



# **Technical Review of Revised Regulatory Proposal**

## **Review of Proposed Replacement Capital Expenditure in Ausgrid's Revised Regulatory Proposal**

**Report to**  
**Australian Energy Regulator**  
**from**  
**Energy Market Consulting associates**  
**Strata Energy Consulting**  
**April 2015**

*This report has been prepared to assist the Australian Energy Regulator (AER) with its final determination of the appropriate revenues to be applied to the prescribed distribution services of Ausgrid from 1<sup>st</sup> July 2014 to 30<sup>th</sup> June 2019. The AER's determination is conducted in accordance with its responsibilities under the National Electricity Rules (NER). This report covers a particular and limited scope as defined by the AER and should not be read as a comprehensive assessment of proposed expenditure that has been conducted making use of all available assessment methods.*

*This report relies on information provided to EMCa by the AER and by Ausgrid. EMCa disclaims liability for any errors or omissions, for the validity of information provided to EMCa by other parties, for the use of any information in this report by any party other than the AER and for the use of this report for any purpose other than the intended purpose.*

*In particular, this report is not intended to be used to support business cases or business investment decisions nor is this report intended to be read as an interpretation of the application of the NER or other legal instruments. EMCa's opinions in this report include considerations of materiality to the requirements of the AER and opinions stated or inferred in this report should be read in relation to this over-arching purpose.*

*Except where specifically noted, this report was prepared based on information provided by the AER pertaining to Ausgrid's Revised Regulatory Proposal replacement capex forecast expenditure.*

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## About EMCa

Energy Market Consulting associates (EMCa) is a niche firm, established in 2002 and specialising in the policy, strategy, implementation and operation of energy markets and related network management, access and regulatory arrangements. EMCa combines senior energy economic and regulatory management consulting experience with the experience of senior managers with engineering/technical backgrounds in the electricity and gas sectors

## About Strata

Strata Energy Consulting Limited specialises in providing services relating to the energy industry and energy utilisation. The Company, which was established in 2003, provides advice to clients through its own resources and through a network of Associate organisations. Strata Energy Consulting has completed work on a wide range of topics for clients in the energy sector both in New Zealand and overseas.

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# Findings summary

## Background

1. Ausgrid submitted its Revised Revenue Proposal (RRP) to the AER in February 2015 for the five-year regulatory control period from 2014/15 to 2018/19. The AER has requested that EMCa review the claims and information provided by Ausgrid in its RRP regarding our October 2014 report (our “initial review”) and consider whether Ausgrid’s revised proposed replacement capital expenditure reflects an efficient and prudent expenditure forecast.
2. We have re-assessed the impact of the systemic issues identified in our October 2014 report to take into account the additional information provided by Ausgrid.
3. Ausgrid has reduced its Replacement and Duty of Care capital expenditure forecast by 19% (\$510.2m). The key variations are attributed to:<sup>1</sup>
  - the application of cost benefit analysis techniques to major cable and switchgear renewal projects;
  - improved segmentation and improved understanding of consequences arising from further development of its risk-cost assessment approach; and
  - top-down allocation of efficiency improvements.
4. Ausgrid has included a comprehensive Delivery Strategy and Resourcing Plan for the revised work program to be delivered in the 2015-19 RCP.

## Our findings

5. Ausgrid’s RRP substantively confirms the systemic issues identified in our October 2014 report, as evidenced by the 19% reduction in the proposed repex forecast in its RRP and which has resulted from Ausgrid reconsidering its proposal in light of the issues that we identified. Despite this reduction, we consider that Ausgrid has retained a residual bias towards conservative risk assessment and cost over-estimation.
6. In its RRP documentation, Ausgrid was critical of the assessment approach undertaken by EMCa in our initial review. We have carefully considered the claims and assertions made by Ausgrid. Our response is summarised below:
  - i. the methodology we have applied to our reviews is consistent with the scope as requested by the AER and is fit-for-purpose in providing technical advice as to whether Ausgrid has proposed an efficient and prudent expenditure forecast that is consistent with the requirements of the NER and aligned with the AER’s Better Regulation Guidelines;

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<sup>1</sup> Ausgrid, *Revised Regulatory Proposal*, pages 75-76

- ii. the reduced repex forecast provided by Ausgrid in its RRP demonstrates the validity of our October 2014 finding (i.e., that the original RP forecast did not comply with the Expenditure Criteria); and
- iii. Ausgrid's rationale for the reduced repex forecast in its RRP is consistent with our October 2014 findings concerning the systemic issues that we found in Ausgrid's RP expenditure forecast.

### Our revised assessment

- 7. By reducing its forecast repex by 19% (\$510m), we consider that Ausgrid has recognised that its original repex expenditure proposal: (1) was not efficient and prudent; (2) was over-estimated due to insufficient options, risk and cost benefit analysis; and (3) did not reflect a top-down challenge that was sufficiently rigorous to have removed the inefficient and imprudent expenditure.
- 8. The AER has asked EMCa to consider if Ausgrid's revised repex forecast now reflects an efficient and prudent expenditure forecast. Regarding our initial review, we are satisfied that the revised repex forecast provided by Ausgrid in its RRP:
  - i. has substantially mitigated our October 2014 concerns regarding its application of contingency allowances and is, in most cases, based on reasonable estimates of efficient costs;
  - ii. reflects a more effective top-down challenge process that incorporates enhanced qualitative risk assessment, as evidenced by the \$510m reduction in proposed expenditure; and
  - iii. is supported by a comprehensive delivery strategy and resourcing plan which, when coupled with the 19% RRP expenditure reduction, has addressed our primary delivery concerns.
- 9. Notwithstanding, we consider that there is scope for further expenditure reductions by Ausgrid to achieve a prudent and efficient level of expenditure. Specifically, we consider that the following issues have contributed to a residual over-estimation bias:
  - i. there is evidence of a conservative risk bias in Ausgrid's sub-transmission cable replacement and LV switchgear programs; and
  - ii. Ausgrid has not adequately justified the activity forecast and cost of its pole program.



# 1 Introduction

## 1.1 Purpose of this report

10. The purpose of this report is to provide the AER with our updated assessment of Ausgrid's RRP and to respond to new information provided by Ausgrid in its Attachment 5.07 "*Assessment of EMCa technical review*" and associated documents.
11. As part of our assessment, we have considered several other documents, including two specific documents that Attachment 5.07 relies upon: Attachment 5.11 "*Quantitative risk evaluation – selected replacement projects*"; and Attachment 1.16 "*Jacobs – System Capex and Maintenance Prudency Assessment*". We have only assessed those aspects of the reports that are directly relevant to our initial review.<sup>2</sup>
12. Both our current assessment and initial review are based on limited scope reviews consistent with our terms of reference,<sup>3</sup> and which do not take into account all factors or all reasonable methods for determining a capital allowance in accordance with the National Electricity Rules (NER). We understand that the AER will establish a capital expenditure allowance for Ausgrid based on assessments undertaken by its own staff and that other advisers are also contributing to the AER's overall assessment.

## 1.2 Scope of requested work

13. The AER issued a Scope of Work to EMCa requesting that we consider and respond to Ausgrid's claims in Attachment 5.07 and, where relevant, the supporting information provided in Advisian's report "*Network NSW's Independent Review of risk based prioritisation process*". We were also requested to review Attachment 5.11: "*Quantitative*

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<sup>2</sup> EMCa, *Review of Proposed Replacement Capex - Ausgrid's Regulatory Proposal 2014-2019*, Oct 2014

<sup>3</sup> The scope of our review considers specific capex projects and programs for replacement works. This expenditure is a subset of the replacement capital expenditure within Ausgrid's Revenue Proposal

*risk evaluation – selected replacement projects*”, so as to provide our advice on the methodology, inputs and assumptions in this attachment and identify whether the results might impact on EMCa’s October 2014 findings.

14. We proposed a desktop review of the information provided in which we would:
  - review the documentation provided and identify any new information or reasoning that might be relevant to our October 2014 findings regarding Ausgrid’s proposed repex;
  - clearly identify the reasons for acceptance, in whole or in part, of Ausgrid’s position where we are convinced that the new information provides sufficient evidence to support amendment of our October 2014 findings; and
  - as necessary, expand and clarify the reasoning and evidence to support our October 2014 findings in circumstances where the new information does not provide sufficient evidence to warrant amendment.
15. The AER asked us to proceed with this work on 18 February, 2015. The assessment in this report is based on the information provided to us through this process.

## 1.3 Structure of this report

16. Our main findings are summarised at the beginning of this report.
17. In the subsequent sections and appendices, we provide our assessment of Ausgrid’s revised repex forecast and address the claims that Ausgrid has made regarding EMCa’s initial review:
  - In section 2, we set out our updated assessment of Ausgrid’s revised repex proposal; and
  - In section 3, we provide our updated assessment of the new information provided by Ausgrid and the AER.
18. Appendix A contains our comments on Ausgrid’s RRP Attachment 5.11 “*Qualitative risk evaluation – selected replacement projects*” and responds to the matters raised in section 6 of Ausgrid’s RRP Attachment 5.07.
19. Appendix B provides our general response to Ausgrid’s claims regarding EMCa’s October 2014 report.
20. Appendix C addresses specific areas of concern raised by Ausgrid regarding EMCa’s October 2014 report. These concerns pertain to our initial review of Ausgrid’s governance and management framework and its capital expenditure forecasting methods.
21. Appendix D provides a table to address the specific points raised by Ausgrid regarding EMCa’s assessment of a sample of expenditure programs.
22. Appendix E lists the documents that EMCa has reviewed to prepare this report.

## 2 Ausgrid's revised repex proposal

### 2.1 Our initial RP assessment of proposed expenditure programs

23. When assessing Ausgrid's original RP, we reviewed a sample of Ausgrid's replacement programs. The review was comprised of the four largest expenditure programs (cables, switchgear, poles, and transformers) and secondary systems. Ausgrid had proposed an approximately 300% increase in expenditure in the 2015-19 RCP compared to the prior RCP (based on relevant RIN data).
24. In our assessment of the RP documents pertaining to these programs, we found in four programs<sup>4</sup> that Ausgrid's justification for the expenditure was not sufficient to fully support the volume, timing and cost proposed.
25. We have revisited our assessment to consider the additional information provided to us for review.

### 2.2 Summary of Ausgrid's revised response

26. In its RRP, Ausgrid has proposed a \$510m (19%) reduction in Replacement & Duty of Care capital expenditure (i.e., from \$2,707m to \$2,197m)<sup>5</sup> due to:

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<sup>4</sup> We reviewed a number of asset sub-programs and projects for each asset category, as denoted in Appendix B of our original report

<sup>5</sup> Ausgrid RRP, Figure 8, page 76

- further development of the Capital Program Optimisation tool to provide more relevant risk quantification from failure mode consequence analysis - including incorporation of the corporate risk framework;
  - greater use of quantified risk assessments, rather than subjective assessments; and
  - enhanced top-down assessment for validation of program level expenditures.
27. Ausgrid states that the “largest change in the revised program has resulted from the subject matter expert review of the programs at a more granular level. This has been facilitated by new analysis that further considers the range of consequences associated with various asset failure modes. In addition, as part of the bottom up program reviews, individual program assumptions have been reassessed which has enabled improved targeting of higher risk assets for Replacement & Duty of Care programs. This has enabled us to maintain the risk profile at a lower cost.”<sup>6</sup>
28. The approach that Ausgrid has adopted in its RRP (to refine its Replacement & Duty of Care capex) responds directly to the key concerns we raised with its original approach in our October 2014 report.
29. Table 1 below shows Ausgrid's RRP versus RP reductions in the Replacement and Duty of Care programs that we reviewed. In our initial review, we identified concerns about the justification for the proposed expenditure in each program, with the exception of transformers.

