliability capex amount on the basis that:

1) *A review of Endeavour Energy's supporting information does not indicate the amount and the basis for this amount that has been proposed to address any compliance issues related to the Schedule 3 licence conditions (i.e. individual feeders performance obligations)*
2) *It appears that the proposed amount includes expenditure to avoid penalties under the STPIS; and*
3) *The amount proposed has not been allocated in such a way that enables us to identify whether this amount already forms part of our analysis of other capex driver categories (e.g. we may have taken into account compliance related repex as part of our consideration of* repex)

(AER Endeavour Energy draft decision, attachment 6, p 6-66)

Jacobs considers this assessment to be reasonable and would expect Endeavour Energy to specifically address these concerns within its revised Expenditure Proposal.

Service Targets Performance Incentive Scheme (STPIS)

The AER's STPIS determinations are summarised below. The AER has accepted for all NSW DNSP's to cap the revenue at risk of the STPIS at ±2.5%.

- Ausgrid: The AER has adjusted Ausgrid's performance targets for System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) at 5.5% and 12.38% below the respective latest 5 (five) regulatory year average performance levels. AER has based this determination on the trend of the system SAIDI and System SAIFI, which over the past 5 years has declined by 5.5% and 12.38% respectively.

  (Source: AER Ausgrid draft decision, attachment 11, p11-22)

- Endeavour Energy: Endeavour Energy's reliability performance trends are either stable or deteriorating. However, the AER still considers some improvement is likely to be evident over the 2015-19 regulatory control period, mainly based on the capex spend over the previous regulatory control period in system security and reliability improvements. As a result, the AER has adjusted the unplanned SAIDI and SAIFI based on Ausgrid's improvement trend and applied indices that are some 9 to 16% lower than Endeavour Energy's forecasted values.

  (AER Essential Energy draft decision, attachment 11, p11-20)

- Essential Energy: In a similar manner as for Endeavour Energy, the AER has adjusted Essential Energy's SAIDI and SAIFI values based on Ausgrid's trend.

  (AER Essential Energy draft decision, attachment 11, p11-20)

The AER attributes the improvement trend to the investments in the network in the past and expects that the investments in the past regulatory period will have the same impact. In Ausgrid's STPIS determination it is stated that:

"The key determinant of a DNSP's reliability performance is its existing network assets and their configuration, which is the result of the DNSP's historical investment and its operating practices. Most of these assets have an

expected life in excess of 50 years; therefore by discounting for uncontrollable external impacts such as weather variations, the DNSP's reliability level should not change abruptly."

(Source: AER Ausgrid draft decision, attachment 11, p18)

Jacobs notes the above statement. However, we also note that this assumes that health of the existing assets will remain at the current levels. **Jacobs considers that if the significant capex and opex reductions outlined in the NSW DNSP Draft Determinations are imposed, then it can reasonably be expected that asset health will deteriorate over the 2009-14 period.** It is likely that:

- In the short term there will be increased asset failures due to reduced maintenance levels resulting from the opex reductions.
- In the medium term there will be increased asset failures due to reduced asset replacement levels resulting from the repex reductions.
- Additionally, in the long term there will be decreased network capability due to the reduced network augmentation levels resulting from the augex reductions.

This would be consistent with the AER's conclusion that the NSW DNSPs are "overly risk averse" and its implicit intention to increase the risk profiles of the networks (to undefined levels) through significant expenditure reductions. Based on this it seems unreasonable to expect Ausgrid's trend of improving performance over the 2009-14 period to continue throughout the entire 2014-19 period.

Additionally, Jacobs would expect that in its 2009-14 determination the AER would only have allowed Ausgrid sufficient expenditure to meet its requirements. This seems contradictory with the AER's expectation that Ausgrid will now continue to improve beyond its 2009-14 requirements based on the expenditure allowed over the 2009-14 period.

The AER has then extrapolated its finding on Ausgrid and applied the determination on Ausgrid's performance targets to Endeavour Energy and Essential Energy, despite them not exhibiting the same improving trend as Ausgrid over the 2009-14 period. **Jacobs considers the lack of rigour in this approach to be inappropriate given the significance of the issue and the potential impact of network risk and performance. In saying this, we are not saying that efficiencies cannot be obtained by the DNSP's, but that the AER's approach In attempting to drive this behaviour is unscientific, imprudent and likely to lead to higher levels of network risk that may be unacceptable to the community at large.**

Draft Determination Anomalies

Ausgrid and Endeavour Energy have included reliability capex in their expenditure proposals. The AER has disallowed all proposed expenditure on the grounds that it has not been adequately justified. We consider this position to be reasonable and would expect that the DNSPs would demonstrate a robust business case in their revised expenditure proposals to justify this expenditure.

Jacobs has reviewed the performance target (STPIS) Draft Determinations and is of the view the AER's position relating to the STPIS targets does not take into account the effects of deteriorating asset health. Furthermore, we consider that a lack of rigour has been applied in extrapolating its conclusions relating to Ausgrid to the other NSW DNSPs.

However, Jacobs notes that in the Draft Determinations the AER has significantly reduced expenditure across both capex and opex. Jacobs considers that the NSW DNSPs cannot reasonably be expected to absorb the magnitude of expenditure reductions through efficiency gains alone. That is, Jacobs expects that the reductions will not be achieved without significantly reducing the number and size of projects and programmes.

It is Jacobs' view that the AER has not given due regard to the overall reductions in expenditure which will likely result in poorer reliability performance and difficulty to meet higher targets. In this scenario the NSW DNSPs are likely to be further penalised under STPIS for not meeting the performance targets.

4. Potential Impacts of Draft Determinations

4.1 Overview

The AER's Draft Determinations impose significant expenditure reductions upon the NSW DNSPs across both opex and capex categories. The combined opex and capex reductions are in the order of 35% to 37%. Jacobs acknowledges that the AER's intent in imposing these reductions to align the expenditure levels with those that a prudent service provider would require.

However, based on our review we consider that the AER has not duly regarded the associated risk profiles. In Jacobs' view the expenditure and risk profiles of the NSW DNSPs are directly linked. Thus, it would appear imprudent to reach a position on expenditure without considering risk profiles. From our understanding of the NSW DNSP's risk profiles gained throughout the course of this review we consider that, if imposed, the AER's Draft Determinations could potentially lead to a situation where the businesses are unable to effectively mitigate the risks associated with their network assets. Critically, in our review of the AER's discussions supporting the Draft Determination expenditure reductions we were unable to observe robust consideration of critical risk factors such as bushfires and public safety; where, in Jacobs' opinion the overarching thread focuses on costs versus reliability of supply.

Although Jacobs' has not rigorously tested the methodologies applied by the AER in reaching its expenditure reductions, our review of the Draft Determinations highlights a number of issues with respect to the approach. With respect to each area of system expenditure reviewed, Jacobs was able to observe apparent flaws in reasoning, poorly substantiated decisions, and an over reliance on speculative views.

This was not only evident within the approaches adopted by the AER, but also with respect to the reasoning used to discount the approaches adopted by the NSW DNSPs in preparing their Expenditure Proposals. In cases, Jacobs also found that the approaches used by the NSW DNSPs better aligned with the AER's stated criteria for the elements that a robust approach "should" comprise. Overall, Jacobs considers that the approaches used by the NSW DNSPs demonstrated greater rigour than the AER's substituted approaches.

Two of the AER's central criticisms of the overall Expenditure Proposals were that the NSW DNSP's Expenditure Proposals are overly risk averse and lack the top down assessment required to ensure that overall efficiencies are achieved. Jacobs' found that the basis on which the AER drew these conclusions overlooked key aspects of the processes used to prepare the Expenditure Proposals. Rather Jacobs' found that the NSW DNSPs are able to demonstrate that their Expenditure Proposals are based upon both a bottom up and a strategic top-down assessment of the risk versus expenditure profiles.

Moreover, the NSW DNSPs understanding of their risk profiles has the granularity required to transparently demonstrate the outcomes to risk profiles with varying levels of expenditure. While the AER has attempted to reduce expenditure to efficient levels, in Jacobs' view the magnitude of the reductions cannot be absorbed by efficiencies alone. In Jacobs' view this is self-evident in the risk profiling analysis. The AER does not appear to have adopted a position on the proportion of expenditure that it expects the NSW DNSPs to absorb through efficiency improvements and the proportion absorbed though increasing the risk profile of their businesses.

The capacity with which the NSW DNSPs have to absorb the reductions though efficiency gains is further compounded by the fact that the AER's determinations will apply retrospectively, which means that the first year of expenditure will be predominantly "locked in". **This will have the effect of increasing the opex and capex reductions from 35% and 37% over 5 years to 44% and 46% over 4 years.**

Although Jacobs considers that the AER's analysis presented within the Draft Determinations does demonstrate scope for material efficiency improvements, in Jacobs view it is not reasonable to expect the NSW DNSPs to achieve a step change in efficiency of this magnitude. **This means that the majority of this expenditure reduction will translate into an increased risk profile rather than increased efficiency**; at least within the short to medium term. The relationship between costs and risks is bi-directional. This means that there is an optimal balance point between risks and expenditure. Whereby, **if expenditure levels are reduced too low the benefits can be expected to be overwhelmed by risk costs in the longer term.**

Jacobs also notes that the Draft Determinations indicate expenditure reductions across all categories that have been reviewed. In reaching its decisions the AER does not appear to have given due consideration to the trade-offs between different expenditure categories, for example a reduction in repex is likely to lead to an increase in the opex required to maintain the aging assets. Again, the balance between the expenditure categories appears to have been more rigorously tested by the NSW DNSP's approaches in preparing their Expenditure Proposals than the AER's substituted approaches.

Jacobs notes that the AER has also expressed concerns regarding the NSW DNSP's capability to deliver their capex programmes. While Jacobs' considers their ability to deliver their 2014-19 Expenditure Proposals to be demonstrated by the delivery of larger capex programmes over the 2009-14 period it is not clear what the outcome will be of deferring such large proportions of network investment. The AER does not appear to have considered the future impacts of the deferred expenditures. It Jacobs' view there is significant potential for this to lead to unmanageable capex programmes in future, particularly in the case of Ausgrid and Essential Energy's future repex requirements.

4.2 Expenditure Programme Impacts

While Jacobs considers that expenditure reductions in the order of 10% may be reasonably achieved through increased efficiencies over the 2009-14 period, we do not expect that the NSW DNSPs will be able to achieve the remaining reductions without increasing their risk profiles through reductions to the expenditure programmes i.e. through cutting projects and programs.

The following section provides analysis on the likely impacts on the NSW DNSPs capex and opex programmes due to the expenditure reductions indicated in the Draft Determinations.

Capex

The combined capex programme proposed by the NSW DNSPs includes projects and programmes with a CASH/PIP score over 7,200 which is around 80% of the baseline capex programme. The AER's Draft Determinations would increase the CASH/PIP cut-off score to around 10,125, which is 63% of the proposed capex programme. Arbitrarily assuming that a 10% efficiency through productivity gains can reasonably be achieved by the NSW DNSPs this would put all projects and programs below 73% of the proposed capex programme at risk (CASH/PIP score of around 9,900).

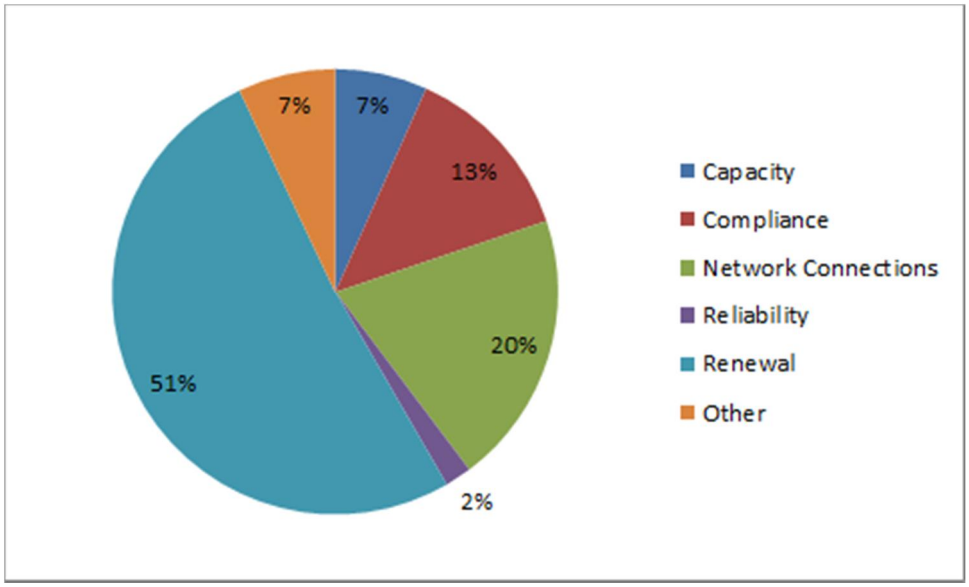
Figure 4-1 and Figure 4-2 below show a breakdown by primary driver and project category for the capex at risk (i.e. those falling below 73% of expenditure sorted based on highest CASH/PIP score). These charts illustrate the difficulty that the NSW DNSPs will have in managing the overall risks associated with providing essential electricity services if the capex reduction indicated in the Draft Determinations are imposed.

They show that the largest proportions of capex at risk are for asset renewals, mandatory programs to meet minimum regulatory requirements, and strategic projects to meet short term needs. This suggests that the networks are likely to:

- Have difficulty meeting their regulatory, customer and other stakeholder obligations.
- Begin showing signs of decreasing reliability and increasing risks to public safety within the 2014-19 regulatory period (as discussed in Section 3.3 with respect to when the impacts on network performance are likely to be evident from reduced opex, repex and augex).

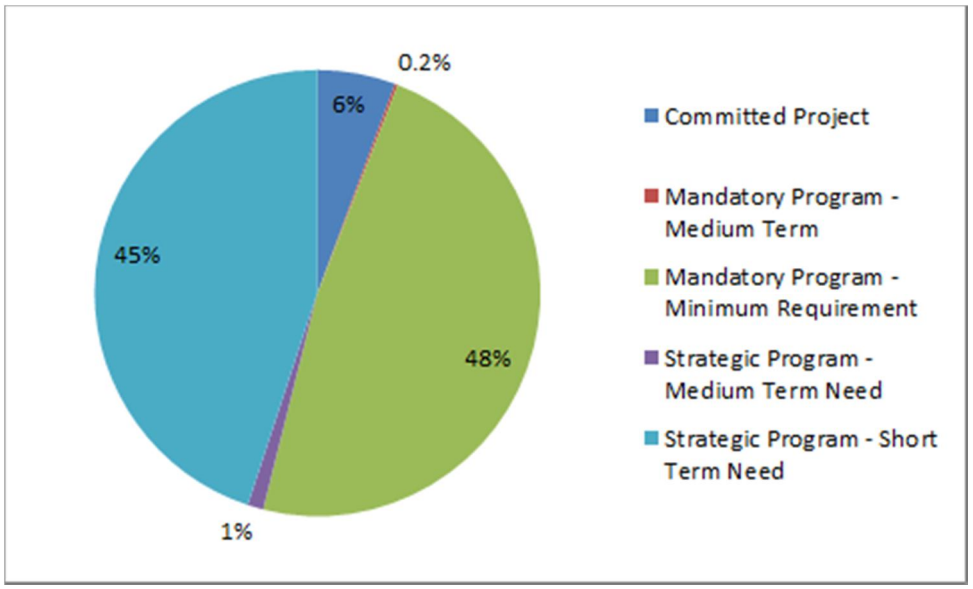
* Note that this analysis has been carried out with respect to the combined capex programme as a whole (i.e. all NSW DNSPs grouped together). Thus, the analysis outcomes should be treated as indicative only.

Figure 4-1: Breakdown of capex at Risk by Primary Driver



(Source – derived from: PIP_project_list_ES_EN_AG_20140129 v3 2 for AER)

Figure 4-2: Breakdown of capex at Risk by Project Category



(Source – derived from: PIP_project_list_ES_EN_AG_20140129 v3 2 for AER)

Table 4-1 provides a sample of capex projects and programmes at risk – these are the highest risk projects falling below the 73% line (and therefore will remain at risk even with a 10% efficiency though productivity gains). The full list of projects falling below the 63% line (i.e. 37% reduction in combined capex and no efficiency gains) is provided in Appendix D.

Table 4-1: Highest Risk Projects Expected to be Unachievable under the Draft Determination -

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of proposed capex	RISK LEVEL
Ausgrid	New Leightonfield 33/11kV Zone	Mandatory Program - Minimum Requirement	Renewal	9900	$ 20,930,046	74%	High
Ausgrid	New Enfield 132/11kV Zone with 11kV LTs and Decom (DP Costed	Mandatory Program - Minimum Requirement	Renewal	9900	$ 30,981,921	74%	High
Ausgrid	New Greenacre Park 132/11kV Zone with 11kV LTs and Decom	Mandatory Program - Minimum Requirement	Renewal	9900	$ 30,510,306	74%	High
Ausgrid	Flemington to SOPA 11kV LT and 11kV SG Decom (DP Costed) (ch	Mandatory Program - Minimum Requirement	Renewal	9900	$ 2,900,151	74%	High
Ausgrid	Narrabeen 33kV Busbar Retirement	Mandatory Program - Minimum Requirement	Renewal	9900	$ 1,894,572	74%	High
Ausgrid	Waratah Busbar Decom (check)	Mandatory Program - Minimum Requirement	Compliance	9900	$ 365,901	74%	High
Ausgrid	11kV SG Replacement at Myuna & Coorabong Mines (Check)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 18,132,736	75%	High
Ausgrid	New Paxton 33/11kV Zone (SJ-06023)	Committed Project	Renewal	9900	$ 1,817,937	75%	High
Ausgrid	New Cessnock 33/11kV Zone (SJ-06026)	Committed Project	Renewal	9900	$ 18,056,907	75%	High
Ausgrid	Cessnock Decom with 11kV LTs (check)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 1,076,457	75%	High
Ausgrid	New Aberdeen 66/11kV Zone (SJ-05634)	Committed Project	Renewal	9900	$ 1,440,928	75%	High
Ausgrid	Muswellbrook Zone 66kV Conversion (SJ-06030)	Committed Project	Renewal	9900	$ 17,964,972	75%	High
Ausgrid	AC & DC Boards - ZN	Mandatory Program - Minimum Requirement	Compliance	9900	$ 543,104	75%	High
Ausgrid	Oil Containment - ZN	Strategic Program - Short Term Need	Compliance	9900	$ 36,439,086	76%	High
Ausgrid	Oil Containment - TS	Strategic Program - Short Term Need	Compliance	9900	$ 2,732,721	76%	High
Endeavour	Ground Substation Refurbishment Program	Strategic Program - Short Term Need	Renewal	9900	$ 26,328,265	76%	High
Endeavour	Compact LV Switchgear Replacement	Strategic Program - Short Term Need	Renewal	9900	$ 765,238	76%	High
Endeavour	Non Urban	Mandatory Program - Minimum Requirement	Connections	9900	$ 7,701,738	76%	High
Endeavour	Catherine Fields ZS Site Purchase	Mandatory Program - Minimum Requirement	Connections	9900	$ 1,000,966	76%	High
Endeavour	URD	Mandatory Program - Minimum Requirement	Connections	9900	$ 60,045,836	77%	High
Essential Energy	Cobaki - establish 66/11kV substation	Mandatory Program - Minimum Requirement	Connections	9825	$ 10,393,983	77%	High

(Source – derived from: PIP_project_list_ES_EN_AG_20140129 v3 2 for AER)

Opex

The opex maintenance review detailed in Section 3.2 illustrated the business impacts of reduced funding to maintenance programmes, as shown by the FMECA/RCM tool outputs. It showed the imprudence of reducing funding below optimal levels, as the increased periods between carrying out inspections and maintenance would lead to higher business costs overall, which in time can be expected to overwhelm the short term gains achieved through reduced maintenance.

