Technical Review of Regulatory Proposals

Review of Proposed Replacement Capex in Essential 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 Essential Energy (Essential) 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 Essential Energy prior to 5th September 2014 and any information provided subsequent to this time may not have been taken into account.

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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

The application of Essential's capex governance to this forecast is inadequate

1. In our view, the scale of the adjustment applied by the Networks NSW (NNSW) Board (i.e., a 16% reduction to the capex allowance first developed by Essential) indicates that Essential's internal management challenge process for its proposed expenditure, was inadequate, either in terms of the prudency of the repex work (volume and timing) and/or the cost of the work.

2. From the information provided to us, it is evident that Essential followed the CASH/PIP methodology as prescribed by NNSW when assembling and approving its proposed repex portfolio. However, it is unclear what approach Essential used to recast its portfolio following the 16% reduction in overall capex imposed by the NNSW Board. Moreover, it is not clear by what proportion (if any) the repex component of total capex was reduced.

3. The 'Capital Governance Framework' provided to us by Essential appears to be out of date (updated in 2011) and does not reflect our understanding that the framework should operate in accordance with the NNSW Board's requirements.

Asset management approach is still maturing

4. Essential's governance approach includes an asset management framework which does not yet align with good industry practice. We found material issues with its implementation of portfolio management, investment planning and delivery management approaches. Whilst we found that Essential has sufficient asset information to determine which assets need attention, we are concerned that poor data quality and options analysis compromise its decision-making.

Repex program has deliverability risk

5. Essential has proposed increasing repex for the forthcoming RCP. This is likely to be different from historical work due to higher volumes of brownfields work. It does not appear to have applied sufficient consideration to deliverability risks when planning its repex program. In particular, we would expect to see a resourcing and delivery strategy that identified the inevitable resourcing challenges and set out strategies for their

mitigation. We would expect the repex program to be scoped in line with such a strategy.

Questionable basis for activity forecasts

6. Essential's repex activity forecasts are developed on a bottom-up basis. However, the quality of supporting data and analysis is questionable. We found that its approach has:

   - material issues with the quality of its asset data and its asset knowledge base;
   - over-reliance on simplistic forecasting in some asset classes; and
   - overly conservative risk assessments.

7. It was not always clear how Essential derived the prescribed volume of work to be undertaken, or how any associated delivery risk was considered and whether it was mitigated adequately.

8. There was a lack of compelling justification of the need for step changes in activity from the prior to current RCP and of the total volume of work required. This casts doubt on the prudency (i.e., volume, timing and cost) of its proposed repex programs.

Approach to risk is overly conservative

9. Essential's risk-based repex justifications are a cause for concern, due to Essential's use of a variety of risk assessment tools and an apparently over-conservative application of risk criteria. This reduces our confidence that its risk rankings are internally consistent, in turn reducing the likelihood of selecting the optimal mitigation action(s). Its approach to risk assessment often appears to be overly conservative due to unreasonably high frequency assumptions for major and catastrophic consequences.

Options analysis and cost-benefit analysis are inadequate

10. In general, Essential's repex strategies are not subject to robust options analysis. The quality of options 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 that the option was dismissed as it led to intolerable risk; and
    - In many cases only the recommended option was discussed as an alternative.

11. We would expect that Essential would evaluate a range of options, considering life extension strategies and hybrids of replacement and life extension strategies, together with scenarios of alternative work volumes and/or deferral.

12. In the available information, we found a lack of robust cost-benefit analysis, even for preferred options. Commensurate with the magnitude of the repex proposed, we would expect to see comprehensive cost-benefit analyses based on robust input data for a range of credible options. The lack of robust cost-benefit analysis for credible options diminishes the prospect of Essential selecting the correct strategy.

Cost estimation approach is unclear

13. The proposal documentation does not provide adequate visibility of Essential's cost estimation process. Essential did not provide a standalone cost estimation methodology document. We needed to infer its approach from the AMPs and Investment Cases that we reviewed. It is also unclear how Essential's project estimates treat estimation risk

that might arise due to its scope creep experience in the previous RCP. We did not see compelling evidence of Essential's claims that is was pursuing more efficient unit costs. We remain unconvinced that the cost estimation approach is sufficiently robust.

Conclusions

14. Essential has proposed increasing repex requirements in the forthcoming RCP using a questionable governance process and without sufficient evidence. There are flaws in Essential's repex proposal. We consider that its proposed allowance overstates the prudent and efficient amount that it will reasonably require. On balance, we are persuaded that there is justification for Essential to undertake a larger repex program relative to the 2009-14 RCP. However, Essential has not sufficiently justified the amount of increase proposed.

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 (repex) that Essential Energy (Essential) has proposed as part of its Regulatory Proposal (RP) for the 2015-19 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 Essential'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 Essential 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 Essential's RP. The requested assistance was to "identify whether Essential's processes, systems, behaviours and/or cultures are leading to any biases in the capex[1] forecasts" and to "identify whether these biases mean that the capex forecast does not meet the capex criteria."

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

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

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

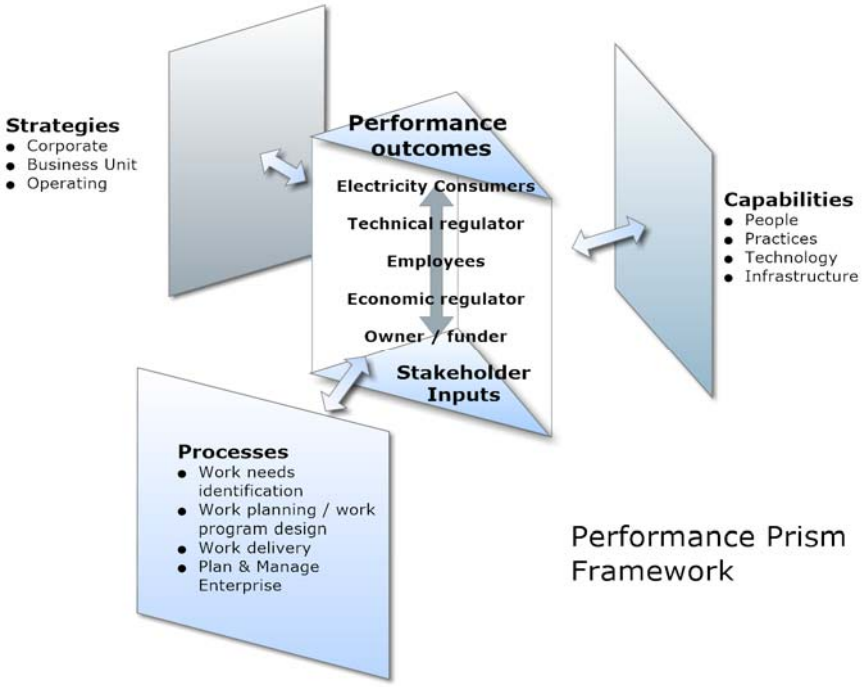
- Whether Essential's risk management is prudent and efficient.

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 Essential 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 findings are summarised at the beginning of this report.

25. In section 2, we provide a context overview of the repex proposed by Essential, along with the hypotheses and focus issues that the AER asked us to assess. This overview includes consideration of past repex trends and Essential'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 Essential 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 Essential used to determine its proposed repex forecast, together with any systemic issues that we identified with this forecasting process;
- In section 5, we consider Essential'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 Essential'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 Essential 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 Essential's repex forecasting performance, as evidenced from variance analysis comparing its historical repex with the repex that it claimed was required at the previous revenue reset, coupled with any explanations that Essential has provided for those variances.

2.2 Summary of Essential's proposed repex

30. From information provided in its Regulatory Information Notice (RIN) documentation, Essential is proposing $857m of total direct replacement expenditure in the forthcoming regulatory period. Refer to Table 1 below. This equates to average annual forecast expenditure of $171m, compared to an average annual spend of $139m in the prior period.

31. We understand that RIN Replacement expenditure covers direct costs only and we note the significant separate line items for capitalised overheads, which are applied at a project and program level as "indirect costs. No apportionment of indirect costs to repex has been provided. The RIN also shows a "balancing item" in its listing of total capex for which there is insufficient information to ascertain whether, or to what extent, this relates to repex.

Table 1: Proposed capex as shown in RIN

RIN - ($m) real June 2014

Expenditure category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Replacement expenditure	154	165	180	177	180	**857**
Connections	6	6	6	6	6	**30**
Augmentation Expenditure	169	155	144	140	137	**745**
Non-network	78	55	55	50	46	**284**
Capitalised network overheads	56	56	57	57	57	**282**
Capitalised corporate overheads	80	79	80	80	81	**399**
Balancing item	92	65	71	64	66	**358**
TOTAL GROSS CAPEX (includes capcons)	**635**	**580**	**592**	**575**	**573**	**2,955**
Capcons	89	61	64	61	61	**336**
TOTAL GROSS CAPEX (excludes capcons)	**545**	**519**	**528**	**515**	**512**	**2,619**

Source: Essential RIN data

32. In its RP, Essential presented capex in the format shown in Table 2 below. We infer that the expenditure of $1,215m defined as "Refurbishment" is equivalent to the AER's definition of "network repex".