Table 1: Revisions to proposed Replacement and Duty of Care program expenditure (\$m excluding overheads)

Program	RP expenditure	RRP expenditure	Change
Replacement & Duty of Care program	\$2,707	\$2,197	-19% <sup>7</sup>
Cables	\$116.0	\$79.2	-32% <sup>8</sup>
Switchgear	\$240.5	\$203.8	-18% <sup>9</sup>
Poles	\$296.1	\$255.0	-14% <sup>10</sup>
Transformers	Not available	Not available	0%
SCADA, network control and protection	Not available	Not available	-50% <sup>11</sup>

Source: Ausgrid 2014/15 – 2018/19 RP and RRP

<sup>6</sup> Ibid

<sup>7</sup> Ausgrid RRP, Figure 8, page 76

<sup>8</sup> Att 5.11, Table 8

<sup>9</sup> Ibid, Table 7

<sup>10</sup> Att 5.09, Section 4, pages 8-18

<sup>11</sup> Att 5.07, page 16

## 3 Assessment of additional information provided by Ausgrid

### 3.1 Assessment of systemic issues

30. In our initial review of Ausgrid's RP, we identified that repex prudence was undermined by systemic issues that contributed to an over-estimation bias. Specifically, we identified:
- a lack of robust options, risk and cost-benefit analysis supporting the timing/volume of activity at both a project and portfolio level, with replacement targets seemingly based subjectively around regulatory period end points;
  - a lack of reliable asset condition and failure data for some asset classes; and
  - an apparent use of multiple risk assessment approaches and tools, relatively coarse and/or subjective risk rating assessments, and in-built conservatism that was evident in key elements of the risk assessment process.
31. Further, our initial review evidenced three associated issues:
- i. top-down adjustments are likely to be insufficient;
  - ii. cost estimation is biased towards over-estimation; and
  - iii. repex program has material deliverability risk.

32. As part of this review of Ausgrid's RRP and the new information presented therein, we looked for evidence that the issues identified in our initial review had been considered. We are satisfied that Ausgrid's \$510m reduction in its RRP has significantly addressed the issues. Ausgrid has now presented sufficient information to demonstrate that the deliverability risk to the repex program is low. However, we consider that an otherwise prudent forecast of repex in Ausgrid's RRP is undermined by the following issues:
- i. insufficient justification for the proposed volume of activity - for example, the inclusion of low- and medium-risk projects in cable and switchgear expenditure programs and for pole activity forecasts (see below);
  - ii. limited application of enhanced risk quantification methodology to other expenditure programs; and
  - iii. questionable costing basis - for example, for pole replacement unit costs (see below).
33. Refer to our assessment of expenditure programs below and in Appendix C and Appendix D for more detail.

## 3.2 Assessment of expenditure programs

34. In this section, we provide our response to Section 6 of Ausgrid's RRP Attachment 5.07. We re-visit our "original assessment" of the five repex programs reviewed and provide an "updated position" to consider the new information provided by Ausgrid. Refer also to Appendix C and Appendix D.

### 3.2.1 Cables

#### EMCa's original assessment

35. We supported Ausgrid's strategy of progressively removing high risk cables.
36. We agreed with Ausgrid's consultant (JacobsSKM) in finding that we were not able to observe how the target for the replacement program was "*set and adjusted, and whether it was undertaken on a risk-based cost-benefit analysis*".<sup>12</sup>
37. Our confidence in the 'stability' of the proposed program for the 2014-19 RCP was undermined by: (i) the quality of the options analysis undertaken; (ii) the history of deferral and reprioritisation of planned cable work in the previous RCP; and (iii) apparent inconsistencies in the RIN data.

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<sup>12</sup> Jacobs SKM, *Subtransmission cable replacement strategy, Peer review, Final report v2.2*, April 2014, page 5

### New information provided by Ausgrid

38. Ausgrid provided an updated cost-benefit assessment which resulted in a reduction of its sub-transmission cable program by 32% (\$36.8m).<sup>13</sup>
39. Ausgrid advised that comments it made regarding its intent to undertake more detailed analysis of cable failures was in the context of continuous improvement, not as an indicator that its cable failure data was inadequate for prudent expenditure planning.
40. Ausgrid confirmed that it did not base the replacement dates of its cables on the cable's age against its standard life – rather, the prioritisation of cable replacement was based on cable condition.

### EMCa's updated position

41. We have reviewed the additional information provided by Ausgrid and find no evidence that supports amendment of our October 2014 findings. For clarity:
  - we support Ausgrid's strategy of progressively replacing its high risk cable population;
  - Ausgrid has confirmed our original concerns regarding the justification of the volume and timing of the cable replacement work by deferring 32% of its program as a result of enhancing its quantitative risk evaluation; and
  - we note that, on the basis of Ausgrid's 'preferred timing', a total of 88% (\$102m) of the program could be deferred to the next RCP.<sup>14</sup> This represents a prospective expenditure deferral of an additional \$65m.
42. Ausgrid has reduced the proposed allowance for this program considerably. However, its identification of a "preferred timing" (or medium risk position), that results in considerably less expenditure than the allowance it has proposed, is evidence that an upwards bias remains.

## 3.2.2 Switchgear

### EMCa's original assessment

43. We found that the investment driver for the replacement of 11kV zone substation switchgear was sound (i.e., risk of catastrophic failure).
44. We were not convinced by the risk assessment (potentially conservative) nor by the options analysis. We noted that a more robust cost-benefit analysis that considered variations of the timing of the work would assist in providing more compelling evidence.
45. We did not see compelling evidence to suggest that Ausgrid would deliver the program on time at an efficient cost.

<sup>13</sup> Ausgrid, *Attachment 5.11, Quantitative risk evaluation, Table 8*, page 11; we provide our views on the methodology in Appendix A

<sup>14</sup> *Ibid*

### New information provided by Ausgrid

46. Ausgrid has provided an enhanced cost-benefit analysis which Ausgrid has used to defer 18% (\$45m) of the original program to the next RCP or beyond.
47. Ausgrid advised that delivering a higher volume of low voltage switchgear replacement was less complex than delivering a lower volume of HV switchgear. Therefore, EMCa's concerns regarding the deliverability of the program were unfounded.

### EMCa's updated position

48. Ausgrid has responded to EMCa's primary concerns regarding the program timing and volume of 11kV switchgear replacement work by enhancing the cost-benefit analysis and deferring 18% (\$36.7m) of the work.
49. Based on Ausgrid's 'Early' timing (or low risk position), we consider that a further program (Lisarow) should also be considered for deferral. This would result in a 23% (\$45.6m) deferral of the original program to the next RCP.<sup>15</sup> In its RRP, Ausgrid did not explain why this program has not been deferred. This represents a prospective expenditure deferral of an additional \$8.9m.
50. Ausgrid's qualitative information about reduced delivery risk for this work program is plausible. Ausgrid has provided a Strategic Delivery and Workforce Plan for 2015-19 which, in conjunction with the reduced level of expenditure, mitigates our concerns about Ausgrid's capacity to deliver the program efficiently.

## 3.2.3 Poles

### EMCa's original assessment

51. We interpreted a reference to a wood pole failure rate of 0.1 per 10,000 poles (well below the current failure rate of 0.18) as Ausgrid's target. It was unclear to us how this had influenced the investment profile. We also found there to be inadequate justification of the 26% increase in expenditure from 2017/18 to 2018/19. We were unconvinced that the rapid acceleration in replacement and reinforcement expenditure in the 2015-19 RCP was sufficiently justified.
52. We considered the average pole reinforcement cost to be reasonable. However, we considered that the average pole replacement cost (at \$10,700 per pole) was potentially excessive. We were not convinced that it was an efficient cost.

### New information provided by Ausgrid

53. Ausgrid advised that it did not base its investment strategy on a target of 0.1 pole failures per 10,000; rather, it would be reinforcing (nailing) between 46-48% of LV poles during the RCP.

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<sup>15</sup> Ausgrid, Attachment 5.11, Table 7, page 10



54. Ausgrid has also reduced its proposed pole replacement expenditure by \$41m (14%) *“based on a review of the currently observed failure rate, revised expectation of average life extension afforded by staking and review of hierarchy of controls”*.<sup>16</sup>

#### EMCa's updated position

55. The clarification from Ausgrid removes our concern that Ausgrid's pole replacement/reinforcement program is determined by a strategy of achieving a rate of 0.1 pole failures per 10,000 poles.
56. In our original report, we queried the large step change in expenditure in the last year of the 2015-19 RCP that was driven by an assumed 12 year life extension from reinforcements. We now assume that a significant proportion of this increase (if not all) has been deferred to the next RCP.
57. Ausgrid has not provided any new information to address our original concern regarding the assumed pole replacement cost. We therefore remain unconvinced that Ausgrid's forecast average pole replacement cost is efficient.
58. Furthermore, from the information provided, we were unable to discern the nature of any changes to failure rate targets, reinforcement life extension assumptions and/or review of the hierarchy of controls made by Ausgrid in reducing its forecast by 14%. We therefore remain unconvinced that Ausgrid has proposed a prudent and efficient wood pole investment program.

### 3.2.4 Transformers

#### EMCa's original assessment

59. We found that Ausgrid's strategies for transformer replacement have a sound basis for their selection and are appropriate for the asset classes.
60. Whilst we had reservations about Ausgrid's risk analysis, which resulted in most risks being rated extreme, we noted that Ausgrid's actual expenditure forecast was derived from a reasonable /replacement/refurbishment options analysis. Overall, we were satisfied with the prudence of the program.

#### New information provided by Ausgrid

61. We were not able to discern any specific new information pertaining to Ausgrid's transformer program.

#### EMCa's updated position

62. We have assumed that Ausgrid's proposed expenditure remains unchanged. In our original review, we found that Ausgrid had robust condition and cost data for this asset class and had undertaken acceptable options analysis. Accordingly, we see no reason to amend our original finding.

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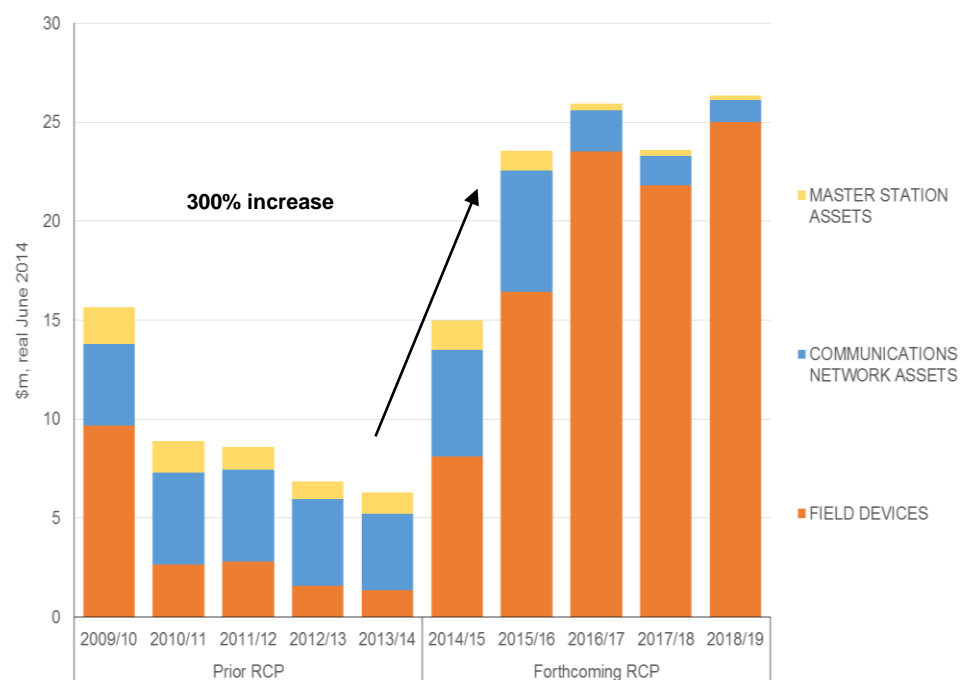
<sup>16</sup> Ausgrid RRP, Attachment 5.09, page 8

### 3.2.5 SCADA, network control and protection

#### EMCa's original assessment

63. We found that Ausgrid proposed a \$100m+ expenditure program that appeared to lack sufficient justification, including a lack of: (1) reliable data; (2) robust options analysis; and (3) compelling financial analysis. Refer to Figure 1 below.