Table 4-2 below aggregates the analysis that has been carried out to-date on the potential impacts of the Draft Determination reductions on maintenance task scheduling. It shows that the NSW DNSPs can expect a combined long term business impact increase of 56% for these assets groups. While the analysis shows a small sample of asset types, it suggests that the increased indirect and risk costs associated with the combined 35% reduction in opex will be outweighed by the business impact increase of 56%. **This would mean an increased overall business cost of 56% in the long run as a result of the reduced maintenance programme.**

Table 4-2: Increases in overall business impact due to reduced maintenance

Asset	Business Impact Increase
Ausgrid	
• Wood Poles	73%
• Concrete Poles	34%
• Metal Poles	90%
• Cross-arms	124%
• Conductors (including low spans)	34%
Ausgrid Average	71%
Endeavour Energy	
• Wood Poles	12%
• Concrete Poles	5%
• Metal Poles	35%
• Cross-arms	~0%
Endeavour Energy Average	13%
Essential Energy	
• Wood Poles	38%
• Concrete Poles	138%
• Cross-arms	139%
• Conductors (including low spans)	9%
Essential Energy Average	81%
NNSW Average TBI Increase	*56%*

(Source: AER OPEX Reduction Implications Rev04)

JACOBS

Appendix A. Networks NSW Risk Matrix

								Rare	Unlikely	Possible	Likely	Almost Certain
Residual Risk Rating = Consequence Factor x Probability Factor Consequence Factor is a measure of the expected maximum level of harm or impact. Probability Factor is a measure of the chance or likelihood of the selected level of consequence occurring. Both factors must take into account the existing controls and the effectiveness of the control environment.								The event has not occurred in the past but could or the event has occurred less than once every thirty years.	The event has occurred less than once every ten years, but more than once every thirty years.	The event has occurred less than once a year, but more than once every ten years.	The event has occurred more than once a year, but less than several times.	The event has occurred several times a year or more than once during the Project / Program.
Consequence	**Safety**	**Environmental**	**Financial Impact**	**Compliance**	**Reputation**	**Network Reliability**	**Factor**	**E**	**D**	**C**	**B**	**A**
Severe	One or more fatalities, or significant irreversible injuries to multiple persons	Very serious long term, wide spread impairment of ecosystem function or localised damage to endangered or heritage item beyond recovery.	>$50 million	Very high fines for company and individual; and potential jail term for individuals. Extensive litigation. Loss of Operation License.	Significant adverse national media/public/stakeholders outcry resulting in irreparable damage to brand. Significant change in regulations / legislation.	SAIDI > 100 min. Supply outage to more than 60,000 customers for a period in excess of 24 hours.	5	E5 Medium	D5 High	C5 High	**B5 Extreme**	**A5 Extreme**
Major	Significant irreversible injuries to one or more persons	Serious widespread, long term damage to ecosystem requiring significant rectification.	$50 million - $5 million	High fines for company and individuals. Lengthy litigation.	Significant adverse national media/public/stakeholders attention sustained over several weeks. Adjustment to regulations and or directive to amend practice.	SAIDI > 10 min. Supply outage to greater than 30,000, but less than 60,000 customers for a period greater than 5 hours	4	E4 Medium	D4 Medium	C4 High	B4 High	**A4 Extreme**
Moderate	Moderate irreversible injuries to one or more persons	Measurable, medium term damage over a large area but not affecting ecosystem function.	$5 million - $500,000	Medium level fines for Company only. Medium duration litigation	Attention from media and or heightened concern from local community / external stakeholders. Criticism from multiple sources for one or two days.	SAIDI < 10 min. Supply outage to greater than 4,000, but less than 30,000 customers for a period under 5 hours.	3	E3 Low	D3 Medium	C3 Medium	B3 High	A3 High
Minor	Reversible disability and or medical treatment injury requiring immediate treatment or follow-up treatment by a medical professional.	Medium term impact on biological or physical environment over a limited area.	$500,000 - $50,000	Low level fines for Company only. No possibility for Jail for individuals. Short term duration litigation (<5 Days).	Minor, short duration (one day), adverse local public or media attention and complaints from multiple sources.	SAIDI < 1 min. Supply outage to greater than 1,000, but less than 4,000 customers for a period under 4 hours.	2	E2 Low	D2 Low	C2 Medium	B2 Medium	A2 Medium
Insignificant	Low level symptoms requiring with first aid only.	Limited localised damage to minimal area of low significance	<$50,000	Warning/ Notifications from Regulator. No fines incurred but administration costs may be payable. No litigation.	Public concern restricted to local complaints or intra industry knowledge / awareness.	SAIDI < 15 seconds. Supply outage to less than 1,000 customers for a period under 4 hours.	1	E1 Low	D1 Low	C1 Low	B1 Medium	A1 Medium

(Source: Networks NSW – Risk Matrix)

Appendix B. Age Profiling vs. Repex Requirements

A key finding identified by the AER as a reason not to accept the repex forecasts of the NSW DNSPs results from age profiling analysis that is presented in the Draft Determinations. Jacobs' review of the AER's findings in relation to each of the NSW DNSPs is discussed below.

AER Finding: Network health indicators not supporting the relative increase in repex requirements

- Ausgrid

  The AER concludes that its analysis suggests that *"Ausgrid would require less repex to maintain its network now than it has in the previous regulatory period"*, and the numbers also suggest that Ausgrid "significantly overestimates the stock of old assets in the network that needs to be replaced".

  (Source: p6-56-57, attachment 6: Capital expenditure, Ausgrid draft decision)

  Jacobs notes that the AER's analysis shows the calculated residual service lives to be increasing over the 2006 to 2013 period. (Reference: p6-56, attachment 6: Capital expenditure, Ausgrid draft decision – Figure A-10)

  However, in Jacobs' view this would not necessarily lead to a decreased repex requirement. Jacobs notes that the AER has conducted its analysis based on average asset lives. In Jacobs view such analysis is only indicative and genuine conclusions could only be drawn if the age profile of the assets showed a largely "normal" distribution profile.

  Furthermore, it seems likely that the significant investment in augex over the past decade to cater for increasing demand will have increased the proportion of younger assets within the population as the asset base has grown. While this will increase the average residual lives of the population as a whole, it will not negate the need to replace ageing assets.

  The age profile of Ausgrid's asset population is shown in Figure 4-3 below. It shows that:

  - Ausgrid's asset profile does not follow a normal distribution curve. This suggests that drawing conclusions based on average residual lives may be inappropriate.
  - A large number of new assets were commissioned over the last decade. This would have increased the residual lives of the asset population as a whole. However, it does not indicate that the need to replace aging assets has been reduced; especially considering the augex investments over the past decade which are likely to have reduced the average age of the assets without necessarily replacing aging assets.
  - There is a significant proportion of aging assets commissioned between 1950 and 1980 which are likely to be deteriorating and require replacement.

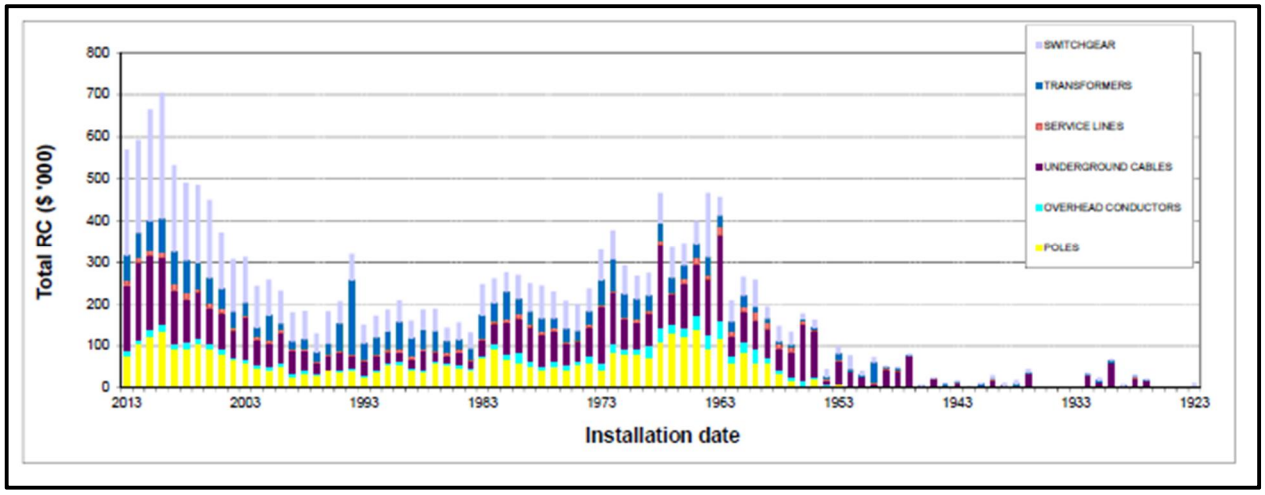
  Jacobs notes that the Draft Determination makes the statement below. In Jacobs' view this highlights the AER's mistreatment of average residual asset lives, which are not viewed appropriately in conjunction with the age profiles. That is, regardless of the number of aging assets that have been replaced through recent augex, the reduction of the average asset age does not negate the need to replace the assets approaching the end of their serviceable life that were commissioned between 1950 and 1980.

  > *"[…] the historically high volume of asset replacement work that Ausgrid has carried out over the last five years is likely to have changed its asset age profile from five years ago. That is, by spending a large amount on repex in the last regulatory control period, Ausgrid is expected to have replaced a significant number of its older assets. This in turn may be expected to reduce the overall age of its network. If the average replacement life and standard deviation stays the same, but the network's overall age is reduced, fewer assets will need to be replaced in the next period."*

(Source: page 6-67 of attachment 6: Capital expenditures, Ausgrid draft decision)

Jacobs also notes that the AER has not included forward projections for the estimated residual lives of Ausgrid's assets as it has with the other NSW DNSPs. It is possible that if the forward projections were included they may highlight further anomalies with the AER's analysis and conclusions.
(Reference: p6-56, attachment 6: Capital expenditure, Ausgrid draft decision – Figure A-10)

Figure 4-3: Ausgrid Asset Age Profile



(Source: p6-57, attachment 6: Capital expenditure, Ausgrid draft decision)

- Endeavour Energy

  The AER established that a relatively similar level of repex to historical values should be sufficient to maintain Endeavour Energy's network.

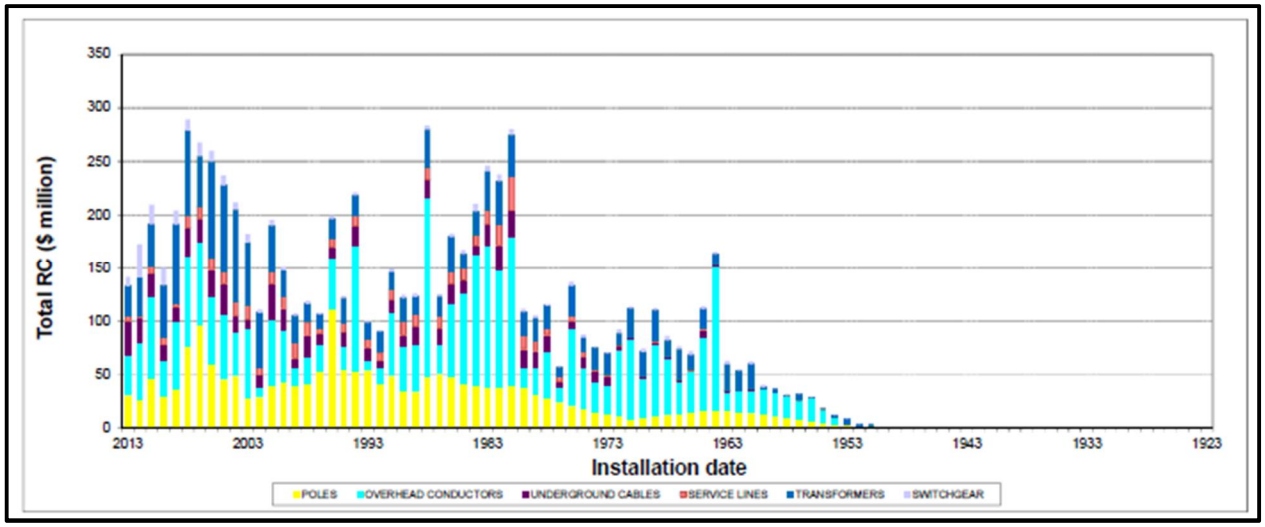
  (Source: p6-53, attachment 6: Capital expenditure, Endeavour Energy draft decision)

  Jacobs notes that the AER's analysis shows the calculated residual service lives either decrease or remain steady over the 2006 to 2013 period and through the forward projections to 2018. (Reference: p6-53, attachment 6: Capital expenditure, Endeavour Energy draft decision – Figure A-12)

  However, as per the discussion with respect to Ausgrid, this would not necessarily result in a steady repex requirement. The age profile of Endeavour Energy's asset population is shown in Figure 4-4 below. It shows that:

  - Endeavour Energy's asset profile shows a skewed normal distribution curve, weighted toward relatively newer assets. This suggests that drawing conclusions based on average residual lives may be more reasonable than for Ausgrid.
  - The majority of assets were commissioned between 1980 and the present. Although, this indicates that the majority of assets should be in reasonable health, it does not negate the need to replace aging assets.
  - Endeavour Energy employ a Weighted Average Remaining Life (WARL) model to make long term forecasts remaining life, which are used in forming their repex programs.

Figure 4-4: Endeavour Energy Asset Age Profile



(Source: p6-53, attachment 6: Capital expenditure, Endeavour Energy draft decision)

- Essential Energy

  The AER states that Essential Energy are forecasting higher residual lives at the end of the 2014-19 period, suggesting that they are seeking more repex than is necessary for some asset classes to maintain their function compared to the past.

  (Source: p6-56, attachment 6: Capital expenditure, Essential Energy draft decision)

  Jacobs does not agree with the AER's conclusion that Essential Energy's repex forecast compares unfavourably with respect to the replacement values. Essential appears to compare reasonably on most metrics. Also, Jacobs understands that Essential Energy has advised that a portion of the RIN data is unsuitable to be applied within he analyses – Jacobs would expect Essential Energy to demonstrate this in its revised Expenditure Proposal submission.

  However, Jacobs does note that the estimated residual service lives are shown to largely decrease or over the 2006 to 2013 period and then increase though the forward projections to 2018. It shows the majority of asset categories returning to 2006 average residual lives with others increasing over the 2006 residual lives. (Reference: p6-53, attachment 6: Capital expenditure, Essential Energy draft decision – Figure A-11). However, Jacobs understands that this is also largely attributable to the previously mentioned errors within the RIN data relied upon by the AER.

  Notwithstanding, as per the discussion with respect to Ausgrid, this would not necessarily translate into repex requirements. The age profile of Essential Energy's asset population is shown in Figure 4-5 below. It shows Essential Energy's asset profile as relatively level, with a large number of aging assets commissioned between 1945 and 1970.

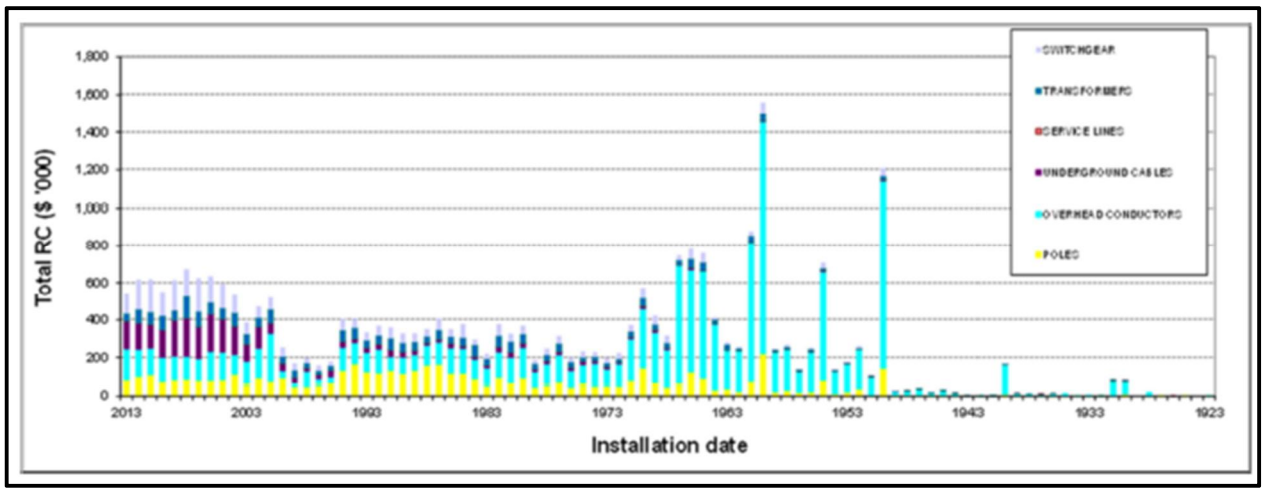
  This suggests that the declining residual asset lives over the 2006 to 2013 period is likely to be an emerging issue, especially given the large augex investment over the past decade which, due to the use of average estimated residual lives, would have masked the decline in the residual lives of the aging assets.

  Given this age profile and the declining residual lives over the 2006 to 2013 period, it appears that it would not be unreasonable for some of the assets categories (especially the overhead network shown in light blue in Figure 4-5) to have their residual lives increased above 2006 levels.

  Jacobs notes that underground assets above 33kV show a significant increase over 2006 levels. Jacobs expects that in its revised Expenditure Proposal Essential Energy would provide robust

justification that demonstrates the reasons for why the increased estimated residual lives for underground assets 33kV and above are warranted.

Figure 4-5: Essential Energy Asset Age Profile



(Source: p6-56, attachment 6: Capital expenditure, Essential Energy draft decision)

Appendix C. Calibrated Replacement Life Analysis

The table below compares the replacement lives advised by the NSW DNSPs in their RIN submissions to the “calibrated” replacement lives calculated by the AER to determine repex allowances.

Table A-1: Comparison of asset replacement lives advised by the NSW DNSPs with the “Calibrated Forecast” replacement lives calculated by the AER to determine repex allowances

		Ausgrid			Endeavour Energy			Essential Energy		
Asset Category	Asset ID	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase
POLES	STAKING OF A WOODEN POLE	6.77	12.56	86%	15.00	13.21	-12%	53.80	23.38	-57%
	< = 1 kV; WOOD	40.61	60.16	48%	58.00	63.85	10%	53.80	70.44	31%
	> 1 kV & < = 11 kV; WOOD	40.61	53.10	31%	58.00	58.55	1%	53.80	69.29	29%
	> 11 kV & < = 22 kV; WOOD	40.61	57.34	41%	58.00	59.48	3%	54.90	72.77	33%
	33kV Wood	-	-		58.00	60.18	4%	-	-	
	66kV Wood	-	-		58.00	70.01	21%	-	-	
	> 22 kV & < = 66 kV; WOOD	40.61	56.62	39%	58.00	58.00	0%	54.90	62.40	14%
	> 66 kV & < = 132 kV; WOOD	40.61	60.42	49%	58.00	62.05	7%	54.90	87.02	59%
	> 132 kV; WOOD	0.00	0.00		58.00	58.00	0%	53.80	53.80	0%
	< = 1 kV; CONCRETE	27.63	48.11	74%	58.00	21.25	-63%	53.80	42.98	-20%
	> 1 kV & < = 11 kV; CONCRETE	27.63	26.76	-3%	58.00	17.25	-70%	53.80	45.30	-16%
	> 11 kV & < = 22 kV; CONCRETE	0.00	0.00		58.00	18.77	-68%	54.90	43.45	-21%
	33kV Concrete	-	-		58.00	22.45	-61%	-	-	
	66kV Concrete	-	-		58.00	26.85	-54%	-	-	
	> 22 kV & < = 66 kV; CONCRETE	27.63	44.19	60%	58.00	58.00	0%	54.90	39.98	-27%
	> 66 kV & < = 132 kV; CONCRETE	27.63	41.03	48%	58.00	24.20	-58%	54.90	38.68	-30%
	> 132 kV; CONCRETE	0.00	0.00		58.00	58.00	0%	0.00	0.00	
	< = 1 kV; STEEL	38.19	55.51	45%	58.00	23.01	-60%	53.80	72.04	34%
	> 1 kV & < = 11 kV; STEEL	38.19	48.39	27%	58.00	22.73	-61%	53.80	29.87	-44%
	> 11 kV & < = 22 kV; STEEL	38.19	16.66	-56%	58.00	4.63	-92%	54.90	9.09	-83%
	33kV Steel	-	-		58.00	9.15	-84%	-	-	
	66kV Steel	-	-		58.00	58.00	0%	-	-	
	> 22 kV & < = 66 kV; STEEL	38.19	11.46	-70%	58.00	58.00	0%	54.90	9.16	-83%

Asset Category	Asset ID	Ausgrid			Endeavour Energy			Essential Energy		
		Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase
	> 66 kV & < = 132 kV; STEEL	38.19	47.80	25%	58.00	58.00	0%	54.90	63.08	15%
	> 132 kV; STEEL	0.00	0.00		58.00	58.00	0%	53.80	53.80	0%
	Towers	47.25	67.23	42%	60.00	60.00	0%	-	-	
	OTHER - BOLLARDS	-	-		-	-		53.80	68.83	28%
OVERHEAD CONDUCTORS	< = 1 kV	40.61	67.22	66%	50.00	67.92	36%	53.80	76.12	41%
	11 & 22kV	-	-		50.00	49.08	-2%	-	-	
	> 1 kV & < = 11 kV	40.61	47.38	17%	50.00	50.00	0%	53.80	78.44	46%
	> 11 kV & < = 22 kV ; SWER	40.61	87.95	117%	50.00	87.57	75%	53.80	93.91	75%
	> 11 kV & < = 22 kV ; SINGLE-PHASE	40.61	40.61	0%	50.00	50.00	0%	53.80	86.33	60%
	> 11 kV & < = 22 kV ; MULTIPLE-PHASE	40.61	75.62	86%	50.00	50.00	0%	53.80	86.33	60%
	33kV	-	-		55.00	52.24	-5%	-	-	
	66kV	-	-		55.00	62.29	13%	-	-	
	> 22 kV & < = 66 kV	40.61	54.79	35%	55.00	55.00	0%	54.90	102.74	87%
	> 66 kV & < = 132 kV	40.61	63.75	57%	55.00	55.00	0%	54.90	80.22	46%
	132kV Pole Line	-	-		55.00	55.31	1%	-	-	
	132kV Tower Lines	-	-		60.00	60.00	0%	-	-	
	> 132 kV	40.61	40.61	0%	55.00	55.00	0%	54.90	54.90	0%
UNDERGROUND CABLES	< = 1 kV	42.49	66.20	56%	60.00	44.11	-26%	53.80	73.82	37%
	> 1 kV & < = 11 kV	45.67	70.60	55%	60.00	39.25	-35%	53.80	61.26	14%
	> 11 kV & < = 22 kV	45.67	66.51	46%	60.00	15.75	-74%	53.80	45.49	-15%
	> 22 kV & < = 33 kV	46.66	77.08	65%	45.00	45.80	2%	54.90	63.85	16%
	> 33 kV & < = 66 kV	46.66	46.66	0%	45.00	28.90	-36%	54.90	54.90	0%
	> 66 kV & < = 132 kV	53.50	47.26	-12%	45.00	45.34	1%	54.90	45.09	-18%
	> 132 kV	0.00	0.00		NA	NA		54.90	54.90	0%
	OTHER - PLEASE ADD A ROW IF NECESSARY AND NOMINATE THE CATEGORY	0.00	0.00		0.00	0.00		0.00	0.00	
SERVICE LINES	< = 11 kV ; RESIDENTIAL ; SIMPLE TYPE	33.93	63.85	88%	NA	NA		53.80	61.00	13%
	< = 11 kV ; COMMERCIAL & INDUSTRIAL ; SIMPLE TYPE	37.27	76.28	105%	NA	NA		53.80	56.48	5%
	< = 11 kV ; RESIDENTIAL ; COMPLEX TYPE	0.00	0.00		NA	NA		53.80	53.80	0%
	< = 11 kV ; COMMERCIAL & INDUSTRIAL ;	0.00	0.00		NA	NA		53.80	53.80	0%