33. Total capex as provided in the RIN (and excluding capital contributions) is $2,619m, which is close to, but does not precisely match the total capex of $2,575m proposed in Essential's RP[3]. This aggregate capex difference is not material for the purpose of our assessment. 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 Essential. For the purposes of this report, we used RIN data to establish the relative magnitude of proposed project and program expenditure trends. The RIN data was the only available source of disaggregated historical and forecast repex time series information.

Table 2: Proposed capex

Proposal - ($m) real 2013 - 2014

Expenditure category	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Growth	189	159	140	135	129	**752**
Refurbishment	217	233	255	253	257	**1,215**
Reability	31	33	33	34	34	**165**
Compliance	27	36	39	39	40	**181**
Non-system	77	51	52	44	38	**262**
Total	**541**	**512**	**519**	**505**	**498**	**2,575**

Source: Essential Revenue Proposal, table 5-1, page 40

34. Table 3 below and associated graph (Figure 2) show Essential's proposed repex by asset group, relative to actual expenditure in the prior RCP.[4] The major expenditure items, and major changes in the mix of expenditure can be clearly seen in this data. In section 5, we return to consider the implications of our assessment of systemic and asset fleet-specific issues for the dominant asset groups (i.e., according to proposed expenditure level).

[3] We asked AER about its reconciliation of this information. To date we have not been provided with a response, but we note that in aggregate the difference is 1.7% and we infer that this could be the result of a 6-month shift in the real dollars base (mid-year versus end of year).

[4] There is a small discrepancy between this disaggregated RIN data in Essential's spreadsheet and the aggregate information, which is not explained. The RIN data contains data values only and the aggregate data is not formula-linked to the component values.

35. From this data, it can be seen that the three major asset groups targeted for expenditure are: poles and pole top structures ($319m); switchgear ($155m); and overhead conductors ($79m). Collectively, these three programs equal $553m or 64% of total forecast repex. These proposed expenditures can be seen to generally reflect a continuation of major programs undertaken in the prior RCP. It is also evident from this information that the proposed repex for the three 'poles and wires' categories (i.e., poles and pole top structures, overhead conductors and service lines) has been calculated simply as a 20% increase on prior period expenditure.

36. Essential proposes considerable expenditure (around $80m) on sub-transmission lines and distribution lines refurbishment "balancing items" not included in the prior period, and which further increases 'poles and wires' expenditure relative to the prior period.

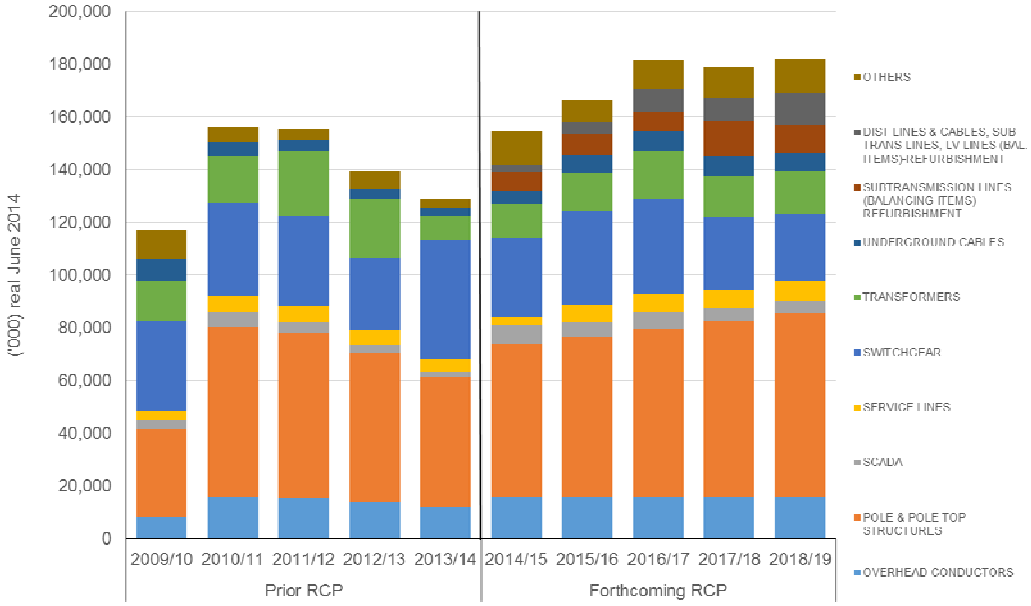
Table 3: Proposed repex by asset group compared with prior RCP expenditure

	Prior RCP	Forthcoming RCP						
ASSET GROUP	Total	2014/15	2015/16	2016/17	2017/18	2018/19	Total	% ±
OVERHEAD CONDUCTORS	**65,739**	15,779	15,779	15,779	15,779	15,779	**78,893**	**20%**
POLE & POLE TOP STRUCTURES	**266,115**	58,178	60,960	63,806	66,723	69,693	**319,361**	**20%**
SCADA	**18,324**	7,040	5,604	6,339	4,667	4,726	**28,375**	**55%**
SERVICE LINES	**25,963**	3,116	6,232	7,270	7,270	7,270	**31,158**	**20%**
SWITCHGEAR	**175,685**	30,085	35,867	35,641	27,504	25,696	**154,792**	**-12%**
TRANSFORMERS	**89,226**	12,786	14,353	18,122	15,648	16,193	**77,102**	**-14%**
UNDERGROUND CABLES	**24,358**	5,016	6,905	7,535	7,535	6,915	**33,906**	**39%**
SUBTRANSMISSION LINES (BALANCING ITEMS) - RE	**0**	7,203	7,559	7,364	13,176	10,468	**45,770**	**100%**
DIST LINES & CABLES, SUB TRANS LINES, LV LINES (	**0**	2,437	4,670	8,484	8,916	12,402	**36,909**	**100%**
OTHERS	**31,978**	13,098	8,304	11,197	11,482	12,502	**56,583**	**77%**
TOTAL	**697,390**	**154,737**	**166,233**	**181,537**	**178,700**	**181,642**	**862,849**	**24%**

Source: Essential RIN

37. Essential's proposed repex of $863m for the 2015-19 RCP reflects an increase of $166m (24%) compared to actual repex of $697m for the prior RCP. From Figure 2 below, it can also be seen that the proposed expenditure allowance would, if the work is undertaken, reverse the decline trend in repex that has occurred since 2011/12.

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



Source: Essential RIN data

2.3 Assessment of historical repex

38. In its prior RCP, Essential's planned repex was $936m, against which it spent 8% more (a total of $1,012m)[5]. In its review submitted as part of the RP[6], Parsons Brinkerhoff attributes this to scope creep and some projects being brought forward to coincide with growth projects, with deliverability constraining some projects.

39. Expenditure in the first three years of the prior RCP was considerably more than the allowance, in the fourth year it was approximately the same, and in the fifth year it was less. PB attributes this slow-down to enhanced governance processes following the commencement of the Networks NSW Board and changes to licence conditions easing requirements and allowing previously-planned projects to be downscaled or deferred.

40. In its RP, Essential states that it "…*re-prioritised its program to respond to actual conditions experienced during the 2009-14 regulatory control period, resulting in significant underspends in the final two years of the period"* and that *"in the last two years of the period, we focused on efficiencies and deferrals to reduce the pressure on charges faced by customers when transitioning to the 2014-19 regulatory control period."* Essential claims that *"(o)ur forecast capital expenditure for the 2014-19 regulatory control period has incorporated the improvements we have made over the 2009-14 regulatory control period."*[7]

2.4 AER's initial focus issues and hypotheses

41. In its preliminary assessment, the AER noted Essential's considerable expenditure variance against its previously-proposed total capex requirements. We find that Essential spent $1.1 billion (nearly 25%) less than its allowance. The AER noted the higher repex, but considered that other capex categories appeared to be poorly forecast with outcomes very different from the forecast.

42. The AER noted significant proposed expenditure of $109m on refurbishment / renewal / replacement of sub-transmission equipment, including zone substation buildings, with little justification other than age.

43. The AER also flagged that Essential proposes a 17% increase in proposed pole replacements, with a lower rate of reinforcement than other DNSPs and unwarranted additional conservatism inherent in the way that it specifies safety factors.

5 Both figures converted to $2013/14. N.B that these values include overheads, and are not comparable with RIN data

6 AER Determination Project – Review of Actual Spend vs Regulatory Allowance. Parsons Brinkerhoff (29 May 2014). Submitted as attachment 5.1 to the Revenue Proposal

7 RP, page 43

3 Governance and management framework

3.1 Findings

The application of Essential's capex governance to this forecast is inadequate

44. Whilst enhanced governance practices imposed by the NNSW Board are evident, there remain gaps between Essential's governance processes and what we would consider appropriate for a utility of its size.