Figure 1: RCP step change in SCADA, network control and protection



Source: EMCa, Review of Proposed Replacement capex in Ausgrid's Regulatory Proposal 2014-19, Oct 2014, page 13

#### New information provided by Ausgrid

64. Ausgrid has recognised that the lack of data for the secondary protection and control systems asset class implies a higher level of uncertainty and that a better informed view of consequences as “informed by our revised risk-cost assessments” has reduced the program by 50%.<sup>17</sup>

#### EMCa's updated position

65. Ausgrid has addressed the three concerns identified in our October 2014 report by enhancing its risk-cost assessment and adopting our preferred option, which was to reduce proposed expenditure whilst it collects more data to confirm future CBRM-based expenditure. However, we do not have visibility to Ausgrid's rationale for selecting a 50% program reduction.

<sup>17</sup> Ausgrid RRP, Attachment 5.07, page 18

### 3.3 Summary and concluding comments

66. Despite its criticisms of our approach, Ausgrid has revisited its justification for its RP programs. In the process, Ausgrid has made significant progress towards addressing the issues identified by EMCa and reduced its repex proposal by 19%.
67. However, we have identified significant further potential expenditure reductions from Ausgrid's quantitative risk-cost analysis of its switchgear and cables programs. Further, Ausgrid has not adequately justified the activity forecast and cost of its pole program. Accordingly, we consider that there remains a degree of over-estimation bias in Ausgrid's forecast.

# Appendix A Quantitative risk evaluation report

## Introduction

68. We observe that Ausgrid has enhanced its risk cost assessment approach and applied its methodology to selected replacement projects to identify areas where it may be possible to defer replacement costs. We note that Ausgrid has selected the projects on the basis that they were major projects (in expenditure terms), that each project addresses unique and significant risks, and it has good data to support the evaluation.<sup>18</sup>

## Assessment Summary

69. The enhanced risk assessment methodology applied by Ausgrid to repex projects and programs in its RRP is a positive development and reflects a substantive improvement over the subjective risk assessments used in Ausgrid's RP.
70. Ausgrid has applied the enhanced risk assessment approach to 11kV switchgear and subtransmission cable systems and determined that:<sup>19</sup>
- 3 switchboard projects (\$36.7m, 18%) can be deferred to the next RCP;
  - 3 subtransmission cable projects (\$36.8m, 32%) can be deferred to the next RCP; and
  - All four of the combined replacement projects it presents should proceed in the 2015-19 RCP.
71. Ausgrid appears to have made an error in not deferring the Lisarow switchboard project consistent with this new approach.<sup>20</sup> If deferred, the program expenditure would be reduced by a further \$8.9m for a total of \$45.6m (23%).
72. Furthermore, if Ausgrid applied 'Preferred timing' (medium risk) to the subtransmission cable projects, three additional projects (\$65.4m, 56%) could be deferred to the next RCP or beyond, for a total deferred amount of \$102.4m (88%).
73. Ausgrid has not explained why it has only applied the 'Early timing' (low-risk) scenario to identify deferral candidates for subtransmission cable projects.

<sup>18</sup> Ausgrid RRP, *Attachment 5.11*, page (i)

<sup>19</sup> *Ibid*, *Tables 7 and 8*, pages 10-11

<sup>20</sup> Based on the indicated 'Early' timing of 2030 and 'Preferred' timing of 2033

## Assessment details

### Derivation of annualised project cost

74. The annualised project cost is determined according to the following equation:

$$\$A_n = \frac{r}{1 - e^{-rn}} \$Y$$

where: r is the discount rate; n is the asset lifespan; and \$Y is the initial project cost.

75. This is a reasonable approach for estimating the cost per year of owning and operating an asset over its lifespan.

### Derivation of monetised baseline risk

76. The monetised baseline risk is determined by:

- evaluating the failure likelihood;
- evaluating the failure consequence; and then
- calculating the monetised baseline risk.

77. Ausgrid determines the failure likelihood (within a 12 month period) using different approaches for switchgear and cables based on their dominant failure modes and characteristics. Ausgrid assumes switchgear failures are non-repairable. Given the age and type of circuit breaker/switchboard in question in this study, this is a reasonable assumption. Ausgrid uses Weibull analysis to determine a probability of the asset's age at the time of failure, with the time to failure equal to the point of assessment of conditional failure. In the case of switchgear, Ausgrid uses the results of an unspecified limit on insulation test to determine conditional failure.
78. Using Weibull distributions is a common approach for failure analysis. Provided the condition assessment threshold selected is aligned with industry practice for the switchgear type, Ausgrid's approach is reasonable. Switchgear that are not yet at the point of conditional failure are also included in the analysis, which is appropriate.
79. We have not assessed the resultant Weibull parameters, however, the probability functions presented (failure intensity vs age; and probability of non-repairable failure) appear to be reasonable.
80. Ausgrid assumes underground cable failures are repairable, which is an appropriate assumption. It uses the Crow-AMSAA<sup>21</sup> to determine failure likelihood of oil-filled, gas pressure, solid/HSL, and XLPE cable systems. It assumes a Weibull failure rate function to determine the probability of failure in one year. This is then applied in increments of time and the cable length to determine the failure 'growth curve' for each cable type.

<sup>21</sup> CRO-AMSAA reliability growth plots show how reliability changes over time and are suitable for reliability analysis for complex, repairable systems

Whilst we have not assessed the Crow-AMSAA parameters, the approach appears to be reasonable.

81. Ausgrid determines the failure consequence in accordance with the corporate Risk Management Policy (GV0000-Y0014), which specifies consequence ratings for safety, compliance, reputation, environment and financial. Whilst the method is described, the details of the derivation of the consequence cost for each of the risk categories has not been shown. Importantly, Ausgrid applies a conditional probability factor to the consequence cost to determine a probability weighted consequence cost. This is an appropriate step and the probability weightings denoted in Appendix B of Ausgrid's report appear to be reasonable for the purposes of the analysis.
82. Ausgrid determines 'network' consequences (i.e., interruptions to supply) using VCR<sup>22</sup> and applies this to the unserved energy it calculates for each scenario. Different approaches are used for switchboards, meshed cables and radial cables. The approach appears to be reasonable. Without a full audit of the inputs and calculations, the results cannot be verified by us.
83. The monetised baseline risk is calculated for each year in the forecast period (2015-2034) by deriving consequence costs from each of the six consequence categories for a number of failure scenarios.
84. We conclude from our assessment that Ausgrid's approach to determining the annualised project costs and monetised risk provides a reasonable (and less subjective) basis to determine the volume and timing of work. We support Ausgrid's intention of progressively broadening its application to other asset classes. We expect that the methodology will be improved over time with iterations and validation as improved data from the field becomes available.

### Economic timing

85. Ausgrid compares the annualised monetised risk against the annualised project cost to determine a 'baseline' economic replacement time. Ausgrid defines this as the year before the cost of risk exceeds the project cost. Ausgrid refers to this as its 'Preferred timing', which represents 'Medium' risk.<sup>23</sup>
86. Ausgrid has also considered two sensitivity cases, as described below:<sup>24</sup>
  - 'High risk', which represents 'Late timing' - determined by selecting the year before the annualised project cost exceeds 125% of the total monetised baseline risk; and
  - 'Low risk', which represents 'Early timing' - determined by selecting the year before the annualised project cost exceeds 75% of the total monetised baseline risk.
87. The results for the 11kV switchgear replacement program (Table 7, Attachment 5.11) show the majority of Ausgrid's programs identified for replacement are justified for replacement in the 2015-19 RCP. Ausgrid has nominated three of the 22 projects that,

<sup>22</sup> Based on AEMO's 2014 report

<sup>23</sup> Ausgrid RRP, *Attachment 5.11*, page 6

<sup>24</sup> *Ibid*

on a cost-benefit basis, should be deferred to the next RCP: (1) Nelson Bay; (2) Terrey Hills; and (3) Blakehurst. The Blakehurst substation project's 'Early timing' is 2019 and the 'Preferred timing' is 2023. Deferring these three projects reduces the program by \$36.7m. It is not clear why a fourth project (Lisarow) is not also recommended for deferral as there is no indicated economic net benefit in replacing it until at least 2030. Deferring this project would result in total deferred expenditure of \$45.6m (23% of the original program).

88. From the results for the subtransmission cable replacement program (Table 8, Attachment 5.11), Ausgrid recommend deferral of three of the eight projects to the next RCP or beyond based on 'Early timing'. This results in deferred expenditure of \$36.8m. If the 'Preferred timing' (medium risk) approach was applied, a further three projects should be deferred, resulting in a total reduction of \$102.4m (88% of the original program). Ausgrid do not offer any justification for not applying the 'Preferred timing' criteria.
89. Whilst we support Ausgrid's new (enhanced) risk quantification methodology, we have concerns with the application of Ausgrid's own criteria to the results of its analysis. We find justification for a greater level of expenditure reduction in both the cable and switchgear asset categories.<sup>25</sup>

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<sup>25</sup> Ausgrid also present the results for 'Combined' projects, which show that based on both Early and Preferred timing, the projects should proceed in the 2015-19 RCP

# Appendix B Response to Ausgrid's claims

## Introduction

90. Ausgrid's Attachment 5.07 'Assessment of EMCa technical review' states that EMCa's report is of "*limited utility due to the lack of depth of review possible with the time and resources available.*" It refers to the limited nature of the review and the consequent limited validity of some conclusions, the subjective and qualitative nature of the findings, and flaws, misrepresentations and incorrect use of data by EMCa.
91. However, it concludes by saying that "*the review by EMCa is not entirely without merit ... identifies a range of issues with the data in the RIN, identifies areas where more detailed investigation would be fruitful, and raises a number of concerns that should be legitimately considered by the AER and addressed by EMCa.*"<sup>26</sup>
92. In the sections below, we summarise Ausgrid's claims and provide our response, taking into account new information provided by Ausgrid.

## The nature of the review

### Ausgrid's position

93. In its RRP, Ausgrid has identified that:<sup>27</sup>
- (i) EMCa's scope of work was representative of a 'process review' or 'technical review', not an 'engineering review'. In doing so, it compares EMCa's review with the advice to the AER in the 2009-14 determination from consultants which "*engaged more thoroughly with the substance of Ausgrid's capital expenditure forecasts and the engineering justification for proposed expenditures*";
  - (ii) EMCa only engaged with Ausgrid 'on-site' on one occasion and concluded its assessment whilst responses from Ausgrid to our Information Requests were outstanding;
  - (iii) EMCa relied heavily on RIN data provided by Ausgrid despite its warning that "*the information has been prepared for Ausgrid's reporting obligations to the AER and ... may not be suitable for any other purpose*". Ausgrid observed that EMCa's analysis suffers from attempting to reconcile this data over that provided in its proposal; and
  - (iv) It was the AER's choice to undertake assessments of augex and repex, ignoring Ausgrid's construction of its capital expenditure proposal because of "*a desire by reviewers for their task to be simpler*".

<sup>26</sup> Ausgrid RRP, Attachment 5.07, p.1

<sup>27</sup> *Ibid*, pp. 2-3



## EMCa's response

94. The scope of EMCa's review is clearly set out in our October 2014 report. The scope was set by the AER and reflects but one input to its determination. Our report is not intended as a definitive basis for the AER's findings regarding Ausgrid's proposed capital expenditure.
95. The approach we took is consistent with the Better Regulations guidelines developed and published prior to the assessment of Ausgrid's Regulatory Proposal (RP). In particular, our approach involves a top-down assessment of the governance, management and forecasting methodologies that Ausgrid claims it has applied, supported by 'bottom-up' evidence of any systemic issues from our review of a sample of projects and programs. This approach does not require a detailed 'bottom up' review of Ausgrid's "*130 main documents and several hundred supporting documents*".<sup>28</sup>
96. The AER commissioned EMCa to assist with the identification of any systemic issues that may be resulting in forecasting biases in Ausgrid's RP. Our approach to this task incorporated an independent assessment of Ausgrid's governance, management, planning, forecasting and budgeting frameworks. Our assessment included a review of Ausgrid's process documentation. Further, we tested Ausgrid's application of these frameworks and processes to achieve prudent and efficient outcomes by reviewing a sample of repex programs. We were not required by the AER to recommend specific expenditure adjustments in our report and we did not do so.
97. In accordance with the AER's direction, we relied upon the RIN data (as an audited submission from Ausgrid) and which was required by the AER to, among other things, inform its analysis of Ausgrid's proposed expenditure for the 2015-219 RCP. It is our view that the onus is on Ausgrid to present clear, consistent and compelling information to the AER and its consultants in support of its proposal. We consider that provision of this evidence should not be perceived as a difficult task by Ausgrid, since we expect that the same (or higher) levels of justification will have already been required by Ausgrid's internal approval bodies.
98. In any event, the regulatory review process provides Ausgrid with the opportunity to review and respond to the draft decision by providing additional information as it deems necessary through the Revised Regulatory Proposal (RRP) and any subsequent submissions as applicable.
99. We have reviewed the new/additional information provided by Ausgrid and have provided our updated position in each of the topic areas identified for review.
100. Ausgrid appears to contend that if EMCa had been commissioned to undertake a more detailed 'bottom-up' review of every project, as was done by the AER's advisors as part of the previous regulatory proposal determination process, we would have arrived at different conclusions on the RP.
101. Based on the issues we found - and the fact that Ausgrid confirmed the majority of the issues identified by EMCa were real, systemic and material by reducing its proposed repex expenditure by \$510m in its RRP - we consider it unlikely that we would have

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<sup>28</sup> *Ibid*, p. 1

arrived at a different conclusion with a detailed, 'bottom-up' review. Notwithstanding, we were not asked to conduct such a review.

