

Technical Review of Regulatory Proposals

Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015 - 2020

PUBLIC VERSION

Report to

Australian Energy Regulator

Energy Market Consulting associates Strata Energy Consulting

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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 distribution services of Ergon Energy (Ergon) from 1st July 2015 to 30th June 2020. The AER's determination is conducted in accordance with its responsibilities under the National Electricity Rules (NER). This report covers a particular and limited scope as defined by the AER and should not be read as a comprehensive assessment of proposed expenditure that has been conducted making use of all available assessment methods.

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

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

Except where specifically noted, this report was prepared based on information provided by Ergon and the AER prior to February 13th, 2015 and any information provided subsequent to this time may not have been taken into account.

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About EMCa

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

About Strata

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

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Findings

Overarching findings and observation of systemic issues

- 1. Ergon has developed its network capex expenditure forecast by first establishing a bottom-up build of project and program requirements and then subjecting that first-cut program to successive iterations of a top-down challenge process.
- 2. Evidence provided by Ergon indicates that the top-down challenge process was driven to achieve a CPI-based price objective. Given the head-room afforded by a low WACC, the considerable under-spend on augex in the current period (relative to the allowance for this period) and the movement of significant expenditure into Alternative Control Services (ACS) from Standard Control Services (SCS), we consider that a CPI-based price objective does not provide a meaningful discipline that would lead Ergon to a prudent and efficient capex level, consistent with the NER expenditure criteria.
- 3. We consider that, while Ergon's top-down challenge process resulted in a more prudent and efficient forecast than it initially considered, it has nevertheless resulted in an upwardly-biased capital expenditure forecast. This finding reflects:
 - i. insufficient evidence that the iterative feedback loops described by Ergon have delivered an optimum risk/cost position, despite Ergon's claims that the capex program proposed represents the upper risk boundary of the programs that it considered; and
 - ii. Ergon's tendency to adopt a conservative approach to risk when assessing project and program need. We found Ergon's planning approach to be reliant on qualitative risk assessments and to misapply the 'ALARP principle'. This approach reflects a bias towards over-estimation of risk, the effect of which is to produce a larger bottom-up expenditure plan than is prudent and to increase the apparent risk sensitivity of the proposed expenditure to Ergon's top-down (price path) challenge.



Findings specific to augex

- 4. We find that Ergon's augex proposal generally reflects its lower demand forecast (as compared with previous forecasts) and incorporates a reasoned calibration of top-down and bottom-up forecasts.
- 5. We found evidence of systemic issues in our governance level review that the augex forecast reflects an over-estimation bias. This bias arises from cost and risk over-estimation, coupled with inadequate linkage to a needs-driven asset management strategy to justify proposed expenditure and identify opportunities for prudent deferral.
- Based on our assessment of a sample of augmentation projects and programs, we estimate the aggregate impact of these systemic issues to be in the order of 5% to 15% of proposed augmentation capital expenditure
- 7. In the absence of better information from Ergon, we consider that a proportional reduction of its proposed augmentation expenditure would reasonably reflect a prudent and efficient expenditure level for the forthcoming RCP. This is based on the following findings:
 - For distribution projects, we observed that a number of projects are dependent on demand growth occurring in specific locations and, where this is the case, each is dependent on specific new large loads connecting during the RCP. When aggregated, it would be reasonable to make a portfolio-level adjustment to reflect the level of probability that not all growth will occur as anticipated. We did not find evidence that this top-down adjustment had been made.
 - ii. We found evidence that Ergon is producing higher cost estimates than seems reasonable. For example, we found comments in planning documents such as: *"in reality, costs will be significantly lower"*.¹ We also observed that demand management options are considered as a separate option to the proposed augmentation option, whereas a hybrid option might produce a lower cost approach.
 - iii. We did not find sufficient evidence of the application of the revised demand outlook to 'unspecified works', for which significant expenditure is proposed. Specifically, we observed a tendency for unspecified works to be determined on a "*find as you go*" basis, using historical trending, to address network issues which are not anticipated, forecast or planned. In the absence of sufficient justification, we consider that a portion of this expenditure is likely to be overstated.
 - iv. We consider that the case for the level of proposed expenditure on PV remediation for power quality purposes remains unproven. Whilst there is a clear need for proactive management of inverter energy systems, we find that the strategy proposed by Ergon is not supported by a sufficiently robust business case to justify the proposed expenditure and appropriately enforce voltage compliance requirements on customers.
- 8. Taking the above findings into account, we consider that the aggregated bottom up forecast is likely to have excessive costs over that which is efficient and prudent.