Asset management approach is still maturing

45. Essential's asset management systems, data quality and analysis do not adequately support prudent investment decision-making and justification.

Repex program has deliverability risk

46. We have not seen evidence that Essential has considered how to efficiently deliver the increasing level of repex it has proposed. This risk is exacerbated by the increasing levels of brownfields work in the forthcoming RCP.

3.2 Overview

47. 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. Essential is represented on the NSC. Collectively, this reflects a typical investment governance framework. Our major concerns with this framework are not with the structure itself, but rather with the information presented to the various committees and Essential's conservative asset risk assessments and limited options analysis.

48. We understand that Essential formed its view of the expenditure required to respond to the three expenditure objectives (as set out below) while being cognisant of historical deferred repex:

    - Continuously improvement in safety performance;
    - Maintaining the reliability and sustainability of the network;
    - Containing average network tariff increases to CPI for its customers.

49. Essential's governance approach comprises the most typical elements found in good industry practice - it includes an asset management framework, investment decision polices and standards[8] and design, operations, and maintenance standards. Essential's governance approach seems to be evolving progressively to align with the requirements of NNSW. Its objectives of safety, reliability and sustainability are typical electricity network management objectives and are appropriate. However despite having these elements, we found material issues with Essential's implementation of portfolio management, asset management, risk assessment and delivery management.

50. While Essential'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 well 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

3.3.1 Portfolio management

Essential's approach to portfolio management

51. Essential's Capital Governance Framework appears to be out of date – it was last updated in 2011 – and does not reflect our understanding of the governance framework that now operates in the context of the NNSW Board.[9] Whilst it provides information on project governance, it is largely silent on the approach Essential used to formulate and then recast its capex portfolio to incorporate the 16% capital expenditure reduction imposed by the NNSW Board.

52. We understand from discussions with management that Essential was required to adopt the CASH/PIP[10] methodology for rating and ranking its proposed expenditure for submission to the NNSW Board. CASH/PIP produces project scores and rankings using

[8] Policies: Network Investment and Network Reliability; Standards: Area, Replacement, Distribution, Low Voltage, and a series of Reliability planning standards

[9] The Essential Capital Governance Framework (CEOP2191, p6) refers to a Capital Review Committee chaired by the Managing Director (of Essential) as being accountable for *'reviewing the Portfolio Information produced at a Divisional level to ensure appropriate Corporate visibility and transparency'* – it is not clear whether the CRC still operates within Essential

[10] CASH = Capital Allocation Selection Hierarchy; PIP = Portfolio Investment Prioritisation

a relatively simplistic risk assessment that is prone to subjectivity.[11] We would expect Essential's management team, in assembling its repex sub-portfolio and in addition to the information contained in the CASH/PIP tool, 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); [12]
- 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 its business objectives; and
- the delivery strategy and plan.

53. However, we have not seen compelling evidence of this process at the portfolio level within Essential (i.e., in addition to the CASH/PIP process). This diminishes our confidence that the portfolio was subjected to a rigorous internal review process.

NSNW's approach to portfolio management

54. We understand that the NNSW Board decided to reduce the overall capital expenditure forecast originally developed within Essential by 16%.[13] The advice received from the DNSPs indicates that this decision was informed by the CASH/PIP methodology and was in response to the NNSW Board's objective of reducing expenditure, but only to the extent that a prudent risk level would be maintained.[14]

55. The -16% capex portfolio adjustment imposed by the NNSW Board indicates that whatever 'challenge' process was used by Essential was inadequate, either in terms of the prudency of the repex work proposed (volume and timing) or the cost of the work.

56. Two questions arise from the NNSW Board's 16% capex reduction:

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

57. Essential believes that the resulting 84% of its original forecast is sufficient to meet its objectives and maintain risk at current levels. The fact that a 16% reduction could be made to forecast capital expenditure, without a material impact on network risk, suggests that Essential's planning process delivers an overestimated repex forecast. We asked for, but have yet to receive, information on the process it used to revise its portfolio of expenditure to accommodate the reduction.

[11] Ausgrid has been progressively developing and applying a Capital Optimisation Portfolio methodology based on CBRM and cost benefit analysis which, when fully developed, would be less prone to subjective outcomes

[12] Acknowledging that at this stage of the project development lifecycle, there would be a relatively low percentage of projects with business cases – the AMPS and ICs are the best alternatives within Essential

[13] We were provided with some information on the NNSW process subsequent to our assessment which informs this report. While we have used some such information in the current report, we have not had the opportunity to review the NNSW process and we observe only the reported outcome of that process

[14] *Ibid*

58. We understand that the NNSW Board applied a "sense check" to the CASH/PIP results by reviewing a number of projects and, based on this sample, it reduced Essential's proposed expenditure.

59. However, we have not seen compelling evidence: (i) that the Board was provided with information of sufficient quality to make a fully informed decision; and/or (ii) that Essential has an adequate understanding of its network condition or has undertaken a sufficiently robust investment analysis and portfolio optimisation approach to ensure that its expenditure is optimised. 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

60. Essential's asset management objective is "*to manage the network assets to minimise lifecycle cost whilst meeting the high level network service obligations set out in section 5.3 of the NAMP, and the asset specific obligations set out in each Asset Management Plan, within the risk tolerance of the business*."[15] Essential's asset management strategy is to "*ensure that the average age of the network is maintained within an acceptable range that is consistent with reliability and safety obligations,*"[16] with expenditure programs developed to achieve this outcome.

61. The objective and overarching strategy are both reasonable. We endorse Essential's aim to use condition-based risk analysis and root-cause analysis in identifying replacement/refurbishment needs rather than relying on asset age as a primary driver.[17]

62. Essential acknowledges that improving knowledge of its assets during the 2009-14 RCP was a factor in reducing its expenditure. However, it is clear from the improvement initiatives denoted in its NAMP[18] and the quality of data and analysis supporting its AMPS that Essential does not yet have an effective asset management system capable of producing the right data to support quality analysis and investment decision-making. The lack of a comprehensive asset management system impacts on the management of data, metrics, expenditure and asset management activities and causal analysis.

3.3.3 Program/project capital governance

63. Essential's Capital Governance Framework presents a relatively rudimentary approach to project and program governance. Refer to Figure 3 below. Whilst it contains the basic elements, we query the effectiveness of the peer and other review processes during the project development lifecycle given both the NNSW Board's and our findings about its proposed expenditure. Project plans that are not rigorously tested during the approval process for both prudency and efficient delivery are likely to lead to failure to realise the intended benefits.

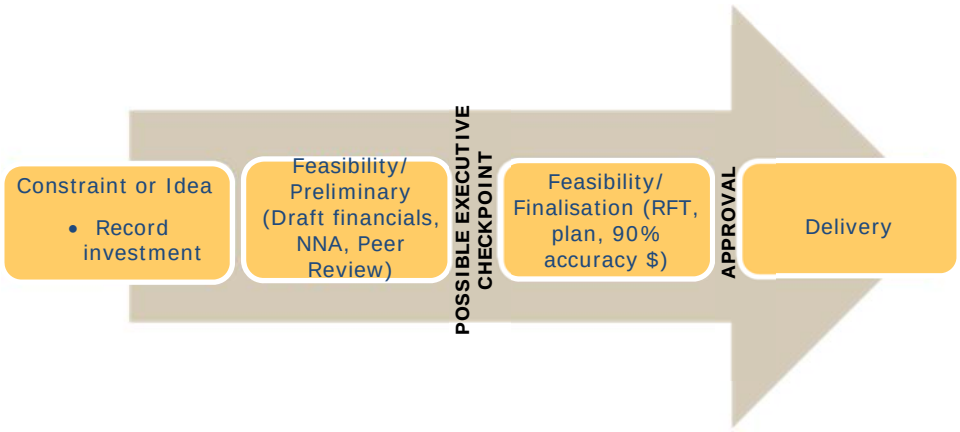
[15] Att 5.2, *Network Asset Management Plan,* page 16

[16] Essential, Regulatory Proposal, p45

[17] Essential, Network Asset Management Plan 2014-19, Section 6.8, p53

[18] E.g. Implementing an enterprise asset management system; developing the structure and high level specifications for a network risk management system to quantify network risks on a common basis; developing CBRM systems for specific assets or asset groups (source: NAMP, Section 8.7, p65)

Figure 3: Essential's capital governance framework for system projects >$2.5M



Source: Essential, CEOP2191 Capital Governance Framework – Capital Portfolio & Investment Approvals

3.3.4 Program Deliverability

64. Essential advises that it has not yet developed a Delivery Strategy or Plan for its proposed portfolio of work. However, it appears confident that be able to deliver the proposed repex with a combination of its own staff and external service providers.

