Technical Review of Regulatory Proposals

Review of Proposed Replacement Capex in Endeavour Energy's Regulatory Proposal 2014 - 2019

Report to

Australian Energy Regulator

Energy Market Consulting associates

Strata Energy Consulting

October 2014

This report has been prepared to assist the Australian Energy Regulator (AER) with its determination of the appropriate revenues to be applied to the prescribed transmission services of Endeavour Energy from 1st July 2014 to 30th 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.

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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 Endeavour Energy prior to 5th September 2014 and any information provided subsequent to this time may not have been taken into account.

Energy Market Consulting associates
605 / 657 Pacific Highway, St Leonards, NSW 2065
and
F1.2 / 572 Hay St, Perth 6000
AUSTRALIA

Email: contact@emca.com.au
Web: www.emca.com.au

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 access and regulatory arrangements. Its Managing Director, Paul Sell, is an energy economist and previous Partner in Ernst & Young and Vice President of Cap Gemini Ernst & Young (now Capgemini). Paul has advised on the establishment and operation of energy markets and on matters such as electricity network open access, pricing and regulation and forecasts for over 30 years.

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.

Authorship

Prepared by:	Paul Sell, Bill Heaps, Mark de Laeter and Gavin Forrest
Quality approved by:	Paul Sell
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Findings

Repex prudency undermined by systemic failings

1. We have identified systemic issues in Endeavour's activity forecasts that, in our view, have led to its repex need being significantly overstated. Its repex forecast is likely to have overestimation bias due to:

    - Inadequate options analysis (including lack of cost/benefit analysis) and lack of justification of the timing for resolving the condition-based issues identified and, therefore, the volume and cost of activity proposed for the 2015-19 RCP;
    - Inadequate explanation of the degree of step-change evident in expenditure proposed at the sub-category level; and
    - Inadequate evidence of efficient costs.

2. This view is supported by:

    - the perceived need for the large downward expenditure adjustment that was identified and applied by the Networks NSE (NNSW) Board; and
    - Endeavour's relatively stable service level performance – Endeavour's proposal does not adequately link its proposed expenditure to performance outcomes.

'Top-down' adjustments likely to be insufficient

3. We understand that the NNSW Board decided to reduce Endeavour's overall capital expenditure proposal by 15%. Normally, we would have increased confidence in a repex program that has had a meaningful 'top-down' challenge. However, such adjustments need to be adequately informed if they are to ensure that the resulting work program is prudent. Moreover, it is not clear by what proportion (if any) the repex component of total capex was reduced.

4. Endeavour believes that the remaining 85% capex allowance is sufficient to meet its objectives and maintain risk at an appropriate level. This position appears to be primarily based on its weighted average remaining life calculation. Endeavour also uses its Value Development Algorithm (VDA) to cross-check its expenditure level.

5. Endeavour maintain that further reductions in expenditure would lead to an unacceptable increase in asset risk (using a lower than acceptable WARL as a proxy for asset condition). However, this assumes that WARL is a suitable proxy for both asset condition and asset risk. It also assumes that the projects and programs of work underpinning the WARL calculation, together with the estimates of remaining life itself, are robust. Endeavour did not provide evidence to validate these assumptions.

6. The fact that a 15% total capex reduction could be made without a material impact on network risk and network performance, and without an apparent asset management-based justification for the reduction, is a strong indicator that Endeavour's forecasting processes have led to an overly conservative risk position and an upwardly-biased expenditure proposal.

Approach to risk is overly conservative

7. Endeavour's investment decision-making relies heavily on risk-based justification. If properly applied, this is appropriate for repex projects and programs of work. However, from our observations, Endeavour tends to overstate asset failure risks (which in turn is used to support higher volumes of repex than is prudently required). Whilst we have found that Endeavour is generally directing its expenditure to the correct asset groups, treating a portion of these assets sooner than required is not in the best long term interests of customers.

8. At the project/program level, we found that Endeavour takes a conservative approach to applying risk assessment criteria. We also found that, at the portfolio level, decision support methods reflect a high level assessment. With a 'bottom-up' portfolio build that is biased towards conservatism, coupled with non-granular decision support tools for 'top-down' review, we believe there is scope for an unjustified volume of work (and associated cost) to be forecast.

Questionable basis for activity forecasts

9. Endeavour's activity forecasts are developed on a bottom-up basis to reflect quantitative asset data (including age, condition and failure rates) to determine probability and consequence of failure according to their corporate risk assessment.

10. Aspects of Endeavour's implementation are susceptible to overestimation bias due to issues relating to the maturity, accuracy and reliability of asset condition data. These shortcomings mean that asset interventions are prioritised based on a high level, conservative approach to using the risk analysis framework. This will tend to bring forward the timing of interventions, increasing activity volumes in the short-term (and potentially also over the long term if the bias is not corrected).

11. Our conclusion is that Endeavour is following an asset management approach that correctly identifies where it should focus its repex, but that its application of the approach to the current Regulatory Proposal is biased towards overstating network risk. The effect of this bias is to overestimate the extent of remedial work required and associated cost. This casts doubt on the prudency of Endeavour's repex, even after the NNSW Board-enforced reduction.

Cost estimation is biased towards overestimation

12. In addition to the need for a 'top-down' adjustment, we found further evidence that Endeavour's cost estimates are likely to be biased towards overestimation, leading to

unjustified costs to customers. Our review of Project Implementation Review reports indicates a systemic bias of actual repex being considerably less than forecast. Whilst Endeavour claims that it has recognised these shortcomings, we have not seen evidence that this bias has been resolved. This indicates inadequate governance over the cost estimation methodology and its application.

13. Endeavour's estimating process allows for a contingency for risk to be applied at the final (Gate 3) approval stage to individual projects. We believe this is unnecessarily conservative in a portfolio forecast and recommend that the aggregate contingency amount in Endeavour's repex portfolio forecast should not be allowed. Whilst Endeavour claims that it has recognised these shortcomings, we remain unconvinced that the cost estimation approach applied in developing its expenditure forecasts is sufficiently robust. As such, there is an increased likelihood that Endeavour will prudently incur lower expenditure during the period than it has proposed.

Conclusions

14. Endeavour significantly over-estimated its replacement expenditure requirements in the prior RCP. It claims to have achieved significant efficiencies and to now have materially improved its asset management methods. It contends that this is evident in the significant decline in repex over the final two years of the prior RCP. Despite these claimed improvements in operational asset management, Endeavour has nevertheless forecast increasing repex from recent levels. We have not seen evidence to clearly show how claimed efficiencies and improvements have been incorporated into its forecasts. We are not convinced that Endeavour has provided sufficient justification for the extent of repex work proposed.

15. In summary, there are significant flaws in Endeavour's repex proposal. We consider that its proposed repex allowance overstates the prudent and efficient amount that it will reasonably require.

1 Introduction

1.1 Purpose of this report

16. The purpose of this report is to provide the AER with technical advice on the network replacement expenditure that Endeavour Energy (Endeavour) has proposed as part of its Regulatory Proposal (RP) for the 2015 – 2019 control period. The assessment contained in this report is intended to assist the AER in establishing an appropriate capital expenditure allowance as an input to its Draft Decision on Endeavour's revenue level.

17. Our assessment is based on a limited scope review in accordance with the terms of reference. It does not take into account all factors or all reasonable methods for determining an expenditure allowance in accordance with the National Electricity Rules (NER). We understand that the AER will establish a capital expenditure allowance for Endeavour based on assessments undertaken by its own staff and that other advisers are also contributing to this assessment.

1.2 Scope of requested work

18. The AER issued a Scope of Work to EMCa on 17th July 2014, requesting assistance in identifying any systemic issues that may be resulting in forecasting biases in Endeavour's RP. The requested assistance was to "identify whether Endeavour's processes, systems, behaviours and/or cultures are leading to any biases in the capex[1] forecasts" and if so to "identify whether these would lead to the capex forecast not meeting the capex criteria."

19. The AER noted three areas in which it considered there may be systemic issues:

- Whether Endeavour's forecast is reasonable and unbiased;
- Whether Endeavour's costs and work practices are prudent and efficient; and

[1] The scope was subsequently narrowed to a review of replacement capex ("repex") only

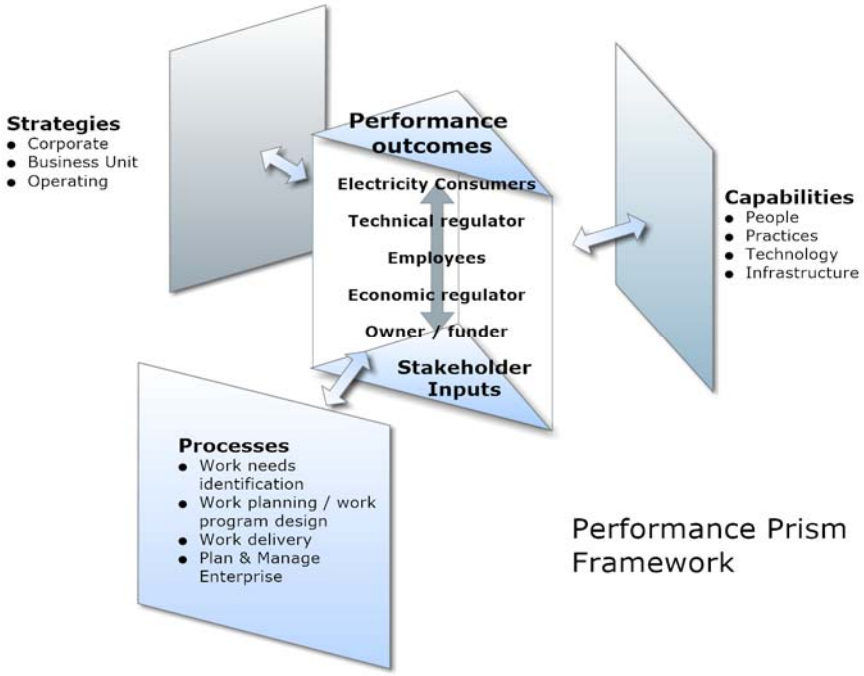
- Whether Endeavour's risk management is prudent and efficient.