¹ 050(5)-Appendix 1-POVE RWR.pdf section 1.9.1



Findings specific to repex

- 9. We found that Ergon has developed a bottom-up program broadly based upon identified focus areas. However, it is seeking to include increasing levels of repex in some programs, for which we found insufficient justification.
- 10. We consider that elements of the proposed repex have not been subjected to rigorous top down challenge to achieve and demonstrate an optimal risk/cost position. We also have reservations regarding the completeness and prudency of the analysis and justification of several asset categories to support the timing and volume of proposed activity with the next RCP.
- 11. We found that prudency of the repex forecast was undermined by:
 - i. Insufficient project and program analysis to support the timing and volume of activity;
 - ii. a bias in replacement programs towards bulk replacements of targeted asset categories, with insufficient justification for choosing the forthcoming RCP as the replacement period;
 - iii. Application of risk assessments that appear to result in a reactive approach to identified issues;
 - iv. Step changes in expenditure that are not the result of a CBRM methodology or RCP trend data, but appear to align with RCP revenue reset periods; and
 - v. Lack of identified condition data from which to make informed asset management decisions using condition and CBRM tools.
- 12. We note that Ergon's proposed repex appears to be less than is shown by Ergon's application of the AER's repex model. However, for the reasons noted above, we consider that the aggregated bottom up forecast is likely to have excessive costs over that which is efficient and prudent.

Other findings

- 13. On sourcing, procurement, deliverability and efficiency we found no material issues that would require an adjustment to proposed capex. We consider that Ergon has the resources and capability to deliver the proposed program.
- 14. Whilst outside the scope of this review, we observe that the allocation of overheads to direct capex costs is significant, and as proposed by Ergon, will climb considerably over the next RCP. There is typically a strong correlation between capex and overheads, yet Ergon is forecasting a relatively static headcount despite lower direct capex. We consider that this issue is worthy of noting to the TAG.

Addressing TAG observations

15. We summarise the AER Technical Advisory Group's (TAG) initial observations on Ergon's proposed network capex allowance in section 2.5. Having completed our review, we respond to the TAG's initial observations as follows.



Preliminary assessment matters

- 16. Our findings concur with the TAG's initial observation as summarised below:
 - i. The augmentation capex has not been adequately linked to a prudent needsdriven strategic asset management program and there is insufficient evidence that the proposed increased level of expenditure reflects an efficient means of managing the identified risks;
 - We observe a bias in replacement programs towards bulk replacements of targeted asset categories. Moreover, we find that these are proposed to occur within the 2015/20 RCP, with insufficient justification for choosing this time period; and
 - iii. Ergon's application of CBRM and its risk framework are likely to be biased towards over-estimation of risk and therefore of its expenditure forecast.

Systemic issue hypothesis

- 17. In regard to the TAG's hypotheses regarding possible systemic issues, we find as follows:
 - i. **'That the business's forecast is reasonable and unbiased**': We find that Ergon's proposed forecast is not reasonable and exhibits a degree of upwards bias that reflects cost and risk over-estimation and the application of a CPIbased price objective as its primary top-down challenge constraint;
 - ii. **'That the business's costs and work practices are prudent and efficient**': Based on our review of Ergon's cost estimation, sourcing and procurement processes and on the network programs that we reviewed, we find that Ergon's costs and work practices are prudent and efficient, within the bounds of reasonableness as referred to in the NER.
 - iii. **"That the business's risk management is prudent and efficient**": We consider that Ergon's risk management has elements that are likely to have led to a degree of engineering conservatism and therefore to a degree of upwards bias in its forecast.



1 Introduction

1.1 Purpose of this report

- 18. The purpose of this report is to provide the AER with technical advice on the network augmentation expenditure (augex) and replacement expenditure (repex) that Ergon has proposed as part of its Regulatory Proposal. 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 Ergon's revenue requirements.
- 19. Our assessment is based on a limited scope review² 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 Ergon based on assessments undertaken by its own staff and that other advisers are also contributing this assessment.