65. There are significant changes between the work programs undertaken in the previous and current periods. Essential intend to use external resources when required and where more cost-effective than using internal staff. Essential also advocates the flexibility of their internal staff to move from major 'greenfields' project work to 'brownfields' repex work.

66. We have not found evidence that Essential has considered these issues adequately or taken them into account when considering the deliverability of its proposed repex. In particular, we would have expected to see a delivery strategy that incorporated the following components: (i) identification of resourcing challenges in moving from greenfields capex to brownfields repex; (ii) mitigation strategies for identified challenges; (iii) an implementation plan; and (iv) the expected efficiencies to be realised from using external resources and other practices.

67. We contrast Essential's position and information with Endeavour Energy. Endeavour has a fully developed Delivery Plan for the current RCP and advises that, during the course of the 2009-14 RCP, it was able to reduce the cost of internal resources by 30% by leveraging off its experience with use of external resources.[19]

68. In the absence of such a strategy it is inevitable that Essential will be operating in a reactive rather than proactive manner and that this will lead to inefficiencies in delivering the planned repex program.

[19] Verbal advice from General Manager Network Development, Endeavour Energy at site meeting, 25 August 2014

4 Forecasting methods

4.1 Findings

Questionable basis for activity forecasts

69. Essential has not provided compelling justification for the extent by which it proposes significantly increasing its repex in the forthcoming RCP. This casts doubt on the prudency of the programs.

Approach to risk is overly conservative

70. Essential's risk-based repex justifications are a cause for concern, particularly due to its apparent over-conservative application of its risk criteria.

Options analysis and cost-benefit analysis are inadequate

71. In general, Essential's repex strategies were not informed by robust options analysis or adequate cost-benefit analysis.

Cost estimation approach is unclear

72. It is unclear, at a detailed level, how Essential has estimated its proposed repex program. We are unconvinced that the cost estimation approach is sufficiently robust to ensure efficient outcomes.

4.2 Replacement activity forecasting

4.2.1 Overview

73. Essential uses an asset management framework which is aligned with PAS 55 and which guides its repex decision-making. Of particular relevance are its Asset Management Plans (AMP) and Investment Cases (IC) for the various asset groups and asset sub-groups, respectively. These define the applicable service levels which are compared to current and forecast capability to identify gaps and root causes. Each AMP identifies the specific refurbishment activities and tasks required for the asset group it

covers. Each IC covers the analysis supporting the recommended expenditure at an asset sub-category.

74. Utilities typically use a risk assessment framework based on the ISO 31000 standard. 'Extreme' or 'high' risks are typically considered intolerable and the objective is to mitigate them to be 'As Low As Reasonably Practicable' (ALARP). Although not stated in these terms, Essential's approach appears generally consistent with these methodologies.

4.2.2 Needs assessment

Driver for replacement/refurbishment

75. Essential uses a combination of asset age, defect rates, and condition assessment to determine the need for proactive or reactive replacement of its assets. We found that:

- Essential has material issues with the quality of its asset data and its asset knowledge base for most asset classes – it acknowledges the need to progressively improve the quality of asset data and information management and intends to pursue a number of improvement initiatives in 2014-19.[20]
- there is a reliance on asset age in some asset classes in the absence of quality condition data, noting that age-driven strategies can result in an over-estimation of overall asset replacement activity and reduced risk reduction (i.e., through not targeting the highest risk individual assets).

76. Whilst in broad terms we believe Essential has enough asset information to determine which assets need attention and to inform its intervention strategy, we are concerned that the following data quality shortcomings compromise its decision-making:

- Detailed asset strategies (e.g., run-to-fail versus replace/refurbish at an asset sub-category level and life extension versus replacement ratios);
- Risk assessment (discussed below); and
- The justified volume of activity over time (also discussed below).

Risk assessment

77. We reviewed a number of large repex programs with a primary focus on the reasonableness of the risk assessment. We found that:

- The Essential Corporate Risk Matrix is consistent with the NNSW equivalent and presents a reasonable categorisation and allocation of tolerable / intolerable risk;
- Essential has taken into account changes in the external environment (e.g., customer and owner expectations and requirements, and changes to standards) and takes account of new or improved asset information in its risk assessment;
- Essential uses at least three risk assessment methodologies - this reduces our confidence that Essential's risk rankings are consistent, in turn reducing the likelihood of selection of the optimal risk mitigation activity;[21]

[20] NAMP, Section 8.7, p65

[21] Our concern is mitigated somewhat at the portfolio level by the application of the CASH/PIP prioritisation model by the NNSW NSC and Board and the subsequent refinements to Essential's overall investment portfolio

- Essential's approach to risk assessment appears to be overly conservative in some cases due to the application of an unreasonably high assumed frequency of occurrence to major or catastrophic consequences; and
- Essential typically applies a rudimentary approach to determining defect trends in the absence of replacement or refurbishment.[22]

78. This does not necessarily mean that a particular repex program is not required. However it does lead to a bias towards over-estimating activity volumes as the resultant intolerable risk ratings all require 'immediate' action according to Essential's and NNSW's Corporate Risk Framework.

4.2.3 Options analysis

79. In general, we found the quality of Essential's options analysis to be inadequate due to a lack of: (i) robust input data and assumptions, including needs and risk assessment; (ii) options considered; (iii) robust cost-benefit analyses; and (iv) process visibility for considering deliverability of the proposed program.

Low number of options considered

80. In the available information,[23] we found that the quality of option analysis varied greatly between asset groups and asset classes:

- In some 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 some cases only one other option (i.e., the recommended option) was discussed.

81. We would expect that for investment programs of the magnitude proposed, Essential would evaluate a range of options, considering the impact on risk of options based on:

- life extension strategies;
- hybrids of replacement and life extension strategies; and
- alternative volumes of work (i.e., deferral or advancement).[24]

82. At the very least, these approaches would provide sensitivity analysis of the preferred option and should be coupled with a robust cost-benefit analysis to demonstrate that Essential has chosen the optimal path to mitigating risk to an ALARP level.[25]

Lack of transparency in determining the prescribed volume of work

83. From the information reviewed, it was not always clear how Essential derived the prescribed volume of work. Most Investment Cases included statements to advise how factors such as resource availability and risk severity were taken into account. However,

22 This is an essential aspect of options analysis – using Weibull trajectories or distributions to predict the increase in defect rates with time in the absence of replacement or refurbishment is a commonly accepted improvement to linear regression or similar analysis and is used by Essential in its pole replacement analysis

23 AMPS and Investment Cases

24 Representative of credible opex/capex trade-off scenarios

25 That is, to be consistent with Essential's stated asset management objective

in some cases, there was a lack of detailed justification of the need for a step change in activity from the prior to current RCP, or of the total volume and timing of work required.

84. Sensitivity analysis to show an increase or reduction in risk with volumetric adjustments, coupled with a compelling view of the overall resourcing strategy and plan, would provide more confidence in the recommended expenditure.

Lack of robust cost-benefit analysis

85. In the available information, we found a lack of robust cost-benefit analysis, even for the preferred option. Whilst Essential typically provides a reasoned qualitative assessment of the cost and benefits to support the chosen investment plan, for the magnitude of the expenditure programs proposed we would expect to see comprehensive quantitative cost-benefit analyses based on credible input data for a range of credible options.

86. The lack of robust cost-benefit analysis for a range of technically feasible options greatly diminishes the prospects of Essential selecting the right strategy and the optimal volume of work to mitigate the risk to ALARP.

4.3 Cost estimation

4.3.1 Overview

87. In general, Essential uses a combination of 'bottom-up' estimates and historical-based methodologies to estimate repex unit costs.

88. Essential's bottom-up estimates appear to be based on unit cost components that are aggregated based on the scope of work. Historical costs are derived from the most recently available project cost information, updated to account for inflation and any other relevant adjustments.[26]

89. We have not been able to establish how Essential constructs its estimates. For example, it is not clear whether (or how) Essential applies contingency costs at either a project or portfolio level.

4.3.2 Cost estimation performance

Approach used for the 2009-14 RCP

90. Parsons Brinkerhoff provided a report[27] with high level information on Essential's repex performance in the prior RCP. It made the following observations:

- Repex exceeded the regulatory allowance by 11% ($96.6m over the $896.4m allowance);
- spend was running ahead of budget in the first three years due to scope creep and project roll-ins; and

[26] We infer from Investment Cases that we reviewed that this is the approach it follows. We note that Essential has some form of cost estimating database (per Figure 3 in the NAMP)

[27] Essential, Attachment 5.1, Report on 2009-14 regulatory control period actuals versus allowances, Table 2.2, Parsons Brinkerhoff, 29 May 2014

- expenditure slowed in the last two years due to approval delays following the introduction of the NNSW Board and revised project plans due to imminent licence condition amendments.

91. Essential contends that improved asset management systems when implemented, combined with recent experience, will improve the accuracy of repex forecasts. We have not seen compelling evidence of this assertion.