20. The AER asked us to consider a number of specific matters. These are set out in Appendix A and summarised below.

- Whether the business' forecasts, forecasting practices, and assumptions are reasonable and unbiased.
- Whether differences between historical forecasts and actual expenditures stem from prudent and efficient responses to changes in the business circumstances.
- Are resources estimates and unit-rates reasonable and unbiased? Is investment timing unbiased and reasonably optimal?
- Are the business' (implicit or explicit) identification, characterisation and evaluation of risk reasonable and unbiased?
- Are risk treatments reasonably optimal in terms of customer costs and benefits?

21. We proposed an approach based on assessing the "performance prism" in which the performance outcomes of the business are determined by its strategies, processes and capabilities, as shown in the following diagram.

Figure 1: Performance Prism Framework



Source: EMCa, adapted from Performance Prism concept[2]

22. The AER asked us to proceed with this work on 30th July 2014. We assessed for systemic issues through a desktop review of: (i) governance and management documentation; (ii) planning, forecasting and budgeting process documentation; (iii) planning and forecasting tools, documentation and input assumptions for each of the material "asset fleet" strategies and plans; and (iv) through an all-day on-site meeting at which Endeavour executives described their use of this performance framework. To

[2] Neely, A.D., Adams, C. and Kennerley, M. (2002), The Performance Prism: The Scorecard for Measuring and Managing Stakeholder Relationships, Financial Times/Prentice Hall, London

further evidence what the business does, we also reviewed a sample of projects and programs.

23. The assessment in this report is based on the information provided to us through this process.

1.3 Structure of this report

24. Our main findings are summarised at the beginning of this report.

25. In section 2, we provide a context overview of the repex that Endeavour has proposed, along with the hypotheses and focus issues that the AER asked us to assess. This overview includes consideration of past repex trends and Endeavour's' past forecasting performance.

26. In the subsequent three sections, we present the assessment that supports our findings. We have structured this as follows:

- In section 3, we describe our assessment of the governance and management processes that Endeavour uses to plan and approve its repex projects and programs, together with any systemic issues that we identified with these processes;
- In section 4, we describe our assessment of the methods, tools and assumptions that Endeavour used to determine its proposed repex forecast, together with any systemic issues that we identified with this forecasting process;
- In section 5, we consider Endeavour's proposed repex by asset fleet and describe any issues that we identified with the proposed expenditure programs. These issues tend to result from systemic issues with Endeavour's: (1) program and project governance and management; (2) expenditure forecasting processes; and (3) application of these processes and/or use of the relevant tools and input assumptions.

2 Background

2.1 Introduction

27. This section provides background context to the assessments which follow. We first set out the repex allowance that Endeavour has proposed, in the context of its total proposed capex and relative to its historical repex.

28. We next summarise the focus issues and hypotheses that the AER has already developed from its initial focus assessment and from its top-down assessments of proposed repex, using other techniques.

29. Finally, we consider Endeavour's repex forecasting performance as evidenced from variance analysis comparing its historical repex with the repex that it claimed to require at the previous revenue reset, coupled with any explanations that Endeavour has provided for those variances.

2.2 Summary of Endeavour's proposed repex

30. In its RP, Endeavour proposes to spend $923m on "Asset renewal/replacement", or an average of $184m/year over the five year RCP. We have taken this to reflect the "network repex" amount that the AER has asked us to review.

Table 1: Proposed capex in Endeavour's RP – "Asset renewal/replacement"

Proposal - ($m) real 2013-14

Expenditure category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Growth	120	93	62	77	77	**429**
Asset renewal/replacement	208	198	179	176	162	**923**
Reliability and quality of service enhancer	14	12	13	13	14	**65**
Compliance	30	18	24	23	21	**116**
Other system assets	7	7	8	7	8	**37**
Non-system assets	54	33	29	29	31	**177**
Total	**433**	**361**	**314**	**326**	**312**	**1,746**

Source: Endeavour Revenue Proposal, table 18, page 62

31. Endeavour's proposed asset renewal and replacement expenditure is not further disaggregated in its RP. However, Endeavour's Regulatory Information Notice (RIN) data provides disaggregated proposed "Replacement expenditure" totalling $740m (averaging $148m/year) as shown in Table 2 below. This amount excludes capitalised overheads, which are applied at a project and program level as "indirect costs". The apportionment of these indirect costs to repex has not been provided. The RIN also shows a "balancing item" for which there is insufficient information to ascertain whether or to what extent this relates to repex.

32. It can be seen that Endeavour's total capex of $1,746m as proposed in its RP equals the total proposed capex in its RIN data, after netting off capital contributions. However, the proposed repex values are markedly different. Proposed repex in the RP is $923m, whereas proposed repex in the RIN documentation is $740m. Our understanding is that the difference reflects some combination of 'capitalised overheads' and 'balancing items'.

Table 2: Proposed capex in Endeavour's RIN – "Replacement expenditure"

RIN - ($m) real June 2014

Expenditure category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement expenditure	169	160	142	140	129	740
Connections	15	15	15	15	16	76
Augmentation Expenditure	116	64	39	50	46	315
Non-network	54	33	29	29	31	176
Capitalised network overheads	38	36	36	37	36	183
Capitalised corporate overheads	25	23	25	26	27	126
Balancing item	76	90	88	89	89	433
TOTAL GROSS CAPEX (includes capcons)	**493**	**422**	**375**	**386**	**372**	**2,048**
Capcons	60	60	60	60	60	302
TOTAL GROSS CAPEX (excludes capcons)	**433**	**361**	**314**	**326**	**312**	**1,746**

Source: Endeavour RIN data

33. Our scope of work is to provide technical advice on the proposed programs and expenditure levels for repex only. Accordingly, we did not seek to reconcile the overall capex information provided by Endeavour. We used RIN data to identify proposed repex and establish the relative magnitude of expenditure trends between the forthcoming and prior periods. The RIN data was the only available source of disaggregated historical and forecast repex time series information. We have assumed that the RIN data contains all direct costs for replacement programs as required by the AER and as referred to in the Board's certification of key assumptions[3].

34. Table 3 below and associated graph (Figure 2) show Endeavour's proposed repex by asset group, relative to actual expenditure in the prior RCP. The major expenditure items, and major changes in the mix of expenditure can be clearly seen in this data. Overall, there is a 5% reduction in forecast repex compared to the prior RCP. The following features of this data are evident:

- At $137m, replacement of overhead conductors is the largest proposed program - this represents a 30% expenditure increase compared to the prior RCP;
- Endeavour's proposed SCADA expenditure of $108m is the second largest program - this represents a 122% increase on expenditure compared to the prior RCP;

[3] Endeavour RP Attachment 0.06: Board Certified Key Assumptions

- Endeavour's proposed zone and sub-transmission substation renewal / replacement is also large, at $99m; however, this represents a 70% decrease on expenditure compared to the prior RCP;
- Other proposed programs over $50m that show increases relative to the prior RCP include pole and pole top structures ($82m), underground cables ($76m) and switchgear ($57m). Endeavour also proposes spending $69m on transformers, which is slightly less than in the prior RCP.

35. In section 5, we return to consider the implications of our assessment of systemic and asset fleet-specific issues for repex expenditures for the most dominant asset groups (i.e., based on proposed expenditure).