Asset Category	Asset ID	Ausgrid			Endeavour Energy			Essential Energy		
		Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase
	COMPLEX TYPE									
	< = 11 kV ; SUBDIVISION ; COMPLEX TYPE	0.00	0.00		NA	NA		53.80	53.80	0%
	> 11 kV & < = 22 kV ; COMMERCIAL & INDUSTRIAL	0.00	0.00		NA	NA		53.80	53.80	0%
	> 11 kV & < = 22 kV ; SUBDIVISION	0.00	0.00		NA	NA		53.80	53.80	0%
	> 22 kV & < = 33 kV ; COMMERCIAL & INDUSTRIAL	0.00	0.00		NA	NA		54.90	54.90	0%
	> 22 kV & < = 33 kV ; SUBDIVISION	0.00	0.00		NA	NA		54.90	54.90	0%
	> 33 kV & < = 66 kV ; COMMERCIAL & INDUSTRIAL	0.00	0.00		NA	NA		54.90	54.90	0%
	> 33 kV & < = 66 kV ; SUBDIVISION	0.00	0.00		NA	NA		54.90	54.90	0%
	> 66 kV & < = 132 kV ; COMMERCIAL & INDUSTRIAL	0.00	0.00		NA	NA		54.90	54.90	0%
	> 66 kV & < = 132 kV ; SUBDIVISION	0.00	0.00		NA	NA		54.90	54.90	0%
	> 132 kV ; COMMERCIAL & INDUSTRIAL	0.00	0.00		NA	NA		54.90	54.90	0%
	> 132 kV ; SUBDIVISION	0.00	0.00		NA	NA		54.90	54.90	0%
	LV OH	-	-		35.00	43.04	23%	-	-	
	LV UG	-	-		60.00	60.00	0%	-	-	
	< = 11kV; RESIDENTIAL ; SIMPLE ; OVERHEAD	30.00	30.00	0%	-	-		-	-	
	< = 11kV; RESIDENTIAL ; SIMPLE ; UNDERGROUND	44.88	44.88	0%	-	-		-	-	
	< = 11kV; COMMERCIAL & INDUSTRIAL ; SIMPLE ; OVERHEAD	30.00	30.00	0%	-	-		-	-	
	< = 11kV; COMMERCIAL & INDUSTRIAL ; SIMPLE ; UNDERGROUND	44.88	44.88	0%	-	-		-	-	
TRANSFORMERS	POLE MOUNTED ; < = 22kV ; < = 60 kVA ; SINGLE PHASE	32.33	79.96	147%	51.00	57.29	12%	45.80	70.12	53%
	POLE MOUNTED ; < = 22kV ; > 60 kVA AND < = 600 kVA ; SINGLE PHASE	36.51	54.35	49%	51.00	48.69	-5%	45.80	66.84	46%
	POLE MOUNTED ; < = 22kV ; > 600 kVA ; SINGLE PHASE	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	POLE MOUNTED ; < = 22kV ; < = 60 kVA ; MULTIPLE PHASE	32.98	59.65	81%	51.00	57.42	13%	45.80	70.19	53%
	POLE MOUNTED ; < = 22kV ; > 60 kVA AND < = 600 kVA ; MULTIPLE PHASE	36.51	58.47	60%	51.00	53.35	5%	45.80	60.31	32%
	POLE MOUNTED ; < = 22kV ; > 600 kVA ; MULTIPLE PHASE	0.00	0.00		51.00	30.19	-41%	45.80	53.83	18%
	POLE MOUNTED ; > 22 kV ; < = 60 kVA	32.98	32.98	0%	51.00	51.00	0%	45.80	56.59	24%

Asset Category	Asset ID	Ausgrid			Endeavour Energy			Essential Energy		
		Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase
	POLE MOUNTED ; > 22 kV ; > 60 kVA AND < = 600 kVA	36.51	36.51	0%	51.00	51.00	0%	45.80	52.31	14%
	POLE MOUNTED ; > 22 kV ; > 600 kVA	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	POLE MOUNTED ; > 22 kV ; < = 60 kVA	32.98	32.98	0%	51.00	51.00	0%	45.80	56.59	24%
	POLE MOUNTED ; > 22 kV ; > 60 kVA AND < = 600 kVA	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	POLE MOUNTED ; > 22 kV ; > 600 kVA	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	KIOSK MOUNTED ; < = 22kV ; < = 60 kVA ; SINGLE PHASE	36.29	36.29	0%	51.00	51.00	0%	45.80	45.80	0%
	KIOSK MOUNTED ; < = 22kV ; > 60 kVA AND < = 600 kVA ; SINGLE PHASE	36.29	36.29	0%	51.00	51.00	0%	45.80	45.80	0%
	KIOSK MOUNTED ; < = 22kV ; > 600 kVA ; SINGLE PHASE	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	KIOSK MOUNTED ; < = 22kV ; < = 60 kVA ; MULTIPLE PHASE	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	KIOSK MOUNTED ; < = 22kV ; > 60 kVA AND < = 600 kVA ; MULTIPLE PHASE	36.29	55.36	53%	51.00	39.97	-22%	45.80	45.14	-1%
	KIOSK MOUNTED ; < = 22kV ; > 600 kVA ; MULTIPLE PHASE	36.29	38.17	5%	51.00	32.64	-36%	45.80	49.87	9%
	KIOSK MOUNTED ; > 22 kV ; < = 60 kVA	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	KIOSK MOUNTED ; > 22 kV ; > 60 kVA AND < = 600 kVA	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	KIOSK MOUNTED ; > 22 kV ; > 600 kVA	36.29	36.29	0%	51.00	51.00	0%	45.80	45.80	0%
	KIOSK MOUNTED ; > 22 kV ; < = 60 kVA	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	KIOSK MOUNTED ; > 22 kV ; > 60 kVA AND < = 600 kVA	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	KIOSK MOUNTED ; > 22 kV ; > 600 kVA	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; < 22 kV ; < = 60 kVA ; SINGLE PHASE	0.00	0.00		51.00	51.00	0%	0.00	0.00	
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; < 22 kV ; > 60 kVA AND < = 600 kVA ; SINGLE PHASE	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; < 22 kV ; > 600 kVA ; SINGLE PHASE	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; < 22 kV ; < = 60 kVA ; MULTIPLE	0.00	0.00		51.00	51.00	0%	45.80	45.80	0%

Asset Category	Asset ID	Ausgrid			Endeavour Energy			Essential Energy		
		Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase
	PHASE									
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; < 22 kV ; > 60 kVA AND < = 600 kVA ; MULTIPLE PHASE	54.39	68.79	26%	51.00	53.84	6%	45.80	59.43	30%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; < 22 kV ; > 600 kVA ; MULTIPLE PHASE	36.63	62.43	70%	51.00	46.97	-8%	45.80	68.39	49%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > = 22 kV & < = 33 kV ; < = 15 MVA	45.66	62.00	36%	55.00	66.47	21%	45.80	55.64	21%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > = 22 kV & < = 33 kV ; > 15 MVA AND < = 40 MVA	45.66	48.24	6%	55.00	51.66	-6%	45.80	48.24	5%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > = 22 kV & < = 33 kV ; > 40 MVA	0.00	0.00		55.00	55.00	0%	45.80	45.80	0%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 33 kV & < = 66 kV ; < = 15 MVA	45.66	65.78	44%	55.00	65.78	20%	45.80	58.83	28%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 33 kV & < = 66 kV ; > 15 MVA AND < = 40 MVA	45.66	41.85	-8%	55.00	53.97	-2%	45.80	42.14	-8%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 33 kV & < = 66 kV ; > 40 MVA	45.66	36.14	-21%	55.00	55.00	0%	45.80	45.80	0%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 66 kV & < = 132 kV ; < = 100 MVA	45.66	49.60	9%	55.00	55.23	0%	45.80	59.56	30%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 66 kV & < = 132 kV ; > 100 MVA	45.66	49.58	9%	55.00	55.00	0%	45.80	45.80	0%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 132 kV ; < = 100 MVA	0.00	0.00		55.00	55.00	0%	45.80	45.80	0%
	GROUND OUTDOOR / INDOOR CHAMBER MOUNTED ; > 132 kV ; > 100 MVA	0.00	0.00		55.00	55.00	0%	0.00	0.00	
	OTHER - PLEASE ADD A ROW IF NECESSARY AND NOMINATE THE CATEGORY	0.00	0.00		0.00	0.00		-	-	
	DISTRIBUTION SUBSTATIONS	32.89	47.51	44%	-	-		-	-	
	OTHER - REGULATORS	-	-		-	-		54.90	46.28	-16%
SWITCHGEAR	< = 11 kV ; FUSE	24.85	134.32	440%	35.00	36.26	4%	53.80	68.24	27%
	< = 11 kV ; SWITCH	29.07	70.97	144%	NA	NA		53.80	70.04	30%
	< = 11 kV ; CIRCUIT BREAKER	50.58	64.24	27%	51.00	47.67	-7%	53.80	52.75	-2%
	> 11 kV & < = 22 kV ; SWITCH	39.72	76.94	94%	NA	NA		53.80	73.18	36%

Asset Category	Asset ID	Ausgrid			Endeavour Energy			Essential Energy		
		Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase	Base-Forecast	Calibrated Forecast	% Reduction / increase
	> 11 kV & < = 22 kV ; CIRCUIT BREAKER	41.80	41.80	0%	51.00	14.37	-72%	53.80	50.07	-7%
	> 22 kV & < = 33 kV ; SWITCH	39.72	59.11	49%	NA	NA		54.90	53.87	-2%
	> 22 kV & < = 33 kV ; CIRCUIT BREAKER	41.80	51.81	24%	51.00	47.43	-7%	54.90	41.66	-24%
	> 33 kV & < = 66 kV ; SWITCH	30.92	99.40	222%	NA	NA		54.90	41.77	-24%
	> 33 kV & < = 66 kV ; CIRCUIT BREAKER	31.78	37.80	19%	51.00	40.16	-21%	54.90	43.04	-22%
	> 66 kV & < = 132 kV ; SWITCH	43.14	57.43	33%	NA	NA		54.90	38.33	-30%
	> 66 kV & < = 132 kV ; CIRCUIT BREAKER	32.63	49.79	53%	51.00	39.79	-22%	54.90	38.49	-30%
	> 132 kV ; SWITCH	0.00	0.00		NA	NA		0.00	0.00	
	> 132 kV ; CIRCUIT BREAKER	0.00	0.00		NA	NA		0.00	0.00	
	Dist USL	-	-		35.00	47.66	36%	-	-	
	Dist ABS	-	-		35.00	43.98	26%	-	-	
	Dist LBS	-	-		35.00	5.65	-84%	-	-	
	Dist SEC	-	-		35.00	5.85	-83%	-	-	
	Dist REC	-	-		35.00	14.97	-57%	-	-	
	Transmission ABS	-	-		35.00	37.85	8%	-	-	
	Transmission USL	-	-		35.00	35.00	0%	-	-	
	Transmission DOF	-	-		35.00	35.00	0%	-	-	
	LV Links	-	-		35.00	52.22	49%	-	-	
	> 11 kV & < ≈ 33 kV ; FUSE & FUSE SWITCH (not including enclosed type)	18.55	18.55	0%	-	-		-	-	
	< 1 kV ; CIRCUIT BREAKER	53.49	53.49	0%	-	-		-	-	
	> 1 kV & < ≈ 11 kV ; CIRCUIT BREAKER	48.94	48.94	0%	-	-		-	-	
	DISTRIBUTION SUBSTATIONS	32.89	47.51	44%	-	-		-	-	
	ZONE & SUBTRANSMISION SUBSTATIONS	40.68	47.51	17%	-	-		-	-	
	OTHER - > 11 KV & < = 22 KV ; FUSE	-	-		-	-		53.80	61.58	14%
	OTHER - > 22 KV & < = 33 KV ; FUSE	-	-		-	-		54.90	51.92	-5%
	OTHER - > 33 KV & < = 66 KV ; FUSE	-	-		-	-		54.90	57.70	5%

(Sources: Derived from the Base Forecast Models and Calibrated Forecast Models for each DNSP available on the AER's website – www.aer.gov.au – refer to footnotes on page 40)

Appendix D. Capex at Risk

The table below gives an indicative list of the projects and programmes at risk due to the combined 37% capex reduction across the NSW DNSPs indicated in the Draft Determinations. All capex projects and programmes have been ranked by CASH/PIP score from highest to lowest. The bottom 37% of expenditure is then assumed to be at risk due to the combined 37% capex reduction.

* Note that this analysis has been carried out with respect to the combined capex programme as a whole (i.e. all NSW DNSPs grouped together). Thus, the analysis outcomes should be treated as indicative only.

Table B-1: Comparison of asset replacement lives advised by the NSW DNSPs with the "Calibrated Forecast" replacement lives calculated by the AER to determine repex allowances