## The nature of our findings

### Ausgrid's position

102. Ausgrid contends that:<sup>29</sup>

- (i) EMCa's findings are "*on the whole subjective and qualitative*" and that this is related to "*issues of inadequate engagement and effort*". Ausgrid make the observation that this is to be expected from the limited time and resources afforded by the AER's task to EMCa, but that "*the nature of the review's findings are inadequate to enable the AER to reasonably draw the conclusions that it has*"; and
- (ii) EMCa's findings are "*justifiable causes for concern and further inquiry, they do not form a prima facie case that the forecasts are wrong*". Ausgrid also states that EMCa's review findings are "*not sufficient for the AER to ignore its proposal and substitute it with a forecast that largely ignored the substance of the proposal.*"

### EMCa's response

103. As discussed above, our scope and approach is entirely consistent with providing the AER with credible advice on Ausgrid's proposal. It is a component of the AER's determination process and is considered in conjunction with other methodologies, such as benchmarking and its REPEX model.

104. Having read Ausgrid's response to our report and other relevant additional information in its RRP, we stand behind our original findings and conclude from Ausgrid's own revision to its expenditure proposal that our original concerns were justified.

## Use of data

### Ausgrid's position

105. Ausgrid determined that:<sup>30</sup>

- (i) EMCa's review was based on flaws, misrepresentation and incorrect use of data. Ausgrid offers a possible explanation that this resulted from "*limitations of depth and scope of the EMCa review*";
- (ii) A key problem is the repeated resort by EMCa to the data in Ausgrid's RIN response rather than to the data in its proposal;
- (iii) The AER did not follow fair process – for example, EMCa relied upon a response from Ausgrid asked without notice at the single meeting with EMCa about analysis

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<sup>29</sup> *Ibid*, page 3

<sup>30</sup> *Ibid*, pages 3-4

Ausgrid had not previously seen. EMCa did not follow up with a further information request for clarification, and

- (iv) EMCa's statements about "*governance process...contingency allowances...lack of a top-down review and assumptions about the way risk assessments were used*" were all based on misunderstandings.

### EMCa's response

106. The examples provided by Ausgrid in section 3.3 of Attachment 3.07 point to what in Ausgrid's view is a misunderstanding by EMCa of some aspects of Ausgrid's proposal. We consider that any misunderstanding arose from our necessary reliance on RIN data that Ausgrid had provided to the AER in support of its proposal, coupled with the difficulty that Ausgrid presented through its repex program from the complex linkages and overlaps between the multiple Area Plans and Replacement and Duty of Care plans.<sup>31</sup>
107. We note that our reliance on the RIN data was responsive to the AER's direction, in part, but it was also the only practical way to base our analysis on a single source of audited information provided by Ausgrid. Ausgrid did little to assist in reconciling its RIN data with information scattered around multiple documents pertaining to Replacement capex. Nonetheless, having reviewed Ausgrid's additional information and clarifications, we do not believe the RIN data issues detracted from our overall findings.
108. As to fair process, Ausgrid was aware of its response to our question at the on-site meeting and could have followed up with its own clarification if it considered that its explanation was insufficient. An opportunity to correct any misunderstanding is also provided by the RRP. We have examined the updated information provided by Ausgrid and confirm that it does not materially affect our original findings.
109. With respect to statements referred to in item (iv) above, EMCa's response is provided in the relevant sections of this report for the expenditure programs reviewed.

### Summary

110. Our October 2014 report was based on a scope of work designed by the AER to assist it in its draft determination by identifying systemic issues that may result in forecasting biases in Ausgrid's RP. We understand that our report is not the sole determinant of the AER's adjustments.
111. We stand behind the 'utility' of our report, noting that it is primarily a qualitative review.
112. We confirm the difficulty that we had in isolating a consistent view of the expenditure proposal and finding clear justification for both the requirements and the efficiency of the assumed costs. We sought to acknowledge in our original report the challenges presented by what appeared to be conflicting data by qualifying our findings, subject to clarification from Ausgrid in its RRP.

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<sup>31</sup> Noting that whilst we referred to two Duty of Care related ACAPS, review of the Duty of Care programs were out of scope

113. Through its RRP, Ausgrid has clarified many of these misunderstandings. We are grateful for the clarity, which we consider to support our October 2014 findings.

# Appendix C Addressing specific Ausgrid concerns

## C.1 Governance and management framework

114. Ausgrid has identified concerns with EMCa's assessment of its governance and management framework and which are addressed under the following headings:

- Risk assessment; and
- Top-down adjustments

### C.1.1 Risk assessment

#### Ausgrid's position

115. Ausgrid disagreed with our assessment that its approach to risk assessment was, on balance, conservative and would lead it to overstate the risk posed by its assets.

116. Ausgrid asserted that:<sup>32</sup>

- Whilst it is now moving to use the corporate risk framework as the basis for future replacement planning, there is no fundamental issue with the assessment of corporate risk and operational risk using different frameworks. Ausgrid sought to demonstrate this by mapping the risk-cost estimated from the Evans & Peck report<sup>33</sup> using both the operational risk matrix and corporate risk matrix and achieving similar results;
- Ausgrid has made "*some progress toward a framework of risk cost assessment...to avoid the potential for subjective assessments of risk to enable conservative biases to drive investment decisions*";
- EMCa did not provide sufficient justification of our assertion that "*in some asset categories, Ausgrid has insufficient quality data to make an optimal assessment of particular asset strategies and to justify the volume and timing of activity*"; and
- EMCa did not provide sufficient justification of our assertion that "*Ausgrid failed to provide comprehensive cost-benefit analysis to support some of its key asset strategies*".

<sup>32</sup> Ausgrid RRP, Attachment 5.07, pages 5-6

<sup>33</sup> Evans & Peck, *Capital Program Optimisation Methodology*, June 2010

## EMCa's response

117. We have reviewed the reasons for Ausgrid's rejection of our core finding that there were *"systemic issues in Ausgrid's activity forecasts that, in our view, have led to its repex requirements being overstated"*.<sup>34</sup> We have also reviewed the additional information it provided in response to our review of a sample of its proposed expenditure programs.
118. Taking this information into account, we conclude that our original findings have been borne out by Ausgrid's RRP, which proposes a 19% reduction to its Replacement and Duty of Care program<sup>35</sup> based on:
- an enhanced risk-cost quantification methodology, which removes some of the potential for subjective assessments of risk to drive investment decisions; and
  - revised investment strategies which result in reduced expenditure and, in turn, respond to our core concerns.
119. Ausgrid states in its RRP that it *"stands by the basis of our initial proposal and asserts that, taking proper account of the age and condition of our assets, the proposed replacement expenditure is both efficient and prudent and is in the long term interests of consumers"*.<sup>36</sup> This statement contrasts with Ausgrid's \$510m reduction in its RRP.
120. The indicators of conservative risk assessment from Ausgrid's RP that led us to determine its approach to be a systemic issue are described below.
121. Ausgrid's operational risk matrix<sup>37</sup> is shown in Table 2 below. In our initial review, we compared it to the Corporate risk matrix,<sup>38</sup> shown in Table 3 overleaf, and the default risk matrix in ISO 31000 (2009). We observed that almost two thirds of the operational risk matrix produced Extreme/High results that required immediate action (Extreme) or senior management attention (High). When the definitions of risk and consequence are taken into account, the operational risk matrix appeared to be biased towards conservative results compared to the corporate risk matrix. We note that the corporate risk matrix is more consistent with the recommended approach in ISO 31000.

Table 2: Ausgrid's operational risk matrix

Likelihood		Consequences				
		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
A	Almost Certain	A1	A2	A3	A4	A5
B	Likely	B1	B2	B3	B4	B5
C	Possible	C1	C2	C3	C4	C5
D	Unlikely	D1	D2	D3	D4	D5
E	Rare	E1	E2	E3	E4	E5

<sup>34</sup> EMCa, *Review of Proposed Replacement capex in Ausgrid's Regulatory Proposal 2014-19*, page (i)

<sup>35</sup> Ausgrid RRP, *Figure 8*, page 76

<sup>36</sup> *Ibid*, page 93

<sup>37</sup> Ausgrid, *ID82462\_INV-STD-100035 Replacement Planning\_140328*, page 4

<sup>38</sup> Ausgrid, *ID00216\_Board Policy Governance - Risk Management\_140507*, page 6

Source: Ausgrid, ID82462\_INV-STD-100035 Replacement Planning\_140328, p. 4

Table 3: Ausgrid's corporate risk matrix

	CONSEQUENCE				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	Medium

Source: Ausgrid, ID00216\_Board Policy Governance - Risk Management\_140507, p. 6

122. Ausgrid states that there is no fundamental issue with the assessment of corporate risk and operational risk using different frameworks. Ausgrid identifies “*the extent that it drives action or investment*”<sup>39</sup> to represent a key outcome of the assessment.
123. In our initial review, we noted the absence of robust cost-benefit analysis to justify the timing and volume of work. It was our view that Extreme/High risk rankings derived from the application of largely subjective assessments in accordance with the operational risk matrix were leading to the unnecessary promotion of ‘immediate’ (RCP 2015-19) expenditure in some cases.<sup>40</sup>
124. As discussed in section 5 of our October 2014 report, we found through our review of a sample of the replacement projects that Ausgrid’s application of the corporate risk matrix supported conservative timing and volume of the work in some instances.
125. Ausgrid’s cost-benefit analysis appeared to be typically adequate for screening (i.e., options comparison). However, we did not see sufficiently robust options analysis to support the timing and volume of work proposed with the preferred option.
126. Ausgrid’s submission to the NNSW Board using the CASH/PIP process was reduced by 24% from its pre-RP expenditure forecast, indicating an unjustifiable level of expenditure from an overly-conservative risk assessment.
127. Ausgrid referred to a third risk assessment matrix in another document (Maintenance Requirements Analysis Manual AM-STG-10005) as the basis for analysis.<sup>41</sup> We did not review this document in our original assessment. The existence of a third risk matrix undermined our confidence in the quality and consistency of Ausgrid’s risk assessment.