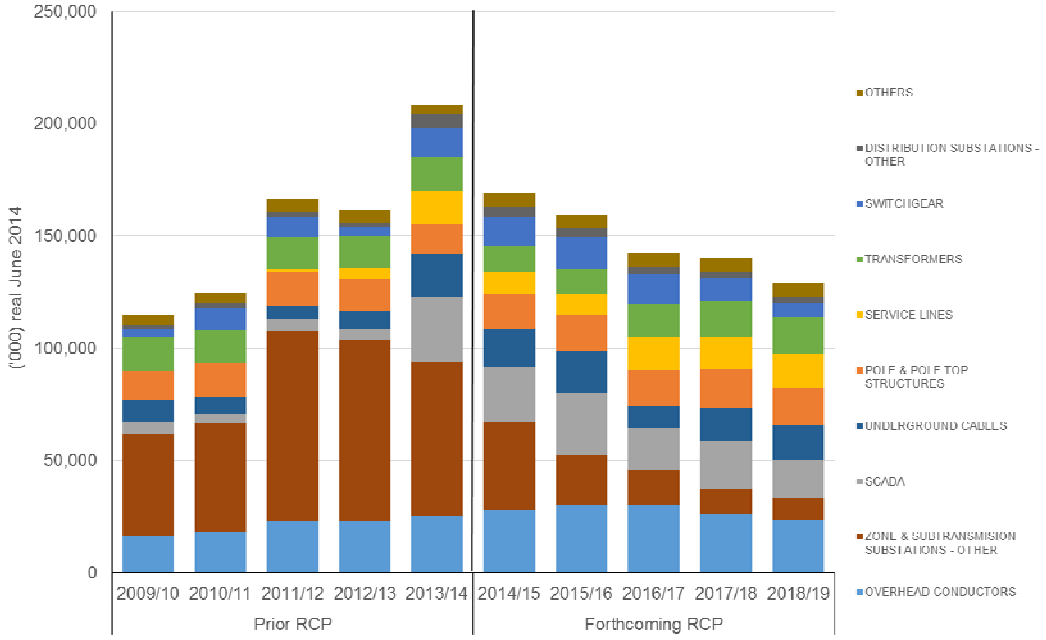
Table 3: Proposed repex by asset group compared with prior RCP expenditure

	Prior RCP	Forthcoming RCP						
ASSET GROUP	Total	2014/15	2015/16	2016/17	2017/18	2018/19	Total	% ±
OVERHEAD CONDUCTORS	**105,534**	27,937	29,761	29,830	26,260	23,659	**137,446**	**30%**
POLE & POLE TOP STRUCTURES	**71,624**	15,941	15,844	16,195	16,927	17,171	**82,078**	**15%**
SCADA	**48,737**	24,160	27,045	18,396	21,470	17,129	**108,200**	**122%**
SERVICE LINES	**21,614**	9,893	9,754	14,650	14,650	14,650	**63,596**	**194%**
SWITCHGEAR	**38,809**	12,864	14,120	13,245	10,430	6,232	**56,892**	**47%**
TRANSFORMERS	**72,718**	11,101	10,978	14,552	15,563	16,548	**68,742**	**-5%**
UNDERGROUND CABLES	**49,558**	16,779	19,073	9,707	15,171	15,024	**75,755**	**53%**
ZONE & SUBTRANSMISION SUBSTATIONS - OTHER	**327,900**	39,485	22,752	16,142	10,694	9,565	**98,637**	**-70%**
DISTRIBUTION SUBSTATIONS - OTHER	**14,471**	4,767	4,284	3,458	2,849	2,849	**18,206**	**26%**
OTHERS	**24,589**	6,259	5,961	5,961	5,961	5,961	**30,102**	**22%**
TOTAL	**775,555**	**169,187**	**159,571**	**142,136**	**139,974**	**128,787**	**739,656**	**-5%**

Source: Endeavour RIN

36. Figure 2 compares five years of forecast expenditure with five years of actual expenditure to show Endeavour's ten year repex trends by asset group. In this graph, the increase in overhead conductors work can be seen to be part of a steady upward trend through the prior RCP. The considerable drop-off in zone and sub-transmission substation work is also evident. Work on poles and pole-top structures can be seen to be part of a relatively steady program throughout the ten-year period, as is transformer work. Endeavour's SCADA, underground cables, service lines and switchgear repex all show considerable increases that started in 2013/14 and which have been projected to continue at around the level established in that year.

Figure 2: Repex comparison by asset group – 10 year trend



Source: Endeavour RIN

2.3 Assessment of historical repex

37. After adjusting to $2013/14, Endeavour's proposed total capex for the prior RCP was $3.4 billion and its proposed repex was $902m[4]. We assess that its actual total capex was of the order of $3.0 billion, or 12% less than it had proposed. Endeavour states the majority of the "underinvestment" occurred in 2009/10 and 2010/11, and summarises the reasons for the lower expenditure as follows:

> *"While reductions in demand growth compared to forecasts can explain some of the reductions, we note that there have been a number of relevant factors that explain the reductions. In particular, we note that our peak resourcing strategy and industry reform have also driven reductions to our capital program. We also note that delivery issues also played a part in a lower capex profile to forecast, this was related to the significant increase in resourcing required to deliver the program."*[5]

38. For the forthcoming period, Endeavour states that *"(w)e consider these delivery issues will not arise in the 2014-19 period due to improved processes now implemented, and substantially reduced workload from a smaller capital program."*[6]

39. Endeavour has not provided any information in its Revenue Proposal comparing its actual repex with the repex that it proposed for its prior RCP. Its RIN data shows actual repex of $776m, as shown in Table 3. This data reflects direct costs only and so cannot be directly compared with its prior RCP proposal. However, if the ratio of direct to indirect costs was similar to the current ratio, and if we assume that this is the only material difference between the RIN and RP data for the prior period, then it would appear that Endeavour's actual repex was similar in aggregate to what it had proposed.

[4] We understand that this figure includes indirect costs

[5] RP page 48

[6] RP page 48

40. Endeavour claims to have made efficiency and prudent management improvements over the prior RCP and this this and the achievement in the 2015-19 RCP of one-off supply security requirements will allow it to spend less in the next RCP. Relevant statements from its RPO are as follows:

- *In order to deliver the program, we developed a number of strategies that focused on efficiency and sustainability. The application of these strategies enabled us to deliver our capital program without using our full expenditure allowance.* [7]
- *Our forecast capital expenditure is 43% lower than allowed capital expenditure for 2009-14. This reflects that we will have achieved the step change in the supply security required under our licence conditions. The lower capital expenditure also reflects strategic re-alignment of objectives under industry reform, with a greater focus on minimising prices for our customers and observed reductions in the rate of growth in peak demand.*

41. In our view, it is relevant to our assessment that Endeavour has not shown what it achieved from its prior RCP repex program relative to what it proposed, nor the extent to which its actual repex program differed from its plans of five years ago and (if so) why. This lack of evident planning continuity, lack of internal assessment of forecasting performance and lack of a strategic narrative for its 2015-19 RCP repex program, raises concerns with regards to Endeavour's ability to forecast a reasonable, prudent and efficient repex program for the next RCP.

2.4 AER's initial focus issues and hypotheses[8]

42. In its preliminary assessment, the AER noted that Endeavour over-forecast capex in the prior RCP and questioned whether this may imply bias or over-forecasting for the 2015-19 RCP.

43. The AER noted the emphasis that Endeavour has given to Weighted Average remaining Life (WARL), in particular its target of maintaining a WARL of 50% ±5%, with no justification for its assertion that "…*the resultant network risk is considered to be acceptable*".[9] The AER also noted that Endeavour appeared to have conflated asset condition with asset age, stating that the "*…WARL… measures the remaining life of the network assets, taking into account both age and condition issues*".[10]

44. The AER drew attention to RP attachment 5.03 – SAMP – Appendix C which sets out Endeavour's risk profile and changes resulting from the proposed expenditure and Appendix A of the same document which provides a prioritised list of projects and associated risk levels. The AER noted that Endeavour indicates that its proposed repex program will result in its WARL decline being arrested and its risk level reducing and questions whether these outcomes justify the level of proposed expenditure and the sensitivity of these outcomes to the level of future expenditure.

[7] RP page 46

[8] The AER's initial assessment was reported to us in its Primary Issue documents numbered 20141002, 20141003, 20141020 and 20142023

[9] RP page 58

[10] RP page 58

45. The AER noted that Endeavour's proposed repex appears to be a bottom-up forecast for the first two years of the 2015-19 RCP and derived from a top-down model for the remaining three years. From inspection of its Strategic Asset Management Plan[11] and its Strategic Asset Renewal Plan,[12] the AER noted that Endeavour's projected risk profiles tended to reduce considerably and to go flat over the period 2019/20 to 2023/24 and queried whether this implies that expenditure might have been inefficiently brought forward into the 2015-19 RCP.

46. The AER raised numerous queries relating to justification of need, timing and appropriate assessment of options at the asset fleet strategy level. They also queried the efficiency and/or forecasting accuracy of a number of unit cost assumptions used.

[11] RP Attachment 5.03

[12] RP Attachment 5.06

3 Governance and management framework

3.1 Findings

Repex prudency undermined by lack of robust information and analysis

47. In some asset categories, Endeavour has inadequate data quality to make an optimal assessment of particular asset strategies and to justify the volume and timing of activity.

48. Endeavour uses an industry standard risk management framework for assessing bottom-up risk, but applies the risk assessment criteria conservatively by overstating the likelihood (or frequency of occurrence) of the worst case event. In aggregate, this results in overstating the risk posed by its assets.

49. Endeavour has failed to provide comprehensive justification for its activity of work – the information presented reflects inadequate options analysis, including a lack of options considered, and inadequate cost-benefit analysis.

'Top-down' adjustments inadequately informed

50. Endeavour uses three decision support tools at the portfolio level: (1) CASH/PIP; (2) WARL; and (3) VDA. The 15% capex reduction imposed by the NNSW board to Endeavour's originally proposed portfolio is evidence of a conservative bottom-up and top-down risk assessment by Endeavour. It is our view that the Board's high-level reduction may be inadequately informed to ensure that Endeavour's repex program is prudent. Further, it is not clear how (or if) this 15% reduction has been applied to repex in the proposal and RIN data. It would be fortuitous if the aggregate forecast adjustment using the CASH/PIP process represents a prudent and reasonable amount.