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Endeavour	St Marys ZS Renewal	Committed Project	Renewal	10125	$ 16,973,962	64%	High
Endeavour	Castle Hill ZS Renewal	Committed Project	Renewal	10125	$ 12,940,221	64%	High
Endeavour	Bulli Zone Substation Renewal	Committed Project	Renewal	10125	$ 2,502,415	64%	High
Ausgrid	100% Pyrmont Additional 132/11kV Tx and Associated SG	Mandatory Program - Minimum Requirement	Network Connections	10050	$ 4,073,275	64%	High
Ausgrid	10% New Warnervale 132/11kV Zone	Mandatory Program - Minimum Requirement	Network Connections	10050	$ 959,473	64%	High
Ausgrid	Marrickville Ring Main CB (SJ-05960)	Committed Project	Reliability	10050	$ 2,152,311	64%	High
Ausgrid	Mascot 33kV Feeders Replacement (Alexandria - Mascot)	Mandatory Program - Minimum Requirement	Renewal	10050	$ 16,528,185	65%	High
Ausgrid	New Olympic Park 132/11kV Zone (SJ-05947 & SJ-06147 & SJ-061	Committed Project	Renewal	10050	$ 20,154,552	65%	High
Ausgrid	Camperdown Zone Refurbishment (SJ-02883, SM-04738, SM-06358)	Committed Project	Renewal	10050	$ 2,766,536	65%	High
Ausgrid	Hunters Hill Refurbishment (SJ-00043 & SJ-04784)	Committed Project	Renewal	10050	$ 14,872,857	65%	High
Ausgrid	Top Ryde Additional Tx and 11kV SG	Mandatory Program - Minimum Requirement	Network Connections	10050	$ 5,932,510	65%	High
Ausgrid	Macquarie Park to Top Ryde 11kV LT Stage 1 (DP Costed)	Strategic Program - Short Term Need	Network Connections	10050	$ 593,177	65%	High
Ausgrid	Tee 95Z to Feeder 250 (check)	Strategic Program - Short Term Need	Capacity	10050	$ 1,119,302	65%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Ausgrid	Peats Ridge 11kV and 33kV SG Replacement (check)	Committed Project	Renewal	10050	$ 6,496,694	65%	High
Ausgrid	New Medowie 33/11kV Zone (SJ-00041)	Committed Project	Capacity	10050	$ 4,742,503	65%	High
Ausgrid	Asbestos Fire Doors - DC	Mandatory Program - Minimum Requirement	Compliance	10050	$ 7,936,651	65%	High
Ausgrid	Asbestos Fire Doors - TS	Strategic Program - Short Term Need	Compliance	10050	$ 373,367	65%	High
Ausgrid	Asbestos Fire Doors - ZN	Strategic Program - Short Term Need	Compliance	10050	$ 2,144,681	65%	High
Ausgrid	LV Board Screening - Chamber Type DCs	Mandatory Program - Minimum Requirement	Compliance	10050	$ 3,698,905	65%	High
Ausgrid	Lighting Spires - ZN	Mandatory Program - Minimum Requirement	Renewal	10050	$ 788,163	65%	High
Ausgrid	132/66kV Bushings - ZN	Strategic Program - Short Term Need	Renewal	10050	$ 5,014,749	65%	High
Ausgrid	132 kV Fault Thrower - ZN	Strategic Program - Short Term Need	Renewal	10050	$ 1,327,559	65%	High
Ausgrid	Surge Arrestors - ZN	Strategic Program - Short Term Need	Renewal	10050	$ 3,936,459	65%	High
Ausgrid	Refurbish Access Tracks - 33kV Lines	Strategic Program - Short Term Need	Renewal	10050	$ 675,905	65%	High
Endeavour	Substation switchyard lighting Improvement	Mandatory Program - Minimum Requirement	Renewal	10050	$ 5,687,693	66%	High
Endeavour	TS & ZS Building Fire Alarm Systems	Strategic Program - Short Term Need	Renewal	10050	$ 403,044	66%	High
Essential	HV regulator replacement	Strategic Program - Short Term Need	Renewal	9975	$ 12,182,009	66%	High
Essential	Sectionaliser Replacement	Strategic Program - Short Term Need	Renewal	9975	-	66%	High
Essential	LV Spreader Installation in Bushfire prone areas	Strategic Program - Short Term Need	Compliance	9975	$ 11,457,674	66%	High
Essential	Refurbish OH Lines in frequented areas	Strategic Program - Short Term Need	Compliance	9975	-	66%	High
Essential	Enclosed Substation Refurbishment Program	Strategic Program - Short Term Need	Renewal	9975	$ 47,760,061	66%	High
Essential	LV UG pit and pillar	Strategic Program - Short Term Need	Renewal	9975	-	66%	High
Essential	Pole Top Refurbishment	Strategic Program - Short Term Need	Renewal	9975	$ 37,336,212	67%	High
Essential	ZS transformer replacement plan	Strategic Program - Short Term Need	Renewal	9975	$ 52,441,903	67%	High
Essential	Battery replacement	Strategic Program - Short Term Need	Renewal	9975	$ 6,206,913	67%	High
Essential	Surge diverter replacement	Strategic Program - Short Term Need	Renewal	9975	$ 2,592,792	67%	High
Essential	Earthing - ZS	Mandatory Program - Minimum Requirement	Compliance	9975	$ 2,963,191	67%	High
Essential	LIDAR - Capitalised Overhead Data Capture	Mandatory Program - Minimum Requirement	Other	9975	$ 19,097,418	68%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Ausgrid	New North Sydney 132/11kV Zone (SJ-05969 & SI-05341)	Committed Project	Renewal	9975	$ 3,380,803	68%	High
Ausgrid	Substations with Exposed 11kV	Strategic Program - Short Term Need	Compliance	9975	$ 19,084,553	68%	High
Ausgrid	Optical Arc Fault Protection Trial	Mandatory Program - Minimum Requirement	Compliance	9975	$ 19,432,201	68%	High
Ausgrid	Reactive Electrical Safety - DC	Mandatory Program - Minimum Requirement	Compliance	9975	$ 3,218,408	68%	High
Ausgrid	Reactive Electrical Safety - DM	Mandatory Program - Minimum Requirement	Compliance	9975	$ 2,726,532	68%	High
Ausgrid	Reactive Electrical Safety - TM	Mandatory Program - Minimum Requirement	Compliance	9975	$ 1,548,048	68%	High
Ausgrid	UHCC Substation	Strategic Program - Short Term Need	Renewal	9975	$ 3,455,511	68%	High
Ausgrid	Chamber DC Subs - Newcastle	Strategic Program - Short Term Need	Renewal	9975	$ 2,358,518	68%	High
Ausgrid	SF6 Switchgear - Low Gas	Mandatory Program - Minimum Requirement	Renewal	9975	$ 1,938,623	68%	High
Ausgrid	Distribution Substation Heritage Buildings	Mandatory Program - Minimum Requirement	Renewal	9975	$ 3,637,257	68%	High
Ausgrid	System Spare Transformers - ZN	Mandatory Program - Minimum Requirement	Renewal	9975	$ 8,990,345	68%	High
Ausgrid	Earthing Equipment - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 1,216,345	68%	High
Ausgrid	Post VTs - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 2,422,805	69%	High
Ausgrid	11kV Capacitor Bank - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 3,323,837	69%	High
Ausgrid	PINC/MPLS Edge - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 9,441,523	69%	High
Ausgrid	Transformer Replacement (utilising existing holdings) - ZN Med	Mandatory Program - Minimum Requirement	Renewal	9975	$ 7,028,303	69%	High
Ausgrid	CLC Controllers - ZN Reactive	Mandatory Program - Minimum Requirement	Renewal	9975	$ 324,856	69%	High
Ausgrid	132 kV Circuit Breakers - ZN Reactive	Mandatory Program - Minimum Requirement	Renewal	9975	$ 7,667,681	69%	High
Ausgrid	Voltage Regulation Equipment - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 20,312,266	69%	High
Ausgrid	Post CTs - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 331,760	69%	High
Ausgrid	Zone Substation Building Refurbishment/Replacement Works High	Strategic Program - Short Term Need	Renewal	9975	$ 4,997,325	69%	High
Ausgrid	Controlled Load - ZN	Strategic Program - Short Term Need	Renewal	9975	$ 2,806,818	69%	High
Ausgrid	Earthing Equipment - ZN	Mandatory Program - Minimum Requirement	Renewal	9975	$ 382,877	69%	High
Ausgrid	System Spare Transformer - TS	Mandatory Program - Minimum Requirement	Renewal	9975	$ 4,668,256	69%	High
Ausgrid	Earthing Equipment - TS	Strategic Program - Short Term Need	Renewal	9975	$ 608,172	69%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Ausgrid	Post VTs - TS	Strategic Program - Short Term Need	Renewal	9975	$ 4,514,873	69%	High
Ausgrid	CFC Lids - TS	Mandatory Program - Minimum Requirement	Renewal	9975	$ 1,668,979	69%	High
Ausgrid	PINC/MPLS Core - TS	Strategic Program - Short Term Need	Renewal	9975	$ 6,952,016	69%	High
Ausgrid	Transformer Replacement (utilising existing holdings) - TS	Mandatory Program - Minimum Requirement	Renewal	9975	$ 2,333,604	69%	High
Ausgrid	33/66kV Capacitor Banks - TS	Strategic Program - Short Term Need	Renewal	9975	$ 6,607,327	69%	High
Ausgrid	Post CTs - TS	Strategic Program - Short Term Need	Renewal	9975	$ 4,102,829	69%	High
Ausgrid	STS Building Refurbishment	Strategic Program - Short Term Need	Renewal	9975	$ 3,627,994	70%	High
Ausgrid	Surge Arrestors - TS	Strategic Program - Short Term Need	Renewal	9975	$ 3,131,274	70%	High
Ausgrid	Oil Drainage System - TS	Strategic Program - Short Term Need	Renewal	9975	$ 239,054	70%	High
Ausgrid	11kV Essantee ABS HS641	Mandatory Program - Minimum Requirement	Renewal	9975	$ 7,543,754	70%	High
Ausgrid	11kV Taplin ABS D571	Mandatory Program - Minimum Requirement	Renewal	9975	$ 5,070,392	70%	High
Ausgrid	LV OH ABC Link Boxes (No.)	Strategic Program - Short Term Need	Renewal	9975	$ 1,149,995	70%	High
Ausgrid	11kV Under Slung Link (No.)	Strategic Program - Short Term Need	Renewal	9975	$ 2,597,030	70%	High
Ausgrid	HV OH Mains (ACSR/Quince) (km)	Strategic Program - Short Term Need	Renewal	9975	$ 14,573,131	70%	High
Ausgrid	11/5kV Undergound Mains (km) - Reactive	Mandatory Program - Minimum Requirement	Renewal	9975	$ 24,101,068	70%	High
Ausgrid	LV Underground Services (No.)	Mandatory Program - Minimum Requirement	Renewal	9975	$ 3,150,367	70%	High
Ausgrid	Tower Grillage System	Strategic Program - Short Term Need	Renewal	9975	$ 584,267	70%	High
Ausgrid	Refurbish 132kV Cable Tunnel	Strategic Program - Short Term Need	Renewal	9975	$ 1,036,717	70%	High
Ausgrid	Cable Pressure Alarm Replacement	Strategic Program - Short Term Need	Renewal	9975	$ 4,266,742	70%	High
Endeavour	Mitigation of Fire Risk to Pad-mount substations	Strategic Program - Short Term Need	Renewal	9975	$ 2,330,369	70%	High
Endeavour	Installation of Vibration Dampers (Transmission)	Mandatory Program - Minimum Requirement	Renewal	9975	$ 1,366,547	70%	High
Endeavour	Optical Fibre Protection and Communication Upgrades in the Macarthur Area	Strategic Program - Short Term Need	Renewal	9975	$ 10,288,192	70%	High
Endeavour	132kV CB Replacement	Strategic Program - Short Term Need	Renewal	9975	$ 1,114,742	70%	High
Endeavour	TS Capacitor Bank Replacement	Strategic Program - Short Term Need	Renewal	9975	$ 3,171,904	70%	High
Endeavour	Lawson TS - RailCorp Connections Works	Committed Project	Renewal	9975	$ 352,841	71%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Endeavour	Carramar ZS switchgear replacement	Committed Project	Renewal	9975	$ 5,112,894	71%	High
Endeavour	Power Transformer Replacement	Strategic Program - Short Term Need	Renewal	9975	$ 19,965,481	71%	High
Endeavour	West Liverpool 132 kV No 3 - Transformer Replacement	Strategic Program - Short Term Need	Renewal	9975	$ 1,876,812	71%	High
Endeavour	Jasper Road 33kV No 3 - Transformer Replacement	Strategic Program - Short Term Need	Renewal	9975	$ 625,604	71%	High
Endeavour	West Liverpool 132 kV No 1 - Demolition	Strategic Program - Short Term Need	Renewal	9975	$ 125,121	71%	High
Ausgrid	Nelson Bay 11kV SG Replacement	Mandatory Program - Minimum Requirement	Renewal	9900	$ 8,968,762	71%	High
Ausgrid	New Lambton 11kV SG Replacement	Committed Project	Renewal	9900	$ 6,733,121	71%	High
Ausgrid	Beaconsfield West 132kV Busbar Replacement (SJ-06136)	Committed Project	Renewal	9900	$ 11,466,928	71%	High
Ausgrid	New Bligh St Zone 132kV Connections (SJ-06104)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 11,053,851	71%	High
Ausgrid	City East 11kV Ductlines	Mandatory Program - Minimum Requirement	Renewal	9900	$ 25,919,519	72%	High
Ausgrid	New City East 132/11kV Zone (check)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 131,133,064	73%	High
Ausgrid	New Botany 33/11kV Zone (SJ-05108 & SI-05670)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 1,618,317	73%	High
Ausgrid	New Rockdale 132/11kV Zone	Committed Project	Renewal	9900	$ 29,816,024	73%	High
Ausgrid	Port Hacking Refurbishment (SJ-06039)	Committed Project	Compliance	9900	$ 4,795,384	73%	High
Ausgrid	Jannali Refurbishment (SJ-04900)	Committed Project	Compliance	9900	$ 1,800,427	73%	High
Ausgrid	New Leightonfield 33/11kV Zone	Mandatory Program - Minimum Requirement	Renewal	9900	$ 20,930,046	74%	High
Ausgrid	New Enfield 132/11kV Zone with 11kV LTs and Decom (DP Costed	Mandatory Program - Minimum Requirement	Renewal	9900	$ 30,981,921	74%	High
Ausgrid	New Greenacre Park 132/11kV Zone with 11kV LTs and Decom	Mandatory Program - Minimum Requirement	Renewal	9900	$ 30,510,306	74%	High
Ausgrid	Flemington to SOPA 11kV LT and 11kV SG Decom (DP Costed) (ch	Mandatory Program - Minimum Requirement	Renewal	9900	$ 2,900,151	74%	High
Ausgrid	Narrabeen 33kV Busbar Retirement	Mandatory Program - Minimum Requirement	Renewal	9900	$ 1,894,572	74%	High
Ausgrid	Waratah Busbar Decom (check)	Mandatory Program - Minimum Requirement	Compliance	9900	$ 365,901	74%	High
Ausgrid	11kV SG Replacement at Myuna & Coorabong Mines (Check)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 18,132,736	75%	High
Ausgrid	New Paxton 33/11kV Zone (SJ-06023)	Committed Project	Renewal	9900	$ 1,817,937	75%	High
Ausgrid	New Cessnock 33/11kV Zone (SJ-06026)	Committed Project	Renewal	9900	$ 18,056,907	75%	High
Ausgrid	Cessnock Decom with 11kV LTs (check)	Mandatory Program - Minimum Requirement	Renewal	9900	$ 1,076,457	75%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Ausgrid	New Aberdeen 66/11kV Zone (SJ-05634)	Committed Project	Renewal	9900	$ 1,440,928	75%	High
Ausgrid	Muswellbrook Zone 66kV Conversion (SJ-06030)	Committed Project	Renewal	9900	$ 17,964,972	75%	High
Ausgrid	AC & DC Boards - ZN	Mandatory Program - Minimum Requirement	Compliance	9900	$ 543,104	75%	High
Ausgrid	Oil Containment - ZN	Strategic Program - Short Term Need	Compliance	9900	$ 36,439,086	76%	High
Ausgrid	Oil Containment - TS	Strategic Program - Short Term Need	Compliance	9900	$ 2,732,721	76%	High
Endeavour	Ground Substation Refurbishment Program	Strategic Program - Short Term Need	Renewal	9900	$ 26,328,265	76%	High
Endeavour	Compact LV Switchgear Replacement	Strategic Program - Short Term Need	Renewal	9900	$ 765,238	76%	High
Endeavour	Non Urban	Mandatory Program - Minimum Requirement	Network Connections	9900	$ 7,701,738	76%	High
Endeavour	Catherine Fields ZS Site Purchase	Mandatory Program - Minimum Requirement	Network Connections	9900	$ 1,000,966	76%	High
Endeavour	URD	Mandatory Program - Minimum Requirement	Network Connections	9900	$ 60,045,836	77%	High
Essential	Cobaki - establish 66/11kV substation	Mandatory Program - Minimum Requirement	Network Connections	9825	$ 10,393,983	77%	High
Ausgrid	Canterbury STS Refurbishment (SJ-05740)	Committed Project	Renewal	9825	$ 9,603,071	77%	High
Ausgrid	Lindfield STSS 132kV RMCB (SJ-06106)	Committed Project	Renewal	9825	$ 3,915,238	77%	High
Ausgrid	Brick Wall OE Substations	Mandatory Program - Minimum Requirement	Compliance	9825	$ 13,005,008	77%	High
Ausgrid	Compliance (Schedule 3)	Mandatory Program - Minimum Requirement	Reliability	9825	$ 25,170,822	77%	High
Ausgrid	Feeder Segment	Mandatory Program - Minimum Requirement	Reliability	9825	$ 4,434,755	77%	High
Ausgrid	Public Lighting	Mandatory Program - Minimum Requirement	Renewal	9825	$ 61,749,747	78%	High
Ausgrid	System Spares Equipment - TS	Strategic Program - Short Term Need	Renewal	9825	$ 2,151,490	78%	High
Endeavour	Installation of OPGW on Feeders 98W and 98F	Committed Project	Capacity	9825	$ 628,302	78%	High
Endeavour	Street lighting growth	Mandatory Program - Minimum Requirement	Capacity	9825	$ 15,227,114	78%	High
Endeavour	Refurbishment prjects Endeavour funded	Mandatory Program - Minimum Requirement	Renewal	9825	$ 26,197,842	79%	High
Endeavour	Busbar Supports and Isolator Replacement	Strategic Program - Short Term Need	Renewal	9825	$ 819,928	79%	High
Essential	Sutton ZS - install 66/11kV transformer	Mandatory Program - Minimum Requirement	Capacity	9750	$ 2,071,892	79%	High
Essential	Tralee - ultimately establish 132/11kV substation, initally establish 11kV feeders (built at 132kV) from Googong & 11kV regulators	Mandatory Program - Minimum Requirement	Capacity	9750	$ 842,007	79%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Essential	Black Spot pole replacements	Mandatory Program - Minimum Requirement	Renewal	9750	$ 12,346,631	79%	High
Ausgrid	Transfer Equinix and Airport Load to Alexandria STS	Mandatory Program - Minimum Requirement	Network Connections	9750	$ 23,185,436	79%	High
Ausgrid	Dulwich Hill 33kV Feeders Replacement	Mandatory Program - Minimum Requirement	Renewal	9750	$ 33,574,418	79%	High
Ausgrid	Concord to Olympic Park 11kV LT (DP Costed)	Strategic Program - Short Term Need	Renewal	9750	$ 3,583,154	79%	High
Ausgrid	Narrabeen Zone CLC Uprating	Mandatory Program - Minimum Requirement	Capacity	9750	$ 628,963	79%	High
Ausgrid	Belrose 11kV Busbar Split and Install 2nd CLC	Mandatory Program - Minimum Requirement	Capacity	9750	$ 672,570	79%	High
Ausgrid	New Empire Bay 66/11kV Zone with 11kV LTs (SI-05732) (check)	Committed Project	Capacity	9750	$ 526,303	79%	High
Ausgrid	Perimeter Fencing - ZN	Strategic Program - Short Term Need	Compliance	9750	$ 5,075,933	79%	High
Ausgrid	Perimeter Fencing - TS	Strategic Program - Short Term Need	Compliance	9750	$ 2,030,373	80%	High
Ausgrid	Reactive Environmental Projects - DC High	Mandatory Program - Minimum Requirement	Compliance	9750	$ 2,936,860	80%	High
Ausgrid	Reactive Environmental Projects - TS High	Mandatory Program - Minimum Requirement	Compliance	9750	$ 1,153,621	80%	High
Ausgrid	Reactive Environmental Projects - ZN	Mandatory Program - Minimum Requirement	Compliance	9750	$ 2,018,837	80%	High
Ausgrid	System Spares Equipment - DC Subs	Strategic Program - Short Term Need	Renewal	9750	$ 1,440,970	80%	High
Endeavour	Microwave Refurbish and extension	Strategic Program - Short Term Need	Renewal	9750	$ 5,910,521	80%	High
Endeavour	Traffic Black Spot Remediation	Strategic Program - Short Term Need	Renewal	9750	$ 13,434,790	80%	High
Endeavour	Reliability Focused Distribution Mains Renewal	Strategic Program - Short Term Need	Renewal	9750	$ 7,342,999	80%	High
Endeavour	Miscellaneous Renewal Expenditure Substation	Strategic Program - Short Term Need	Renewal	9750	$ 6,442,131	80%	High
Endeavour	PQ Surveying	Strategic Program - Short Term Need	Compliance	9750	$ 335,870	80%	High
Endeavour	Mamre ZS Transformer Augment and 11kV busbar extension	Committed Project	Network Connections	9750	$ 12,512	80%	High
Endeavour	Line Fault Indicators	Strategic Program - Short Term Need	Reliability	9750	$ 2,416,894	80%	High
Endeavour	Oil filled cable auxiliary equipment refurbishment	Strategic Program - Short Term Need	Renewal	9750	$ 129,691	80%	High
Endeavour	Installation/replacement of Surge Arrester in ZS/TS	Strategic Program - Short Term Need	Renewal	9750	$ 187,794	80%	High
Endeavour	Deluge Showers, Gel / Dry Blankets	Mandatory Program - Minimum Requirement	Renewal	9750	$ 2,686,958	80%	High
Essential	HV UG-OH cable terminations	Strategic Program - Short Term Need	Compliance	9675	$ 5,646,526	80%	High
Essential	LV UG-OH cable terminations	Strategic Program - Short Term Need	Compliance	9675	-	80%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Essential	Voltage transformer replacement	Strategic Program - Short Term Need	Renewal	9675	$ 3,127,813	80%	High
Essential	Current transformer replacement	Strategic Program - Short Term Need	Renewal	9675	$ 9,266,196	80%	High
Essential	Terranora to QLD border - refurbish 110kV towers in line with Powerlink	Mandatory Program - Minimum Requirement	Renewal	9675	$ 6,929,322	80%	High
Essential	ZS Capacitors Bank Replacement	Mandatory Program - Minimum Requirement	Renewal	9675	$ 3,457,057	80%	High
Ausgrid	Campbell St 3rd Tx and 11kV SG	Mandatory Program - Minimum Requirement	Renewal	9675	$ 5,960,659	80%	High
Ausgrid	Darlinghurst 33kV Feeder and 33kV SG Retirement (RS-00450)	Mandatory Program - Minimum Requirement	Renewal	9675	$ 9,287,027	81%	High
Ausgrid	Graving Dock 33kV Feeder Replacement	Mandatory Program - Minimum Requirement	Renewal	9675	$ 5,559,638	81%	High
Ausgrid	New Hurstville 132/11kV Zone (SJ-05277 & SM-06472)	Mandatory Program - Minimum Requirement	Renewal	9675	$ 987,928	81%	High
Ausgrid	New Auburn South 132kV Zone	Mandatory Program - Minimum Requirement	Renewal	9675	$ 30,976,340	81%	High
Ausgrid	11kV LTs to Decommision Auburn	Mandatory Program - Minimum Requirement	Renewal	9675	$ 18,409,001	81%	High
Ausgrid	11kV LTs to Decommision Lidcombe	Mandatory Program - Minimum Requirement	Renewal	9675	$ 3,393,366	81%	High
Ausgrid	Auburn Decommission	Mandatory Program - Minimum Requirement	Renewal	9675	$ 1,704,283	81%	High
Ausgrid	Lidcombe Decommission	Mandatory Program - Minimum Requirement	Renewal	9675	$ 1,756,864	81%	High
Ausgrid	Camperdown 33kV Feeder Replacement (SJ-02875)	Committed Project	Renewal	9675	$ 524,805	81%	High
Ausgrid	Blackwattle Bay 5kV Load Conversion (DP Costed) (check)	Mandatory Program - Minimum Requirement	Renewal	9675	$ 10,853,401	81%	High
Ausgrid	St Ives 33kV Feeders Replacement (SJ-06017)	Committed Project	Renewal	9675	$ 343,872	81%	High
Ausgrid	Relocate Poles in RTA Blackspots - TM	Mandatory Program - Minimum Requirement	Compliance	9675	$ 957,149	81%	High
Ausgrid	Reactive Electrical Safety - TS High	Mandatory Program - Minimum Requirement	Compliance	9675	$ 1,442,027	81%	High
Ausgrid	Reactive Electrical Safety - ZN High	Mandatory Program - Minimum Requirement	Compliance	9675	$ 2,884,053	81%	High
Ausgrid	Waverley 33kV Feeders 391 &396 Retirement (SI-10015)	Strategic Program - Short Term Need	Renewal	9675	$ 260,626	81%	High
Endeavour	Line works associated with Oran Park	Committed Project	Network Connections	9675	$ 7,531,991	82%	High
Endeavour	Menangle Park 66/11kV ZS establishment (mobile)	Mandatory Program - Minimum Requirement	Network Connections	9675	$ 1,284,748	82%	High
Endeavour	South Marsden Park (Industrial) 132/11kV ZS establishment	Mandatory Program - Minimum Requirement	Network Connections	9675	$ 3,720,310	82%	High
Endeavour	Jordan Springs establishment	Committed Project	Network Connections	9675	$ 3,277,539	82%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Endeavour	Leppington South ZS Establishment (interim initially)	Committed Project	Network Connections	9675	$ 1,061,024	82%	High
Endeavour	Building & Amenities Construction / Refurbishment	Strategic Program - Short Term Need	Renewal	9675	$ 15,697,667	82%	High
Endeavour	TS & ZS Safety Fence Upgrades, ongoing program	Mandatory Program - Minimum Requirement	Renewal	9675	$ 780,478	82%	High
Ausgrid	Dalley St 11kV LTs for Decom (over 3 years)	Mandatory Program - Minimum Requirement	Renewal	9600	$ 21,181,483	82%	High
Ausgrid	Mascot Zone Refurbishment	Mandatory Program - Minimum Requirement	Renewal	9600	$ 9,476,525	82%	High
Ausgrid	Blakehurst Decom with 11kV LTs and 33kV Feeder Rearrangement	Mandatory Program - Minimum Requirement	Renewal	9600	$ 11,342,091	82%	High
Ausgrid	Peakhurst 33kV SG Replacement	Mandatory Program - Minimum Requirement	Renewal	9600	$ 29,024,876	83%	High
Ausgrid	Leichhardt 11kV SG LTs (Check)	Mandatory Program - Minimum Requirement	Renewal	9600	$ 960,972	83%	High
Ausgrid	Strathfield STS Refurbishment	Strategic Program - Short Term Need	Renewal	9600	$ 2,764,437	83%	High
Ausgrid	Blackwattle Bay Decom	Mandatory Program - Minimum Requirement	Renewal	9600	$ 573,560	83%	High
Ausgrid	New Toronto 132/11kV Zone (SO-06009)	Mandatory Program - Minimum Requirement	Renewal	9600	$ 19,053,084	83%	High
Ausgrid	UG Substations Cascade modernisation	Strategic Program - Short Term Need	Compliance	9600	$ 34,635,417	83%	High
Ausgrid	Relocate Poles in RTA Blackspots - DM	Mandatory Program - Minimum Requirement	Compliance	9600	$ 4,937,528	83%	High
Ausgrid	Substation Fencing Upgrade - DC	Mandatory Program - Minimum Requirement	Compliance	9600	$ 8,469,811	83%	High
Ausgrid	Noisy Tx Replacement - DC	Mandatory Program - Minimum Requirement	Compliance	9600	$ 1,434,427	83%	High
Ausgrid	Noisy Tx Replacement - ZN Planned	Strategic Program - Short Term Need	Compliance	9600	$ 12,651,452	84%	High
Ausgrid	Electronic Security - ZN	Strategic Program - Short Term Need	Compliance	9600	$ 2,602,440	84%	High
Ausgrid	Electronic Security - TS	Strategic Program - Short Term Need	Compliance	9600	$ 22,143,809	84%	High
Ausgrid	Franchise Meters	Strategic Program - Short Term Need	Compliance	9600	$ 26,582,347	84%	High
Endeavour	Meters Renewal	Mandatory Program - Minimum Requirement	Renewal	9600	$ 18,273,769	84%	High
Endeavour	Relays - Renewal	Mandatory Program - Minimum Requirement	Renewal	9600	$ 1,462,475	84%	High
Endeavour	Labour (Meter/Relay Renewal)	Mandatory Program - Minimum Requirement	Renewal	9600	-	84%	High
Endeavour	DFA - Radio, SCADA, Software	Strategic Program - Short Term Need	Reliability	9600	$ 1,343,479	84%	High
Endeavour	Portable earthing set cabinets	Strategic Program - Short Term Need	Compliance	9600	$ 76,444	84%	High
Endeavour	Substation internal fence replacement (s)	Strategic Program - Short Term Need	Renewal	9600	$ 370,055	84%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Essential	LV Protection Installation program forecast Far West	Strategic Program - Short Term Need	Renewal	9525	$ 8,231,087	84%	High
Essential	Substation Installation Due to LV Protection program forecast Far West	Strategic Program - Short Term Need	Renewal	9525	-	84%	High
Essential	Replace redundant live choke boxes	Strategic Program - Short Term Need	Renewal	9525	$ 106,918	84%	High
Essential	Replace rusting triangular streetlight columns	Strategic Program - Short Term Need	Renewal	9525	$ 2,732,721	85%	High
Essential	Replace unsafe pot belly columns	Strategic Program - Short Term Need	Renewal	9525	$ 3,899,254	85%	High
Ausgrid	Mascot to Green Sq 15MVA	Mandatory Program - Minimum Requirement	Renewal	9525	$ 2,841,164	85%	High
Ausgrid	Caringbah 33kV SG Replacement	Mandatory Program - Minimum Requirement	Renewal	9525	$ 642,182	85%	High
Ausgrid	Careel Bay 11kV SG Replacement (check)	Mandatory Program - Minimum Requirement	Renewal	9525	$ 9,433,325	85%	High
Ausgrid	Lisarow 11kV and 33kV SG Replacement (check)	Mandatory Program - Minimum Requirement	Renewal	9525	$ 12,404,353	85%	High
Ausgrid	Paxton Decom with 11kV LTs (check)	Mandatory Program - Minimum Requirement	Renewal	9525	$ 884,295	85%	High
Ausgrid	Stockton 11kV SG Replacement (Q13645)	Strategic Program - Short Term Need	Renewal	9525	$ 169,510	85%	High
Ausgrid	Singleton 11kV SG Replacement	Strategic Program - Short Term Need	Renewal	9525	$ 4,967,024	85%	High
Ausgrid	Tower Anti-climb Devices	Strategic Program - Short Term Need	Compliance	9525	$ 7,354,778	85%	High
Ausgrid	Small Distributor Projects H	Strategic Program - Short Term Need	Network Connections	9525	$ 3,830,690	85%	High
Ausgrid	Kiosk large [L] H	Strategic Program - Short Term Need	Network Connections	9525	$ 30,183,303	85%	High
Ausgrid	Small PT Projects H	Strategic Program - Short Term Need	Network Connections	9525	$ 2,147,155	85%	High
Ausgrid	LV Distributor All H	Strategic Program - Short Term Need	Network Connections	9525	$ 74,270,422	86%	High
Ausgrid	Kiosk small [S] H	Strategic Program - Short Term Need	Network Connections	9525	$ 33,786,352	87%	High
Ausgrid	PoleTop large [L] H	Strategic Program - Short Term Need	Network Connections	9525	$ 13,054,942	87%	High
Ausgrid	Replacement Meters - High	Strategic Program - Short Term Need	Other	9525	$ 102,107,462	88%	High
Ausgrid	High Voltage C Type OCB Subs	Strategic Program - Short Term Need	Renewal	9525	$ 3,572,315	88%	High
Ausgrid	Hazemeyer RMIs - Harsh Environment	Strategic Program - Short Term Need	Renewal	9525	$ 4,794,545	88%	High
Ausgrid	Protection Schemes - ZN	Mandatory Program - Minimum Requirement	Renewal	9525	$ 5,019,777	88%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Ausgrid	Protection Relays - ZN Reactive	Mandatory Program - Minimum Requirement	Renewal	9525	$ 6,471,685	88%	High
Ausgrid	Protection Schemes - TS	Mandatory Program - Minimum Requirement	Renewal	9525	$ 5,019,777	88%	High
Ausgrid	Protection Relays - TS Reactive	Mandatory Program - Minimum Requirement	Renewal	9525	$ 2,957,213	88%	High
Ausgrid	Small PT Projects H	Strategic Program - Short Term Need	Network Connections	9525	$ 939,652	88%	High
Ausgrid	Planning and Investigations	Strategic Program - Short Term Need	Network Connections	9525	$ 17,557,255	88%	High
Ausgrid	PI Historian License True-up	Strategic Program - Short Term Need	Other	9525	$ 677,735	88%	High
Ausgrid	Planning and Technology Data Usage	Strategic Program - Short Term Need	Other	9525	$ 9,337,097	89%	High
Ausgrid	Distributed Temperature Sensing (DTS)	Strategic Program - Short Term Need	Other	9525	$ 821,383	89%	High
Ausgrid	ETP Platform EOL Upgrade	Strategic Program - Short Term Need	Other	9525	$ 912,279	89%	High
Ausgrid	Engineering Applications EOL Upgrade	Strategic Program - Short Term Need	Other	9525	$ 938,713	89%	High
Ausgrid	Low Voltage Information System (LVIS)	Strategic Program - Short Term Need	Other	9525	$ 3,298,532	89%	High
Ausgrid	Network Infrastructure Growth (10 Gb Port Upgrade) *	Strategic Program - Short Term Need	Other	9525	$ 4,310,741	89%	High
Endeavour	Edmondson Park ZS Establishment	Committed Project	Network Connections	9525	$ 14,611,227	89%	High
Endeavour	Oran Park (permanent) ZS Establishment	Committed Project	Network Connections	9525	$ 21,127,440	89%	High
Endeavour	Catherine Fields ZS Establishment (interim)	Mandatory Program - Minimum Requirement	Network Connections	9525	$ 15,229,276	89%	High
Endeavour	Cordeaux Feeder - LFI installation	Committed Project	Reliability	9525	$ 43,792	89%	High
Endeavour	Transformer Oil Replacement	Strategic Program - Short Term Need	Renewal	9525	$ 901,402	89%	High
Ausgrid	New Enfield 132kV Connection (RS-00130)	Mandatory Program - Minimum Requirement	Renewal	9450	$ 5,318,394	89%	High
Ausgrid	Toronto Zone Decom	Mandatory Program - Minimum Requirement	Renewal	9450	$ c729,753	89%	High
Ausgrid	Telarah Decom with 11kV LTs (DP Costed)	Mandatory Program - Minimum Requirement	Renewal	9450	$ 4,458,230	89%	High
Ausgrid	New Metford 33/11kV Zone with East Maitland Decom and 11kV L	Mandatory Program - Minimum Requirement	Renewal	9450	$ 14,486,109	90%	High
Ausgrid	Reactive OH&S Projects - DM	Mandatory Program - Minimum Requirement	Compliance	9450	$ 11,756,019	90%	High
Ausgrid	Reactive OH&S Projects - DC	Mandatory Program - Minimum Requirement	Compliance	9450	$ 5,873,719	90%	High
Ausgrid	Reactive OH&S Projects - TM	Mandatory Program - Minimum Requirement	Compliance	9450	$ 1,174,839	90%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Ausgrid	Rose Bay Decom (check)	Committed Project	Renewal	9450	$ 520,209	90%	High
Ausgrid	City Main Building Decomission (SJ-00118)	Mandatory Program - Minimum Requirement	Renewal	9450	$ 521,252	90%	High
Endeavour	Leppington North ZS Establishment (interim initially)	Mandatory Program - Minimum Requirement	Network Connections	9450	$ 14,790,465	90%	High
Endeavour	Southpipe (Oakdale Estate) ZS 132/11kV establishment	Mandatory Program - Minimum Requirement	Network Connections	9450	$ 2,261,358	90%	High
Endeavour	Automated Load Break Switches	Strategic Program - Short Term Need	Reliability	9450	$ 4,803,743	90%	High
Endeavour	ZS & TS Oil Containment Program - Bund Walls	Mandatory Program - Minimum Requirement	Renewal	9450	$ 2,779,655	90%	High
Endeavour	TS & ZS Fire Stopping Measures	Strategic Program - Short Term Need	Renewal	9450	$ 1,007,609	90%	High
Endeavour	TS & ZS Security Systems	Strategic Program - Short Term Need	Renewal	9375	$ 11,330,313	90%	High
Essential	Substation Augmentation - PQ	Mandatory Program - Minimum Requirement	Capacity	9300	$ 29,558,707	90%	High
Essential	Remove overhead public lighting control wire and associated SLCP's.	Strategic Program - Short Term Need	Compliance	9300	$ 7,023,516	91%	High
Essential	Gunnedah 22/11kV - augment 22/11kV transformers	Mandatory Program - Minimum Requirement	Capacity	9300	$ 1,385,864	91%	High
Ausgrid	New City North 11kV Ductlines	Committed Project	Renewal	9300	$ 11,755,492	91%	High
Ausgrid	Castle Cove 132kV Feeder 925/3 and 9E4/3 Replacement (SJ-059	Committed Project	Renewal	9300	$ 11,690,055	91%	High
Ausgrid	Land Remediation Transmission	Mandatory Program - Minimum Requirement	Renewal	9300	$ 821,234	91%	High
Endeavour	Technology Pilots	Strategic Program - Short Term Need	Other	9300	$ 13,434,792	91%	High
Endeavour	Menangle Park 66/11kV ZS Site Purchase	Mandatory Program - Minimum Requirement	Network Connections	9300	$ 1,000,966	91%	High
Endeavour	Protection Refurbishment (Miscellaneous)	Strategic Program - Short Term Need	Renewal	9300	$ 2,351,088	91%	High
Endeavour	Substation power outlets installation	Strategic Program - Short Term Need	Renewal	9300	$ 1,326,390	91%	High
Essential	Replacement FI Plants	Strategic Program - Short Term Need	Renewal	9225	$ 3,950,922	91%	High
Essential	ZS transformer refurbishment	Strategic Program - Short Term Need	Renewal	9225	$ 9,794,994	91%	High
Essential	ZS On Line Tap Changer replacement	Strategic Program - Short Term Need	Renewal	9225	$ 2,304,704	91%	High
Essential	ZS On Line Tap Changer refurbishment	Strategic Program - Short Term Need	Renewal	9225	$ 263,395	91%	High
Essential	Spot Luminaire Replacements	Strategic Program - Short Term Need	Renewal	9225	$ 9,054,196	91%	High
Essential	Googong Town - establish new 132/11kV substation	Mandatory Program - Minimum Requirement	Network Connections	9225	$ 12,633,721	91%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Essential	Googong Town - refurb and reconnect incoming 132kV supplies	Mandatory Program - Minimum Requirement	Network Connections	9225	$ 4,210,035	92%	High
Ausgrid	Pelican 11kV Transportable (SJ-06073)	Mandatory Program - Minimum Requirement	Renewal	9225	$ 130,313	92%	High
Ausgrid	Low Voltage ACB Subs	Strategic Program - Short Term Need	Renewal	9225	$ 1,853,609	92%	High
Ausgrid	System Spares - DM (No.)	Strategic Program - Short Term Need	Renewal	9225	$ 578,300	92%	High
Ausgrid	System Spares - TM (OH & UG)	Mandatory Program - Minimum Requirement	Renewal	9225	$ 2,261,942	92%	High
Endeavour	Protection Refurbishment (Interfacing Feeders)	Strategic Program - Short Term Need	Renewal	9225	$ 3,431,337	92%	High
Endeavour	Spares Purchase	Strategic Program - Short Term Need	Renewal	9225	$ 10,076,093	92%	High
Endeavour	Roof Refurbuishment for Control & Switch Rooms.	Strategic Program - Short Term Need	Renewal	9225	$ 5,559,311	92%	High
Ausgrid	132kV Feeder 202 Replacement (RS-00200)	Mandatory Program - Minimum Requirement	Renewal	9150	$ 754,249	92%	High
Ausgrid	Burwood 132kV feeders 923/2 and 924/2 Repalcement (RS-00430)	Strategic Program - Short Term Need	Renewal	9150	$ 188,023	92%	High
Ausgrid	Waratah Busbar Refurbishment (SJ-05975)	Mandatory Program - Minimum Requirement	Renewal	9150	$ 16,807,840	92%	High
Ausgrid	Awaba 33kV Feeders Augmentation (Check)	Mandatory Program - Minimum Requirement	Renewal	9150	$ 1,886,335	92%	High
Ausgrid	Awaba STS 33kV Busbar Decom (Check)	Strategic Program - Short Term Need	Renewal	9150	$ 388,013	92%	High
Ausgrid	33kV Feeder 760 & 766 Replacement (SJ-05976 & SJ-10011)	Mandatory Program - Minimum Requirement	Renewal	9150	$ 8,464,592	92%	High
Ausgrid	New Telarah West 33kV Zone	Mandatory Program - Minimum Requirement	Renewal	9150	$ 22,752,549	92%	High
Endeavour	Box Hill ZSSite Purchase	Mandatory Program - Minimum Requirement	Network Connections	9150	$ 1,556,298	92%	High
Endeavour	Reliability Transmission Development	Strategic Program - Short Term Need	Reliability	9150	$ 1,679,349	92%	High
Essential	New load control Relays	Strategic Program - Short Term Need	Network Connections	9075	$ 1,100,990	92%	High
Ausgrid	33kV UG Sections Replacement (S08, S10)	Mandatory Program - Minimum Requirement	Renewal	9075	$ 27,395,388	93%	High
Ausgrid	Fire Mitigation - TS	Mandatory Program - Minimum Requirement	Compliance	9075	$ 2,889,821	93%	High
Ausgrid	Fire Hydrants - TS	Strategic Program - Short Term Need	Compliance	9075	$ 7,285,118	93%	High
Ausgrid	Reliability Modelling Tool Replacement	Strategic Program - Short Term Need	Other	9075	$ 99,739	93%	High
Endeavour	Box Hill ZS Establishment (interim)	Mandatory Program - Minimum Requirement	Network Connections	9075	$ 14,075,021	93%	High
Endeavour	Culburra Beach Development (33kV fdr and single transformer ZS)	Mandatory Program - Minimum Requirement	Network Connections	9075	$ 5,606,622	93%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Endeavour	Riverstone West	Mandatory Program - Minimum Requirement	Network Connections	9075	$ 143,089	93%	High
Endeavour	Steel Tower Painting Program	Strategic Program - Short Term Need	Renewal	9075	$ 8,206,810	93%	High
Essential	Noise related replacements	Mandatory Program - Minimum Requirement	Compliance	9000	$ 131,697	93%	High
Essential	Replacement program of existing RTU hardware	Strategic Program - Short Term Need	Renewal	9000	$ 9,877,305	93%	High
Essential	Installation of SCADA facilities into existing ZSS sites where none currently exists	Strategic Program - Short Term Need	Capacity	9000	$ 12,840,496	93%	High
Essential	Broken Hill Fuel farm	Mandatory Program - Minimum Requirement	Compliance	9000	$ 494,424	93%	High
Essential	ZS Perimeter Fencing/Security	Strategic Program - Short Term Need	Compliance	9000	$ 2,222,394	93%	High
Essential	Environmental Compliance - ZS	Mandatory Program - Minimum Requirement	Compliance	9000	$ 7,258,626	94%	High
Essential	ZS Buliding repairs and upkeep	Strategic Program - Short Term Need	Compliance	9000	$ 12,042,081	94%	High
Essential	Ancillary radio Asset Replacement	Strategic Program - Short Term Need	Renewal	9000	$ 7,078,735	94%	High
Essential	Two Way Radio Base Replacement	Strategic Program - Short Term Need	Renewal	9000	$ 2,261,564	94%	High
Essential	Mobile Two Way Radio Replacement	Strategic Program - Short Term Need	Renewal	9000	$ 3,967,610	94%	High
Endeavour	Asset Relocation	Mandatory Program - Minimum Requirement	Renewal	9000	$ 5,849,349	94%	High
Endeavour	PM102 ZS SCADA Upgrades	Strategic Program - Short Term Need	Renewal	9000	$ 11,327,173	94%	High
Endeavour	PM121 (MD1000) MD3 to DNP3 Conversion	Strategic Program - Short Term Need	Renewal	9000	$ 671,740	94%	High
Endeavour	Comms Development SCADA	Strategic Program - Short Term Need	Renewal	9000	$ 5,373,465	94%	High
Endeavour	Meters - Growth	Mandatory Program - Minimum Requirement	Capacity	9000	$ 9,950,972	94%	High
Endeavour	Relays - Growth	Mandatory Program - Minimum Requirement	Capacity	9000	$ 1,074,783	94%	High
Endeavour	Test Equipment	Mandatory Program - Minimum Requirement	Other	9000	$ 671,740	94%	High
Endeavour	Aux. Switchgear Replacement	Strategic Program - Short Term Need	Renewal	9000	$ 6,105,464	94%	High
Endeavour	Substation Fire Hydrant Installations	Mandatory Program - Minimum Requirement	Renewal	9000	$ 6,448,699	94%	High
Endeavour	ZS & TS Oil Containment Program - Separators	Mandatory Program - Minimum Requirement	Renewal	9000	$ 335,870	94%	High
Endeavour	Tunnelboard refurbishment	Strategic Program - Short Term Need	Renewal	9000	$ 1,308,556	94%	High
Endeavour	Austral ZS Site Purchase	Mandatory Program - Minimum Requirement	Network Connections	8925	$ 2,627,536	94%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Endeavour	Austral ZS Establishment (interim initially)	Mandatory Program - Minimum Requirement	Network Connections	8925	$ 8,445,013	95%	High
Essential	Albury Nth - acquire site for future zone substation	Committed Project	Network Connections	8850	-	95%	High
Ausgrid	Smoke Detection Installation - TS	Mandatory Program - Minimum Requirement	Compliance	8850	$ 2,354,284	95%	High
Ausgrid	Reactive Infrastructure Risk Projects - TS	Mandatory Program - Minimum Requirement	Compliance	8850	$ 574,338	95%	High
Endeavour	Low Voltage System Augmentations	Strategic Program - Short Term Need	Capacity	8850	$ 984,541	95%	High
Endeavour	Dsub Monitoring & LV Feeder Monitoring for Solar PV	Strategic Program - Short Term Need	Capacity	8850	$ 4,064,787	95%	High
Endeavour	Demand management technology	Strategic Program - Short Term Need	Other	8850	$ 9,137,728	95%	High
Essential	Power factor correction - DM	Strategic Program - Short Term Need	Capacity	8775	$ 16,187,020	95%	High
Essential	HV UG Cable replacement	Strategic Program - Short Term Need	Renewal	8775	-	95%	High
Essential	RF Infrastructure Refurbishment	Strategic Program - Short Term Need	Renewal	8775	$ 7,258,631	95%	High
Essential	RF Linking replacement	Strategic Program - Short Term Need	Renewal	8775	$ 9,436,118	95%	High
Essential	Replacement Relay projects (20 000pa)	Strategic Program - Short Term Need	Renewal	8775	$ 16,113,176	95%	High
Essential	Exhaust Stack Unit #1 Broken Hill	Mandatory Program - Minimum Requirement	Renewal	8775	$ 160,283	95%	High
Essential	Exhaust Stack Unit #2 Broken Hill	Mandatory Program - Minimum Requirement	Renewal	8775	$ 160,283	95%	High
Essential	ZS transformer unplanned failure	Mandatory Program - Minimum Requirement	Renewal	8775	$ 13,169,740	95%	High
Essential	Data Network Asset Replacement	Mandatory Program - Minimum Requirement	Renewal	8775	$ 2,921,432	95%	High
Ausgrid	Paddington 33kV Feeders Replacement (RS-00460)	Mandatory Program - Minimum Requirement	Renewal	8775	$ 11,125,490	96%	High
Ausgrid	Castle Cove and Mosman 132kV Disconnector Replacement (check	Mandatory Program - Minimum Requirement	Renewal	8775	$ 1,156,302	96%	High
Ausgrid	Chatswood 33kV Feeder 554 Uprate	Mandatory Program - Minimum Requirement	Renewal	8775	$ 21,398	96%	High
Ausgrid	33kV Feeder 773/767 Oil Section Replacement	Mandatory Program - Minimum Requirement	Renewal	8775	$ 599,498	96%	High
Ausgrid	Reactive OH&S Projects - ZN	Mandatory Program - Minimum Requirement	Compliance	8775	$ 2,884,053	96%	High
Ausgrid	Reactive OH&S Projects - TS	Mandatory Program - Minimum Requirement	Compliance	8775	$ 1,442,027	96%	High
Ausgrid	Low Voltage (LV) Underground Mains Reactive	Mandatory Program - Minimum Requirement	Renewal	8775	$ 19,762,726	96%	High
Endeavour	Eschol Park ZS Establishment	Mandatory Program - Minimum Requirement	Network Connections	8775	$ 6,193,009	96%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Endeavour	Eschol Park ZS Site Purchase	Mandatory Program - Minimum Requirement	Network Connections	8775	$ 875,845	96%	High
Endeavour	Central to Southern Regional Communication Link	Strategic Program - Short Term Need	Renewal	8775	$ 4,733,739	96%	High
Endeavour	Control Cable Trench / Cover Refurbishment / Replacement	Strategic Program - Short Term Need	Renewal	8700	$ 335,870	96%	High
Ausgrid	Reactive Infrastructure Risk Projects - ZN	Mandatory Program - Minimum Requirement	Compliance	8625	$ 1,435,844	96%	High
Essential	Distribution Feeder Voltage Profile - end of feeder -IN	Strategic Program - Short Term Need	Capacity	8550	$ 8,117,571	96%	High
Essential	Distribution Feeder Voltage Profile (Voltage control devices)- IN	Strategic Program - Short Term Need	Capacity	8550	$ 1,826,120	96%	High
Essential	Feeder Dynamic Rating - IN	Strategic Program - Short Term Need	Capacity	8550	$ 6,071,516	96%	High
Essential	Capitalised research expenditure - DM volt-var control	Strategic Program - Short Term Need	Capacity	8550	-	96%	High
Essential	Four Quadrant inverter based Rollout (DM)	Strategic Program - Short Term Need	Capacity	8550	-	96%	High
Essential	Switched Reactor Rollout (DM)	Strategic Program - Short Term Need	Capacity	8550	-	96%	High
Essential	Customer Outage Information - IN	Strategic Program - Short Term Need	Compliance	8550	$ 14,262,398	96%	High
Essential	Customer Premise Register (support database)	Strategic Program - Short Term Need	Compliance	8550	$ 1,975,461	96%	High
Essential	Distribution Substation Monitoring - IN	Strategic Program - Short Term Need	Capacity	8550	$ 6,797,966	96%	High
Essential	Transformer Tap Point Monitoring - IN	Strategic Program - Short Term Need	Capacity	8550	$ 348,998	96%	High
Essential	New/refurbished Zone Substation - Comms	Strategic Program - Short Term Need	Capacity	8550	$ 706,080	96%	High
Essential	Telecomms into Brownfields zone subs	Strategic Program - Short Term Need	Capacity	8550	$ 4,425,033	97%	High
Essential	IN devices - Smart Grid (IN projects)	Strategic Program - Short Term Need	Capacity	8550	$ 4,416,143	97%	High
Essential	Low voltage Feeder end point monitoring (IN project)	Strategic Program - Short Term Need	Capacity	8550	$ 2,239,330	97%	High
Essential	New FI Plant - Growth	Strategic Program - Short Term Need	Capacity	8550	$ 3,198,565	97%	High
Essential	Controllable load - DM program	Strategic Program - Short Term Need	Capacity	8550	$ 6,016,533	97%	High
Essential	Convert existing legacy controllers to MD3311-derived devices to enable migration into ENMAC	Strategic Program - Short Term Need	Renewal	8550	$ 987,730	97%	High
Essential	Mobile FI Plant Studies – plans and equipment necessary for installation of emergency plant where required	Strategic Program - Short Term Need	Renewal	8550	$ 230,470	97%	High
Essential	Synchronisation of multiple FI plant in Lismore Region	Strategic Program - Short Term Need	Renewal	8550	$ 509,135	97%	High
Essential	Greenfield SCADA -inc in ZSS Projects	Strategic Program - Short Term Need	Network Connections	8550	-	97%	High