<sup>39</sup> Ausgrid, Attachment 5.07, page 5

<sup>40</sup> EMCa, Review of Proposed Replacement capex in Ausgrid’s Regulatory Proposal 2014-19’, Section 5, pages 21-36

<sup>41</sup> Ausgrid, ACAPS2012- Zone substation 11kV circuit breakers, March 2014, page 19

## Quantitative risk evaluation

128. We consider that Ausgrid's enhanced risk-cost quantification methodology is a more robust approach to determining the timing of various replacement options. We support the extension (and further refinement) of this methodology to other categories of program expenditure. However, we note that this approach only appears to have been applied to 11kV switchboard and subtransmission cable replacement projects and four 'combined' projects.
129. We were not able to discern if, or how, Ausgrid applied this new assessment approach to determine expenditure in other categories. Further, we note that Ausgrid still appears to be taking a conservative approach in its switchgear and cable expenditure programs. Specifically:<sup>42</sup>
- the Lisarow cable project (\$8.9m) has low monetised risk and could be deferred to the next RCP, resulting in a 23% (\$45.6m) reduction of the 11kV switchboard project;<sup>43</sup> and
  - there is scope to defer a further three sub-transmission cable projects with a 'Preferred' risk profile to the next RCP, resulting in a further \$65m reduction for a total expenditure reduction of \$102m (88%).<sup>44</sup>

## Data quality

130. With respect to our comments about '*insufficient quality data*', we note that: (1) Ausgrid appears to have applied its enhanced risk-cost quantification methodology to two asset categories because it has adequate data only for these categories; and (2) Ausgrid has recognised that the lack of data for the secondary protection and control systems asset class implies a higher level of uncertainty and has reduced the program by 50%. We believe this confirms our broad concerns regarding the 'quality of data' issue that we found through the review of the sample asset categories.

## Cost-benefit analyses

131. With respect to our comments about Ausgrid's failure to provide comprehensive cost-benefit analysis, the basis for our assessment was: (i) our review of Ausgrid's methodology; and (ii) the results of our assessment of individual project ACAPS as discussed in Section 5 of our October 2014 report. We revisit our assessment in Appendix B of this report.

<sup>42</sup> We acknowledge that there may be other reasons for retaining this project in the 2015-19 RCP, but as far as we can tell, the rationale is not present in the RRP information provided to us

<sup>43</sup> Ausgrid Attachment 5.11, Table 7, page 10

<sup>44</sup> *Ibid*, Table 8, page 11 – Ausgrid identifies 3 projects for deferral representing 32% of the original expenditure



## C.1.2 'Top-down' adjustments

### Ausgrid's position

#### *24% adjustment by the Board*

132. Ausgrid has challenged EMCa's interpretation of the information provided in its RP and at the on-site meeting pertaining to the top-down challenge process. Ausgrid has also challenged the AER's use of EMCa's advice in making its draft determination. Ausgrid's key points are summarised below:<sup>45</sup>

- (i) Ausgrid has a prudent and robust process in place to ensure that its capital expenditure program represents a reasonable estimate of the lowest cost solution to address a genuine network need;
- (ii) risk based prioritisation is one of the key stages in the governance process and it has been developed to be consistent, efficient and transparent;
- (iii) delivery risks and constraints are also reviewed and where required incorporated into the plan;
- (iv) factors driving investments and risks change over time;
- (v) Evans & Peck (now Advisian) reviewed Ausgrid's risk based prioritisation process, determined that there were significant positive aspects to the process, and provided a number of improvement opportunities. These improvement opportunities have been incorporated in the expenditure forecast supporting the revised proposal; and
- (vi) Jacobs disagreed with EMCa's interpretation in their review.

#### *Deliverability risk*

133. Ausgrid has challenged the basis and materiality of EMCa's concern with Ausgrid's capacity to deliver the proposed repex program at an efficient cost.<sup>46</sup>

134. Ausgrid has now prepared a delivery and resourcing strategy which, in its opinion, confirms that EMCa's concerns were unfounded.

### EMCa's response

#### *24% adjustment by the Board*

135. With AER representatives present, we were advised by Ausgrid, Endeavour Energy and Essential Energy at respective on-site meetings that the NNSW board had reduced each DNSP's bottom-up forecast. In the case of Ausgrid, the quoted board adjustment was -24%.

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<sup>45</sup> Ausgrid, *Attachment 5.07*, pages 7-10

<sup>46</sup> *Ibid*, page 10

136. The message was consistent; it was heard and understood in the same way by AER and EMCa representatives attending the meetings.
137. This indicated to us that the Board was indeed fulfilling an important role in challenging the bottom-up risk-based assessment from the businesses. However, as discussed in our October 2014 report, we were not convinced by the information we considered in our repex review that the 'board-adjusted' replacement expenditure forecast represented a prudent and efficient level.
138. In our October 2014 report, we also noted that we were provided with some information on the NSW top-down process subsequent to our assessment. Accordingly, we did not have the opportunity to review the NSW process in its entirety.<sup>47</sup>
139. We have now had the opportunity to review this information and the further information provided by Ausgrid in its RRP. Ausgrid has advised that the starting point for the reduction was the 2012 SCI forecast and that the Board's top-down assessment was only 2% below the 2013 gate 1 replacement expenditure submission.
140. In our October 2014 report, we questioned whether the quality and/or robustness of the inputs to the board's top-down assessment process was sufficient to allow it to determine the optimal expenditure program.<sup>48</sup> We note that the board did not previously identify the \$510m in reductions now proposed in Ausgrid's RRP. This indicates that the robustness of the information initially provided to Ausgrid's Board and/or the strength of the initial top-down challenge provided was unsatisfactory. Notwithstanding, Ausgrid's reduction of its repex program by 19% in its RRP has substantially mitigated our concerns.
141. We acknowledge that expenditure programs evolve and necessarily adapt to new information. We further acknowledge the adoption by Ausgrid of an enhanced cost-benefit quantification methodology.

### *Deliverability risk*

142. In its RRP, Ausgrid states that it "*accepts that it is reasonable to expect that delivery issues should be considered in developing a forecast of expenditure, and that a delivery and resourcing strategy is important to the prudent and efficient management of the business*".<sup>49</sup>
143. Ausgrid also acknowledges that "*a shift from greenfield to brownfield can increase complexity in construction and therefore can therefore place delivery at risk*".
144. We note that, in its RP, Ausgrid did not:

<sup>47</sup> EMCa Review of Proposed Replacement capex in Ausgrid's Regulatory Proposal 2014-19, footnote 16, page 12

<sup>48</sup> E.g., (i) inputs to the new CASH process, and (ii) compelling cost-benefit analyses to help it determine the optimal volume and timing of replacement work in the asset classes presented as extreme/high risk

<sup>49</sup> Ausgrid, Attachment 5.07, page 10

- provide a delivery strategy or resourcing plan to demonstrate that it understood the detail of the challenges in meeting the \$3,226m<sup>50</sup> Replacement and Duty of Care capex forecast; and
- provide any confidence in its ACAPS that it recognised delivery risk as a factor to be considered and that it had a delivery strategy and plan for individual asset categories to deliver the work efficiently in the context of a portfolio-level strategy and plan.

145. In the absence of this information, we considered that Ausgrid had not adequately demonstrated that there were no material risks to the efficient delivery of its replacement work program.
146. Ausgrid has now provided in its RRP a comprehensive delivery strategy and resourcing plan which concludes that overall it has “*sufficient internal and external supply capability and flexibility to efficiently meet forecast demand over 2015-19*”.<sup>51</sup>
147. We accept that with the proposed reduction in repex expenditure by 19% to \$2,197m Ausgrid, and with the delivery plan now provided, it is reasonable to assume that Ausgrid can implement its strategy of supplementing its internal resources with a modest amount of external service providers to deliver this program.
148. We are less convinced that the delivery strategy demonstrates that the optimal mix of internal resourcing and external service provision has been achieved. We have not seen the ‘out-workings’ of the strategy in revised ACAPS.

## C.2 Forecasting methods

149. In its RRP, Ausgrid identified three thematic issues it had with EMCa’s assessment of its repex program as described below:
- approach to risk assessment;
  - basis for activity forecasts; and
  - cost estimation.

### C.2.1 Approach to risk assessment

#### Ausgrid's position

150. Ausgrid raised two further issues with our assessment of its approach to risk assessment:<sup>52</sup>
- (i) our conclusion that its approach was overly conservative; and

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<sup>50</sup> As we understood it to be – refer to Table 15 of Ausgrid’s RRP and the accompanying explanation

<sup>51</sup> Ausgrid, *Attachment 5.05, Strategic delivery and workforce plans for 2015-19*, page 9

<sup>52</sup> Ausgrid, *Attachment 5.07*, page 10

- (ii) our concern that the risk framework was not used in every case overlooked the difference between Ausgrid's proactive and reactive program strategies.

### EMCa's response

151. Our concern that the risk framework was not used in every ACAPS that we reviewed was based on the following factors:

- (i) Variability of frameworks – in some cases, the *Maintenance Requirements Analysis Manual* (AM-STG-10005) was used; in others, the Planning standard (INV-STD-10035) was used or no framework was apparent. We did not understand the role of the corporate risk framework (which did not appear to be in use). In each case, the subjective nature of the assessment and the absence of a robust cost-benefit analysis served to mitigate our confidence in the forecast expenditure.
- (ii) Lack of adequate risk assessment and options analysis – this undermined our confidence that the correct balance between proactive and reactive expenditure and the volume and timing of expenditure had been achieved with the various risk management approaches applied.
- (iii) As discussed elsewhere in this report, the application of the quantitative risk evaluation approach to two of the largest repex programs (cables and switchgear), among other things, has since helped to mitigate our concerns in this area.

## C 2.2 Basis for activity forecasts

### Ausgrid's position

152. Ausgrid refers to issues that have been identified and responded to in previous sections of our October 2014 report, including:

- inadequate justification of the timing and volume for resolving the condition-based issues;
- inadequate explanation of the degree of step change evident in expenditure; and
- lack of robust delivery risk management.

### EMCa's response

153. We have offered responses to these issues in preceding sections of this report. We confirm that:

- The basis for our original findings were reviews of governance and management information and the sample of ACAPS reviewed and critiqued in section 5 of our October 2014 report; and
- We have considered the additional information provided by Ausgrid to clarify what, in its opinion, were errors and/or misunderstandings. The new information has not materially altered our original findings that in deriving its RP repex forecast Ausgrid:
  - i. failed to apply robust options, risk and cost-benefit analysis;

- ii. failed to utilise reliable asset condition and failure data for some asset classes; and
- iii. applied multiple risk assessment approaches and tools, relatively coarse and/or subjective risk rating assessments, and in-built conservatism that was evident in key elements of the risk assessment process.

## C 2.3 Cost estimation

### Ausgrid's position

154. Ausgrid identifies two issues with our original findings regarding cost estimation bias, whereby it considers that EMCa has:<sup>53</sup>

- (i) incorrectly interpreted its application of contingency to its projects; and
- (ii) unreasonably concluded from historical project variance analysis that its cost estimates were likely to be over-estimated in preparing the 2015-19 expenditure forecast.

155. Ausgrid has advised in its RRP that:

- (i) since its forward cost estimate for RCP 2009-14 was developed, it has undertaken a wide variety of major and minor projects using a variety of delivery mechanisms and undertaken many cost reviews; and
- (ii) the information base on which the current costs forecasts are based is vastly superior to that available five years ago.

156. Ausgrid contends that this will result in a substantial improvement in forecasting accuracy.

157. In its RRP, Ausgrid also reports that it has: (i) explicitly recognised ongoing improvements in cost structures from its current efficiency programs; and (ii) applied a top-down reduction to the forward capital program.

### EMCa's response

#### Contingency

158. We acknowledge in our October 2014 report that only *if* our interpretation of the application of multiple levels of contingency were correct would it contribute to overly conservative estimates. The rationale to qualify this finding was the lack of clarity in Ausgrid's RP, particularly the lack of detail about the application of its project budget model in its Planning Standard<sup>54</sup> to its 2015-19 cost estimates.

<sup>53</sup> Ausgrid, *Attachment 5.07*, page 12

<sup>54</sup> Ausgrid, *Planning Standard INV-STD-10024 Economic Appraisal*, page 6

159. We accept Ausgrid's explanation that contingency is not applied twice in the project governance cycle and that there is no over-estimation bias from this factor in the proposal.