3.2 Overview

51. The NNSW Board is supported by the Investment Steering Committee (ISC), which reports to the NNSW Board, which in turn is supported by the Network Steering Committee (NSC) and an Investment Evaluation Unit. Endeavour is represented on the NSC.

52. We understand that Endeavour formed its view of the expenditure required to respond to the same three expenditure objectives as its NSW DNSP peers and as directed by the NNSW Board. These objectives are set out below:

- Continuously improve safety performance;
- Maintain the reliability and sustainability of the network; and
- Contain average network tariff increases to CPI for its customers.

53. Endeavour's objectives of safety, reliability and sustainability are typical electricity network management objectives and are appropriate.

54. While Endeavour's objective of containing network tariff increases to CPI could be construed as a cost forecasting discipline, this objective is not within the remit of the NER which, more appropriately, supports the determination of tariffs based on prudent and efficient expenditure allowances. In other words, the process is not driven in the opposite direction. It may be the case, for example, that forecasting expenditure levels to "contain average network tariff increases to CPI" results in an excessive network expenditure forecast and that a prudent and efficient expenditure forecast would allow network tariffs to be reduced.

3.3 Assessment

55. We do not have major concerns with Endeavour's documented governance framework structure, but we do have concerns with regard to the quality of information presented to the various committees and to the NNSW Board from Endeavour and with its application of that governance structure. Specifically, we have material issues with Endeavour's implementation of portfolio management, asset management and project governance frameworks as discussed below.

3.3.1 Portfolio management

Endeavour's approach to portfolio management

56. Endeavour applied the Capital Allocation Selection Hierarchy (CASH) tool and Portfolio Investment Prioritisation (PIP) methodology to its proposed project/program portfolio for 2014-19, as did the NNSW Board. Endeavour's proposed bottom-up investment program was assigned a risk ranking and weighted score through CASH/PIP and was submitted to the Board.

57. CASH/PIP produces weighted project scores and rankings, providing a decision support tool for portfolio management within Endeavour that allows comparison and calibration

with the inputs and outputs of its peer NNSW DNSPs. However, it is based on a simplistic risk assessment and is prone to subjectivity.[13]

58. We would expect Endeavour's management team, in assembling its repex sub-portfolio and in addition to the information contained in the CASH/PIP tool and its other portfolio decision support tools,[14] to have reviewed:

- the investment strategies, volume, cost and benefit assumptions and conclusions for at least the major repex projects (based on the best available information);[15]
- justifications for material step changes in repex;
- the expected impact of the repex program on the state of the network and its performance;
- sensitivity analyses that help demonstrate that increased or reduced repex would be sub-optimal in achieving Endeavour's business objectives; and
- the delivery strategy and plan.

59. Endeavour's bottom-up Strategic Asset Renewal Plan (SARP) results in an average annual expenditure of $156m over ten years (in $2013/14), compared to VDA output of $210m per annum average expenditure with a WARL trajectory acceptable to Endeavour's management.

60. We are not in a position to comment on the specific content or algorithms underpinning these models, but assuming the inputs and algorithms are valid, we acknowledge their usefulness as lead indicators and for 'sense-checking' investment scenarios. However, they are decision support tools and not a substitute for rigorous project/program-level development and governance.

61. Our view of the apparent lack of internal project/program-level rigour is supported by the surprisingly high number of medium risk projects/programs submitted to the NNSW Board[16] and the Board's 15% imposed reduction. This diminishes our confidence that Endeavour's portfolio was subjected to rigorous internal review on either an activity or cost efficiency basis.

NSNW's approach to portfolio management

62. The NNSW Board decided to reduce Endeavour's total forecast capital expenditure by 15%. This decision was informed by the CASH/PIP methodology and was in response to the NNSW Board's objective of reducing expenditure for DNSPs, but only to the extent that a prudent risk level would be maintained.[17]

[13] Ausgrid for example, which has been progressively developing and applying a Capital Optimisation Portfolio methodology based on CBRM and cost benefit analysis

[14] Endeavour also uses its Weighted Average Remaining Life (WARL) and Value Development Algorithm (VDA) tools to provide a view of the impact of different investment scenarios over the long term

[15] Acknowledging that at this stage of the project development lifecycle, there would be a relatively low percentage of projects with business cases – the SARP appears to be the best available source of information within Endeavour (based on the limited additional information provided to us in response to our Information Request)

[16] Assuming that Endeavour has contributed a portion of the 'medium' risk projects identified in the NNSW document, *Delivering efficiencies for our customers, Section 3.3*, Figure 10, May 2014

[17] *Ibid*

63. The -15% capex portfolio adjustment imposed by the NNSW Board indicates that whatever 'challenge' process was used by Endeavour was inadequate, either in terms of the prudency of the repex work proposed (volume and timing) or the cost of the work.

64. Two questions arise from the NNSW Board's 15% reduction:

- Does it result in a reasonable forecast that is prudent and efficient or does further excess proposed expenditure remain?
- Does Endeavour have a firm understanding of the risk implications of the reduction?

65. If the Board followed a similar process to that which we believe Endeavour's management should have followed, then the Board would have a reasonable basis on which to determine an appropriate level of prudent repex rather than rely only on the CASH/PIP (and possibly WARL and VDA) output. We have not seen compelling evidence that: (i) the Board was provided with information of sufficient quality to make a fully informed decision; or (ii) Endeavour has an adequate understanding of its network condition or risk profile to ensure that its proposed expenditure is prudent. The extent of the Board's reduction indicates that any information it did receive was not compelling. Moreover, it is not clear what proportion (if any) of the overall capex reduction was applied to the initially-proposed repex.

3.3.2 Asset management

66. Endeavour's Strategic Asset Management Plan (SAMP) is designed to ensure "*the safety of our employees, contractors and the public, meeting customers' reliability needs; servicing growth in demand; and managing the network efficiently and sustainably.*" Endeavour's asset management strategy is based on not allowing the average age of the network to deteriorate to unacceptable levels.[18]

67. Endeavour's asset management framework is progressively being aligned with good industry practice. It encompasses investment decision policies, governance frameworks and standards and design, operations and maintenance standards.

68. Both the objective and overarching strategy are reasonable. We endorse Endeavour's aim of using condition-based risk analysis and root-cause analysis in identifying replacement/refurbishment needs rather than relying on asset age as a primary driver.

69. Endeavour claim that improving knowledge of its assets during the prior RCP was a factor in reducing its expenditure. However, based on the information provided in the SARP and the business cases provided to us for review, we were unable to assess the quality of the information Endeavour has, nor the quality of the analysis that it derives from available fault data. As discussed in more detail in Section 5, we were not provided with compelling justification for the repex program. There is insufficient evidence of the analysis and information which is typically generated by a quality asset management system.

3.3.3 Program/project capital governance

70. Endeavour now follows the NNSW Capital Governance Framework. Whilst it contains the basic elements, we believe its apparent lack of review gates during the project

[18] Endeavour, *Strategic Asset Management Plan, Sections 2.1.1, 2.3.3.2*, April 2014

development lifecycle is likely to lead to sub-optimal project plans. In turn, this is likely to lead to sub-optimal project execution and failure to realise the intended benefits.

71. We have seen evidence of gate approval submissions, change controls and PIRs, collectively indicating that the process is being followed at least at the high level. However, we are concerned about the quality of inputs and outputs from these steps in the governance program. For example:

- we have observed cases of significant brownfields repex program underspends,[19] but we have not been provided with compelling evidence that the reasons for the underspend are well understood by Endeavour or that the cost estimating process has been enhanced accordingly;
- we have seen evidence of stronger governance imposed on Endeavour's project portfolio by NNSW due to lack of sufficient justification for the proposed scope of work;[20] and
- the NNSW Board imposed a 15% reduction in Endeavour's proposed 2014-19 portfolio without a material impact on network risk.[21]

72. Collectively, this indicates that:

- Endeavour's internal governance process has not been applied with sufficient rigor in developing the current expenditure forecasts, resulting in higher forecast activity (volume and/or scope of work) than is justified; and
- Whilst the NNSW governance process is likely to have resulted in improving the quality of Endeavour's project justification over time, the full effect does not yet appear to have been fully incorporated into Endeavour's proposed repex program for 2014-19.[22]

[19] Forecast vs actual expenditure, eg. (i) Smithfield ZS renewal, (ii) Ringwood ZS renewal, (iii) Kemps Creek renewal PCRs

[20] For example, the required review of the Castle Hill zone substation redevelopment (TS127), memorandum, 20140731

[21] NNSW, *Delivering efficiencies for our customers, Section 3.3*, May 2014

[22] This statement is made cognisant of the 15% reduction in the overall portfolio imposed by the NNSW Board as we are referring here to project-level estimates

4 Forecasting methods

4.1 Findings

Questionable basis for activity forecasts

73. Endeavour has presented inadequate justification for its selected repex activities. Based on the information provided to us: the selected strategies were not subject to robust options analysis; there was an inadequate number of options considered; cost-benefit analysis was rudimentary (where conducted); and there was a lack of sensitivity analysis.