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Essential	Brownfield SCADA - ZSS Developments	Strategic Program - Short Term Need	Capacity	8550	$ 1,175,596	97%	High
Essential	Commissioning of existing and new DSA sites	Strategic Program - Short Term Need	Capacity	8550	$ 5,867,119	97%	High
Essential	General Civil Improvements - BH	Strategic Program - Short Term Need	Renewal	8550	$ 494,424	97%	High
Essential	Broken Hill CO2 systems	Mandatory Program - Minimum Requirement	Compliance	8550	$ 494,424	97%	High
Essential	Zone Substation Dynamic Rating - IN project	Strategic Program - Short Term Need	Compliance	8550	$ 158,037	97%	High
Essential	Unplanned equipment failure replacement (CB's and Instrument Tx sets)	Strategic Program - Short Term Need	Renewal	8550	$ 6,996,424	97%	High
Essential	Civil - ZS	Strategic Program - Short Term Need	Compliance	8550	$ 856,033	97%	High
Essential	Minor Zone Substation Monitoring - IN	Strategic Program - Short Term Need	Compliance	8550	$ 1,316,974	97%	High
Essential	Meters for new connections	Mandatory Program - Minimum Requirement	Network Connections	8550	$ 23,414,156	97%	High
Essential	Meter replacement program	Strategic Program - Short Term Need	Renewal	8550	$ 47,279,657	98%	High
Essential	New Zone Substations meters	Strategic Program - Short Term Need	Capacity	8550	$ 539,918	98%	High
Essential	Power Quality Monitoring - PQ	Strategic Program - Short Term Need	Capacity	8550	$ 1,316,974	98%	High
Essential	Metering for ZS (Power Quality meters)	Strategic Program - Short Term Need	Compliance	8550	$ 1,646,218	98%	High
Ausgrid	New 132kV Feeder Bunnerong to Kingsford and Retire Feeder 26	Strategic Program - Short Term Need	Renewal	8550	$ 3,435,588	98%	Medium
Ausgrid	Install PIR relays in the Sydney CBD	Mandatory Program - Minimum Requirement	Compliance	8550	$ 5,281,492	98%	Medium
Ausgrid	Spares Storage Facilities - ZN	Strategic Program - Short Term Need	Renewal	8550	$ 4,028,231	98%	Medium
Ausgrid	Capital Works - Natural Disasters, Storms and Bushfires	Mandatory Program - Minimum Requirement	Renewal	8550	$ 7,044,555	98%	Medium
Ausgrid	Projects Apportioned from Non-System IT	Strategic Program - Short Term Need	Other	8550	$ 12,042,606	98%	Medium
Endeavour	Upgrading of Direct Connected Substations	Strategic Program - Short Term Need	Renewal	8550	$ 13,758,600	98%	Medium
Endeavour	TS & ZS Control Room Temperature Reduction Initiatives	Strategic Program - Short Term Need	Renewal	8550	$ 604,566	98%	Medium
Endeavour	TS Capacitor Refurbishment POW switching	Strategic Program - Short Term Need	Renewal	8550	$ 778,149	98%	Medium
Essential	Rectification of low clearance infringements on subtransmission feeders	Mandatory Program - Medium Term	Renewal	8200	-	98%	Medium
Essential	Fault level related CAPEX	Mandatory Program - Medium Term	Network Connections	7900	-	98%	Medium
Essential	Voltage related CAPEX	Mandatory Program - Medium Term	Network Connections	7600	-	98%	Medium