### *Historical cost forecasting performance*

160. Historical estimating performance (i.e., actual versus forecast) is typically a starting point for our assessment of the adequacy of a business' cost forecasting methodology. We then consider the information provided to demonstrate the effectiveness of the changes implemented over time to improve estimating performance. For example, this could include evidence of reduced unit rates for volume intensive work from the prior RCP and through the next RCP. We also look for evidence of diminishing cost variance with time over the prior RCP as an indication of the success of the improvement initiatives.
161. The only source of information provided that gave any indication of Ausgrid's historical performance was the Arup report, which showed high level information on selected programs in the 2009-14 period.<sup>55</sup> As noted by Arup, Ausgrid's cost estimation performance in the prior RCP was erratic.
162. We could not discern any unit cost improvement from the RIN data provided by Ausgrid.
163. We have reviewed the additional information provided by Ausgrid in support of its claim that its unit costs are efficient and find that:
- (i) it's cost forecasting methodology is reasonable;
  - (ii) it has identified a number of efficiency initiatives which it plans to introduce in the next RCP;<sup>56</sup>
  - (iii) it has incorporated efficiency improvements in the forward estimates;<sup>57</sup> and
  - (iv) it has substantially mitigated our concerns that poor program delivery performance would lead to inefficient costs.
164. On this basis, we are satisfied that the revised expenditure proposed is likely for the most part to be based on reasonable estimates of efficient unit costs.

<sup>55</sup> EMCa, *Review of Proposed Replacement capex in Ausgrid's Regulatory Proposal 2014-19*, pages 18-19

<sup>56</sup> Ausgrid, Attachment 5.05, pages 5, 25-26, 70

<sup>57</sup> *Ibid*, page 33

# Appendix D Response to Ausgrid's commentary on our program expenditure assessment

## Prudency

### Lack of robust options

Ref.	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.2.1 para 133	<i>Cables</i> <i>The Area Plan considers a number of options relating to the resultant rating, capacity and replacement timing of its 132kV cable network</i>	The report finds that, in respect of major underground cable projects, a number of options are considered. This contradicts the finding.	We examined 9 ACAPS and one Strategic Asset Prioritisation document and determined that only 1 of them presented a comprehensive analysis of options (ACAPS7007 - transformers).
S5.2.2 para 148	<i>Switchboards</i> <i>Ausgrid only considers one option in addition to 'Do nothing'. The options analysis should consider reasonably plausible options, including the cost-benefit of varying levels of replacement over time and risk mitigation options.</i>	<p>In this ACAPS relating to switchgear, the 'Do Nothing' option represents the following actions:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Continue with current maintenance practices.</li> <li><input type="checkbox"/> Repair where possible.</li> <li><input type="checkbox"/> Replace asset on failure.</li> </ul> <p>Ausgrid has considered replacement with a new 11kV vacuum circuit breaker as the only reasonable alternative to the 'Do Nothing' case.</p> <p>Ausgrid's MRA process coupled with its condition base replacement ensures maximum life is achieved from its assets. The replacement program is targeted at high risk assets, or where the solution represents the lowest long term cost. This is evaluated across the entire subset.</p> <p>Due to this targeted approach and the benefits from this program, Ausgrid have assessed the need to replace all assets within this targeted subset. As such, the benefits in replacing multiple assets are proportional to the increases in cost. The most appropriate timing becomes a consideration of deliverability in the context of all other programs of work. This conclusion has been validated using the</p>	<p>We formed the view that, overall, the quality of Ausgrid's options analysis was inadequate to support the <i>timing and volume</i> of the investment represented by the ACAPS/SAP.</p> <p><u>Switchboards</u></p> <p>Other options that Ausgrid could have discussed in ACAPS2012 are:</p> <ul style="list-style-type: none"> <li>(i) An enhanced maintenance regime (e.g., higher frequency of targeted preventative maintenance);</li> <li>(ii) An alternative strategic spares approach, and</li> <li>(iii) Changes to operational procedures.</li> </ul> <p>We note that these alternatives may not replace the preferred approach, but they may contribute to reducing failure risk and impact of asset failure until the cables are replaced.</p> <p>Ausgrid's updated advice is that the timing and volume of the switchboard replacement work was dependent only on deliverability, and that it took the whole portfolio of work into account. This was not mentioned previously and we were</p>



Ref.	EMCa Quote (original report)	Ausgrid response	EMCa response
		<p>Risk Quantification Model.</p> <p>In EMCa's evaluation they have suggested that investment delay was not a factor considered by Ausgrid. However, due to the proportionate relationship between cost and benefit for a targeted subset of asset, Ausgrid rejects this as a meaningful consideration for this program.</p>	<p>advised that no portfolio-level delivery strategy had been developed for the 2014-19 RCP.</p> <p>In the RRP, Ausgrid has provided new cost-benefit analyses for the switchgear program which indicates it is prudent to defer four of the 22 switchboard projects worth \$45.6m (18%) well beyond 2019 on economic grounds.<sup>58</sup></p> <p>The updated Ausgrid analysis confirms EMCa's original concerns regarding the lack of robust options analysis.</p>
S5.2.3 para 156 & 160	<p><i>Poles</i></p> <p><i>Following options analysis, Ausgrid concluded that continuing the condition based replacement/reinforcement option had the lowest cost and delivered the lowest risk position.</i></p> <p><i>Ausgrid has identified and analysed a reasonable number of credible options in ACAPS4001.</i></p>	<p>The report finds that, in respect of pole replacement, a reasonable number of options are considered. This contradicts the finding.</p>	<p><u>Cables</u></p> <p>Similarly, Ausgrid's updated cost/benefit analysis for cables indicates it is prudent to defer between 32% (\$36.8m) and \$102.2m (88%) of the original program.<sup>59</sup></p>
	<p><i>Secondary systems</i></p> <p><i>ACAPS2009 only considers one option (in addition to doing nothing), which is planned replacement (i.e. prior to breakdown failure) ... There is no option analysis in ACAPS2003</i></p>	<p>In the case of SCADA, there is one program (ACAPS 2003) that is a forecast of the need for reactive replacement of failed equipment, and one (ACAPS 2009) which contemplates planned replacements to avoid in-service failures. The suggested alternatives in the ACAPS document are not alternative options but suggestions for trade-offs in realised dollars versus unrealised (risk) dollars. The comments by EMCa suggest that they have a limited technical understanding on this particular asset type and the availability of options that are available.</p> <p>ACAPS 2003 is reactive replacement. As this is a run to fail approach, no option analysis was undertaken. This is consistent with all run to fail programs.</p>	<p>The updated Ausgrid analysis confirms EMCa's original concerns regarding the lack of robust options analysis.</p> <p><u>Poles</u></p> <p>Ausgrid has not provided the results of its analysis of the pole program with the revised quantitative risk evaluation (if done).</p> <p>Our concerns with the options analysis are unchanged from our original report. We did not believe that Ausgrid had undertaken a sufficiently detailed analysis of the possible options available to optimise the cost/benefit of the proportion of replacement/reinforcement work on poles, nor had it adequately justified the ~26% step up in expenditure in 2019.</p> <p>Ausgrid has revisited its program timing and has deferred 50%.</p> <p>The updated Ausgrid analysis confirms EMCa's original concerns regarding the lack of robust options analysis.</p> <p><u>Secondary systems</u></p> <p>In its RP, Ausgrid proposed a large expenditure program without robust option analysis. Specifically, there was a:</p>

<sup>58</sup> Ausgrid, Attachment 5.11, Table 7, p. 10

<sup>59</sup> Ibid, Table 8, p. 11 – with 32% deferred based on 'early' timing and 88% based on 'preferred' timing



Ref.	EMCa Quote (original report)	Ausgrid response	EMCa response
			<p>(i) lack of reliable data to support the need for the step change from 2013/14 of ~ \$6m pa to an average of more than \$20m pa for 5 years; and</p> <p>(ii) lack of compelling financial analysis (primarily because of the lack of reliable data) to confirm that the proactive/reactive replacement mix was optimal.</p> <p>In response to the lack of reliable data, we expected to see alternative investment profiles considered – such as a lower level of investment in proactive replacement and a more modest assumption for the extent of reactive replacement required until more data was gathered and analysed.</p> <p>We are aware of the technical issues with this important asset class. As stated in our original report, we support the investment in prudent and efficient replacement of the secondary equipment considered. However, Ausgrid did not provide a compelling case for over \$100m worth of investment.</p> <p>In its RRP, Ausgrid has reduced its proposed expenditure by 50%. The updated Ausgrid analysis confirms EMCa's original concerns regarding the lack of robust options analysis.</p>

### Lack of risk and cost-benefit analysis in support of the timing/volume of activity

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.2.1 para 123	<p><i>Cables</i></p> <p><i>We were not able to observe a risk-based cost-benefit analysis for determining the timing of the work. Risk analysis seemed only to be used for comparative analysis ... We could not observe the application by Ausgrid of a formal risk framework.</i></p>	<p>Ausgrid accepts that its processes could always be improved, and has been working on broadening the use of cost-benefit and risk cost assessment techniques in the period since the substantive proposal was prepared. This was foreshadowed in discussions with EMCa and in our substantive proposal. EMCa acknowledged this as a developing area that "shows promise" in their report. In our revised proposal we have applied a risk assessment and quantification methodology to the major replacement projects to enable us to clearly identify those projects that can be cost effectively deferred without undue risk, and those that need to proceed. We have also expanded our application of risk cost quantification to Replacement and Duty of Care programs.</p>	<p>We acknowledge that Ausgrid is working to improve its risk-based cost-benefit assessment techniques.</p> <p>Ausgrid's application of the quantitative risk evaluation approach to selected replacement projects (Attachment 5.11) gives us a greater level of confidence in Ausgrid's RRP and serves to validate our concerns regarding the repx expenditure proposed in the RP.</p>
S5.2.3 para 155	<p><i>Poles</i></p> <p><i>We observe that Ausgrid has a current pole failure rate of 0.18 per 10,000 poles per year, well below the industry benchmark and that the failure rate has remained relatively constant for a number of years. Ausgrid state an aspirational target of 0.1 per 10,000</i></p>	<p>The EMCa report incorrectly ascribes the 'aspirational target' as being Ausgrid's target.</p> <p>The aspirational target was footnoted on page 20 of ACAPS4001 as being sourced from the document</p> <p>'Department of Consumer and Employment Protection Government of Western Australia –WESTERN POWER'S WOOD POLE</p>	<p>This was a relatively minor point in our assessment.</p> <p>Ausgrid has provided additional information that explains that a failure rate of 0.1 pole failures per 10,000 poles is not an aspirational target which we accept. In our October 2014 report, we could not see how this was influencing Ausgrid's original program.</p>

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
	<i>poles however we were not able to observe an economic analysis supporting this. It is unclear how this target has informed the strategy selection</i>	<p>MANAGEMENT SYSTEMS: REGULATORY COMPLIANCE AUDIT 2005 - EXECUTIVE SUMMARY citing Electricity Council of NSW guide EC8 -1994'. As there are no other documented industry sources of acceptable pole failure targets this figure has been used as a reference to provide externally sourced context. At no stage did we describe it as our strategic target.</p> <p>Ausgrid's pole replacement program has predominantly been forecast on historical pole condemnation rates and the expectation that a level of reinforced poles are coming to the end of the life extension period that the pole reinforcement provides. A comprehensive explanation of the proposed program and timing is included in Section 8.2 of ACAPS4001</p>	
S5.2.5 para 178	<p><i>Secondary systems</i></p> <p><i>The average age and the age of assets above the standard life reported in ACAPS2009 do not support the rapidly increasing expenditure. As discussed, there is inadequate condition based justification.</i></p>	<p>Ausgrid has acknowledged that it has limited data in this area but has made significant improvements over the last few years. However it would not be prudent to forecast no requirement for expenditure in the absence of good quality data.</p> <p>We have observed recent failures of particular asset models as described in ACAPS2009. The emergence of these failures and the presence of dominant failure modes has led to a targeted replacement of distance and voltage regulation schemes. 3 years of data has allowed Ausgrid to capture these failures. EMCa acknowledge the importance of these schemes in protecting the network and the associated consequences.</p> <p>Recognising that the lack of data does imply a higher level of uncertainty, we have reviewed the based on a more granular view at equipment level and a better informed view of consequences (informed by our revised risk-cost assessments). As a result the revised forecast for expenditure on this program has been reduced by 50%, reflecting a continuation of a mainly reactive program while failure data is acquired.</p>	<p>We recognise that Ausgrid has correctly identified a key asset group that needs a certain degree of remedial investment to ensure acceptable performance.</p> <p>Our concern was that the volume of work proposed was not justified from the analysis presented in the RP (ACAPS2009).</p> <p>We note that Ausgrid's revised analysis has led it to a similar conclusion, in that Ausgrid has decided that the program should be reduced by 50% whilst it collects more data to strengthen the basis for investment.</p> <p>However, we do not have visibility of the rationale for selecting a 50% program reduction.</p>