Cost estimation is biased towards overestimation

74. We found evidence that Endeavour's cost estimates are likely to be biased towards overestimation.

4.2 Replacement activity forecasting

4.2.1 Overview

75. Endeavour outlines its intended renewal work in the annual SARP. The process for developing the SARP involves:

- *Identifying specific short-term (1-2 year) renewal needs through analysis of asset age, asset condition and performance analysis and taking account of the consequence of failure;*
- *Formulating a long-term position on renewal needs using asset renewal expenditure modelling;*
- *Collating and integrating short term and long term renewal expenditure needs in the SARP;*
- *Prioritising renewal expenditure; and*

- *Integration and prioritisation against other expenditure in the network investment program, especially to identify and eliminate growth and renewal project overlaps*.

76. Endeavour states that its overarching objective for the asset renewal strategy is "*to achieve an appropriate balance between age or condition-related equipment failures sustainable capital and maintenance expenditure levels."*[23] To achieve this, Endeavour has developed an asset renewal planning framework that includes:

- *High level asset renewal expenditure modelling;*
- *The development of 'bottom-up' short-term expenditure projections for various asset classes based on asset condition;*
- *The development of long-term renewal plans and associated expenditure projections based on prioritisation methodologies for major assets and asset classes; and*
- *The alignment over time of the bottom-up and high level expenditure projections to achieve asset age objectives.*

4.2.2 Needs assessment

Driver for replacement/refurbishment

77. We found that:

- Endeavour presents sufficient information in the SARP to indicate that it has identified the appropriate asset groups to direct its expenditure towards;
- Endeavour appears to have insufficient asset information and asset knowledge for most asset classes, leading to questionable proposed asset activity levels and an over-reliance on the high level VDA/WARL analysis for expenditure beyond 2015/16; and
- Endeavour apparently applies a rudimentary approach to defect/failure analysis. Endeavour acknowledge that it needs to continue to develop its capability in this area, extending the use of Failure Modes, Effects and Criticality Analysis (FMECA).[24]

78. In our experience, age-driven strategies can result in an over-estimation of overall asset replacement activity and sub-optimal risk reduction (i.e., through not targeting the poorest condition, most likely to fail, and/or highest risk individual assets) and we consider that the lack of apparent understanding of defects and failures makes it unlikely that the proposed expenditure represents a prudent forecast of what is required to meet NER objectives.

Risk assessment

79. As discussed in Section 5, we reviewed a number of large repex programs with a primary focus on the reasonableness of the risk assessment. We found that:

[23] 5.03 SAMP section 5.3.1

[24] In the information provided to us, there was scant information provided on fault statistics or root cause analysis; SAMP, *Section 3.5.2*

- The Endeavour Corporate Risk Matrix is consistent with the NNSW equivalent and that it presents a reasonable categorisation and allocation of tolerable and intolerable risk; and
- Endeavour's approach to risk assessment appears to be based on limited fault information and lack of detailed analysis.

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

4.2.3 Options analysis

81. We found the quality of Endeavour's options assessment to be inadequate because of: (i) the lack of robust input data and assumptions; (ii) the paucity of options considered; and (iii) the lack of robust cost-benefit analyses.

Low number of options considered

82. In the available information,[25] the quality of option assessment varied greatly between asset groups and asset classes:

- In many cases, only a perfunctory review of the 'do nothing' option was presented, typically declaring the risk posed by 'doing nothing' to be dismissed as presenting intolerable risk to the business;
- In many cases, only one other option (i.e., the recommended option) was discussed.

83. We would expect that for investment programs of the magnitude proposed, Endeavour would evaluate a range of options, sensitivities and risks with regard to:

- Life extension strategies;
- Hybrids of replacement and life extension strategies; and
- Alternative volumes of work (i.e., deferral or advancement).[26]

84. At the very least, these approaches would provide a sensitivity analysis of the preferred option and should be coupled with a robust cost-benefit analysis to demonstrate that Endeavour has chosen the optimal path to mitigating risk to an ALARP level.

Lack of transparency in determining the prescribed volume of work

85. In the information available, it was not always clear how Endeavour derived the prescribed volume of work to be undertaken. In the project justifications provided in the SARP (and in the few Business Cases provided following our request for such information), there are statements that indicate volumes were decided on the basis of engineering judgement supported by the high level VDA/WARL indicators. We contend that this is inadequate for multi-million dollar program expenditures.

[25] SARP and provided Business Cases

[26] Representative of credible opex/capex trade-off scenarios

Lack of robust cost-benefit analysis

86. In the available information, we found a lack of robust cost-benefit analysis, even for the preferred option. Endeavour's SARP often only presents a qualitative assessment of the cost and benefits to support the chosen investment plan. Again, for at least the major proposed expenditure programs, we would expect to see comprehensive quantitative cost-benefit analyses based on credible input data for a range of credible options.

87. The lack of robust cost benefit analysis for a range of technically feasible options in the information provided by Endeavour in support of its proposal greatly diminishes the prospects of it selecting the right strategy and the optimal volume of work to mitigate the risk to ALARP.

4.3 Cost Estimation

4.3.1 Overview

88. Endeavour uses a combination of top-down and bottom-up approaches to forecast the expenditure for this capex category (with the 'top-down' cross-check of the 'bottom up' forecast based on the outputs of the VDA model):

> *Replacement of high value, low volume assets (such as sub-transmission transformers) are determined using stringent replacement criteria outlined in the Strategic Asset Renewal Plan. The forecast replacement costs of these assets is developed using a bottom-up build based on historical unit rates and current equipment costs and labour rates. Replacement of low value, high volume assets (e.g. poles) is forecast using a top-down approach. The forecasts are based on an average replacement value per year, accounting for network/asset growth and changes in regulatory requirements.*[27]

89. Endeavour '*largely used historical costs to determine the expected costs of completing works, and have modified this where appropriate to reflect site specific factors. Historical unit costs, current labour and contractor rates and materials and equipment costs have been used to develop the bottom-up forecasts.*'[28]

90. We have observed in the information provided, that Endeavour typically applies contingency amounts of between 5-10% to its base estimates.

4.3.2 Cost estimation performance

Approach used for the 2015-19 RCP

91. We have been unable to confirm the extent of repex underspend in the prior RCP (2009-14) on a comparable basis, from the information provided by Endeavour. However, it did underspend its AER capex allowance by $345m (12%) overall, with most of the under-spend in the first two years.

[27] Endeavour, *Expenditure Forecasting Methodology, Section 3.4*

[28] *Ibid, Section 3.5*

92. From the PIRs provided, which are for major substation renewal projects, the average underspend was 28%, not including contingency provisions. Although this is based on a small sample, it is indicative of poor estimating performance.

Approach used for the 2015-19 RCP

93. The SARP indicates that Endeavour's repex programs are at an early stage of estimation, although most programs are continuations of work commenced in the previous RCP. We would therefore expect the estimates in the RCP to be of reasonable accuracy (± 10-15%). However, based on our interpretation of NNSW's and therefore Endeavour's capital approval process, it is not until approval Gate 3 that works must be estimated with accuracy of ± 10% and, based on the information provided, with contingency amounts still included. This provides leeway for Project Managers to achieve budget targets without driving hard for internal and external efficiencies. Of greater concern is that these project-level contingencies appear to be inherent in the portfolio forecast that Endeavour has proposed to the AER and this will, all else being equal, result in an upwardly-biased forecast.

94. We noted in discussions with Endeavour that increasing volumes of units to be replaced should allow some discounts to be realised. Endeavour considered that this would not be the case.

95. We are also cognisant of the $170m forecast cost reduction across the three businesses that is targeted by NNSW's joint procurement initiative. Combined with the apparent immaturity of the estimates for the bulk of Endeavour's proposed repex, this means there is likely to be considerable scope for improving its bottom-up estimates to reduce the overall portfolio cost.

5 Proposed expenditure programs

5.1 Findings

96. We reviewed the information provided by Endeavour in support of its repex program, drawing primarily on the SARP[29] and found the following issues:

- Inadequate options analysis, including lack of cost/benefit analysis;
- Lack of justification of the timing for resolving the condition-based issues identified (and therefore lack of justification for the volume of activity proposed in the RCP);
- Inadequate explanation of the degree of step-change evident in expenditure proposed at the sub-category level;
- Inadequate evidence of efficient costs; and
- Lack of robust delivery risk management.[30]

5.2 Assessment

97. The forecast increase in repex is driven by expenditure in the Conductor, Switchgear, Cables and SCADA, Network Control & Protection asset categories. Accordingly, our review focussed on these major expenditure drivers. Our review of programs and

[29] We also reviewed the Pole Replacement and Steel Mains business cases provided on 29 August 2014 in response to our Information Request

[30] We suspect that Endeavour has more information from its asset management analysis for its 2014-19 repex program, but that it has chosen not to provide the information for review. The business cases provided more information than in the SARP, but did not provide sufficiently compelling analysis to justify the expenditure proposed

projects sought to establish the strategic basis for, and the reasonableness of, the increases in repex for each of these asset categories.

5.2.1 Conductors

Endeavour's strategy for Conductors

98. Endeavour's SARP sets out its strategy to replace 11kV and 22kV overhead mains and hardware on the basis of age and condition '*as they arise*[31] or *within specific line refurbishment programs'*.

99. Endeavour discussed its long aging rural 'steel mains' conductor issues with us at our onsite session and indicated that the solution for the issue was uncertain and that the program was on hold pending a resolution.