DNSP	Project / Program Description	Project / Program Type (Division)	Principle Driver	Weighted Ranking (CASH)	Reg Period $s	Percent of Expenditure Proposal	RISK LEVEL
Essential	Thermal related CAPEX	Mandatory Program - Medium Term	Network Connections	7600	-	98%	Medium
Essential	Poles and Capitalised defects (based on inspection)	Strategic Program - Medium Term Need	Renewal	7400	-	98%	Medium
Essential	Replacements due to voltage drop - Services	Mandatory Program - Medium Term	Reliability	7400	-	98%	Medium
Essential	STOHS Pole Replacement (based on inspection)	Strategic Program - Medium Term Need	Renewal	7400	-	98%	Medium
Ausgrid	Fire Fighting Water Storage Tanks - ZN	Mandatory Program - Medium Term	Compliance	7400	$ 634,492	98%	Medium
Ausgrid	Fire Fighting Water Storage Tanks - TS	Mandatory Program - Medium Term	Compliance	7400	$ 1,442,027	98%	Medium
Essential	LV network augmentation - PQ	Mandatory Program - Medium Term	Capacity	7300	-	98%	Medium
Essential	Overhead Bulk Replacement - Services	Strategic Program - Medium Term Need	Renewal	7250	-	98%	Medium
Essential	Poor Performing Feeders	Mandatory Program - Medium Term	Reliability	7200	-	98%	Medium
Essential	Customer Service: Worst serviced customers	Strategic Program - Medium Term Need	Reliability	7200	$ 3,325,913	98%	Medium
Essential	ZS PCB decontamination (Power Transformers)	Mandatory Program - Medium Term	Compliance	7100	-	98%	Medium
Essential	Poletop Switchgear replacement	Strategic Program - Medium Term Need	Renewal	7050	$ 6,984,416	98%	Medium
Essential	Switchboard replacement	Strategic Program - Medium Term Need	Renewal	7050	$ 15,069,917	99%	Medium
Ausgrid	Long & Crawford T3GF3 Ring Main Isolators	Mandatory Program - Medium Term	Renewal	7050	$ 2,497,850	99%	Medium

(Source – derived from: PIP_project_list_ES_EN_AG_20140129 v3 2 for AER)

Appendix E. CVs of Jacobs Team Members

The curricula vitae (CVs) of the Jacobs team members involved in producing this report are provided below. The CVs are provided to give assurance on the qualification of the document authors – in terms of their education, training and experience in relation to the subject matter of the report – to provide the professional opinions expressed within this report.

Michael Tamp

SENIOR CONSULTANT

Michael Tamp has spent over 30 years in the NSW electrical supply industry at both transmission and distribution levels, working in strategic planning, asset management, information management, administrative and regulatory roles. Mike has extensive senior leadership experience in network strategy development, strategic asset management and asset renewal as well as extensive experience in network planning and system development at both transmission and distribution levels. He brings with him a strong knowledge of the current electricity regulatory framework and is highly experienced in high voltage power system equipment and asset management principles.

During his career Mike has directed the development of electrical network capital development programs, the introduction of risk-based planning methodologies, and the implementation of strategic asset management plans. He also has senior level experience in HV electrical asset management, and has strategically and operationally managed network asset information functions.

CURRENT POSITION

Senior Consultant

QUALIFICATIONS

Bachelor of Engineering, Honours Class 1

University of New South Wales, 1982

PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS

Chartered Member of the Institute of Engineers, Australia

Registered on the National Professional Engineers Register (NPER-3)

EXPERTISE

- Strategic management of electricity supply networks, including the development of network capital investment programs targeting network capability, security, and reliability.
- Strategic Asset Management of HV Power System Equipment, especially substation assets and HV underground cables.
- Knowledge and experience in the current electricity regulatory framework
- The development, integration and implementation of network asset investment methodologies.
- Knowledge and experience in high voltage power system equipment and asset management principles.
- Knowledge and experience in high voltage power system behaviour and modelling techniques
- Business process management and process re-engineering

PROFESSIONAL EXPERIENCE

JACOBS

Senior Consultant – Utilities Management and Regulation

TransGrid – establishing an Asset Management Competency framework as part of TransGrid's project to obtain accreditation under ISO55001. Undertaking control audits of key asset management processes as part of this process.

Critical review and assistance in developing response to AER's draft Determination in November 2014.

Endeavour Energy – Development of a position paper on Endeavour Energy's long-established approach at asset replacement planning. Provided relevant argument in support of Endeavour Energy's response to the AER draft Determination of November 2014.

Western Power (WA) – Senior Consultant undertaking a comprehensive review of Western Power's asset management systems in accordance with regulatory requirements, covering 12 key performance areas and verification of previous review action item close-outs.

Ausgrid – critical review of business documentation supporting the regulatory pricing submission in 2014. Documents reviewed ranged from business justifications for network investment decision, project post implementation reviews, and asset management strategies.

Strategic review of Ausgrid's sub-transmission fluid filled cable replacement program, advising on the validity of Ausgrid's approach and opportunities for improvement in program justification, planning and governance.

Transend Networks (Tasmania) – Review of Transend network planning and investment framework with a particular focus on advising on governance arrangements and integration of expenditure programs to achieve optimised network investment outcomes.

Review of planning for asset replacement programs and planning approaches, focussing on soundness of documentation, robustness of business arguments, and expenditure planning governance.

Networks NSW – Undertook reviews and provided strategic advice on asset replacement planning methodologies and outcomes, and reliability-based investment approaches for the three NSW electricity distribution businesses

Transgrid – seconded for the provision of strategic advice and support in network planning, regulatory matters, network investment business justifications, and management advice.

JACOBS

Michael Tamp

SENIOR CONSULTANT

Essential Energy – Development of a Power Quality Monitoring and Control strategic plan for implementation within the "Intelligent Network" smartgrid framework.

ENDEAVOUR ENERGY (Formerly Integral Energy)

Technologies Development Manager

Led a start-up function aimed at integrating SCADA, Protection and IEC 61850 Substation Automation technologies for new capital works.

Acting Manager Strategic Asset Management

Led the strategic network planning function covering 10 year network investment planning, power quality management, and environmental assessments/approvals for new capital works. Oversaw a capital budget program development of over $500 million p.a. and strategic network maintenance programs of over $200 million p.a.

Acting Manager Transmission Project Development

Led the group responsible for the development of major capital works projects. This included the development of project definitions, design approvals for substation and mains projects, transmission substation equipment specification and acquisition, and other related activities.

Manager, Strategic Asset Renewal Planning

Established the Strategic Asset Renewal Planning function from a zero base. Developed Integral's 10 year Strategic Asset Renewal Planning framework, the annual asset renewal capital budget and major asset renewal projects, with an annual capital budget in excess of $100 million p.a. This included the oversight and collation of myriad minor asset programs, the development of specific major renewal projects with budgets up to $60m, and integrated prioritisation of competing renewal programs.

Network Strategy and Network Pricing Determinations

Developed Integral's Network Strategy that underpinned the submission for the 2004 IPART Network Pricing Determination, requiring the influencing of the executive and the industry regulator. Directly contributed to the final submission and the development of capital projections contained therein. Most recently contributed to the 2009 pricing determination, and associated strategic network business planning initiatives.

Storm Response

Undertook a comprehensive review of Integral's responsiveness to major storm activity and infrastructure damage following the 2006 storms, advising the Executive on initiatives for improved future response.

Reliability Strategy

Developed Integral's first network reliability improvement strategy in 2002/03.

Load Forecasting review

Reviewed Integral's load forecasting methodologies and processes following the 2004 Network Pricing Determination to determine appropriateness and future improvements .

Review of Industry Capex approaches

Undertook a strategic review of industry approaches to capital program development and various regulatory reviews in order to determine transferable learnings for Integral Energy following the 2004 Network Pricing Determination.

Michael Tamp

SENIOR CONSULTANT

MERITEC (Formerly Worley Consultants Of NZ)

Major Projects Included:

Energy Australia - Supply Security Review for the Sydney CBD (October 2001)

Reviewed the planning processes and the identification of credible contingencies associated with the Sydney CBD 132kV and 33kV supply network for the summer of 2000/2001.

Electricity Supply Industry Planning Council of SA - Network Development Strategy for Eyre Peninsula Generation (November 2001)

Senior consultant developing strategic network development options for the connection of up to 1000MW of wind and thermal generation on the Eyre Peninsula of SA.

Electricity Supply Industry Planning Council of SA - Review of Submissions for Riverland Network Augmentation (August/October 2001)

Project manager and senior consultant undertaking a review of submissions relating to the reinforcement of the Riverland 132kV electrical network.

TransGrid, Integral Energy, & Country Energy - Strategic Plan for the NSW Far South Coast Electricity Network (September 2001/ March 2002)

Project manager and senior consultant leading the development of a long-term strategic plan for the 132kV Subtransmission network on the Far South Coast of NSW.

TransGrid Telecommunications Strategic Plan (April/ October 2001)

Project manager and senior consultant preparing a 5-year strategy for the integrated development of TransGrid's telecommunications infrastructure. Specifically advising on asset management and operational needs for telecommunications infrastructure to better leverage asset capability, network management and other corporate resources, and reporting to the TransGrid executive accordingly.

Siemens Ltd – Due Diligence for acquisition of a networks field services company (February/March 2001)

Led the review of strategic network investment and asset management issues. Provided advice on network investment strategies, network capability and development plans, network performance issues, planning processes, and high-level business relationship issues.

INTEGRAL ENERGY

Manager, Network Capability

Led the strategic management of Integral Energy Networks assets and the data/information management systems. Set strategic direction in asset management, optimising new investment, replacement/refurbishment expenditure and operational expenditure.

- Led the Network Planning Issues investigation and advised the Ministerial Inquiry into the Auckland Power Supply Failure (1998). Lead author of a report on the same.
- Directed the development on the inaugural integrated strategic asset management plan (SAMP) within Integral Energy to deal with the emerging issue of a steadily aging electricity supply network and restricted availability of capital funding
- Initiated and directed the review and strategic planning for the integration and renewal of Integral Energy's Asset Information Management systems (The IAIMS initiative).

Michael Tamp

SENIOR CONSULTANT

- Inaugural Convener of the NSW Electricity Distribution Industry Working Group on the Demand Management Code of Practice. (1998)

Manager, Network Substation Assets.

Introduced strategic asset management principles to the behaviour and objectives of the group

Managed the Transmission, Distribution, SCADA and Protection asset management functions

Developed asset management framework targeting asset performance, asset risk management, safety, and overall network performance.

Directed the introduction of the first strategic asset refurbishment plan within Integral Energy.

Retained counsel and managed a complex legal matter (involving customer noise complaints) to the successful conclusion for Integral Energy. Consequently introduced associated risk considerations into asset and business plans.

ILLAWARRA ELECTRICITY

Supervising Engineer Planning (May 1990 to April 1996)

Developed long term plans for the development of the NSW South Coast Transmission and Subtransmission networks, including construction of load-flow models, reactive power planning, risk management planning, and joint planning with TransGrid.

Prepared annual infrastructure development capital programs, and developed capital evaluation methodologies for application in the network investment planning process.

Introduced risk based network planning and investment methodologies to Illawarra Electricity, and applied them in the planning of the 132kV system from Dapto to Moruya

Developed technical and commercial options for the connection of co-generators of sizes beyond 100MW.

Joint author of the ESAA Reliability Assessment Planning Guidelines for distribution system analysis (1995).

ELECTRICITY COMMISSION OF NSW

Senior Engineer, Planning

Led a team of professional and sub-professional staff in the planning of the 500 kV and 330 kV main grid and the 132 kV transmission system.

Workshops and Refurbishment Engineer, Homebush

Managed the HV Power Equipment and general workshops, located in Sydney, providing high voltage power system equipment repair, maintenance and refurbishment services

Engineer, Substation Design

Design of substation control & protection systems, as well as the civil/mechanical aspects of substation design, including lightning protection design, transformer noise reduction design implementation, busbar mechanical design, and substation layout design.

Michael Tamp

SENIOR CONSULTANT

Engineer, Underground Cable Maintenance

Provided technical and administrative support in the maintenance of the Commission's high voltage underground cable network (330 kV, 132 kV, 66 kV, & 33 kV), including

- Programming of major 132 kV cable installation, relocation and refurbishment works
- Investigation/implementation of use of new materials, techniques, and equipment for the maintenance and management of the hydraulic and alarm systems associated with high voltage underground power cables in the Sydney metropolitan area.

Ryan Dudley

EXECUTIVE CONSULTANT

Summary of Competencies

Ryan is the Group Manager of Jacobs' Utilities Management and Regulation Consulting practice. His area of technical specialisation is in the regulation and technical management of transmission and distribution networks.

Ryan has provided strategic advisory services to transmission and distribution network businesses and regulators across Australia, the Philippines, the Solomon Islands and Oman. He has a position on the Australian Cigré AP C5 panel (Electricity Markets and Regulation) and has recently completed projects including analysis and review of revenue proposals, asset management reviews, performance and technical audits and asset valuations. Ryan is a PAS-55 accredited assessor.

Prior to joining SKM, Ryan worked in the Networks and Engineering sections of TransGrid, the NSW electricity transmission authority where he was involved in various sectors of the business including substation construction and commissioning, project engineering, asset management, project management and design.

Recent Project Experience

Advisory

Large Renewable Energy Project Advisory Committee - Solomon Islands Electricity Authority - Solomon Islands (2013/14)

Strategic and technical advisory services to the SIEA, SIG and The Clinton Foundation for the decision-making and development process for two large scale renewable energy projects for Honiara. The project involved working with the proponents (World Bank, IFC and Geodynamics), the Government (through the Renewable Energy Project Advisory Committee chaired by the Prime Minister) and the SIEA to deliver a best for country solution.

Solomon Islands Electricity Authority (2013)

Developed a five year integrated generation and network development plan for the SIEA's Honiara network. The development plans required a comprehensive demand forecast generated by meeting a significant cross section of stakeholders, then considering generation options and sources such as solar PV, diesel, biofuel, geothermal and hydro, identifying network upgrades and providing final recommendations.

Solomon Islands Electricity Authority (2012)

Developed a five year generation and network development plan for the SIEA's 8 outstations being Noro (Munda), Gizo, Auki, Kirakira, Lata, Buala (hydro and diesel), Malu'u, (hydro and diesel) and Tulagi. The development plans required a comprehensive demand forecast generated by meeting a significant cross section of stakeholders, then considering generation options and sources such as solar PV and biodiesel, identifying network upgrades and providing final recommendations.

CURRENT POSITION

Executive Consultant

QUALIFICATIONS

Bachelor of Engineering, Honours

Bachelor of Science

PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS

Member, Institution of Engineers, Australia (NPER)

Chartered Professional Engineer (CPEng) (2570891)

Registered Professional Engineer Queensland (RPEQ) (10608)

CIGRE APC5 – Energy Markets and Regulation – Panel Member

EXPERTISE

- Strategic advice and utility regulatory management
- Energy policy and regulation
- Governance and regulatory compliance
- Valuations and investment analysis

JACOBS

Ryan Dudley

EXECUTIVE CONSULTANT

Solomon Islands Electricity Authority (2009 to 2012)

Project manager for the Solomon Islands Loss Reduction Study. The project involved carrying out a loss reduction study on the SIEA's Honiara network. There were various aspects to the project including field work to determine the magnitude and type of losses, workshops with SIEA staff, network modelling, load forecasting, protection co-ordination studies, preparation of an Electrical Handbook, preparation of specifications and evaluating tenders. SKM found that losses could be economically reduced from around 25% to 10% through the implementation of the recommendations made in the final report.**Essential Energy - Australia (2012)**

Advisory support to Essential Energy's Infrastructure Strategy division to gain an improved understanding of the underlying trends, changes and categorisation of investment drivers for 8,000 distribution projects over three years totalling AUD$1.2 billion. There were a number of changes and other factors which complicated the task of deriving the distribution capex investment 'themes', which needed to be unravelled. Key tasks were to audit recent changes and analyse the data to develop investment themes both geographically across the 8 planning regions and in time through the regulatory period.

TransGrid - Australia (2011)

Development of a methodology and model to support TransGrid's Project Development group determine the most prudent and efficient approach to substation replacement. The project included assessing risks and associated costs of in-situ (brownfield) replacement and comparing this to Greenfield replacement options.

Essential Energy - Australia (2011)

Undertook a review of unit costs review for senior management who required a better understanding of costs associated with building and maintaining the electricity distribution network. This was driven by an increased focus on how the business was delivering against its regulatory submission, and a heightened awareness of the need for the business to understand, and be capable of demonstrating, the efficiency of its operations.

Ausgrid - Australia (2011)

Review of DM&C (Distribution Monitoring and Control) project (~$100M project involving 12,000 devices installed on distribution transformers). Performed a health check on the DM&C programme and provided recommendations for the project moving forward. The review involved assessing the current implementation of the project against the business case, the feasibility of achieving the benefits identified, reviewing the roll-out and deployment of devices and a consideration of alternative delivery models. The project also involved a review of the technology and material risks.

Regulatory

Ausgrid, Australia (2014)

Project Director for review of Ausgrid's sub-transmission cable replacement

Ryan Dudley

EXECUTIVE CONSULTANT

plan in order to identify any gaps in the existing documentation and provide independent advice regarding the consistency of the proposed replacement program with sound engineering practice and expenditure governance requirements.

Ausgrid Australia (2014)

Project Director for the review of the regulatory proposal supporting documents. The purpose of the document review was to identify key regulatory risks that had the potential to result in the regulator not understanding the approach, finding a lack of demonstration or justification or otherwise making an unfavourable finding in relation to Ausgrid's regulatory proposal.

Endeavour Energy – Australia (2013)

Project Director for strategic consultancy support provided to Endeavour Energy for their 2014-2019 regulatory submission. The project included reviewing capital investment justification, asset management, STPIS and operating costs.

TransGrid – Australia (2012/13)

Project Manager Project Manager for the assurance reviews of TransGrid's 2014-2019 revenue reset documentation. The project included reviewing the capital governance framework, project evaluation and selections, capital estimates and the inputs into the operating cost model.

Dhofar Power Company – Oman (2012)

Consultancy assistance for the 3rd Price Control Review. The project involved reviewing and verifying the company forecasts for opex and capex requirements, reviewing existing demand forecasts and identifying sector demand growth for use in capex and opex forecast modelling, identification of opex drivers and historic correlation of drivers according to the best practices, developing unit costs for estimating expenditure and consolidation of the drafting and submission pro-forma tables and narrative responses to regulator.

Majan Electricity Company – Oman (2011)

Project Manager for the 3rd Price Control Review. The project involved reviewing and verifying the company forecasts for opex and capex requirements, reviewing existing demand forecasts and identifying sector demand growth for use in capex and opex forecast modelling, identification of opex drivers and historic correlation of drivers according to the best practices, developing unit costs for estimating expenditure and consolidation of the drafting and submission pro-forma tables and narrative responses to regulator.

Essential Energy (2011 and 2012)

Audit of Essential Energy's 2009/10, 2010/11 and 2011/12 Regulatory Information Notices (RIN). The audit covered reliability, customer service, demand side management, demand forecasting and Efficiency Benefit Sharing Scheme (opex costs) in accordance with regulated AER audit guidelines.

Ryan Dudley

EXECUTIVE CONSULTANT

Asset Management

TransGrid, Australia (2013/14)

Project Director for the project to support TransGrid develop their asset management system documentation to align with the requirements of PAS-55 prior to their revenue proposal submission to the regulator. Specific support included the development of asset management strategies and objectives, and the alignment of asset management strategies, objectives and plans with the corporate plan, asset management policy and risk management system.