1.2 Scope and approach

- 20. The AER issued a Scope of Work to EMCa in January 2015, requesting assistance in identifying any systemic issues that may be resulting in forecasting biases in Ergon's augmentation and replacement network-related capital expenditure. The requested assistance was to: (1) *"identify whether Ergon's business' processes, systems, behaviours and/or cultures are leading to any biases in the capex forecasts"*; and (2) *"to identify whether these biases mean that the capex forecast does not meet the capex criteria"*.
- 21. The AER noted three areas in which it considered there may be systemic issues:

² The capex scope agreed was confined to network replacement ("repex") and augmentation ("augex") capital expenditure (including compliance and reliability-related expenditure). The scope for our review excluded consideration of contingent projects, Customer Initiated Capital Works (CICW) and Other System and Enabling Technologies capex.



- Whether Ergon's forecast is reasonable and unbiased;
- Whether Ergon's costs and work practices are prudent and efficient; and
- Whether Ergon's risk management is prudent and efficient.
- 22. The AER asked us to consider a number of specific matters as part of our assessment. These are summarised as follows:
 - Are the forecasts, forecasting practices and assumptions of the business reasonable and unbiased?
 - Do any observed differences between historical forecasts and actual expenditures stem from prudent and efficient responses to changes in the business circumstances?
 - Are estimates of resources and unit-rates reasonable and unbiased?
 - Is investment timing unbiased and reasonably optimal?
 - Is the business's (implicit or explicit) identification, characterisation and evaluation of risk reasonable and unbiased?
 - Are risk treatments reasonably optimal in terms of customer costs and benefits?
- 23. We undertook 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 concept³

³ 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



- 24. We assessed for systemic issues through: (1) a desktop review of governance and management, planning, forecasting and budgeting process documentation; (2) consideration of Ergon's planning and forecasting methodologies, tools and input assumptions; (3) assessment of Ergon's proposed replacement and augmentation capital expenditure strategies and plans; and (4) through a two-day on-site meeting at which Ergon executives described their use of this framework. To further evidence what the business does, we reviewed a sample of projects and programs.
- 25. The assessment in this report is based on the information provided to us through this process.

1.3 Structure of this report

- 26. Our principal findings are summarised at the beginning of this report.
- 27. In section 2, we provide a contextual overview of Ergon's Regulatory Proposal and expenditure trends, along with the hypotheses and focus issues that the AER has asked us to assess. This section includes consideration of past augmentation and replacement expenditure trends, coupled with Ergon's past forecasting performance.
- 28. In the subsequent five sections, we present the assessment that supports our findings. This assessment is structured as follows:
 - In section 3, we describe our assessment of the governance and management processes that Ergon uses to plan and approve its augex and repex projects and programs, and any systemic issues that we have found with these processes;
 - In section 4, we describe our assessment of the sourcing, procurement, deliverability and efficiency of Ergon's programs of work;
 - In section 5, we summarise and assess the methodologies that Ergon uses to forecast its augex and repex requirements. This is disaggregated into an assessment of augex activity forecasting, repex activity forecasting and the cost estimation methods used by Ergon to prepare its expenditure forecasts;
 - In section 6, we describe our assessment of the application of Ergon's demand forecast and augex forecast by program category. We also identify and quantify our assessment of the prospective impact(s) of any systemic issues that we found in the outcomes of its augex forecasting process; and
 - In section 7, we describe our assessment of the application of Ergon's repex forecast by program category and identify any systemic issues that we found in the outcomes of its repex forecasting process.⁴

⁴ We were not asked to quantify the impact of our assessment of systemic issues applying to Ergon's proposed repex



2 Background

2.1 Introduction

- 29. This section is intended to provide background context to the expenditure assessments which follow. Reference data was primarily sourced from Ergon's Regulatory Information Notices (RIN) and its 2015 – 2020 Regulatory Proposal (RP), including supporting documents. Information was also sourced from responses to our information requests and the material that Ergon provided to us at the on-site meetings.
- 30. We first set out the capex allowances that Ergon has proposed, and consider these relative to its historical capex allowances. We consider Ergon's capex forecasting performance, as evidenced from variance analysis comparing its historical expenditure with the capex that it claimed to require at the previous revenue reset, together with any explanations that Ergon has provided for those variances.
- 31. Subsequently, we 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 capex, using other techniques.

2.2 Augmentation expenditure

2.2.1 Summary of Ergon's proposed augex

32. From information provided in its Regulatory Information Notice (RIN) documentation, Ergon is proposing \$660m⁵ of total augmentation expenditure (direct costs only) in the forthcoming RCP. Refer to Table 1 and Figure 2 below. This equates to an average

⁵ We note that the augmentation costs included in the RIN data include categories of expenditure that were not included within the scope of "augmentation" in the Regulatory Proposal. Refer to section 6 for a listing of the expenditure categories that we reviewed. These Ergon expenditure categories are not directly related to the RIN asset categories shown in Table 2.