100. Endeavour has approximately 800km of these lines currently in service and, according to the SARP, proposes to replace between 600km[32] and 720km[33] over the next 10 years with 550km scheduled for removal in the next six years[34]. The driver for the program is the mitigation of bushfire risk.

101. For its 132kV sub-transmission lines, Endeavour considers that the condition is generally good. We found no documented strategy for this category of assets in the SARP, other than a provision for future works based on condition. This is forecast to increase from 10km per year to 30km per year in the 2020-2024 RCP.

Expenditure trends

102. The repex for conductor replacement over the previous and 2015-19 RCPs is provided in Figure 3 below.

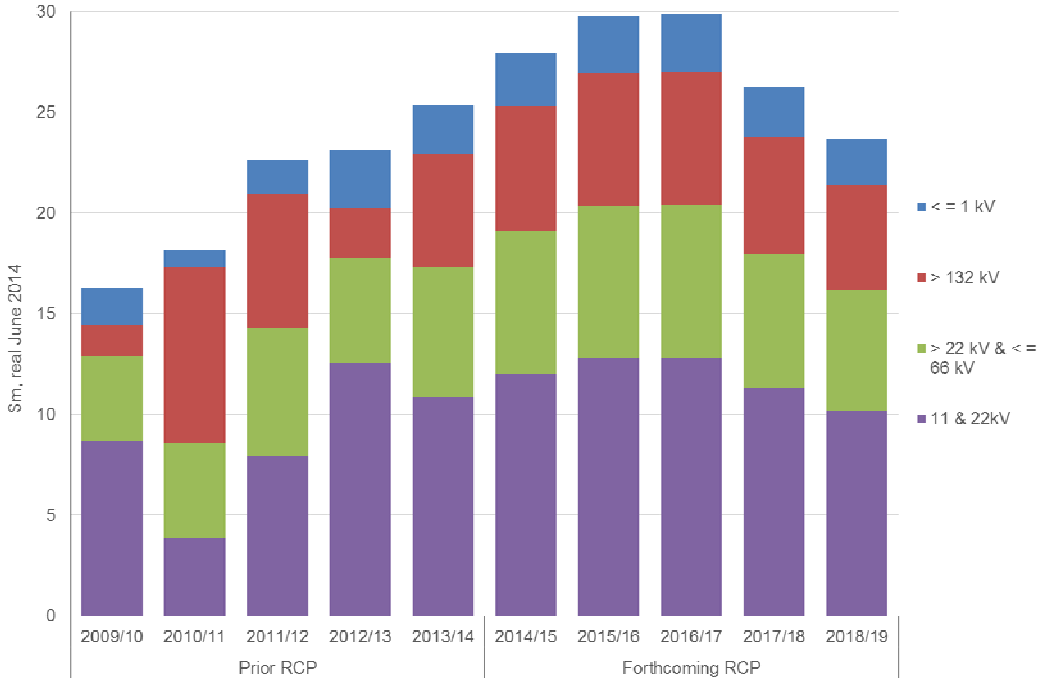
[31] 5.06 SARP page 98

[32] DS011 Steel Mains Business Case

[33] 5.06 SARP section 6.7.5

[34] 5.06 SARP page 360

Figure 3: Endeavour conductor repex compared with historical spend



Source: Endeavour RIN data

103. The information supplied in the RIN appears consistent with a major replacement program being forecast over the 2015-19 RCP for LV, 11kV and 22kV conductors. In our view, the SARP did not adequately explain the RIN data in its entirety.

104. The SARP currently describes the overhead conductor program as including:

> *"...expenditure in this category is at present directed exclusively towards the replacement of steel conductors in distribution lines in rural areas. This has been assessed as a high risk area (due to the potential to initiate bushfires) where insufficient works have been carried out in the forthcoming RCP. In response to the level of risk, the program is being increased in magnitude in the forthcoming RCP."*[35]

Alignment of expenditure and strategy

105. We have been unable to find a compelling explanation of this profile. We have seen limited failure rate information, asset condition data and options analysis in support of the increasing existing and forecast expenditure. Importantly, we note that the steel mains replacement business case states:

> *"Although there is limited recorded information available on the failure of steel mains within Endeavour Energy's network, the regions report that failures are common."*[36]

106. We acknowledge that Endeavour undertook a condition assessment scoping study of its population of steel conductor during 2013/14 to inform its Board of a reasonable program and corresponding risk, as outlined in its business case, but it would appear

[35] SARP, page 19

[36] DS011 Steel mains Business Case, Revision 2.6, 14 May 2013

that the results of this study, if complete, have not been taken into account in the regulatory proposal.

107. We note also that an average replacement of 16km per year was being achieved during the prior RCP and the proposed expenditure corresponds to an increased volume target rate of 60km per year. The increase indicates a significant and sudden change in the risk profile of these conductors, which is not explained in the SARP. The increase also assumes all previous deliverability issues are resolved prior to the commencement of the 2015-19 RCP.

108. Whilst we accept the need for ongoing conductor replacement during the 2015-19 RCP, we remain unconvinced that the level and profile of the expenditure proposed in the RIN is justified and achievable. In addition, such a step change increase in the volume of work would be expected to give rise to deliverability constraints, particularly for this labour intensive work program.

5.2.2 Cables

Endeavour's strategy for cables

109. In its SARP, Endeavour states that for 11kV and 22kV underground cables, "*there are nil requirements or programs for these cables.*"[37]

110. For distribution underground cables, the SARP states that the capital renewal program addresses condition issues which cannot be addressed through maintenance and with a particular emphasis on LV CONSAC replacement.[38]

111. The SARP provides little strategic discussion or assessment of its cable replacement program other than for the aging LV CONSAC cable fleet which poses specific safety issues. Endeavour indicate that CONSAC cable has its own replacement capital renewal program, but a business case and other supporting evidence-based justification has not been provided.

112. The stated volume of CONSAC cable in service varies between 520km and 600km in the SARP. The SARP also states that:

> *"Endeavour Energy's program focusses on systematically replacing CONSAC cables in whole areas where the failure rates are highest."*[39]

113. Other cables have largely been replaced under specific refurbishment programs.

Expenditure trends

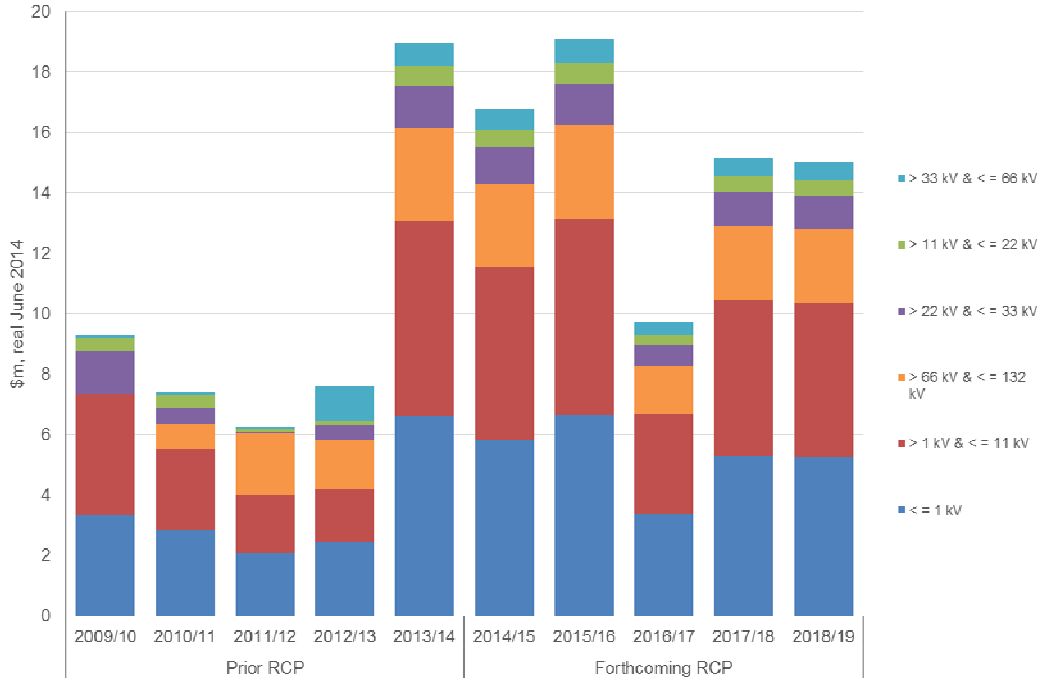
114. The expenditure for cables provided in the RIN is provided in Figure 4.

[37] 5.06 SARP page 101

[38] *Ibid,* page 102

[39] *Ibid,* page 351

Figure 4: Endeavour cable repex compared with historical spend



Source: Endeavour RIN data

115. Historical expenditure provided in the RIN for the prior RCP appears not to be reliable for cables. RCP2 has a quite variable profile largely driven by the 11kV and below replacement programs.

116. The increasing cable replacement expenditure driven by the CONSAC renewal program is evident in the RIN, however, forecast expenditures in the SARP do not readily translate into the RIN data. Further, the SARP states that the replacement volume increases from 2017/18 and then again in subsequent RCPs, but does not explain the dip in 2016/17 expenditure.

Alignment of expenditure and strategy

117. The profile for 2015-19 RCP expenditure is unusual for a program that contains mainly planned replacement expenditure. This is particularly the case for the CONSAC replacement program which would be expected to be relatively constant across the five years. The dip in activity in 2016/17 is not explained in documents nor did Endeavour explain this during our onsite session.