Endeavour Energy – Australia (2013)

Review the adequacy and completeness of Endeavour Energy's asset management plans and business cases that detail the technical and financial justifications supporting the various capex and opex projects and programs.

ElectraNet – Australia (2012)

Gap analysis of ElectraNet's asset management practices and policies using the PAS-55 methodology.

Ausgrid – Australia (2011)

Audit of Ausgrid's Network Management Plan for the Department of Trade, Investment, Regional Infrastructure and Services.

Essential Energy – Australia (2011)

Audit of Ausgrid's Network Management Plan for the Department of Trade, Investment, Regional Infrastructure and Services.

Asset Valuations

Solomon Islands Electricity Authority – Solomon Islands (2012)

Project Manager for the Optimised Depreciated Replacement Cost (ODRC) valuation of the SIEA's generation assets and distribution network. Responsible for leading the team establishing the asset registers, compiling the ODRC databases and determining the replacement costs.

Endeavour Energy – Australia (2010)

Project Manager for the Optimised Depreciated Replacement Cost (ODRC) valuation of Endeavour Energy's (ex Integral Energy) distribution network. Responsible for leading the team establishing the asset registers, compiling the ODRC databases and determining the replacement costs.

Horizon Power – Western Australia (2010)

Project Manager for the Optimised Depreciated Replacement Cost (ODRC) valuation of Horizon Power's Pilbara network. Responsible for leading the team establishing the asset registers, compiling the ODRC databases and determining the replacement costs.

Energy Regulatory Commission (ERC) – Philippines (2009)

Undertook an Optimised Depreciated Replacement Cost (ODRC) valuation of six distribution utilities entering the Performance Based Regulation (PBR) scheme under the ERC. Responsible for establishing the current replacement cost of the network assets across the six utilities and leading the team responsible for the compilation of the ODRC databases.

Adam Homan

STRATEGIC CONSULTANT

CURRENT POSITION

Strategic Consultant

QUALIFICATIONS

Master of Applied Finance – Macquarie University (2015 exp.)

Bachelor of Engineering (Hons) – University of Technology, Sydney (UTS)

Diploma in Engineering Practice – UTS

Electrician, Certificate III

PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS

Member of the Institute of Engineering and Technology (MIET)

EXPERTISE

Financial Analysis

Asset Management

Electrical Engineering

Electrical Contracting

Summary of competencies

Adam is a professional electrical engineer with 15 years' industry experience. This includes time spent with different utilities prior to moving into consultancy. He now applies his experience providing strategic business and regulatory support, primarily within the power and energy sector.

His recent experience includes consultancy services for utilities, developers, industry regulators and corporate financiers internationally – including regulatory consulting, asset management, auditing, capital investment planning, technical due-diligence, financial analysis and business-case development.

Adam has sound knowledge in asset management, performance/cost/risk optimisation and valuation. He is experienced in power-system protection, planning, design, performance and reliability. Adam is also a qualified electrical contractor – familiar with commercial and industrial systems, specialising in substation construction, operation and maintenance.

Adam is currently undertaking his Master of Applied Finance at Macquarie University. He graduated from the University of Technology, Sydney (UTS) with honours as a Bachelor of Engineering. He also holds a Diploma in Engineering Practice, is a qualified Electrician and a Member of the Institution of Engineering & Technology (MIET).

Recent project experience

Adam has recent project exposure to a range of expertise including:

- Asset management (including PAS-55 and ISO-55001), asset condition assessment, asset valuation and Health Index (HI) system review.
- Technical due-diligence transactional support (investor and vendor).
- Financial analysis and business-case development.
- Power station connection consulting between developers and utilities.
- Consultation with industry and regulators under several capacities – including review/auditing, Capex/Opex classification practices, Capex and power system planning and risk exposure management.
- Energy forecasting applied for risk analysis and system planning.
- Power system modelling and analysis.

Examples of recent projects include:

PROJECT | 2014-19 Revenue Reset Support – Australia

Client: TransGrid

Role: Strategic Consultant

- Engaged by TransGrid to provide support in developing aspects of their upcoming revenue reset submission to the Australian Energy Regulator (AER).
- Specific support included the review of business case documents for proposed projects.

PROJECT | 2014-19 Revenue Reset Support – Australia

Client: Ausgrid

Adam Homan

STRATEGIC CONSULTANT

Role: Strategic Consultant

- Engaged by Ausgrid to provide support in developing aspects of their upcoming revenue reset submission to the Australian Energy Regulator (AER).
- Specific support included the review of business case documents for proposed projects.

PROJECT | Capitalisation Audit – United Kingdom

Client: Northern Ireland Authority for Utility Regulation (NIAUR)

Role: Senior Analyst

- Engaged as an analyst by NIAUR to audit the capitalisation practices of Northern Ireland Electricity Limited (NIE). The capitalisation audit investigated changing practices in Opex / Capex classification across regulatory price control periods.

PROJECT | 2012/13 RIN Audit and D-factor Review – Australia

Client: Ausgrid

Role: Project Manager / Lead Auditor

- Engaged by Ausgrid to audit the non-financial templates specified under the Regulatory Information Notice (RIN) issued by the Australian Energy Regulator (AER). Ausgrid extended the audit to also include a technical review of their D-factor projects and report.

PROJECT | 2012/13 RIN Audit – Australia

Client: Essential Energy

Role: Project Manager / Lead Auditor

- Engaged by Essential Energy to audit the non-financial templates specified under the Regulatory Information Notice (RIN) issued by the Australian Energy Regulator (AER). Essential Energy extended the audit to also include a review of the remaining templates.

PROJECT | ISO 55000-1-2 Asset Management Support – Australia

Client: TransGrid

Role: Project Manager / Strategic Consultant

Adam was engaged by TransGrid to provide asset management support in working towards ISO 55000-1-2 accreditation of the asset management system. Specific support included:

- Establishing an asset management system audit program, including a triennial plan for the program and the development of annual audit plans.
- Carrying out the 2014 asset management system audit.
- Establishing and implementing an asset management competency framework.
- Updating and aligning the asset management system documentation developed under PAS-55 to meet ISO 55000-1-2 criteria and the 2014-19 Corporate Plan.

PROJECT | Kuringai STS Budget Overrun Verification – Australia

Client: Ausgrid

Role: Project Manager / Strategic Consultant

- Engaged by Ausgrid to review their forecasted cost to complete the

Adam Homan

STRATEGIC CONSULTANT

Kuringai STS which had a significant budget overrun. The review considered the cost model as well as the circumstances leading to the overrun.

- Recommendations related to the use of project management systems and tools, tendering processes for contractors, appropriate use of price escalators and effective controls for managing internal hours.

PROJECT | B2K Cooks River Variation – Australia

Client: Ausgrid

Role: Project Manager / Strategic Consultant

- Engaged by Ausgrid to review a variation claim exceeding $1 M submitted by a contractor relating to construction delays during project delivery. The review considered the calculation of the claim as well as the validity and circumstances leading to the claim.

PROJECT | PAS-55 Asset Management Support – Australia

Client: TransGrid

Role: Project Manager / Strategic Consultant

- Engaged by TransGrid to provide asset management support as they work towards PAS55 accreditation of their asset management system.
- Specific support included the development of asset management strategies and objectives, and the alignment of asset management strategies, objectives and plans with the corporate plan, asset management policy and risk management system.

PROJECT | Investment Appraisal Support – United Kingdom

Client: Northern Powergrid

Role: Strategic Consultant

- Engaged by Northern Powergrid to assist in the development of Investment Appraisal Documents (IAD) to demonstrate the business case for projects proposed under the upcoming regulatory price control period.

PROJECT | SPEN & SEE Technical Due-Diligence – United Kingdom

Client: Royal Bank of Canada (RBC)

Role: Strategic Consultant

- Provided technical due-diligence support for Royal Bank of Canada (RBC) to guide investment decisions in Scottish Power Energy Networks (SPEN) and Scottish & Southern Energy (SSE).
- Provided technical advice surrounding the deliverability of expenditure plans and their ultimate reflection in the Regulated Asset Base (RAB).

PROJECT | JEPCO Technical Due-Diligence – Jordan

Client: Ernst & Young

Role: Technical Consultant

- Performed intrusive asset condition assessments across Jordan Electric Power Company (JEPCO).
- Provided asset valuations to support the overall company valuation.
- Provided regulated industry advice in view of splitting government owned power utilities to form a competitive privatised market.

Adam Homan

STRATEGIC CONSULTANT

PROJECT | Network Reliability Improvement Plan – Saudi Arabia

Client: Electricity Cogeneration Regulatory Authority (ECRA)

Role: Strategic Consultant / Technical Consultant

- Engaged by the Electricity Cogeneration Regulatory Authority (ECRA) to audit the reliability performance of the Saudi Electricity Company (SEC) and develop a network reliability improvement plan.
- This included a complete review of operational and maintenance practices across the organisation.

PROJECT | Ferrybridge-Ring Risk Management – United Kingdom

Client: Northern Powergrid

Role: Strategic Consultant / Technical Consultant

- Undertook detailed outage and risk analysis and developed Risk Management Statements (RMS) for Northern Powergrid (NP) for network sections in breach of security regulations.

PROJECT | Generation Planning – Solomon Islands

Client: Solomon Islands Electricity Authority (SIEA)

Role: Strategic Consultant

- Developed models to analyse generation requirements and options to meet energy and demand forecasts, with corresponding financial assessments.

PROJECT | Auki Hydropower Station Review – Solomon Islands

Client: Solomon Islands Electricity Authority (SIEA)

Role: Project Manager / Strategic consultant

- Engaged by SIEA to undertake detailed financial and risk assessment of a proposed hydropower station development at Auki.

PROJECT | Asset Health Evaluation & Index Review – United Kingdom

Client: UK Power Networks

Role: Project Manager / Strategic Consultant / Technical Consultant

- Asset Health Indices are reported to the Office of Gas and Electricity Markets (Ofgem) to gauge network health and drive investment.
- This project involved intrusive asset condition assessments across the network and a review UK PN's Health Indices formulation system.

PROJECT | Distribution Design Programme – United Kingdom

Client: Northern Powergrid

Role: Technical Consultant

- Embedded with Northern Powergrid's (NP) distribution design team assisting in the delivery of an ambitious power system design works programme.

PROJECT | 2012-14 Asset Management System Review – Australia

Client: Western Power

Role: Project Manager / Auditor

Adam Homan

STRATEGIC CONSULTANT

- Engaged by Western Power to carry out a review of their asset management system over the two year 2012-14 period. The review involved extensive interviews and evidence verification covering the entirety of Western Power's asset management functions, including twelve 'Key Process Areas' and four 'Areas of Special Focus'.
- The objective was to assess the appropriateness of policies, strategies, processes and procedures as documented, and their effectiveness in implementation. This was carried out in view of effectiveness criteria established under the Economic Regulation Authority's (ERA) Audit and Review Guidelines for Electricity and Gas Licences.

PROJECT | East London Grid Connection – United Kingdom

Client: Biossence

Role: Strategic Consultant / Technical Consultant

- Represented the developer (Biossence) in distribution network operator consultations to explore connection options for a proposed new 30MW Energy from Waste (EfW) power station connection.

Past experience

Country Energy (now Essential Energy) – Australia

Engineer

Network Protection

- Developed protection arrangements and settings for specific projects ranged from major Bulk Supply Point (BSP) upgrades to basic auto-recloser replacements, from 11-132 kV.

Network Reliability & Performance

- Developed project charters for Smart Grid pilot projects in consultation with IBM – specifically for distribution automation, outage intelligence and substation automation.
- Appointed to Chief Engineer coordinating a trial project of new 'Fuse Saver' technology to protect fuses on transient faults – then making value assessments in view of full network deployment.
- Analysed network performance data and developed reports on network reliability. These reports are used to target poor performing sections of the network and support submissions to the Australian Energy Regulator (AER) for reliability driven network investment.

Network Planning

- Developed 5 year Bulk Supply Point (BSP) Plans in accordance with business strategy and industry regulations. These are submitted to the Australian Energy Regulator (AER) to demonstrate network investment over the period.
- Gained experience with energy forecasting and the development of distribution and sub-transmission network solutions. Prospective solutions were assessed on a performance versus cost basis, also taking into consideration social and environmental issues.

Sub-transmission Line Design

- Developed network CAD models based on increased thermal operating limits for overhead power lines, as prescribed by the network regulator.
- Undertook consultation with community stakeholders in addition to preparing designs. Stakeholders included land-owners, council, business, indigenous groups and wider community concerning proposed sub-

Adam Homan

STRATEGIC CONSULTANT

transmission line routes.

Integral Energy (now Endeavour Energy) – Australia

Substation Technologist (Electrician)

Substation Maintenance

- Responsibilities included the maintenance, repair and refurbishment of electrical systems and apparatus within a substation. The focus was on HV apparatus, but also included LV control and protection systems.
- Required to be on-call for out-of-hours system failures within a substation, and to enable power restoration as quickly as possible.

Substation Projects

- Participated in the major upgrade of two of Sydney's largest BSP substations.
- Responsibilities included installation and commissioning of all electrical systems and apparatus within a substation, encompassing the HV network and LV control and protection systems. This included construction of switchyard bus systems, transformer and switchgear installation, and fit-out of control rooms including LV supply, control, protection and SCADA.

Protection & Control

- Responsibilities included testing and commissioning of all control and protection systems. In addition, any protection mal-operation would be followed by protection investigation and resolution.

Underground Mains

- This role required fault-location and documentation following cable failures, before undertaking the necessary repair works. Responsibilities included installation, jointing and termination of underground HV cables from 132-11kV.

Electrical Contractor

Electrician

- Operated as a sole-trader electrical contractor – quoting for services and undertaking electrical installations in commercial, industrial and domestic situations.
- Also worked under sub-contracts with other contractors on large projects predominantly within building services.

Referees

Ryan Dudley
Practice Leader – Utility Management and Regulation
Phone: + 61 2 9928 2462
Mobile: + 61 447 455 900
Email: Ryan.Dudley@jacobs.com

Andreas Laubi

CURRENT POSITION

Principal Consultant

QUALIFICATIONS

Master of Science (Electrical Engineering), Swiss Federal Institute of Technology, Zurich, Switzerland, 1992

Master of Management, Technology and Economics / BWI, Swiss Federal Institute of Technology, Zurich, Switzerland, 1996

PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS

Member CIGRE AP B3 (HV Substations)

Member Engineers Australia

Member, Electrosuisse – Swiss Association for Electrical Engineering, Power and Information Technologies

Alumni, Swiss Federal Institute of Technology

EXPERTISE

- Transmission & Distribution Networks
- HV Gas Insulated Switchgear for Transmission Substations
- Project Management
- Project Director
- Factory Acceptance & Witnessing
- Root Cause Analysis

Summary of Competencies

Andreas is an experienced T&D Engineer with more than 20 years international experience as manufacturer and system provider (ABB) as well as consultant (SKM/Jacobs). He has significant specialist technical experience in the area of HV gas insulated switchgear.

Besides his technical capabilities he has experience in the management of teams of engineering, technical and commercial specialists, mostly in a Project Director role.

Project experience

Jacobs (until March 2014: Sinclair Knight Merz), Sydney, Australia
March 2010 to date; *Senior Executive Engineer*

Diamantina Power Station: Addition of a 132kV bus coupler in hybrid switchgear technology to the existing power Plant's switchyard.

TransGrid: Project Risk workshop for rebuild of 132kV Burrijuck GIS S/S

Diamantina Power Station: Specialist advice on 132kV hybrid switchgear failure (root cause analysis & investigations; supervision of type-testing and factory acceptance testing in Europe; supervision of installation and commissioning)

Ausgrid: Revue of relevant documentation that is part of Ausgrid's submission for the 2014-2019 revenue reset to the Australian Energy Regulator (AER)

AGL: Project Director for Owner's Engineer role for PV Power Plant Nyngan (100MW) and Broken Hill (50MW)

SP AusNet: Specialist assistance in preparing the specification for 66kV and 220kV GIS for rebuild of West Melbourne Terminal Substation

Transurban: Investigation on insulation failure of cables in tunnel ventilation jet fans

KenGen (Kenia): Witness of Factory Acceptance Test for 132kV and 220kV disconnectors in India

TransGrid: HAZID assessment for brownfield augmentation in relation to 330kV series reactors at 330kV Sydney South Substation

TransGrid: Inspection of 132kV GIS pre-shipment at Alstom's factory in Switzerland for 330/132kV Rookwood Substation

Sino Iron: Assessment of earthing installation at 220kV GIS associated to Sino Iron's Mine near Karratha, WA

KenGen (Kenia): Witness of Factory Acceptance Test for 132kV and 220kV circuit breakers, surge arresters and instrument transformers in India

Vector Ltd (NZ): Peer review of manufacturer's work instruction to replace pressure relief devices and indication windows on 110kV GIS Liverpool Zone Substation

Rio Tinto: Witnessing of type tests of auxiliary transformer for Cape Lambert Bulk Supply 220kV GIS substation

TransGrid: Review of Options Feasibility Studies for capital projects 66kV - 500kV (Secondment)

Andreas Laubi

TransGrid: Options Feasibility Study – In situ replacement of existing AIS 66kV switchgear at Orange 132/66kV SS with HV GIS

ElectraNet: On site commissioning 275kV kV GIS 'City West' Adelaide; Witness of power frequency and PD tests.

NationalGrid, UK: Technical tender evaluation of 5 year frame contract for the supply of 132kV, 275kV and 400kV GIS

TransGrid: Options feasibility study – Replacement of 132kV Burrinjuck substation with gas insulated switchgear

SKM: Team Leader for Oracle EPR project 'Iris', CRM module: Requirements Mapping & Design of CRM module (BR030, BD100, CV040, BP080, MD050); Prepare & Conduct Key Users Engagement Seminars in Kuala Lumpur, Malaysia; Undertake Know-How Transfer with ERP build contractor HCL in Chennai, India)

ElectraNet, Adelaide: Witness of factory acceptance tests for 300kV GIS "City East" in Areva T&D's HV GIS factory in Aix-Les-Bains, France

TransGrid: Specialist advice on 330kV GIS substations Rookwood and Holroyd and support of TransGrid staff during a visit to China Light and Power, Hong Kong

Transpower, NZ: Witness support for commissioning of HV tests and partial discharge measurements on 220kV GIS substation Otahuhu, Auckland.

Areva T&D: Reliability study for Otahuhu 220kV GIS substation.

Sinclair Knight Merz, Sydney, Australia

March 2008 to February 2010; *Manager Power Networks NSW*

TransGrid: Preparation, presentation and facilitation of a two day workshop on 330kV GIS for senior TransGrid staff

Bull Son and Schmidt Lawyers: Options study for relocation of a distribution substation in Paddington, Sydney

TransGrid: Preparation of cost estimate for 330kV GIS at Rookwood Road Substation and Holroyd Substation

TransGrid: Preparation of concept design and review of environmental factors for 330/132kV GIS Substation Holroyd

TransGrid: Preparation of concept design for 330kV GIS Substation Chullora

TransGrid: Various consultancy services in relation to replacement and extension of 132kV Beaconsfield West Substation (inclusive future 330kV GIS)

Energy Australia: Review of Fire Risk at 80 Distribution Substations

Transpower, NZ: Inspection of GIS factories in France and Germany for 220kV GIS in relation to design-build contract 220kV GIS Substation "Otahuhu"

Integral Energy: Preparation of various Insulation Coordination Studies for 132kV and 66kV GIS Substations, inclusive Rouse Hill, Cheriton Ave, Guildford and Rydalmere ZS

Energy Australia: Review of Environmental Factors, Upgrade of City South Substation, Sydney, NSW

Sinclair Knight Merz, Sydney, Australia

October 2003 to February 2008; *Executive Engineer – Power Networks*

Transpower, NZ: Tender evaluation and tender clarifications for design-build

Andreas Laubi

contract 220kV GIS Substation “Otahuhu”

TransGrid: Feasibility Studies for two Greenfield 330kV/132kV GIS/AIS Substations and 330kV overhead line routes

Country Energy: Design of 66kV Switchyard “Lismore Uni”

ElectraNet: High level cost estimate for various options of a new 275kV gas insulated switchgear substation in Adelaide

Delfin Lend Lease: Investigations to relocate an existing 500kV overhead line

Energy Australia: Preparation of Specification of 132/66kV 50MVA gas insulated transformers and associated earthing transformers

Energy Australia: EMF measurements for review of environmental factors at City South 132/66kV Substation in CBD Sydney.

Energy Australia: Project study to replace oil filled 132/11kV power transformers at EnergyAustralia’s City South (Sydney) zone substation with Gas Insulated SF_6 132/11kV transformers.

CityPower, Melbourne: Feasibility Study for the replacement of a 66kV indoor air insulated substations with a new 66kV GIS Substation in Melbourne CBD (Victoria Markets)

Transpower, New Zealand: Preparation of specification (desing-build) for 220kV Gas Insualted Switchgear Substation Otahuhu.

Transfield Services - Collinsville Power Station: Desktop investigation on 132 kV resin bonded paper bushings in regards of failure behaviour and replacement options.

Integral Energy: Insulation Co-ordination study for 132kV GIS Substation Springhill and 132kV GIS Substation Bella Vista.

CityPower, Melbourne: Feasibility Study for a new 220kV GIS Substation in Melbourne CBD.

Integral Energy: Review of fence earth design, at Hawkesbury 132/33kV Transmission Substation

Integral Energy: Design of the earth system for new Mt Ousley 33/11kV Zone Substation.

Integral Energy: Design of an earth system for Integral Energy's new 132 kV GIS Springhill Transmission Substation.

Vector Energy (Auckland, NZ): Feasibility Study and options study for an upgrade of Hobson Substation to 110kV and 220kV with GIS, including consideration to use of the airspace above the substation (e.g. car park, offices, etc.).

Energy Australia: Project study to replace oil filled 132/11kV power transformers at EnergyAustralia’s City South (Sydney) zone substation with Gas Insulated SF_6 132/11kV transformers.

Integral Energy: Project Manager for a cost valuation for the redevelopment of Springhill 132/33kV transmission substation. Options include a new 132/33kV indoor Gas Insulated Substation (GIS) and a new 132kV outdoor Air Insulated Substation (AIS) with a new indoor 33kV GIS.

RailCorp: Project Manager for an engineering assessment and review of 22 substation sites (traction substations, distribution substations and sectioning huts) in regards of unauthorised access, access prevention and electrical safety.