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annual forecast expenditure of \$132m in the forthcoming period, compared to an average annual spend of \$162m in the current period.

| | Current RP | | | Forthcor | ning RP | | |
|---|------------|---------|---------|----------|---------|---------|-------|
| | Total | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
| Subtransmission Substations, Switching Stations, Zone Substations | | 47 | 32 | 20 | 24 | 23 | 146 |
| Subtransmission Lines | | 4 | 25 | 37 | 4 | 7 | 77 |
| HV Feeders | | 57 | 47 | 35 | 41 | 39 | 219 |
| HV Feeders - Land Purchases and Easements | | 2 | 1 | 1 | 0 | 0 | 3 |
| Distribution Substations | | 28 | 25 | 27 | 29 | 28 | 136 |
| LV Feeders | | 7 | 7 | 7 | 8 | 8 | 37 |
| Other Assets | | 9 | 11 | 12 | 6 | 5 | 43 |
| Total | 810 | 154 | 147 | 138 | 111 | 110 | 660 |

Sources: 0C.02.01.03 QLD - RESET RIN 2015-20 - Cons Info CONF



Figure 2: Augmentation capex (direct cost) - \$m, real June 2015

Sources: 0C.02.01.03 QLD - RESET RIN 2015-20 - Cons Info CONF. Note: RIN data only provides Augex expenditure from 2013-14 to 2019-20; we used total figures for 2010-11 to 2012-13 for completeness of the data trend.

33. Table 2 and Figure 3 below provide a comparison of Ergon's augmentation capital expenditure between the current and forthcoming RCP. As provided in Ergon's 2015-20 Regulatory Proposal and expenditure summary documents,⁶ Ergon is proposing total augmentation expenditures of \$957m (sum of direct and indirect costs) for the forthcoming regulatory period, whereas it proposed \$2,763m for the current period and spent \$1,228m. Our review of Ergon's expenditure summary documentation has not identified any transfer of SCS to ACS within the augmentation capital expenditure for the RCP that has a material impact to comparing the trend of augex across periods.⁷

⁶ We have included expenditure for CIA, Other system enabling technology and Reliability quality of supply capital expenditure as comprising total augex, excluding Customer Initiated Capital Works (CICW). The scope for our review excluded consideration of contingent projects, Customer Initiated Capital Works (CICW) and Other System and Enabling Technologies capex.

⁷ Of the components of augmentation capital expenditure: CIA, Other system enabling technology and Reliability quality of supply capital expenditure, Ergon state that a total of \$3m (direct costs) is included for Other system enabling technologies.



 Compared to Ergon's Revised Regulatory Proposal (\$2,878m) and AER allowance (\$2,238m) for the current RCP, Ergon's actual augex spend of \$1,228m is \$1,650m and \$1,010m less, respectively.

| Table 2: | Total augmentation | expenditures | (direct & indirect | t costs) - \$m, real 2014-1 | 5 |
|----------|--------------------|--------------|--------------------|-----------------------------|---|
|----------|--------------------|--------------|--------------------|-----------------------------|---|

| | Current RP | | Fo | orthcoming RP | | | |
|---------------------------------|------------|---------|---------|---------------|---------|---------|-------|
| | Total | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
| Regulatory Proposal | | | | | | | |
| Corporation Initiated | 2,250 | 171 | 174 | 178 | 132 | 135 | 790 |
| Reliability and Power Quality | 138 | 3 | 3 | 4 | 4 | 4 | 18 |
| Other enabling systems | 375 | 42 | 31 | 21 | 29 | 26 | 149 |
| Regulatory Proposal total augex | 2,763 | 216 | 208 | 203 | 165 | 165 | 957 |
| Revised Regulatory Proposal | 2,878 | - | - | - | - | - | - |
| AER Determination | 2,238 | - | - | - | - | - | - |
| Actual/Estimate | 1,228 | - | - | - | - | - | - |
| | | | | | | | |

Source: EMCa analysis





Source: EMCa analysis

2.2.2 Observations on augex trends

- 35. Ergon reduced its augmentation expenditure during the current regulatory control period primarily in response to a reduction in peak demand growth, the ENCAP review in 2011-12 and, more recently, changes to the Distribution Authority.
- 36. Ergon has estimated that, of the direct cost variance in its augex relative to the AER allowance for the current RCP, \$638m of the reduction is attributable to external conditions while \$7.5m is attributable to "joint working efficiencies".⁸ The remainder of the variance is not explained.