118. The SARP does not set out a longer-term (say fifteen year) strategy to replace CONSAC cables and we would have expected to see this. The proposed expenditure profile for 2015-19 and outer years does not appear to be supported or justified by analysis.

119. Overall, we remain unconvinced that the documentation provided supports the level and proposed profile of expenditure for cable replacement.

5.2.3 SCADA, network control and protection

Endeavour's strategy for SCDA, NC and Protection

120. In the SARP, Endeavour assess its SCADA assets as being in good condition with ongoing programs used to maintain and replace equipment as specific assets' service life expires. Endeavour says that it has applied sustained effort in recent years to replace aging SCADA assets and bring the SCADA network up to current standards.

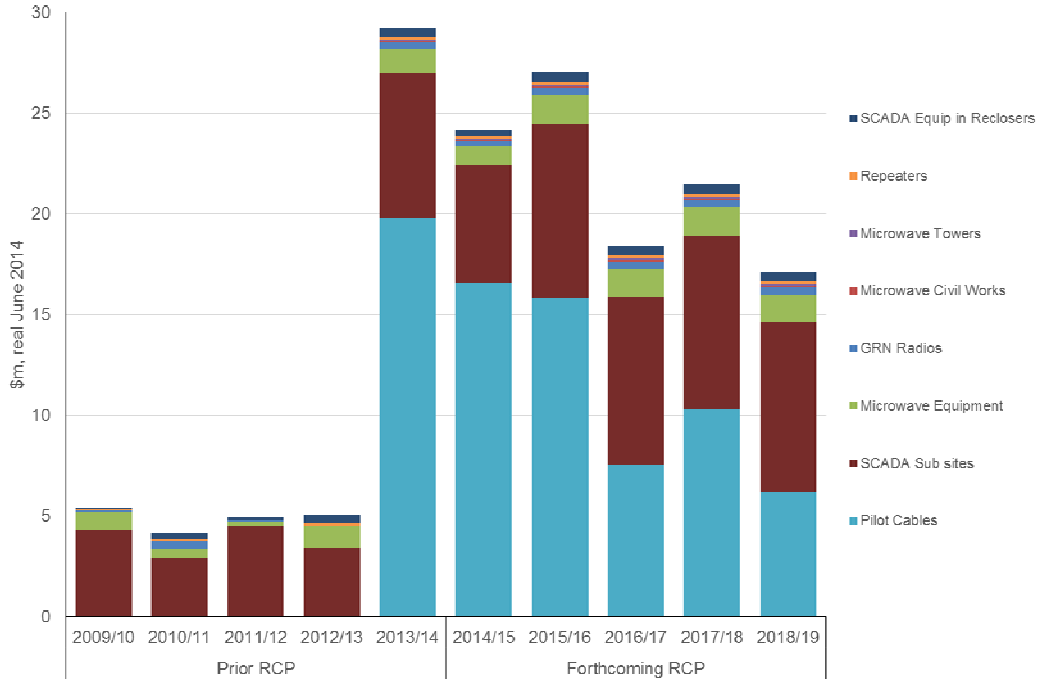
121. Endeavour has a pilot cable network that connects its zone, sub-transmission and a number of distribution substations. These are required for protection signalling and communications. Endeavour state, but do not provide data to support, that many of the pilot cables are approaching end of life and are experiencing increased failure rates. These pilots are being scheduled for renewal.

122. Hardex pilot cables are being targeted for specific replacement programs due to an assessment of poor condition and approaching end of life. Hardex pilot cables are used for differential protection schemes on the 66kV and 33kV feeders. As an overhead earthwire pilot cable, they are also used as an earthwire and for lightning protection.

Expenditure trends

123. Figure 5 shows the RIN repex for this asset category.

Figure 5: Endeavour SCADA repex compared with historical spend



Source: Endeavour RIN data

124. The step change in expenditure in this category can be seen as being attributable to SCADA ($40m) and pilot cable renewal ($56m).

Alignment of expenditure and strategy

125. The information in the SARP for SCADA does not support the increase in expenditure. The fact that Endeavour has applied sustained effort in recent years to bring the assets

up to current standards and its assessment that the condition of the assets is good, does not support the proposed increase.

126. We consider the investment proposal for SCADA replacement should have been supported by a much stronger business case analysis. In particular, we would have expected to see consideration of a more staged implementation of this replacement program.

127. In the absence of more substantial justification than that provided in the documentation available to us (i.e., the SARP description), we are not convinced that such a step change in expenditure has been adequately justified.

128. For pilot cables, we would expect to see a full business case to support an investment step change of this magnitude. Again, the explanation in the SARP is insufficient to support this large expenditure item. In particular, we would have expected to see analysis of failure rates and worst performing assets so as to target and prioritise replacements. The description provided includes additional functions above a direct replacement with potential benefits that should be assessed by such a business case.

129. In the absence of a sound business case we consider that the expenditure on pilot cable replacements is unsupported.

5.2.4 Service wires

Endeavour's strategy for service wires

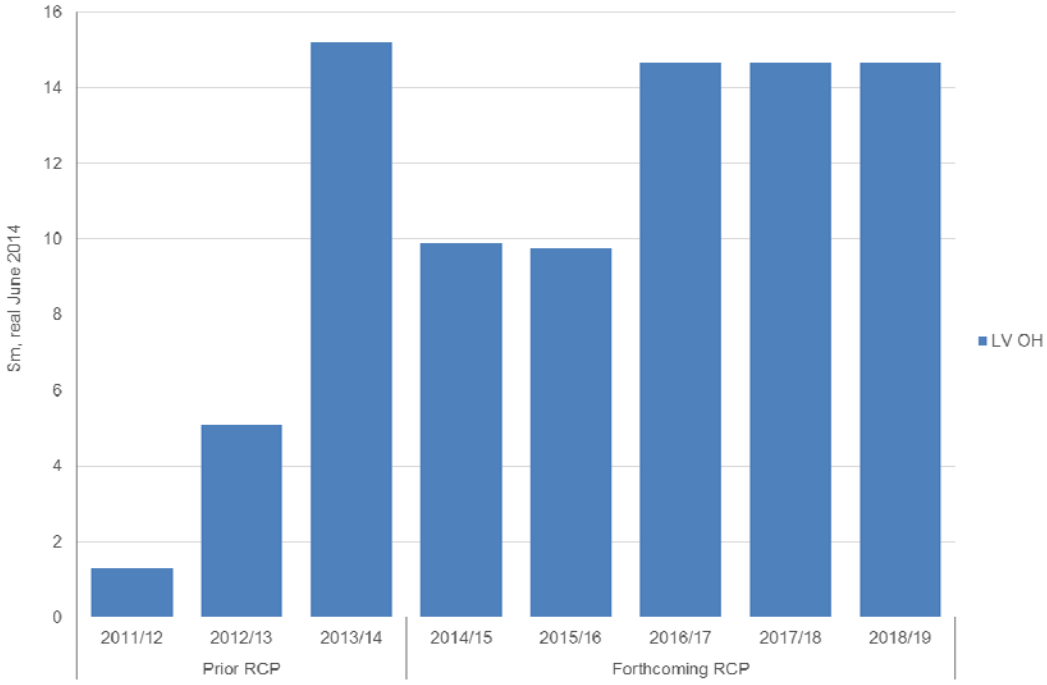
130. Endeavour's SARP sets out its service wire replacement program to inspect and renew service wires based on condition.

131. Endeavour has recently moved from an ad-hoc replacement program following inspection results to a planned replacement using a competitive tender process.

Expenditure trends

132. Figure 6 shows the RIN repex for this asset category.

Figure 6: Endeavour service wire repex comapred with historical spend



Source: Endeavour RIN data

133. The RIN and the SARP show a large increase in expenditure for this program, including a step change in 2016/17.

134. The SARP does not adequately describe the change in expenditure.

Alignment of expenditure and strategy

135. The information in the SARP for service wire does not support the increase in expenditure or the rationale for moving from a reactive to a planned program of this magnitude.

136. Whilst we support the development of a program approach to this type of activity, there is insufficient analysis and justification for the forecast expenditure. In the absence of a more substantial business case, we are not convinced that such a step change in expenditure has been adequately justified.

5.2.5 Switchgear

Endeavour's strategy for switchgear

137. Endeavour has been replacing circuit breakers on the basis of condition, age and volume (smoothing the replacement program over time). A recent change to this strategy has been to extend the life of the breakers, thereby reducing cost. To do this, Endeavour says that it has placed greater emphasis on replacement of individual units based on condition rather than as part of a whole switchyard replacement.