### Lack of reliable asset condition and failure data

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.2.1 para 118, 135	<p><i>Cables</i></p> <p><i>Ausgrid is undertaking more detailed analysis of cable failures in order to better predict specific failure types.</i></p> <p><i>... the reasonableness of forecast expenditure is dependent on the accuracy and reliability of cable</i></p>	<p>These comments appear to be based on statements made in the one review meeting and were intended to convey that Ausgrid adopts an approach of continuous improvement to cable failure data collection and analysis rather than that there was a lack of reliable cable condition and failure data.</p>	<p>We understood the context in which Ausgrid made the comment. However, we combined the data integrity comments with other aspects of Ausgrid's analysis that we were concerned about, including:</p>

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
	<i>failure data. Ausgrid acknowledges the need to improve its analysis of cable failure risks.</i>		<ul style="list-style-type: none"> <li>(i) the lack of compelling risk-based cost-benefit analysis to support the timing of the work;</li> <li>(ii) uncertainty about the appropriate assumptions for cable usable life;</li> <li>(iii) variations to risk rankings over time;</li> <li>(iv) the application of improved risk mitigation techniques; and</li> <li>(v) dependencies and uncertainties related to the timing of replacement of feeder 41 (330kV).</li> </ul> <p>These changes and issues led to deferral of \$185m and \$960m worth of work from two cable replacement programs. Collectively these factors undermined our confidence in the timing/volume of the work required.</p>
S5.2.5 paras 171, 172, 175, 176	<p><i>Secondary systems</i></p> <p><i>In ACAPS2009 Secondary Protection &amp; Control Systems, Ausgrid considers two options: do nothing and planned replacement. It has implemented a planned replacement regime, the justification for which is limited by poor historical failure data. Failure predictions have been extrapolated from only three years' worth of failure data, leading to a slower start to the replacement program to allow further assessment of the condition of the protection relay fleet.</i></p> <p><i>In ACAPS2003 Protection and Control Systems (Reactive), Ausgrid acknowledges the paucity of asset failure history and costs. Its strategy is to make provision for asset replacement based on failure projections derived from ad hoc failure records and to improve its asset data progressively.</i></p> <p><i>ACAPS2003 states that, "the asset base for this ACAPS has not been historically recorded in any corporate database and as a result it is not possible to present detailed failure history and financial costs for these assets. Secondary protection relay devices have recently been added (2012) to Ausgrid's corporate database (SAP). The historical expenditure shows the need for better asset recording for these assets. With the recent creation (2012) of these assets in SAP, the historical data required to provide clarity for replacement program will be available.</i></p>	<p>Ausgrid has acknowledged that it has limited data in this area but has made significant improvements over the last few years. However it would not be prudent to forecast no requirement for expenditure in the absence of good quality data.</p> <p>We have observed recent failures of particular asset models as described in ACAPS2009. The emergence of these failures and the presence of dominant failure modes has led to a targeted replacement of distance and voltage regulation schemes. 3 years of data has allowed Ausgrid to capture these failures. EMCa acknowledge the importance of these schemes in protecting the network and the associated consequences.</p> <p>Recognising that the lack of data does imply a higher level of uncertainty, we have reviewed the based (sic) on a more granular view at equipment level and a better informed view of consequences (informed by our revised risk-cost assessments). As a result the revised forecast for expenditure on this program has been reduced by 50%, reflecting a continuation of a mainly reactive program while failure data is acquired.</p>	<p>We agree that it would not be prudent to propose zero expenditure in the 2014-19 RCP whilst waiting for sufficient accumulation of quality data.</p> <p>The data quality issues did however cause us to conclude that the proposed 300+% increase in expenditure from 2013/14 throughout the RCP was not sufficiently well justified.</p> <p>We are not privy to the revised risk-cost assessments referred to, but acknowledge that Ausgrid has reduced its program expenditure by 50% whilst it assembles a more 'granular' view at the equipment level.</p>

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
	<i>ACAPS2003 also informs us that the projected expenditure for the 2015–19 regulatory period has taken into account “anecdotal evidence and the limited failure data that has been captured in SAP”.</i>		

### A variety of risk assessment approaches ... with biases

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.2.1 para 123	<i>Cables</i> <i>We could not observe the application by Ausgrid of a formal risk framework.</i>	Strategic subtransmission cable risk assessment is inherently more challenging and was not undertaken in the document reviewed by EMCa (which was the program prioritisation document). The full suite of documentation and considerations relating to the strategic decision were reviewed by JacobsSKM who stated “ <i>It is clear that the combination of risk issues, long-term asset management capability, and practical issues (such as restricted access to aged underground cable assets) have been duly considered in both framing the strategic objective as well as setting priorities for individual asset replacements</i> ” <sup>62</sup> and that it “ <i>appears to be based on a sound appraisal of the risk issues</i> ”. The absence of a risk table in the program prioritisation documentation that follows does not signify that the risk assessments were in any way inappropriate. This information was identified among the documents reviewed by EMCa. Risk assessment for programs at the strategy level have been arrived at with direct involvement in judgements by the executive and board, rather than by the application of a derived framework.	We read the JacobsSKM (‘Jacobs’) report and we agreed with its finding (to paraphrase) that: the cable systems nominated by Ausgrid needed to be progressively replaced in the order of priority nominated.  Jacobs stated that the scope of its review “ <i>did not cover the details of the proposed investment program or specific replacement projects, nor the prudence or efficiency of the proposed replacement expenditure</i> ”. <sup>60</sup>  In contrast to Jacobs, we sought evidence of the prudence (and efficiency) of the specific replacement projects.  In our view, the lack of robust cost-benefit analysis was not overcome by the somewhat subjective risk-benefit analysis presented in the report. Our finding was similar to Jacobs’:  “... SKM notes that the basis for the decisions taken by Ausgrid regarding the timing of the replacement program, (both originally and the subsequent decision to defer parts of the program), have not been well documented. Further, it appears that these decisions appear to have been taken on an informed judgment basis at executive level, rather than through a detailed options, risk, and cost-benefit analysis.” <sup>61</sup>
S5.2.1 para 124	<i>Cables</i> <i>We noted that the replacement date of many of the 132kV oil filled cables was presented by Ausgrid as being beyond the standard design life of 45 years. However, we found evidence that the life expectancy of oil-filled cables may be understated and, more</i>	This is a case of EMCa either misunderstanding the information they were presented with, or quoting selectively to make a point that is not supported in the documentation.  Ausgrid did not base the replacement dates of its cables on the cables age against its standard life. The prioritisation of cables was based on	We confirm that we only considered the age of the assets as a ‘sense test’ of Ausgrid’s proposed investment timing/volume and as only one of the factors we took into account in assessing the prudence of Ausgrid’s cable replacement

<sup>60</sup> JacobsSKM, Subtransmission Cable Replacement Strategy, Peer Review, 30 April 2014, page 1

<sup>61</sup> *Ibid*, page 20

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
	<p><i>significantly, may differ from Ausgrid's own planning documents. Ausgrid's 2013 Sydney Inner Metropolitan Area Plan makes the following comment in relation to TransGrid's treatment of its 330kV oil filled cable (Cable 41): "It has been assumed that this cable will have a usable life of approximately 50-55 years, which is consistent with Ausgrid's planned approach to cable replacements on the 132kV network."</i></p>	<p>cable unavailability and oil leakage rates. The condition of these assets and the emerging reliability and environmental exposure risk has led to the replacement timeframes established.</p> <p>The ongoing condition issues increase the risk of cable failure, while the lack of decreasing supportability and pressures from environmental bodies has led to increased consequence exposure.</p> <p>The comparison to Transgrid's Cable 41 is not reasonable, mainly because it is of a different (newer) vintage than the cables Ausgrid is dealing with, and has no history of deterioration. However, the statement is that many cables will be aged above 45 years. Figures 26 and 27 in our Strategic Asset Prioritisation document from which EMCa drew this statement shows that the average age at replacement for fluid filled cables would be over 47 years, with some at 60 years. For gas cables, the average age at retirement is 51 years, with some lasting until 69 years.</p>	<p>program. We were not fully convinced by the analysis presented in the RP to support the proposed program of work.</p> <p>We agree that Ausgrid's investment driver for cable replacement is the condition of the assets and the operational risks that cable failure pose. We also agree that the age profile of the cable population supports the need for an optimised proactive (replacement) and reactive (repair) program.</p>
S5.2.2 para 146, 147	<p><i>Switchgear</i></p> <p><i>Extreme risks and consequences are unlikely to be caused by the types of faults identified by Ausgrid and can generally be addressed through corrective maintenance. ACAPS012 provides the following statement: "The failure of an 11kV circuit breaker will result in either the loss of the associated 11kV distribution feeder or will result in the inability of that particular circuit breaker to operate and provide protection against short circuit or overload."</i></p> <p><i>Ausgrid's risk assessment is based on application of the operational risk matrix and leads to identification of three extreme risk ratings ... the indicated 2% (one in 50 year) likelihood of loss of load following a breakdown failure suggests that the risk rating of 'extreme' is excessive.</i></p>	<p>EMCa has made this statement in reviewing ACAPS2012. Ausgrid in its ACAPS document has stated:</p> <p><i>"The consequences of a catastrophic failure of an 11kV bulk oil circuit breaker can include:</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <i>Potential reduction in network security and reliability.</i></li> <li><input type="checkbox"/> <i>Personnel safety.</i></li> <li><input type="checkbox"/> <i>Failure and subsequent damage to the circuit breaker itself, the 11kV switchboard or electrical equipment which is protected by the circuit breaker."</i></li> </ul> <p>Ausgrid does not see these risks as insignificant.</p> <p>EMCa appears to not have understood that the 'extreme' impact failure assessments are related to the chain of consequence following the circuit breaker failure that involves propagation to a fire, failure of the entire switchboard (and loss of load from the entire substation) or explosive failure and injury to nearby personnel. It is these consequences that drive the risk rating, not the loss of load from a single failure. Note that such consequences have occurred due to circuit breaker failures.</p>	<p>Our comments in paragraphs 146 and 147 were in response to ACAPS2012 in which it seemed to be ranking loss of a distribution feeder as an extreme event (requiring immediate action) and the primary driver for expenditure:</p> <ul style="list-style-type: none"> <li>• Asset performance (i.e., network security and reliability) is identified as the highest priority risk driver, not Safety in section 5.4 of ACAPS2012.</li> <li>• Loss of supply of major consequence appears to be attributed a likelihood rating of 4 = Extreme rating.<sup>62</sup></li> </ul> <p>Ausgrid's RRP response now clarifies that Safety is an extreme risk and the primary driver of investment and that Asset performance risk is of 'lesser consequence'. This is in contrast to ACAPS2012 section 5.4, in which Safety was rated behind asset performance as an investment driver.</p> <p>We did not label the risks denoted as 'insignificant' – we questioned the rating of 'extreme' to an event with a likelihood of 2% occurring which is what was attributed to Supply risk (not Safety).<sup>63</sup></p> <p>Furthermore, Ausgrid's RP includes references to at least three risk frameworks in various documents, each of which</p>

<sup>62</sup> Referring to the definitions in INV-STD-10035, section 2.4, p. 4 and our interpretation of the information in ACAPS2012, Table 19, page 19

<sup>63</sup> For Safety, the probability of outcome upon breakdown failure' was assessed at 5%, not 2% (ACAPS2012, Table 18, page 19)