⁸ This total has been estimated in nominal \$'s of the day and produced as a single value per 07.00.02 CIA Expenditure Summary includes estimated direct costs in Table 8, page 35



37. Ergon's forecast augmentation capex is driven by a large percentage of works in progress for the first few years. The remainder reflects Ergon's assessment of requirements to meet its load and risk level forecast for the network.

2.3 Replacement expenditure

2.3.1 Summary of Ergon's proposed repex

38. From information provided in its Regulatory Information Notice (RIN) documentation, Ergon is proposing \$894m of total direct replacement expenditure in the forthcoming regulatory period. This equates to average annual forecast expenditure of \$179m in the forthcoming RCP, compared to an average annual spend of \$175m in the current RCP. Refer to Table 3 and Figure 4 below.

| Asset Group | Total | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
|---|-------|---------|---------|---------|---------|---------|-------|
| OTHER | 38 | e | e | 14 | e | e | 38 |
| OVERHEAD CONDUCTORS | 167 | 36 | 40 | 37 | 41 | 41 | 195 |
| POLE TOP STRUCTURES | 60 | 20 | 20 | 20 | স | 22 | 103 |
| POLES | 121 | 15 | 21 | 10 | 14 | 15 | 76 |
| SCADA, NETWORK CONTROL AND PROTECTION SYSTEMS | 125 | 36 | 43 | 28 | 33 | 23 | 163 |
| SERVICE LINES | 39 | 10 | 11 | 11 | 12 | 12 | 56 |
| SWITCHGEAR | 123 | 13 | 14 | 14 | 15 | 14 | 30 |
| TRANSFORMERS | 179 | 33 | 34 | 31 | 38 | 41 | 177 |
| UNDERGROUND CABLES | 6 | я | 4 | 2 | 3 | 3 | 15 |
| Total | 858 | 174 | 194 | 166 | 182 | 179 | 894 |
| | | | | | | | |

 Table 3:
 Repex (direct costs only) - \$m, real 2014-15

| Sources: 0C.02.01.03 QLD - | RESET RIN 2015-20 |) - Cons Info CONF |
|----------------------------|--------------------------|--------------------|
| 0001000.00.02.01.00 QLD | 1120211111201020 | |





Sources: 0C.02.01.03 QLD - RESET RIN 2015-20 - Cons Info CONF

39. We observe that the replacement expenditure (direct costs) of \$894m provided in the RIN is not consistent with the replacement expenditure (direct costs) provided by Ergon



in its expenditure summary document⁹ of \$883m. We have not been provided with an explanation of this \$11m difference and have based our assessment on the RIN.

- 40. We also observe that the asset renewal expenditure summary document includes \$50m (direct costs) for ACS over the RCP. Ergon state that this expenditure is associated with "*metering and street lighting related renewal activities which were previously classified as SCS, but which the AER has classified as ACS in the 2015-20 regulatory control period.*"¹⁰
- 41. From Ergon's 2015 2020 RP and Asset Renewal Expenditures Forecast Summary documents, Ergon is proposing total replacement expenditure of \$1,358m (including direct and indirect costs) in the forthcoming regulatory period. This reflects an 8% increase in proposed repex compared to Ergon's \$1,256m actual repex spend in the current period. When the ACS is included to the total replacement expenditure (\$1,434m) to enable direct comparison with the current RCP (\$1,270m), Ergon is proposing to increase its repex by 13% when compared with the actual repex spend.
- 42. As shown in Table 4 and Figure 5 below, Ergon's actual repex spend of \$1,256m in the current period is almost precisely equal to the \$1,255m allowance set by the AER.

| | Current RP | | | Forthco | ning RP | | |
|-----------------------------|------------|---------|---------|---------|---------|---------|-------|
| Regulatory Review process | Total | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
| Regulatory Proposal | 1,372 | 256 | 286 | 256 | 282 | 278 | 1,358 |
| Revised Regulatory Proposal | 1,420 | - | - | - | - | - | - |
| AER Determination | 1,255 | - | - | - | - | - | - |
| Actual/Estimate | 1,256 | - | - | - | - | - | - |

Table 4: Total repex (direct and indirect costs) - \$m, real 2014-15

| Sources: 07.00.01 Asset Renewal Expenditure Forecast Summary, Table 3 | , page | 9 |
|---|--------|---|
|---|--------|---|



Figure 5: Total repex (direct and costs) - \$m, real 2014-15

⁹ 07.00.01 Asset Renewal Expenditure Summary Table 1, page 6

¹⁰ 07.00.01 Asset Renewal Expenditure Summary, page 9

Sources: 07.00.01 Asset Renewal Expenditure Forecast Summary, Table 3, page 9



43. After exceeding the asset renewal allowance in the first three years of the current RCP, Ergon forecasts that it will incur lower costs in the final two years by application of more focused risk assessments coupled with a reassessment of the rebuild of the aging subtransmission feeder population.