Approach used for the 2015-19 RCP

92. The AMPs and ICs state that Essential's repex programs are at an early stage of estimation. In high-volume works continued from the 2009-14 RCP, we would expect the estimate to be of reasonable accuracy (± 10-15%). However, based on our interpretation of Essential's capital approval process, it is not until approval gate "Cap 3" that works must be estimated with accuracy of ± 10%. This is not as restrictive as other utilities where final approval to proceed is based on firm estimates. Essential's approach to applying contingency amounts to projects in practice is not clear.

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

94. We also note that NNSW has set a target to reduce procurement costs by $170m across the DNSP businesses through to 2016. We have not seen evidence that the pro-rated impact of this has been built into Essential's repex forecasts.

95. These factors, combined with the relative immaturity of the estimates in the Essential repex programs we have reviewed, means there is likely to be considerable scope for improving its bottom-up estimates.

5 Proposed expenditure programs

5.1 Findings

Justification for asset-level focus

96. In the programs we reviewed, we found that Essential provided justification to support its focus areas for a major proportion of its forecast 2014-19 RCP expenditure.

Multiple issues with the sub-program justification of expenditure

97. We found the sub-programs of work had one or more of the following issues:[28]

- Inadequate justification for the strategy adopted;
- Inadequate justification of the timing for resolving the condition-based issues (and therefore the volume of activity in the current RCP) either because of inadequate risk assessment or inadequate economic analysis (or both);
- Inadequate justification for the extent of the step-change evident in expenditure proposed at the sub-category level;
- Inadequate evidence of efficient costs, and
- Lack of robust delivery risk management.

98. We note that Essential's Investment Cases rely on the Repex calculator and a risk assessment framework that differs from the Corporate Framework.[29] The Corporate Framework makes no reference to the Repex calculator nor to the alternative risk

[28] Noting that we reviewed in detail a number of asset sub-programs and projects for each asset category, as denoted in Appendix B

[29] CEOP2111, *Operational Procedure, Corporate Risk Management*

assessment framework which casts doubt on the prudence of the corresponding assessment. We observed a conservative approach to risk assessment and a lack of economic analysis in support of replacement as the recommended option in the sample we reviewed. We consider that these factors have resulted in a bias for over estimation of replacement activity in the RCP.

5.2 Assessment

99. The main components of proposed repex (i.e., the movements between actual and prior RCP expenditure and Essential's proposed expenditure) were outlined in section 2. The following subsections provide summary information on the material components of the proposed repex for key asset groups. This analysis provides supporting evidence of the systemic issues reported earlier in our findings.

5.2.1 Poles

Essential's strategy for Poles

100. Essential Energy's network is largely overhead. There are approximately 1.38 million poles (87% timber) with an average age of 33.36 years. Essential has undertaken modelling of the condemnation rate of its pole population to forecast pole replacement and reinforcement rates, and states:

> *"Whilst it could be argued that the mean life expectancy of 74 years is an optimistic prediction of the pole population it will return a reasonable result for the coming 5 year period which is likely to be within the band of an acceptable prediction given the vagaries of the life of a very diverse pole population."*[30]

101. Essential considers that it '*has a robust pole inspection and maintenance programme based on Industry best practice* that prolongs the life of the pole as much as possible and where required preserve it from decay and prevent insect attack.'[31] Essential acknowledges that other utilities have a higher replacement rate than their own.

102. Essential has a pole inspection program that is based on a four year inspection cycle. Essential uses planned pole replacement and reinforcement (staking).

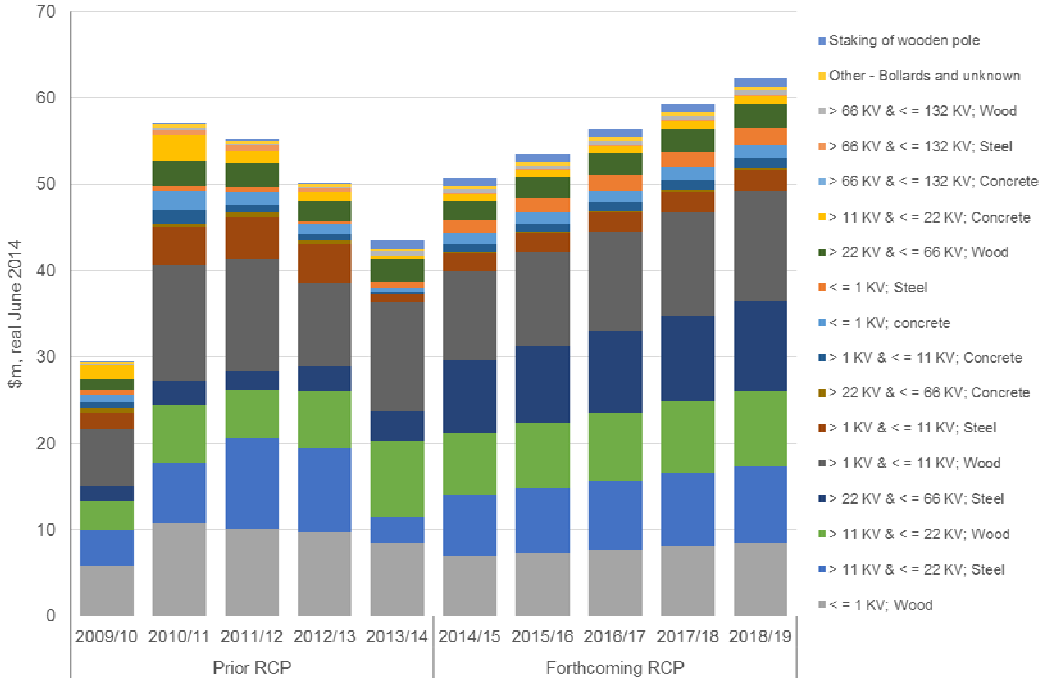
Expenditure trends

103. The repex for poles over the prior and current RCPs is depicted in Figure 4 below.

[30] ESS_17 and ESS_46, section 8

[31] *Ibid*, section 3

Figure 4: Essential pole repex compared with historical spend



Source: Essential RIN data

104. The current RCP expenditure trend is driven by the replacement of condemned wooden poles and therefore the forecast is based on the expected increase in condemned poles found on inspection.

105. The pole replacements and reinforcements forecast for the current RCP are provided in the following table:

Table 4: Essential forecast pole treatments

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Pole Replacement	7563	7580	8151	8623	9106	9601	10105
Reinforcement Current (5 Year Average from 2014/15)	407	505	680	680	680	680	680
Reinforcement - Serviceability Criteria Change	NA	NA	600	600	600	600	600

Source: Essential Asset Investment Case ESS_17 and ESS_46[32]

106. Essential has reviewed its serviceability and reinforcement criteria for timber poles and identified amendments to existing policies and practices. It has predicted that the changes will result in an increased number of poles requiring replacement each year. This assessment is supported by Weibull analysis.

107. Essential's strategy is delivering a lower percentage of reinforcements than would be expected on the basis of our experience with many peer DNSP's across Australia.

108. Essential considers pole-top assemblies and cross-arms to be part of the pole asset and is included in the distribution overhead feeder asset management plan. Essential's forecast pole-top refurbishment program is detailed in ESS_4005 as $21m over the current RCP. The program consists primarily of the refurbishment of PEC (Pigment

[32] Table 13 page 40

Emulsified Creosote) cross-arms on the NSW north coast, and salt affected coastal assets in the highest risk areas. The consideration of options and development of a targeted prioritised program in response to the elevated failure rate appears to be reasonable.

109. Essential has a further planned pole top refurbishment program for its sub-transmission assets described in ESS_45 with forecast expenditure of $15.9m over the 2015-19 RCP. The program appears to target specific problematic feeders based on assessed condition including increasing levels of asset and component failures.

Alignment of expenditure and strategy

110. The expenditure forecast for poles aligns with Essential's strategy and proposed changes to its serviceability and reinforcement criteria. The forecast increase in condemned poles drives the increased replacement program in line with Essential's modelling. However, the flat pole reinforcement (staking) expenditure and volume profile in conjunction with the increasing rate of pole replacements shown in both the RIN graph and Table 4 is not adequately explained by Essential.

111. Essential uses common industry inspection techniques and treatment options. It uses the working strength methodology to assess the serviceability of its poles, noting that AS7000:2010 now requires use of the limit state design approach. Essential's application of the working strength methodology leads to a relatively low wood pole condemnation rate and a low reinforcement ratio.[33]

112. The proportion of unserviceable poles which are deemed to be suitable for reinforcement may increase as Essential refines its practices. At 6-7%, the relatively low rates of poles assessed as being suitable for reinforcement (via staking) is an apparent anomaly which Essential identifies as a by-product of its current strategy.