138. Endeavour has four programs specifically for the renewal of sub-transmission and zone substation circuit breakers:

- 132kV circuit breaker replacement program;

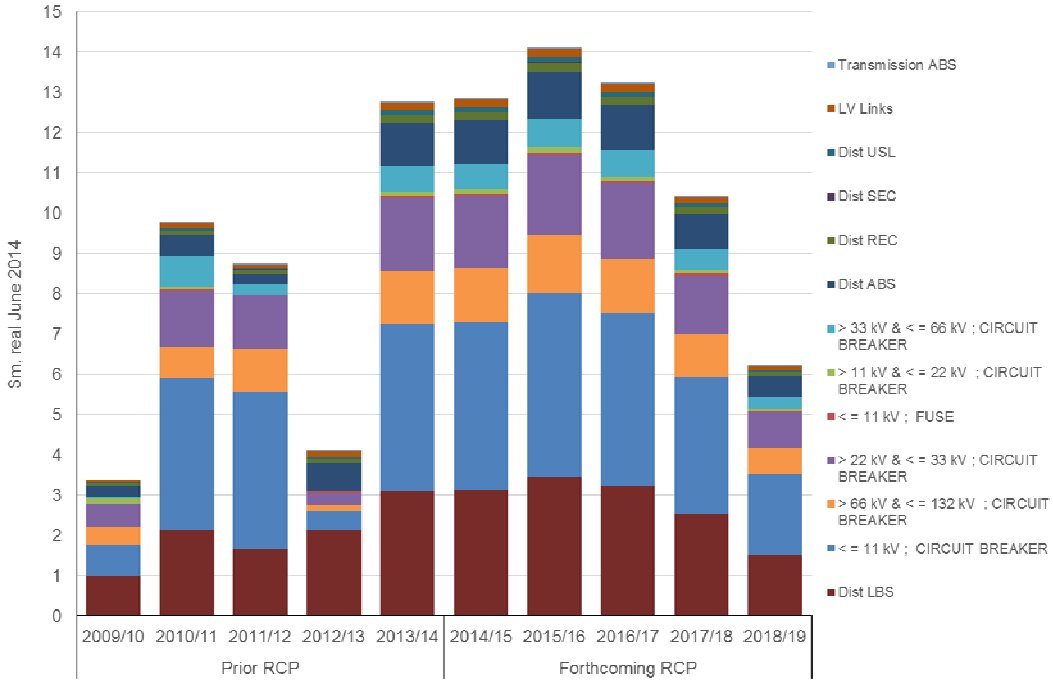
- 66kV circuit breaker replacement program;
- 33kV circuit breaker replacement program; and
- 11 and 22kV circuit breaker replacement program.

139. A large volume of zone substation and distribution switchgear has been replaced under specific substation renewal projects in the prior RCP.

Expenditure trends

140. The repex for switchgear over the prior and current RCPs is shown in Figure 7.

Figure 7: Endeavour switchgear repex compared with historical spend



Source: Endeavour RIN data

141. The aggregated expenditure for the 2015-19 RCP has significantly increased from the expenditure in the prior RCP. The 2014-19 profile presents a marked step up from the historical average. This appears to be the case for all asset classes and types.

142. The expenditure for each for the four strategic replacement programs identified by Endeavour can be seen as the major contributors to the increased expenditure in the 2015-19 RCP.

143. The SARP states that:

"The expenditure in 33, 66 and 132kV circuit breaker replacement is likely to fall below forecast values in the next RCP due to the transition from a strategic replacement model to a more reactive approach of maintaining circuit breakers for as long as practicable.

However, the program of replacement of oil-filled circuit breaker trucks in zone substations is forecast to increase investment over the next two RCPs and will to some

extent balance out the reduction in investment in 33, 66 and 132kV circuit breakers. Overall however, there will be a reduction in investment in this category."[40]

144. For Distribution switchgear, the SARP concludes that the forecast expenditure is likely to be higher until such time as planned replacements achieve the nominated targets.

Alignment of expenditure and strategy

145. We consider that Endeavour's strategy, as set out in the SARP for switchgear replacement appears to adequately address the need for ongoing replacement of the older units. We understand that this program is based on the expected condition (forecast deterioration of the units). We also support Endeavour's intention to smooth the expenditure profile.

146. Whilst Endeavour presents an aging asset portfolio that is likely to develop an increase in end of life failure rates, we have seen insufficient quantitative analysis to support the proposed step change in replacement expenditure in the RIN, and the selection of the optimal timing of this expenditure over the 2015-19 RCP.

147. As an example, the planned ABS replacement strategy DS405 nominates a replacement volume of 130 units in the first year, and assumes this is maintained throughout the 2015-19 RCP. We note that the additional expenditure in the first year appears to be inflated by work from the prior RCP and that the estimates assume 10% of units require motorisation and SCADA.

148. Notwithstanding the safety and operational benefits of installing an enclosed switch, our review has found insufficient justification (including a robust cost/benefit analysis) for neither the volume of replacement work proposed nor for the selection of higher cost replacement options.

149. These issues collectively indicate the likelihood of an over forecasting bias being present for forecast switchgear expenditure in the 2015-19 RCP.

[40] SARP, p423

Appendix A Project Scope

The business forecast is reasonable and unbiased

- Are the forecasting practices and assumptions reasonable and unbiased?
- Note: this applies to all relevant types of forecasts, e.g. expenditures, volumes, resources, performance trends. Among other matters, consideration of practices and assumptions should extend to the standards applied (implicitly or explicitly) over the forecast period.
- Do the differences between historical forecasts and corresponding actual expenditures demonstrate unbiased forecasts?
- Can any variations between historical forecasts and actual expenditure be reasonably explained in terms of prudent and efficient responses to changes in the business circumstances?
- Are the resources estimates and unit rates employed in the business' expenditure forecasts reasonable and unbiased estimates?
- Do estimates include additional works or deliverables that are not related to the identified need(s) for the work?
- Does the business' overall capex works portfolio reflect an efficient allocation of resources over time and ensure delivery of the planned works?

The business' costs and work practices are prudent and efficient

- Do benchmarks demonstrate that the forecast costs are commensurate with industry levels of efficiency after accounting for the reasonable impact of exogenous factors?
- Do the trends in performance outcomes reasonably indicate that the required or efficient service levels are unlikely to be maintained unless additional or modified actions (and hence costs) are taken to intervene?
- Are works reasonably strategically aligned to efficiently allocate resources to the maintenance and development of the network over time?
- Are work practices effective and efficient at achieving the required outcomes with the minimum resources reasonably required?
- In terms of FTE numbers, deployment, insourced versus outsourced resources, do these arrangements reasonably the minimum costs necessary to undertake the work volumes required to achieve the capex objectives and maintain the required or efficient service levels?

The business' risk management is prudent and efficient

- Is the business' (implicit or explicit) identification, characterisation and evaluation of risk a reasonable and unbiased estimate?
- Note: consideration should extend to the nature and character of the hazard, its extent, timing, frequency or realisation, and consequence of realisation including the impact on performance targets and/or performance trends on the required or efficient service levels.
- Is the selection of risk treatment (accept, manage, mitigate, avoid) unbiased and reasonably optimal in terms of customer costs and benefits as well as who can reasonable manage the risk?
- Note: consideration of this aspect should extend to the whether the selection of options (e.g. operational, demand management, risk management, capital based) demonstrates bias in risk management practices (e.g. build the risk out (avoid) rather than manage operationally). Consideration should also include whether the business already treats the risk through other current or planned risk treatments and the implication of this in terms of the significance of the risk and the customer costs and benefits.
- Is investment timing unbiased and reasonably optimal in terms of risk adjusted customer costs and benefits?
- Excluding required (mandated) changes, are any changes in the levels of risk (implicitly or explicitly) commensurate with changes in customer costs or benefits?
- Are work volumes and resources allocated to maintain performance at the required or efficient service levels commensurate with the risk adjusted customer costs and benefits?
- Note: consideration should include how work volumes and allocation of resources reflects targeted management of root causes of that drive performance trends commensurate with the risk adjusted customer costs and benefits.
- Do the relevant applicable standards (i.e. planning, design, asset management, operational standards) applied by the business (implicitly or explicitly) reasonably allocate risk commensurate with the customer costs and benefits?
- Are any risk allowances unbiased estimates of total portfolio level risks?

Appendix B Project reviews

150. In deriving our summary assessment of Endeavour's expenditure programs (presented in Section 5), EMCa reviewed a number of documents presented by Endeavour as part of its 2014-19 Revenue Proposal submission to the AER.

151. The documents were specific to either repex 'programs' (pertaining to asset categories, typically covering high volumes of asset replacement over many years, and found in the SARP) or 'projects' (pertaining to unique parcels of work).

Projects/programs and related reports reviewed (in addition to the SAMP and SARP)

Asset Category	Doc Reference	Document Title
Conductor	DS011	Steel Mains Business Case
Cables	DS006	LV CONSAC cable replacement
	TM133	Hardex pilot cable renewal
Service Wires	SMR-2014-16	Business Case
	SMR-2014-16	Board Paper – Post ISC
	DS007	Service wire replacement program
Switchgear	DS405	Air-break switch replacement
	TS 004	132kV circuit breaker replacement
	TS005	33kV circuit breaker replacement
	TS 007	11kV circuit breaker replacement
	TS055	66kV circuit breaker replacement
Other	DS302	Distribution transformer replacement programs
	TM012	Sub-transmission pole replacement
	DS002	Pole substation refurbishment
	DS005	Pole Replacement Business Case
	Memorandum	Review of Castle Hill zone substation redevelopment (TS127) 20140731
	PIR	TS117 Kemps Creek ZS Tech Review of project outcomes Oct 13
	PCR	Kemps Creek ZS – TS117 Draft
	PCR	TS118 - Smithfield ZS Rebuild
	PCR	TS135 - Ringwood