2.3.2 Observations on repex trends

- 44. In its regulatory proposal, Ergon describes the proposed asset replacement expenditure as being driven predominantly by compliance and safety requirements and replacement of assets that have reached end of life. Ergon notes that its asset renewal expenditure includes \$264m (30%) that is driven by safety issues identified in the current RCP.
- 45. We observe that the pattern of expenditure has hallmarks of being matched to regulatory cycles, with significant changes in expenditure over successive regulatory cycles. We also note that the proposed expenditure is greater than the expenditure that Ergon is currently incurring (i.e., in 2013/14 and 2014/15). This leads us to question whether Ergon might have deferred expenditure from the current RCP into the next RCP for reasons other than engineering/economic prudency and, to address another hypothesis, whether there might be an increased need that Ergon has anticipated to occur in the next RCP, but which currently does not exist or for some reason does not yet require treatment. We looked for evidence to test these hypotheses in our assessment.

2.4 Capex overheads

46. While the focus of our review is on capex direct costs, we had reason to observe the level of indirect costs in Ergon's proposal relative to direct costs. This relationship is shown in Figure 6 below as an "on-cost" percentage. It is difficult to reconcile the step-change increase in overhead costs implicit in Ergon's forecast and which is markedly higher than the indirect cost ratios for the past decade. The trend appears to suggest that Ergon may not have sufficiently challenged the assumed level of indirect costs that it requires to sustain the lower level of capex activity proposed. The on-cost ratios also considerably exceed those implicit in its capex forecast.



Figure 6: Ratio of capex "on-costs" (indirect costs / direct costs)



Source: 07.00.01 Asset renewal expenditure tables 1 and 3; and 07.00.02 CIA expenditure tables 1 and 3

2.5 AER's focus issues and hypotheses

- 47. In its preliminary assessment, the AER noted that:¹¹ (1) the prudency assessment for Ergon's augmentation expenditure requires review; (2) the replacement programs may include a bias towards bulk replacement of a "targeted" asset category resulting in high forecasts; and (3) its application of CBRM and risk management indicates possible bias to over-estimation of risk and therefore expenditure forecasts.
- 48. The AER identified a number of areas in which it considered that there may be systemic issues with the business's capex forecasts. The AER identified three hypotheses:

'The business' forecast is reasonable and unbiased': the business' proposed expenditures are a reasonable forecast of the unbiased efficient cost of maintaining performance at the required or efficient service levels. There are no in-built systemic biases which result in the forecast being higher or lower than is efficient.

'The business' costs and work practices are prudent and efficient': the business uses the minimum resources reasonably practical to achieve the capex objectives and maintain the required or efficient service levels.

'The business' risk management is prudent and efficient': the business manages risk such that the cost to the customer of achieving the capex objectives at the required or efficient service levels is commensurate with the customer value provided by those service levels.

¹¹ Based on advice provided to EMCa by the AER as part of the terms of reference



3 Governance and Management Framework

3.1 Overview

- 49. In this section, we describe our assessment of the governance, risk and asset management frameworks used by Ergon to plan and approve its augex and repex projects and program and which Ergon has used to develop its five-year capex allowance proposals to the AER. We identify and report our views on any systemic issues with these frameworks. (In sections 6 and 7, we report on Ergon's application of these frameworks in developing its proposed augex and repex forecasts.)
- 50. Ergon has a governance structure comprising the Investment Review Committee (IRC) that supports the CEO and Board. The IRC is, in turn, supported by the Network Investment Review Committee (NIRC). Each committee is governed by a charter which sets out its purpose, scope and responsibilities and how the committee will operate, and which are described as follows:
 - "IRC purpose is to support the Chief Executive (CE) and the Board by developing a balanced capital and operating enterprise investment portfolio. The IRC provide strategic oversight and scrutiny across the entire Ergon Energy investment portfolio and ongoing investment stewardship,"¹² and
 - "NIRC, as a sub-committee of the IRC, provides oversight and scrutiny of the elements of the network asset investment portfolio for continued alignment with the purpose and performance outcomes and delivery of projected outcome."¹³
- 51. We note that the IRC Committee Charter identifies specific investment principles intended to support strategically aligned decision making. These include:

^{12 07.09.22} Investment Review Committee Charter

¹³ 07.09.23 Network Investment Review Committee Charter



- "Investments are inclusive of the full scope required to deliver business outcomes and long term sustainability;
- Capital rationing is set by the IRC with advice from Asset Owner roles, Regulatory Affairs and relevant Asset Managers, ensuring that prioritised investments which maximise shareholder value consistent with agreed levels of risk are approved; and
- Delivery practices will be continually monitored, evaluated and improved."14
- 52. We note that the NIRC Committee Charter identifies key objectives which include:
 - "Ensure an appropriate prioritisation between network asset investments in delivering customer and shareholder outcomes across Ergon Energy's geographic footprint;
 - Ensure the investment portfolio and the individual expenditure proposals of the network portfolio is prudent and efficient (to) adequately address risk management, purpose and performance outcomes, sustainability, efficacy and engineering due diligence; and
 - Provide oversight and scrutiny of the elements of the network asset investment portfolio for continued alignment with the Network Optimisation Strategy."¹⁵
- 53. Ergon's Asset Strategy is "a key long-term planning document and decision-making tool, reviewed annually by Network Optimisation".¹⁶ Ergon advised that "the purpose of the Asset Strategy is to specify objectives and outcomes that provide the link between the high-level aspirations and guiding principles articulated in the Asset Management Policy and the operational and tactical activities within the asset management plans".¹⁷
- 54. Ergon states that it has formed its view of the expenditure required on the basis of three expenditure objectives cognisant with optimising its network asset strategy and its commitment to customers as described below:
 - "Provide peace of mind in terms of maintaining quality and reliability of electricity supply; responding to storms, cyclones, and similar events; delivering on our guaranteed service commitments and being the benchmark for safety performance in our industry;
 - Enable broader choice and control mechanisms to make information more readily available when required; make it easier to connect to our network; and support alternative electricity supply options;

- ¹⁶ 07.09.15 Asset Strategy Purpose, page 4
- ¹⁷ 07.09.15 Asset Strategy Purpose, page 4

¹⁴ Ergon 07.09.22, Investment Review Committee Charter - extracts from "Investment Principles", page 1

¹⁵ 07.09.23 Network Investment Review Committee Charter – extracts from "major objectives", page 3



- Deliver our services at the best possible price and ensure below inflation increases in network charges in the next regulatory control period from 1 July 2015 to 30 June 2020." 18,19
- 55. We note Ergon's governance processes are supported by its committee charters;²⁰ network optimisation and asset strategies;²¹ governance, plans, policies and procedures;²² and design, operations, and maintenance standards. Collectively, this reflects a typical utility investment governance framework.

3.2 Assessment

3.2.1 Managing to a desired price outcome

- 56. Ergon state in its supporting documents that, in the context of the 2012 IDC review by the Queensland Government on electricity prices: "*the expectations of our shareholder, the Queensland Government, during the current regulatory control period also supported an increased focus on efficiency in service delivery*".²³
- 57. In Ergon's summary of its corporation initiated forecast expenditure,²⁴ Ergon refer to correspondence from the shareholding Minister, dated 6 September 2012, which included expectations for Ergon to "*position itself so that in the next regulatory control period, the network price for electricity will not increase greater than the CPI.*"
- 58. Ergon has applied an aspirational price path objective to "deliver our services at the best possible price and ensure below inflation increases in network charges in the next regulatory control period". This is evidenced in key asset and customer strategy documentation, such as the "Network Optimisation Asset Strategy",²⁵ "The Best Possible Price Strategy",²⁶ and "Ergon Energy's Strategy".²⁷
- ^{59.} Ergon's objective of delivering services at the best possible price might be construed as a cost forecasting discipline, consistent with the prudency and efficiency criteria of the NER. However, if the objective is interpreted as being met if network price increases are below inflation, then this objective is not within the remit of the NER's prescription of prudent and efficient expenditure.²⁸ Moreover, we consider that specific factors provide significant headroom and which may allow Ergon to meet this objective without necessarily allowing only for prudent and efficient capital expenditure. These

²⁸ Rule 6.5.7 b) and c) of version 58 of the National Electricity Rules (NER) describes capital expenditure criteria and objectives