113. If a higher ratio of pole reinforcement to replacement was prudent, it would deliver a lower overall program cost. Based on an average pole reinforcement cost of one-sixth to one-seventh of the average pole replacement cost, industry-common life extension results for Essential should lead to a superior economic outcome for equivalent risk.[34]

114. Essential states an aspirational pole failure rate target of 1 in 20,000 which is approximately half the current failure rate[35]. Whilst the strategy does not purport to be driven by this target, the changes to serviceability criteria appear to be the result of changes associated with this target. We did not find sufficient justification to support adoption of this revised strategy.

115. The increasing forecast expenditure, when compared to a declining actual expenditure during the prior RCP suggests potential deliverability issues that have not been adequately addressed.

[33] ESS17 and ESS46 IC Pole Replacement, page 32

[34] Ausgrid, for example, bases its economic analysis on staking giving a life extension of 12-15 years on average. Its reinforcement to replacement ratio is 40% or higher. Further analysis would be required to establish the appropriate volume of and ratio of pole replacement and reinforcement for Essential's wood pole population, cognisant of the challenges with wood pole inspection. This is outside of the scope of our review.

[35] Per peer utilities, ESS17 and ESS46 IC Pole Repl, page 6

116. In summary, we acknowledge that Essential needs to progressively increase the number of poles it replaces and reinforces. However, it has not made a sufficiently robust case for its adherence to its current inspection and serviceability criteria, nor for the cost effectiveness of its current and proposed strategies. With a change in strategy, we believe there is the potential for a lower overall cost of wood pole management over the course of the 2015-19 RCP through a higher reinforcement/replacement ratio.

5.2.2 Switchgear

Essential's strategy for switchgear

117. The major contributor to the increase in the current RCP switchgear repex is 11kV and lower voltage switchgear. The strategy for this asset class is set out in a number of investment cases including switchgear specific and substation replacements. The investment cases generally contain strategies to either maintain existing levels of expenditure or undertake replacement based on condition information.

118. For example, the ESS_38 Two Pole Substation Safety Program investment case states that the preferred option for current RCP replacement will be similar to the historical 20 units. Investment case ESS_31 Enclosed Substation Refurbishment Programme states that:

> *"The preferred option aims to ensure that all reasonable steps are taken to provide a safe environment for Essential Energy Staff and the Public in a responsible and proactive manner, whilst ensuring compliance with required industry policies and regulations. The preferred option includes:*
>
> - *On-going inspections which align with the standard inspection programme.*
> - *Upgrading of equipment prone to failure using a prioritised and manageable programme taking advantage of completing multiple tasks on site in one visit to the site.*
> - *Extending the life of the substation by upgrading components to acceptable standards.*
> - *Correcting known operational issues and safety hazards posing risk to employees and the public."*[36]

119. Our onsite discussions confirmed the view obtained from documentation that Essential's strategy for replacement of switchgear was primarily to continue the current replacements based on historical levels.

120. The indoor switchboard program ESS79 involves the replacement, refurbishment and retrofitting of indoor high voltage switchboards that present significant conditional failures and highest risk of catastrophic failure. Essential has considered a large number of alternate investment options and concludes a balanced program be progressed, targeted based on the condition assessment of the switchboard and ability to refurbish components.

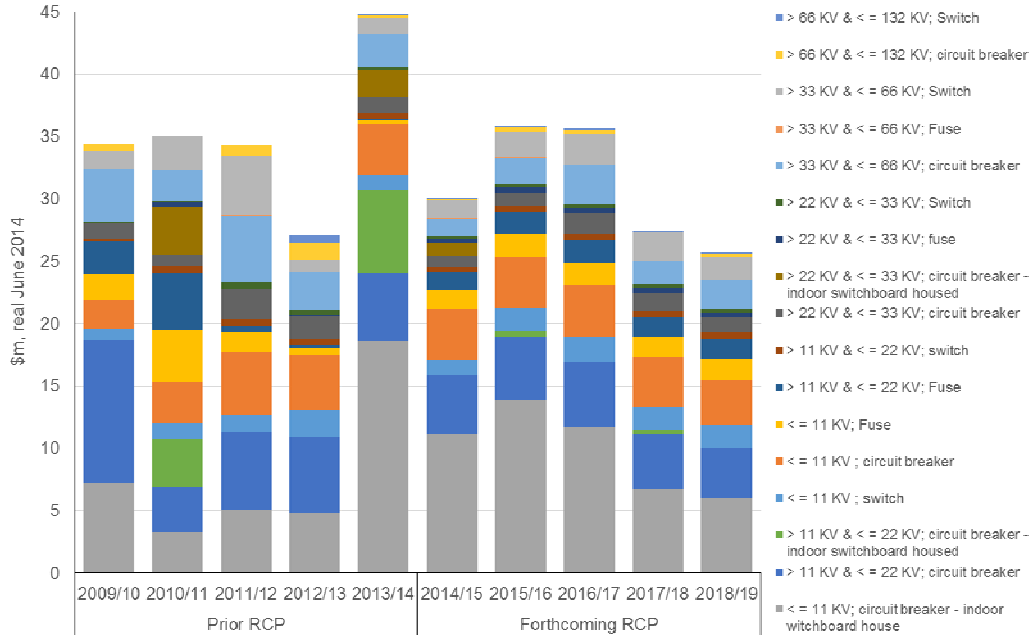
[36] ESS 31 5 Enclosed Substation Refurbishment Programme Section 7.1.2

121. ESS_78 (Zone substation circuit breaker replacement) considers two options in addition to run-to-fail, recommending replacement based on condition assessment, with the expenditure forecast based on the historical failure rate.

Expenditure trends

122. The repex for switchgear over the previous and current RCPs is depicted in Figure 5 below.

Figure 5: Essential switchgear repex compared with historical spend



Source: Essential RIN data

123. The aggregated expenditure for 11kV circuit breakers in the current RCP has increased over the prior period with the step increase evident in 2013/14 not adequately explained. Overall the switchgear repex remains relatively constant across the RCPs.

124. There has been a significant increase in proposed expenditure for switchboards, whilst Essential has reduced expenditure for circuit breaker replacements from the levels in the prior RCP, stating:

> *"Essential Energy has deemed this to be a prudent reduction in expenditure which still allows the risk to be managed at a level that is within the risk tolerance of the business."*

Alignment of expenditure and strategy

125. We are not convinced that the proposed expenditure in the RIN is aligned with the replacement approaches set out in the investment proposals. Whilst the investment proposals present 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 for 11kV circuit breakers evident in the RIN.

126. The asset condition information, risk assessment, unit cost assumptions and options analyses provided are individually and collectively insufficient to conclude that Essential has selected the prudent and efficient approach, timing and volume of activity.

127. Risk assessment in the various Investment Cases in this category is based on a risk framework that differs from the Corporate Matrix. The assessed risk consistently appears to be biased towards conservatism.

128. The absence of robust options analysis tends to compound the bias towards essentially 'defaulting' to the replacement option.[37] There is little or no meaningful economic comparison in the Investment Cases reviewed.

129. The following examples illustrate our concerns:

- the application of the risk assessment factors in the ESS_78 investment case leads to business interruption risk being rated as 'very high' (the highest possible rating). The risks are added together to give an overall risk that is also rated as 'very high';
- the ESS_79 investment case for switchboards only considered the failure of a bulk oil circuit breaker, which suggests the risk assessment was not relied upon in developing the balanced program;
- the pole top switchgear replacement is forecast to continue at a relatively constant rate throughout the current RCP. We note that there is a significant decrease in 2014/15 from historical levels and a flat profile through the remainder of the RCP. Whilst we acknowledge the prioritisation criteria provides some discrimination amongst switchgear types (e.g., not all air break switches will be replaced with enclosed switches), Essential's basis for selection of the volume in the current RCP is not clear, nor the relationship to risk levels, other than the statement:

  "This forecast replacement rate is a reduction in the total number of ABS devices replaced each year compared to the current regulatory period due to the progress on replacement of the higher risk ABS devices at the commencement of this existing programme of work as detailed above."[38]

130. Essential has not demonstrated that it has fully explored whether a more targeted condition-based approach to switchgear replacement and refurbishment based on asset risk assessment would deliver a lower cost and acceptable risk outcome and greater overall asset fleet risk reduction.

131. For a program which represents over $150m expenditure in aggregate, we would also expect to see evidence that initiatives to reducing overall program costs had been explored, quantified and adopted (or assumed benefits built into forward estimates).

132. In summary, whilst we find that Essential has presented a reasonable case for the selection of the various asset classes and sub-classes to focus on, its justification for its proposed treatment plans (option selection, including the timing/volume of activity) is inadequate.

[37] Noting that the robust analysis that we expect may support the selected treatment (i.e. replacement), but may lead to a change in the recommended activity

[38] ESS12, *System Investment Document – Poletop Switchgear Replacement*, page 31

5.2.3 Conductors

Essential's strategy for Conductors

133. The Essential Energy's ESS16 Investment Case for Replacement of Bare Overhead Conductor covers a substantial component (approximately $79m) of the proposed conductor replacement in the current RCP. Essential's stated strategy for this program is to annually replace small diameter copper, steel and ACSR high voltage conductor, based on the age, condition and risk profile.