RailCorp: Project Manager for identification of the hazards and assessment of the risks in relation to the installation of metallic components on railway bridges.

Andreas Laubi

Connell Wagner: Project Manager for a connection study to the 132kV network relating to the proposed Gunning Wind Farm.

RailCorp: Project Director for design of two new 33kV cable feeders in Sydney's underground rail network.

RailCorp: Project Director for engineering assessment of DC circuit breaker installations associated with two traction substations to review the DC frame leakage protection arrangement.

Confidential Client: Project Director for an expert witness inspection and statement in a court case concerning HV cable damage.

EnergyAustralia: Project Manager for a technical study on reduction of fire hazards and replacement of oil filled 132/11kV transformers at EnergyAustralia's City South (Sydney) zone substation with alternative low flammability oils or Gas Insulated SF_6 transformers.

EnergyAustralia: Project Manager for the technical review of a 3MW embedded generator installation near EnergyAustralia's Nelson Bay substation.

Landcom: Project manager for a study looking at communications and power needs for a residential development of approx. 20,000 dwellings in Sydney's South West .

RailCorp: Design of earthing and bonding for the installation of metallic anti throw barriers on 10 rail bridges and over bridges in Sydney metropolitan area.

United KG: Evaluation of variable speed drives and motor starters for the upgrade of the Sydney Water's Pumping Station in Ryde, NSW.

Micon International Limited: Project Director for a study to upgrade hoisting system of Jiangxi Wushan Copper Mine, China, from 3000 tpd to 5000 tpd.

P&O Maritime Services: Advice on feasibility of relocation and expansion of a bulk liquid berth at Port Botany, NSW.

ABB Switzerland Ltd, Zurich, Switzerland

April 2001 to August 2003; *Manager Sales & Marketing, HV Substations*

Responsible for Asia, Africa and America. Screening, evaluation, preparation, pricing and risk assessment of commercial and technical offers for turn-key contracts. Negotiation of contracts (contract value typically US$ 10-50 Million). Projects and activities include:

- Negotiations, clarifications and finalisation of contract for 330kV turnkey AIS Substations 'Kwale' and 'Onitsha extension' to Nigeria Agip Oil Company (NAOC), Nigeria.
- Bid management for extension of 362kV turnkey AIS substation 'Ikeja West' to National Electric Power Authority (NEPA), Nigeria.
- Bid management and clarification of ten 220kV and 132kV turnkey GIS substations '10ème plan' to Société Tunisienne de l'Electricité et du Gaz (STEG), Tunisia.
- Bid management and clarification of 220kV turnkey GIS substation 'Kouba' and 400kV turnkey AIS substation 'Ramdan Dhamel' to Société Algérienne de l'électricité et du gaz (SONELGAZ).
- Concept design for bid and clarification of 400kV turnkey AIS Substation 'Ksara' to Electricité du Liban (EdL), Lebanon.
- Concept design for bid and clarification of 380/132kV turnkey AIS Substation 'Amman North' to National Electric Power Company (NEPCO), Jordan.
- Bid management, clarification an negotiations of 400kV turnkey GIS substation

Andreas Laubi

'Paya Lebar' and extension of 400/220kV GIS substation 'Labrador' to Singapore Power, Singapore.

- Bid management and clarification of 220kV turnkey GIS substation 'Kallang Basin' to Singapore Power, Singapore.
- Concept design for bid for extension of 220kV GIS Substation 'Cairo North' to Egyptian Electricity Authority (EEA), Egypt.
- Bid management for 400kV turnkey GIS Substations 'Gulf', 'Gwarsha', 'Tomina' and 'Al Rawis' to General Electric Company of Libya (GECOL), Libya.
- Bid management for 380kV turnkey GIS Substation '9015' to Saudi Electric Company - Central Region Branch (SEC-CRB), Saudi Arabia.
- Preparation, clarification and submission of proposal for 220kV GIS substation 'Wang Chai' and extension of 220kV substation 'Lamma' to Hong Kong Electric Company (HEC), Hong Kong.
- Business development trips to Saudi Arabia, United Arab Emirates, Oman, Qatar, Bahrain, Kuwait, Egypt, Tunisia, Algeria, Hong Kong.

ABB High Voltage Technologies Ltd, Zurich, Switzerland

February 1999 to March 2001; *Project Manager Sales & Marketing, HV-Substations (turnkey), Middle East*

Elaboration and implementation of the business strategy for HV Substations in selected markets (Oman, Qatar, Bahrain, Kuwait) in the Middle East. Evaluation, preparation and execution of offers for HV-Substations (project volume typically US$ 10-30). Negotiation of contracts. Projects and activities include:

- Preparation, clarification and submission of proposals for 275/132kV turnkey GIS Substations 'Ardiyah W', Shuaiwa X', 'West Jaleeb W' and, 'Ahmadi W' to Ministry of Energy and Water (MEW), Kuwait.
- Preparation, submission of proposals, clarification, negotiation and finalisation of contract for 220kV GIS Substation 'Ras Abu Fontas B extension' to Alstom Power Generation, Italy (End-Client: Qatar General Electricity and Water Corporation).
- Preparation, clarification and submission of proposal for 220kV GIS Substation 'Barka' to Ministry of Energy, Oman.
- Training course and assistance in commissioning of protection & control at 400kV AIS Substation CCP Monterrey II, Mexico.

ABB Transmission and Distribution Ltd, Bangkok, Thailand

September 1997 to December 1998; *Business Development Manager, South East Asia*

Responsible for Malaysia, Vietnam, Singapore, Philippines, Indonesia, Brunei, Laos, Myanmar and Thailand. Product Engineer for Medium Voltage Surge Arresters in South East Asia. Improvement of relationships with existing customers and creation of new business (utilities and industrial customers as well as with regional ABB representations) through local presence, regular visits, technical advice and assistance with applications. Activities include:

- *Consulting and technical support to electrical utilities and ABB's Local Engineering Centres.*
- *Conduct lectures and seminars.*
- *Conduct feasibility study for production of surge arresters in Thailand.*
- *Realise field trial test of Silicone housed MV Surge arresters in the Philippines.*
- *Participator as exhibitor in international conferences in the Philippines, Indonesia, Thailand.*
- *Support of ABB's Sales Division in Switzerland in providing first hand contact to*

Andreas Laubi

customers.

ABB High Voltage Technologies Ltd, Wettingen, Switzerland
March 1996 to August 1997; *Specialist equipment and systems training*

Comprehensive training in various fields of surge arresters, such as technology, applications, insulation co-ordination, factory, sales & marketing, logistics). Further to this training, the following tasks were achieved:

- *Assessment and development of marketing and business strategies in selected markets.*
- *Implementation and analysis of a market survey with local ABB representatives worldwide.*
- *Evaluation and development of a new type of low voltage surge arrester: Pre-studies and Marketing concept.*
- *Support of Sales Division with focus on technical aspects (review & preparation of technical specifications).*

ABB High Voltage Technologies Ltd, Zurich, Switzerland
September 1992 to February 1996; R&D *Engineer, HV Laboratory:*

This position covered research and development in the field of high voltage switchgear, with a focus on gas-insulated switchgear. Main tasks were the planning, implementation and analysis of high voltage tests (gas-insulated switchgear, life tank breakers, surge arresters, generator circuit breakers). Furthermore it involved several tasks in logistics & processes of the daily laboratory work and the management of service personnel of high voltage tests. Roles, activities and key Projects include:

- Head of development team for new type of 500kV gas-insulated disconnector. Various field calculations with software ACE.
- Planning and implementation of dielectric type test of a complete bay of a new 300kV GIS Type (ABB ELK 14).
- HV-Laboratories of Electricité de France in Fontainbleau (France): Planning and implementation of dielectric Type Tests (witnessed; client Hydro Quebec) on a 800kV AIS Circuit Breaker (6 breaking chambers).
- CESI HV-Laboratories in Milan, Italy: Planning and implementation of dielectric Type Tests (witnessed, client Hydro Quebec) on a 420kV AIS circuit breaker.
- Queensland Rail (QR), Brisbane, Australia: Electrical measurements on traction Suburban Multiple Units; 25kV live line measurements of transient overvoltages resulted from switching vacuum circuit breakers and operating the pantograph. Investigation of the impact of such overvoltages into the insulation of the voltage transformers.
- Various dielectric type tests on HV-disconnectors (manufacturer: Alpha Trenner, Switzerland) and Generator Circuit breakers (Manufacturer: ABB).
- Project Manager for evaluation and procurement of a new 920kV/1A HV-Testing Transformer, delivered by Haefely Trench, Switzerland.
- Responsibility over quality control and maintenance/calibration of measurement devices in High Voltage Laboratory.
- Various long term tests with time resolved partial discharge measurement.
- Re-development of a control unit for fast switching-off of HV Testing Transformer.

Marnix Schrijner

CURRENT POSITION

Regulatory Economist

QUALIFICATIONS

Master of Science, Radboud University Nijmegen , Economics, 2006

Bachelor of Science, Radboud University Nijmegen , Economics, 2006

Master Course Energy Finance (2010)

Energy Modelling and Forecasting (2009)

Financial Investment Analysis (FIA) (2007)

EXPERTISE

- International energy sector experience
- Generation and grid studies in Cook Islands, Oman, Egypt and Kenya
- Business case development
- Network asset valuation (transmission, distribution and generation)
- Demand side modelling
- Demand forecast modelling
- Financial (CapEx/OpEx) modelling
- Economic modelling
- Statistics and forecasting

  Economic assessment of (battery) storage technologies

Summary of Competencies

Marnix Schrijner is a skilled economist with almost a decade of international experience in the energy sector. Recently he joined Jacobs from KEMA where he has carried out roles in the Middle-East, Africa, Europe and Asia Pacific. These roles included business case development, network asset evaluations, technical due diligence and financial (CapEx/OpEx/RepEx) forecasting and modelling.

Marnix' experience extends to a variety of assets including automatic metering infrastructure (AMI), smart grids, conventional distribution, transmission (gas, electricity and water) and generation assets, as well as renewable generation assets and storage technologies.

Recent Project Experience (for Jacobs as of 9/2014)

Asset Valuation for GMCP in the Philippines

Client: GMCP

As part of the GMCP's generator connection and transmission assets are to be transferred to the national transmission grid company (NGCP), Jacobs was asked to value those assets as an input to the transfer process of the assets to NGCP. Jacobs applied the ODRC method for the valuation of the assets.

Engineering Project on the Solomon Island

Client: SIEA

Jacobs is involved in several projects for SIEA on the Solomon Islands, providing owner's engineering services. I have been involved in developing an energy contracting assessment to compare the feasibility of a large scale hydro and/or geothermal plant with diesel powered generation. In addition I assisted SIEA with preparing proper World Bank bidding documents for construction tenders of SIEA's electricity network.

For KEMA Australia 2006-7/2014

Review of the System Restart Ancillary Services

Client: AEMO

Key Achievements

Marnix assisted in the review of the SRAS (System Restart Ancillary Services) for AEMO and produced a report advising on the following areas:

- The probability of the assumed blackout condition—NEM-wide versus state-wide;
- The number of sub-networks and SRASs in each; and
- The SRAS definition, quantity and assessment.

Smart Grid Strategic Opportunities

Client: L+G Australia

Key Achievements

The final report identified the major smart grid opportunities for L+G Australia for each of distribution network utilities in Australia in all states and territories. For this purpose an excel model was developed that identified the major smart grid opportunities up to 10 years (2023), based on macroeconomic and

energy market specific data (demand forecasts, renewable penetration etc.), but also distributor specific data, like CAPEX and OPEX forecasts and current numbers and condition of the distribution network components (lines, cables, substations).

Demand Response Mechanisms

Client: AEMO

Key Achievements

The project included an evaluation of the existing Demand Response Mechanisms and testing and verification of some of the preferred DR Baseline evaluation methodologies, using real data collected and provided by AEMO for the purpose of this project.

Demand Management Strategic Plan

Client: Ergon Energy

Key Achievements

Review of current demand management activities of Ergon Energy and the preparation of a Demand Management Strategic Plan. Activities included; stakeholder workshops and interviews, environmental scan and PEST analysis and writing a paper on policy and regulatory developments regarding Demand Management.

National Smart Meter Infrastructure Report

Client: DRET

Key Achievements

For the Department of Resources, Energy and Tourism, we developed a National Smart Meter Infrastructure Report containing a factual representation of the implementation status of smart and interval meters in Australia, Texas (US) and New Zealand. In addition, policy recommendations for smart meters were provided concerning the challenges, key implementation barriers and lessons learned. Activities included; data collection, market analysis and conducting stakeholder interviews.

Economic Feasibility RE in the Cook Islands

Client: TAU

Key Achievements

The integrated utility Te Aponga Uira (TAU) on the Cook Islands hired us to investigate the economic feasibility of renewable energy sources in the Cook Islands. We were asked to model the technical feasibility, costs and benefits of implementing 50% - 100% renewable energy sources (e.g. wind, solar, wave, waste-to-energy, biodiesel) and necessary storage. Activities included; development of an excel based user friendly economic feasibility model, providing training, economical and technical advice.

Review of Energy Efficiency Investment

Client: Vector NZ

Key Achievements

Review of International Energy Efficiency Investment programs for Vector, a multi-network infrastructure company based in New Zealand. Activities included; reporting of active energy efficiency programs in Australia, New Zealand, the United States and Europe.

Marnix Schrijner

Business Case Smart Energy Meters

Client: EDF Luminus

Key Achievements

Cost benefit analysis for smart gas and electricity meters in Belgium for EDF Luminus, a Belgian subsidiary of the French EDF Group. EDF Luminus is the second largest energy retailer in Belgium, with approximately 1.7 million customers. Activities included; development of a cost benefit model for the commercial deployment of smart gas and electricity meters, and the calculation and reporting of several business case scenarios.

EDR Cost Benefit Analysis

Client: Essential Energy

Key Achievements

Cost Benefit modelling for the implementation of the implementation of an Electronic Data Repository (EDR) for Essential Energy in Australia. Activities included cost component estimation and financial model development using excel.

Business Case Smart Water Meters

Client: Brabant Water

Key Achievements

Business case for the deployment of smart water meters for Brabant Water, the integrated water utility in the province of Brabant, the Netherlands. Brabant Water is the second largest water utility in the Netherlands; it services approximately 1 million connections equal to 2.5 million customers. Activities included; project management, financial and economic modelling.

Societal CBA II Smart Meters in Flanders

Client: VREG

Key Achievements

The development of an updated societal cost benefit model for the mass deployment of smart gas and electricity meters in Flanders, Belgium. The District (Gewest) of Flanders is the largest District in Belgium covering more than 8 million electricity and gas customers. The Flemish regulator for gas and electricity VREG (Vlaamse Regulator voor Electriciteit en Gas) had awarded us for the second time a contract emphasizing an update of the first societal CBA conducted in 2008. Activities included; project management, business case development including the modelling of segmented deployment scenarios for e.g. prosumers, large users and users with prepaid/ budget-meter systems.

Business Case Battery Storage Systems

Client: TSA Power Gen

Key Achievements

Development of a business case comparing different battery storage systems for TSA Power Generation, representing a group of Dutch power generators.

Marnix Schrijner

Wind Power Engineering Project Kenya

Client: LTWP

Key Achievements

Engineering project for the Lake Turkana Wind Power (LTWP) farm in Kenya aiming to install 300MW of wind power by the end of 2016. Activities included; occasionally reviewing financial tender responses and providing financial advice to the project management on the implications of payment schedules of technology vendors.

Due Diligence Offshore wind-farm connections

Client: Confidential

Key Achievements

Financial advisor for a due diligence project in Germany in regards to offshore wind-farm grid connections. Activities included; representing the buyers and providing them with direct financial/economical expert support on future capital and O&M expenditures, during negotiations with the vendors.

Cost (dis)placement Smart Meters

Client: MinEZ

Key Achievements

Cost analysis for fee determination of a priority placement, and a displacement of incumbent smart energy meters in the Netherlands, executed on behalf of the Ministry of Economic (MinEZ) in the Netherlands. Activities included; cost modelling and engineering and stakeholder meetings.

Societal CBA Smart Water Meters NLD

Client: KWR

Key Achievements

Societal cost benefit analysis smart water meters for the Water Cycle Research Institute (KWR), representing all water utilities in the Netherlands. The societal CBA was developed for a mass deployment of smart water meters in the Netherlands covering more than 8 million connections equalling almost 17 million Dutch residential customers. Activities included; project management, development of a smart water meter excel based cost benefit model and several stakeholder meetings with water sector representatives.

Smart Grid Investment Plan Jordan

Client: NEPCO

Key Achievements

Development of a Smart Grid Investment Plan including mini roadmap and cost-benefit analysis for NEPCO in Jordan (World Bank funded project). NEPCO is the Jordanian Transmission Grid Operator (TSO).

LNG Terminal Design and Economic Study

Client: Confidential

Key Achievements

Economic advice for the design of a LNG terminal somewhere in the Middle-East (confidential). Activities included; project management support and development of an excel based economic LNG shipping model.

Marnix Schrijner

Electricity and Water Master Plan Qatar

Client: Kahramaa

Key Achievements

Design and implementation of an electricity and water forecasting model as part of the E&W master plan for Kahramaa, the General Electricity and Water Company of Qatar. Activities included; development of demand and load forecasting models for water and electricity, data mining and validation and model training sessions. Most of the activities were executed in Doha, Qatar.

Societal CBA Smart Metering in NLD

Client: MinEZ

Key Achievements

Societal cost benefit analysis and policy advice for the mass deployment of smart electricity and gas meters for the Ministry of Economic Affairs (MinEZ) in the Netherlands. Activities included; development of a societal cost benefit model, demand forecasting and direct support to the Minister while discussing issues in the lower house, regarding smart meters.

Deployment Costs Smart Meters in NLD

Client: Enexis

Key Achievements

Enexis is one of the two largest distributors in the Netherlands with approximately 2.6 million electricity and gas connections. We were asked to provide a high level overview of the deployment costs divided by the different cost components.

Demand Response Survey

Client: Philips

Key Achievements

Demand response survey for Philips International.

Due Diligence of Transpower Germany

Client: TenneT

Key Achievements

Technical due diligence project for the purchase of Transpower (large TSO in Germany) initiated by TenneT, the transmission system operator in the Netherlands. As part of the financial team responsible for CapEx, OpEx and RepEx modelling, forecasting of demand and component costs and advising the buyer during negotiations with the vendor (Transpower).

Due Diligence TSO Germany

Client: Confidential

Key Achievements

Technical due diligence project for a group of investors that were interested in the purchase of a large German TSO. As part of the financial team responsible for CapEx, OpEx and RepEx modelling, forecasting and direct advisory support during negotiations with the vendors.

Societal CBA Smart Metering Wallonia

Client: Belgacom

Marnix Schrijner

Key Achievements

Societal cost benefit analysis for Wallonia (French speaking part of Belgium) initiated by Belgacom, the largest telecom provider in Belgium. Activities included; development of a smart meter cost benefit model for gas and electricity meters and the provision of strategic advice.

Market Value of Gas in the Netherlands

Client: Gasterra

Key Achievements

Determination of the retail market value of gas for Gasterra, a large gas trading company in the Netherlands. Activities included; project management and development of a model that estimated the cost of comparable fuel types.

Societal CBA Smart Metering Brussels

Client: Belgacom

Key Achievements

Societal cost benefit analysis for Brussels (Capital District of Belgium) initiated by Belgacom, the largest telecom provider in Belgium. Activities included; development of a smart meter cost benefit model for gas and electricity meters and the provision of strategic advice.

Societal CBA I Smart Meters in Flanders

Client: VREG

Key Achievements

The development of a societal cost benefit model for the mass deployment of smart gas and electricity meters in Flanders, Belgium. The District (Gewest) of Flanders is the largest District in Belgium covering more than 8 million electricity and gas customers. The Flemish regulator for gas and electricity VREG (Vlaamse Regulator voor Electriciteit en Gas) had awarded us the assignment. Activities included; project management and development of a societal cost benefit model.

Review SDE Rules and Regulations

Client: ECN

Key Achievements

Peer review of the Dutch stimulation of sustainable energy production (SDE) rules and regulations developed by ECN.

Process Manager Focus Programs

Client: Stedin

Key Achievements

Process manager at Stedin (medium size Dutch distributor) for their focus programs: 'Condition of the electricity and gas grids' and 'Safety of domestic gas pipes'.

Energy Island Project the Netherlands

Client: Confidential

Key Achievements

The development of the Energy Island concept, a large artificial island off the coast of the Netherlands mainland, that is used as a reverse pumped storage

Marnix Schrijner

system. Activities included; development of a life-cycle costing model (LCC) that was able to compare the LCC of the Energy Island with other types of electricity storage technologies, like compressed air energy storage (CAES).

Risk Analysis Smart Metering in NLD

Client: EnergieNed

Key Achievements

Project manager risk analysis of the mass deployment of smart-meters in the Netherlands for EnergieNed (the association of energy utilities in the Netherlands). The risk analysis included hard-and software risks, risk in communication (technologies) and general economic risk assessment.

Sanity Check Smart Meters

Client: Netbeheer Nederland

Key Achievements

Sanity check on the costs for smart meters for the association of distribution companies in the Netherlands (Netbeheer Nederland). Activities included; modelling and forecasting the yearly cost-price of the Dutch smart-meters for residential customers and providing a general assessment of the economic feasibility of smart-meters in the Netherlands for a regulated meter tariff.

Failure Analysis of E-Grids

Client: Netbeheer Nederland

Key Achievements

Failure analysis of the Dutch electricity distribution grids for Netbeheer Nederland (Association of Distributors in the Netherlands). Activities included; development of a weather dependent time-series model to estimate the occurrences of failures in the Dutch electricity distribution networks.

Technical Due Diligence CCGT

Client: Sidi Krir Egypt

Key Achievements

Technical due diligence for a CCGT plant owned by Sidi Krir in Egypt. Activities included: forecasting the non-fuel expenditures, analysis of the organizational structure and current insurances.

Technical Due Diligence

Client: Essent/Nuon

Key Achievements

Technical due diligence for the merger of Essent and Nuon, the two largest energy utilities in the Netherlands (at that time still fully integrated). Activities included; the analysis of historical and future non-fuel expenditures, i.e. capital and O&M expenditures.