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
		<p>The 2% likelihood relates to this complete failure scenario, not the single breaker failure.</p> <p>The risk of loss of load as a result of an 11kV circuit breaker failure is classed as 'high', not 'extreme'. This is an error in the EMCa report.</p> <p>The risk assessment only included the worst case risks. It did not include the probability of a lesser consequence. For example, in 60% of cases the load loss could be in the order of 4MVA. By not assessing the cumulative risk factors under both worst case and lesser consequence events, Ausgrid has been less conservative.</p>	<p>have different probability and consequence definitions and risk ratings:</p> <ul style="list-style-type: none"> <li>• Maintenance Requirements Analysis Manual (AM-STG-10005);</li> <li>• Planning standard: INV-STD-10035 Asset Replacement and Network Risk; and</li> <li>• Document ABP005 Risk Management Policy.</li> </ul> <p>It may be the case that Ausgrid is now referring to the risk management policy in ABP005 in seeking to overturn its assignment of the highest risk ranking to Asset Performance in ACAPS2012. We have no way of reconciling the information presented in ACAPS2012 and the criteria in ABP005.</p> <p>We accept the explanation from Ausgrid that it actually meant to rate Safety as the key driver of the switchgear program, but we do not accept that we made an error in our assessment of the information provided in ACAPS2012.</p>



## Efficiency

### Inadequate evidence to show that estimation errors from previous RCP had been addressed

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.23 para 156	<p><i>Poles</i></p> <p><i>We concur with Ausgrid's strategy of reinforcing poles that are assessed as requiring treatment and have sufficient above-ground strength. However, in Figure 9, the proportion of expenditure on reinforcement does not appear to be in the range indicated by Ausgrid (i.e., 40-50% of poles requiring treatment).</i></p>	<p>This seems to be a simple misunderstanding of the arithmetic. It is the ratio of replacement treatments (ie units) that is 40-50%, not expenditure. Replacing a pole costs, on average, about 13 times the cost of nailing. Figure 9 shows expenditure, so the ratios are obviously heavily skewed towards replacement costs. In units replaced, nailing represents between 46% and 48% of LV poles until the last year of the period, when failures of previously nailed poles become a feature in the forecast.</p>	<p>We agree with Ausgrid's interpretation of Figure 9 of our report.</p>
S5.2.5 para 181	<p><i>Secondary systems</i></p> <p><i>Neither ACAPS2003 nor 2009 provide sufficient evidence that the costs incurred, or forecast to be incurred, in undertaking the proposed volumes of secondary equipment replacement are efficient.</i></p>	<p>The derivation of unit costs is not contained in the individual ACAPS documents. Unit costs are derived in accordance with a standardised methodology described in the methodology attachment to our initial proposal. The unit costs derived are listed in a confidential attachment "ID33420_Replacement and DOC plans Unit Rates". This latter document was not reviewed by EMCa.</p>	<p>We have reviewed ID33420 and Attachment 5.15. The former simply provides a list of unit costs. Attachment 5.15 provides information on the methodologies that Ausgrid uses to derive its cost estimates. However, collectively the ACAPS documents (Att 5.15 and ID33420) do not provide sufficient evidence that the costs incurred, or forecast to be incurred, in undertaking the proposed volumes of secondary equipment replacement are efficient.</p> <p>Our reasons for maintaining our original position are:</p> <ul style="list-style-type: none"> <li>Att 5.15 report refers to Ausgrid's 'unique model for network service delivery' and that '[w]hilst it is being improved, this will take time to materialize through the 2014-19 Regulatory Period and beyond.'</li> </ul> <p>It is not clear how this caveat affects ACAPS2003 and ACAPS2009 (or the other four expenditure categories we reviewed). But on face value, it indicates inherent cost inefficiency.</p> <ul style="list-style-type: none"> <li>We infer from Att 5.15 that one or more of the following sources has been used to estimate the cost for the Repex program: internally collected actual data, historical vendor quotes, externally sourced costs.</li> </ul> <p>However, Ausgrid has not provided details of the source of data for secondary systems work.</p> <ul style="list-style-type: none"> <li>For a \$100m+ program, we would expect to see:</li> </ul>

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
			<ul style="list-style-type: none"> <li>- The delivery strategy and the rationale for selecting it in the context of efficient costs;</li> <li>- The specific sources of cost data and the sourcing strategy for this program (if different);</li> <li>- The cost trend over time (actual and forecast), preferably showing declining real costs, but if not, explaining the trend;</li> <li>- The lessons from previously delivered programs and, if any, how they have been accounted for in the cost estimate for this program;<sup>64</sup></li> <li>- Any other efficiencies that have been incorporated;</li> <li>- A breakdown of expenditure, transparently presenting the major categories of expenditure and assumptions regarding such matters as contingency amounts, and</li> <li>- A cost risk assessment and risk mitigation measures.</li> </ul>

### Lack of information in business cases

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.2.2 para 145	<p><i>Switchgear</i></p> <p><i>Ausgrid has an established program for switchgear replacement. ... We note that there is no direct expenditure provision for replacement on failure because Ausgrid intends to manage such failures within its total repex budget.</i></p>	<p>The addendum to ACAPS2012 that EMCa draws this statement from is specific to a single site (City East Zone) and does not suggest the configuration, risks and solutions for this site are generally applicable for Ausgrid.</p> <p>For EMCa to infer that this is therefore the approach for all of the “established program for switchgear replacement” is incorrect and suggests they have misunderstood the document.</p>	<p>We do not understand why Ausgrid has attributed this comment to our concern about the quality of information in business cases. Para 145 was but one aspect of our attempt to understand Ausgrid's asset strategy and proposed expenditure.</p> <p>We accept that we may have misunderstood Ausgrid's intention in this case, but it does not diminish our <i>general</i> concerns with the quality of the business cases.</p>
S5.2.2 para 149	<p><i>Switchgear</i></p> <p><i>Limited information is provided to demonstrate that the cost estimate for the work is efficient.</i></p>	<p>This is in relation to the switchgear replacement strategy. The analysis of costs and alternatives for these projects is undertaken in the relevant Area Plans, where all manner of drivers for major investment in an area are considered together to provide the least cost outcome.</p>	<p>We acknowledge that we did not read the entire suite of documentation available as part of our review as this was not possible within the scope of our work for the AER.</p>

<sup>64</sup> We acknowledge the efficiency initiatives included in Sections 5.1 and 5.3 of Attachment 5.15, however it is not clear when the benefits will be realised, the quantum of the gains, and whether or not these have been included in the forecast costs



Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
		<p>This is also where the range of alternatives to achieve retirement of the poor condition switchboards is undertaken.</p> <p>EMCa only reviewed one Area Plan and chose one that had no relevance to the switchgear program.</p> <p>In addition, all major projects are subjected to multiple levels of review and challenge via the investment governance process to ensure they are necessary and as cost effective as possible.</p> <p>The Area Plans and the costing information that supports them, which was provided as part of the initial proposal has ample descriptions of the cost and benefits of the switchgear program elements.</p>	<p>However, in ACAPS2012 there is limited information provided to demonstrate that the cost estimate is efficient.</p> <p>Cross-referencing applicable Area Plans and the documentation that demonstrated that the cost estimate for the work to be undertaken under the Replacement &amp; Duty of Care category would have been helpful. There is only one relevant reference to a particular Area Plan in ACAPS2012 (in the Addendum).</p> <p>As discussed in our response to Ausgrid's feedback on para 181, above, we outline the sort of information that we believe would support claims of forecast efficient costs. From our review of the referenced cost estimate source documents (Attachment 5.15, and ID33420, we remain of the view that insufficient evidence has been provided to demonstrate efficient costs.</p>
S5.2.5 para 181	<p><i>Secondary systems</i></p> <p><i>Neither ACAPS2003 nor 2009 provide sufficient evidence that the costs incurred, or forecast to be incurred, in undertaking the proposed volumes of secondary equipment replacement are efficient.</i></p>	<p>The derivation of unit costs is not contained in the individual ACAPS documents. Unit costs are derived in accordance with a standardised methodology described in the methodology attachment to our initial proposal. The unit costs derived are listed in a confidential attachment "ID33420_Replacement and DOC plans Unit Rates". This latter document was not reviewed by EMCa.</p>	<p>Refer to comments in relation to a similar response by Ausgrid in relation to paragraph 181 above.</p>

### Lack of a delivery strategy

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
S5.2.2 para 143	<p><i>Switchgear</i></p> <p><i>The shift in strategy from high voltage to lower voltage circuit breaker replacement is confirmed in Figure 8. The step change towards replacement of lower voltage units implies a large increase in the volume of work and is not adequately explained by Ausgrid. As this is labour intensive brownfields work, this will increase the volume and complexity of network and site access issues and related logistical tasks.</i></p>	<p>Ausgrid acknowledges that a shift from greenfield to brownfield can increase complexity in construction and therefore can place delivery at risk.</p> <p>However, the shift from higher voltages to lower voltages will have the opposite effect. A number of outage constraints arose throughout the last period that led to delays in replacement of higher voltage assets. The shift to lower voltage assets will allow for reduced switching constraints and a more "like for like" type replacement approach.</p>	<p>In our October 2014 report we identified the potential cost risk from inadequate delivery phase planning. Our particular concerns were:</p> <ul style="list-style-type: none"> <li>(i) the absence of a delivery strategy and plan for the entire Work Program that provided assurance that the Portfolio was able to be delivered at an efficient cost;</li> <li>(ii) the absence of information in the business case of recognition of delivery risk for the project and risk mitigation measures.</li> </ul> <p>It may be the case that the higher volume of low voltage switchgear replacement work presents a lower delivery</p>

Reference	EMCa Quote (original report)	Ausgrid response	EMCa response
			challenge than the HV switchgear work, but in the absence of analysis from Ausgrid, we were not convinced.
S5.2.5 para 182	<p><i>Secondary systems</i></p> <p><i>Neither ACAPS2009 nor 2003 contain sufficient information to instil confidence that Ausgrid can deliver a rapid escalation in the forecast volume of secondary equipment work at an efficient cost.</i></p>	<p>This is not a relevant consideration in what is, in reality a minor program of work. Ausgrid manages delivery strategy at the overall portfolio level, including both capex and opex activities, not at the individual program level. Delivery groups are involved in framing programs to provide feedback on delivery issues if there are peculiarities. However, it is not relevant to attribute delivery concerns to an increase (in the case of ACAPS 2003&amp; 2009) of \$40m over 5 years in the context of Ausgrid's program.</p>	<p>Our concerns about Ausgrid's capacity to deliver the proposed increased repex program were based not only on the secondary systems program of work but also:</p> <ul style="list-style-type: none"> <li>(i) our review of the sample of repex expenditure categories;</li> <li>(ii) the absence of a portfolio level delivery strategy for the 2014-19 RCP for our review; and</li> <li>(iii) Ausgrid's failure to deliver the planned work in the previous RCP.</li> </ul> <p>We consider that the capacity of specific skill sets required to efficiently deliver significantly increased volumes of work can be underestimated in repex programs due to the added complexities of undertaking brownfields work safely and reliably.</p> <p>We believe prudent project management practice and compelling business cases include a project-level assessment of delivery risk which both informs and draws upon the portfolio level delivery strategy and plan. In the absence of such analysis, we were unconvinced that the 300%+ increase in work in the secondary systems category could be delivered at the forecast cost or that if the budget was to be maintained, the required volume of work would be completed in the 2014-19 RCP.</p>

# Appendix E Documents reviewed

165. In providing advice to the AER in response to Ausgrid's RRP (this report), EMCa reviewed a number of documents specific to Ausgrid's revised replacement expenditure. Refer to Table 4 below.

Table 4: RRP documents reviewed for this assessment

Document Title
Revised Regulatory Proposal 1 July 2014 – 30 June 2019, 20 January 2015
Attachment 1.16 – Jacobs – System Capex and Maintenance Prudency Assessments, January 2015
Attachment 5.07 – Assessment of EMCa technical review
Attachment 5.09 – 2014 Replacement plan review, January 2015
Attachment 5.11 – Quantitative risk evaluation – selected replacement projects
Evans & Peck, Capital Program Optimisation Methodology, June 2010
Ausgrid, ID82462_INV-STD-100035 Replacement Planning_140328
Ausgrid, ID00216_Board Policy Governance - Risk Management_140507
Ausgrid, ACAPS2012- Zone substation 11kV circuit breakers, March 2014
Attachment 5.05 - Strategic delivery and workforce plans for 2015-19
Ausgrid, Planning Standard INV-STD-10024 Economic Appraisal
JacobsSKM, Subtransmission Cable Replacement Strategy, Peer Review, 30 April 2014