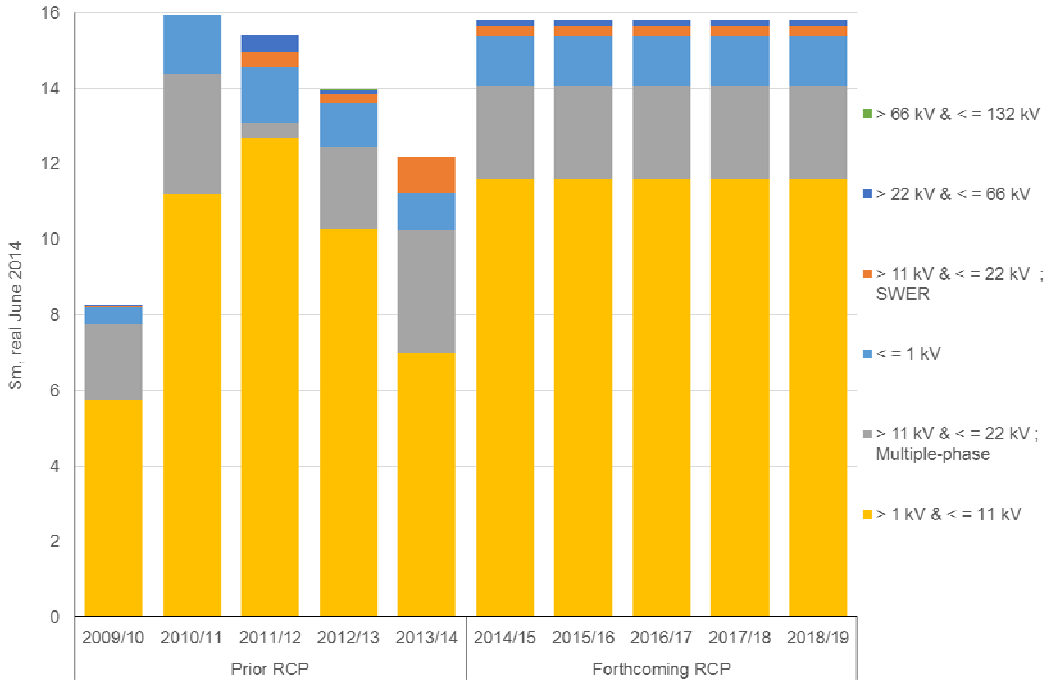
134. The program includes replacing a total of 350km per year (0.32% of the total small diameter bare conductor population), representing an increase from an average of 235km per year during the prior RCP.

135. The strategy includes consideration of a single preferred option, being conductor replacement at a rate of 350km per year based on the success of the existing program.

Expenditure trends

136. The repex for conductor replacement over the prior and current RCPs is shown below in Figure 6.

Figure 6: Essential conductor repex compared with historical spend



Source: Essential RIN data

137. The aggregated expenditure for conductors in the current RCP has increased from a declining trend over the prior RCP. The current RCP profile suggests a marked step change due to ≤11kV bare overhead conductor replacement.

138. Whilst these levels have been achieved previously, the extent of the step change suggests there may be deliverability challenges.

Alignment of expenditure and strategy

139. The expenditure forecast clearly aligns with Essential's strategy to focus on ≤11kV conductor replacements. The flat profile across the RCP is consistent with the Investment Case which denotes that the program is delivery constrained, not based on asset condition or age.

140. Whilst we accept the need for ongoing conductor replacement focusing on small gauge steel and copper clines during the 2015-19 RCP, we remain unconvinced that the level expenditure profile is optimal and, given historical levels, represents the program that will actually be delivered.

141. Essential's options analysis is very limited, noting that the smaller conductor classes tend to be in rural locations with low customer density. Essential acknowledges that the quantity of replacement will not resolve the ongoing issue with its small-diameter overhead power line population. However, we would expect to see some indication that it is looking also at more innovative approaches than advising that future replacement rates are highly likely to escalate significantly.[39]

142. Essential qualifies its unit cost assumptions with the following statement:

> "*This is an indicative base costing and may be significantly impacted by design parameters."*[40]

143. Whilst acknowledging the challenges of estimating expenditure on line work due to the variables involved, this casts further doubt on Essential's ability to achieve its target volumes.

144. The programs covering correction of low clearance overhead conductor and management of conductors over waterways (collectively $33m) are part of the compliance-based Duty of Care expenditure category and were not reviewed in detail.

145. In summary, we acknowledge the need for expenditure on the selected overhead conductor classes but we are not convinced that Essential will deliver the nominated volume of work, given its record in the 2009-14 RCP, the uncertainty over the cost of undertaking the work, and the lack of analysis about how to improve the overall program effectiveness.

5.2.4 Transformers

Essential's strategy for transformers

146. Essential's documentation states that:

> *"Condition monitoring and assessment is a core feature of Essential Energy's maintenance strategy and central to ensuring that the transformer assets continue to meet the service level obligations (see section 4). The practice of condition monitoring and assessment involves data capture from field inspections and*

[39] *Ibid.,* page 43 – for example exploration of removing, not replacing SWER and other lines with low customer density may be a technically and economically viable option in some locations given the reducing cost of standalone power supplies

[40] ESS16, page 43

maintenance activities, as well as a range of predictive techniques that are used to identify corrective maintenance actions as well as to inform decisions regarding maintenance, refurbishment and replacement strategies and plans."[41]

147. During our onsite sessions, we were informed that a range of data (age, condition, risk) is included in a transformer 'model' that is used by Essential to establish a priority order for transformer replacement. The asset condition priority list is then subjected to the CASH risk rating prioritisation.

148. Essential's repex programs for Transformers is comprised of four sub-programs: ESS70 - zone substation power transformer refurbishment ($7m); ESS71 - zone substation power transformer replacement ($31m); ESS31 - enclosed substation refurbishment program ($30m); and ESS32 - overhead substation refurbishment program ($38m).

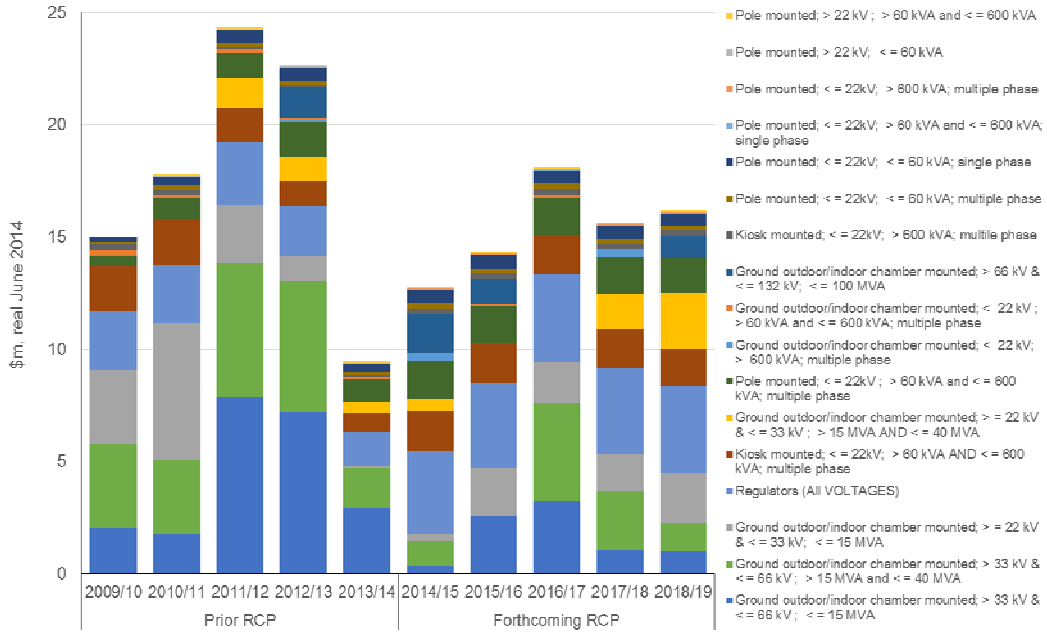
149. These programs include the replacement or refurbishment of ageing assets that are either at the end of their serviceable life and pose a high risk of failure, and/or no longer meet network requirements.

150. Essential decides whether to refurbish transformers or replace them based on condition assessment that leads to a 'health index' and the consequence of failure.

Expenditure trends

151. The transformer expenditure for transformers provided in the RIN is provided in Figure 7.

Figure 7: Essential transformer repex compared with historical spend



Source: Essential RIN data

152. According to the RIN data, average transformer replacement expenditure will reduce between the prior and current RCP. For the current RCP the expenditure profile increases linearly, with the exception of a high expenditure year in 2016/17 (due to an increase in chamber mounted transformers replacements up to 40 MVA).

[41] CEOM8018.11, *AMP Subtransmission Transformers*, page 33

Alignment of expenditure and strategy

153. The documentation provided does not adequately justify the difference in the RIN expenditure profiles between the prior and current RCP. Transformer replacement should be relatively stable and easy to predict. It may be that improvements in Essential's maintenance regime and/or condition assessment and asset information is delivering lower costs and/or has extended the predicted lives of the transformer fleet.

154. However, the transformer repex forecast for the 2015-19 RCP is based on rudimentary assumptions about optimal refurbishment rates (e.g., 2% pa[42]) or replacement rates based on historical levels, with qualitative reference to costs and benefits. What is not evident is a robust cost-benefit analysis of the various options for all transformer classes.

155. We note that the replacement strategy includes the use of standard size transformers for replacement units. As a result, there are many projects where a larger transformer is included for replacement. Again, Essential has not provided the economic justification for this approach.[43] For such a large investment, we would expect a cost/benefit analysis associated with provision of additional capacity, including consideration of planning requirements where there is an opportunity to replace transformers with a smaller capacity unit, and potential for retirement or consolidation of transformer units.

156. For a program which represents over $100m expenditure in aggregate, we would expect to see evidence that initiatives to reduce overall program costs had been explored, quantified and adopted (or assumed benefits built into forward estimates).

157. In summary, whilst it would appear Essential has a sound approach to assessing the condition of its assets, it has not provided compelling evidence that it has derived a prudent and efficient replacement/refurbishment expenditure forecast for its transformer fleet.

5.2.5 Cables

Essential's strategy for cables

158. 11kV and below cables replacements are the sole contributors to the forecast cable repex for the current RCP. The two major contributors to the 2014-19 expenditure profile are: (i) the rural LV overhead conversion program ($23m); and (ii) replacement of the LV CONSAC cables ($19m).

159. The rural LV overhead conversion program is related to rebates to customers to promote conservation of overhead lines in rural areas. It is based on the following policy/strategy:

> *"While it may be considered acceptable to expect customers wanting to construct new electricity supplies to meet minimum safety standards at their own cost, it becomes problematic when asking customers who built lines meeting earlier standards to comply with newer standards. Essential Energy could simply mandate this requirement at the customers' full expense to ensure the safety of persons and*

[42] ESS32, page 26-27;

[43] Whilst acknowledging that it *may* be the appropriate approach, it has not been demonstrated

property as required in the Act, however it is likely to meet with significant protest from rural communities who did not have to meet such obligations previously.

For this reason Essential Energy has adopted a policy of promotion and encouragement for retrospective compliance to safer standards such as undergrounding of assets in fire prone areas, through the UG incentive programme."[44]

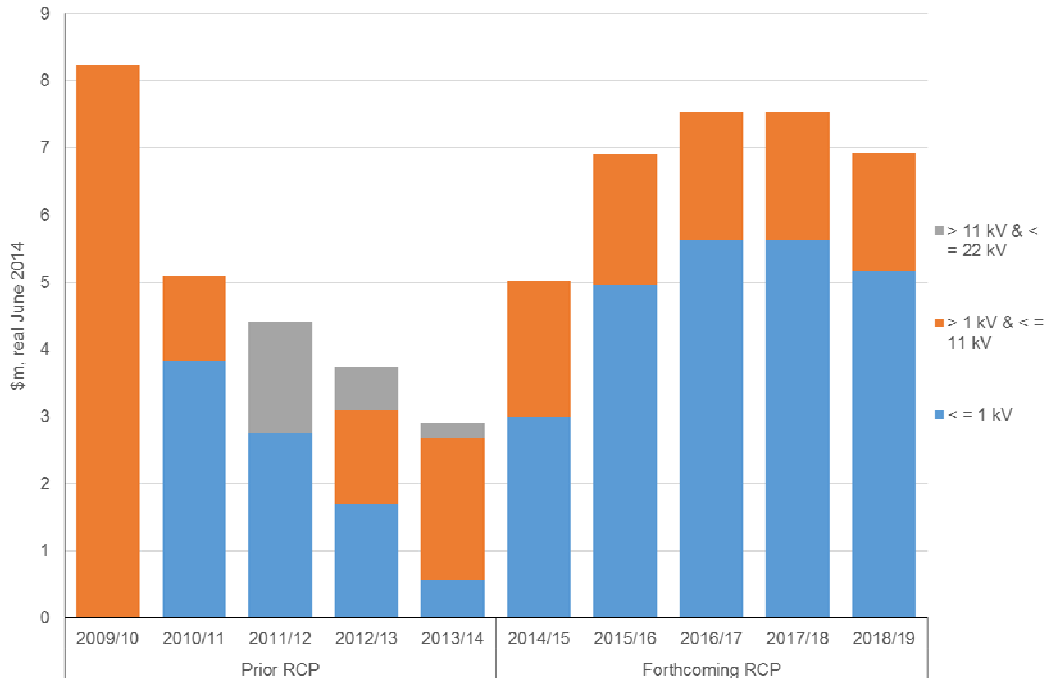
160. Essential's CONSAC replacement program is a 15 year programme commencing in the current RCP. Essential forecasts removing 116km during the 2014-19 period. The early years of the programme will target the highest risk locations.

161. Previously, Essential adopted a run to fail strategy for CONSAC cable, but have subsequently used the ENI database and comparison with other DNSPs with similar aged cables. This resulted in the revised strategy.

Expenditure trends

162. The expenditure for cables provided in the RIN is provided in Figure 8.

Figure 8: Essential cable repex compared with historical spend



Source: Essential RIN data

163. Historical expenditure provided in the RIN appears not to be reliable for cables. The 2015-19 RCP forecast shows a step change from the progressive reduction of cable expenditure in the 2009-14 RCP profile, driven entirely by the 11kV and below replacement programs.

Alignment of expenditure and strategy

164. We support the need for an overarching strategy that promotes safer outcomes to consumers and that seeks to identify lower whole-of life-cost options for the management of rural LV poles. We understand that the proposed underground

[44] ESS 29 section 3

conversions are for lines that are not owned by Essential, but by private landowners. However, ownership may not be well defined in legal documents.

165. We have not observed a sufficiently robust economic analysis providing evidence that the apportionment of costs between the specific rural customers (benefiting from the change from overhead to underground) and Essential's other customers is reasonable. We note that the proposal is a continuation of a policy established in 2010, including an adjustment to reflect actual costs.

166. As Essential has a relatively immature fault record (twelve months data) it seems to have relied on the experience of its peers to determine the risk posed by CONSAC cables and its strategy.

167. The risk has been assessed as very high (the highest risk category), with financial risk the highest individual category.[45] According to its risk management system, the risk must be removed. Essential propose commencing with the highest risk cable (as assessed by its limited failure/defect data, primarily). The options analysis is very rudimentary – only one option is considered, with no cost-benefit analysis.

168. The cost estimate is also rudimentary, with '*2014/15 used as a pilot year to help determine accurate unit costs and more CONSAC condition reports.*'[46] However, Essential do recognise that there may be opportunities to reduce the average unit rate by combining the work with other planned work.

169. In summary, we do not believe Essential has provided compelling evidence that it has derived a prudent and efficient replacement/refurbishment expenditure forecast for its cable program.

[45] ESS43, *LV CONSAC Replacement,* page 16

[46] *Ibid,* page 20

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 Projects reviewed

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

171. The documents listed below are in addition to the Attachment documents (5.1 – 5.13) provided by Essential. They are specific to either repex 'programs' (pertaining to asset categories, typically covering high volumes of asset replacement over many years, and found in AMPS) or 'projects' (pertaining to unique parcels of work, often in ESS and Investment Case documents)

172. We also reviewed the report by Essential-appointed consultants (PB) to examine its forecast vs actual expenditure in the previous RCP.

Projects/programs and related reports reviewed

Asset Category	Doc Reference	Document Title
Poles	CEOM8018.01 (AMP & ICS)	Distribution OH Feeders
	ESS14	Pole top rec refurb
	ESS17 & 46	Various documents re pole replacement
	ESS4005	Composites - Calculating
	ESS32	Pole Service Life
	ESS45	Various OH system manuals
Switchgear	CEOM8018.12 (AMP & ICS)	Subtransmission Equip
	ESS12	Pole top switchgear replacement
	ESS31	Enclosed Substation Refurbishment Programme
	ESS38	Two pole substation
	ESS78	Zone Substation Circuit Breaker Replacement
	ESS79	Zone Substation Indoor Switchboards
Conductors	CEOM8018.01 (AMP & ICS)	Distribution OH Feeders
	ESS16	Asset Investment for Replacement of Bare Overhead Conductor
Transformers	CEOM8018.11 (AMP & ICS)	Subtrans TX's
	CEOM8018.04 (AMP & ICS)	Distn substations
Cables	CEOM8018.05 (AMP & ICS)	Network UG Systems
	ESS43	LV Consac cable