¹⁸ 07.09.15 Asset Strategy – 'Vision' and 'Goals for the Future', pages 7-8

¹⁹ Ergon 07.09.15 Network Optimisation Asset Strategy, page 8

²⁰ Ergon 07.09.22, IRC Charter and 07.09.23, NIRC Charter

²¹ Ergon 07.09.15 Network Optimisation Asset Strategy

²² Ergon 07.09.17, Our Capital Governance and Plans, Policies and Procedures

²³ 0A.01.02 Best Poss ble Price, page 2

²⁴ 07.00.02 CIA Expenditure Forecast Summary, page 9

²⁵ Ergon 07.09.15 Asset Strategy page 8 and 07.09.20 Network Optimisation Strategy, page 7

²⁶ 0A.01.02 Best Possible Price, page 8

²⁷ Chief Executive Introduction Presentation Day 1 - Slides 3, 5 & 6



factors include a low WACC, transfer of services from SCS to ACS (in regards to repex) and considerably reduced augex in the current RCP relative to the allowance that was used in setting prices for this period, and in the forthcoming RCP.

- 60. Put simply, a forecasting process designed to constrain expenditure levels to maintain *"network price increases below inflation"* may result in a network capex forecast that is either too high or too low. In either case, it would be only by coincidence that it would reflect a prudent and efficient expenditure forecast based on demonstrated system needs.
- 61. Capex should be set to provide the prudent and efficient expenditure required to operate a safe and reliable network. We consider that a CPI price cap objective on the overall business does not provide a meaningful discipline that would lead Ergon to a prudent and efficient capex level.

3.2.2 Top-down assessment and portfolio adjustment process

- 62. From information provided by Ergon, we note that the IRC has exercised its charterdefined role in capital rationing. This includes receiving advice from Asset Owner roles, Regulatory Affairs and relevant Asset Managers. We also note that a dedicated Review Committee (ARFEC) Group has been used to test the proposed expenditure.²⁹
- 63. Ergon provided supporting information to demonstrate an iterative process for determining the proposed RP capital expenditure which was considered by the Board, the Regulatory Sub-Committee of the Board and the management-initiated AFREC forums (from March 2014 to final sign-off on the Regulatory Proposal in October 2014).³⁰
- 64. Information from Ergon shows that, between October 2013 and October 2014, this topdown assessment process delivered reductions totalling to the 'initiallyconsidered' capital expenditure allowance over eight successive iterations. Refer to Figure 7 below. We observe that augex was reduced by

, repex was reduced by an expenditure was reduced by an expenditure was reduced by an expenditure was reduced by a second by a

²⁹ ANSWER_AERErgon031_5CONFIDENTIALFinal Question 31 & Attachments 1-9

³⁰ ANSWER_AERErgon031_5CONFIDENTIALFinal Question 31, page 1

³¹ We note iteration 8 of Ergon's top-down review is comparable to the RP when adjusted to \$2014/15

² ANSWER_AERErgon031_5CONFIDENTIALFinal Question 31, page 2



Figure 7: Evidence of Ergon capex review process, showing successive review iterations (direct costs only) - \$m, real 2012/13



Source: ANSWER_AERErgon031_5CONFIDENTIALFinal page 2

- 65. We note that presentations provided by Ergon include strategic environmental scans of the RP's for other regulated agencies,³³ lower expenditure scenarios as illustrated in Figure 8 below,³⁴ and **strategic** positions on regulatory proposals with some anticipation of **strategic environmental**. This process may suggest that a level of conservatism and potential contingency is built into the proposed expenditure allowance, with capex constrained not to an optimal level, but rather strategically positioned to meet capex expenditure expectations following AER review and price path objectives, as described above.
- 66. Ergon's budget reductions in the current RCP were supported by assessments that were intended to test the boundaries of cost and risk.

While these reductions in expenditure are acknowledged, in Figure 8 there are scenarios for further cuts in asset renewal expenditure below the RP that appear to be untested for similar "cost savings".









Source: Attachment 5 AFREC _Board Update_CAPEX_May 2014 V5

67. We consider that Ergon's top-down challenge may embed a conservative approach to risk given the strategic positioning of its RP and the expenditure iterations around an assessed "extreme risk". Where a potential contingency is built into the expenditure forecast (and that reflects conservative risk assessments and/or a price path objective), capex may not be constrained to a prudent and efficient level.

3.2.3 Step Changes in Expenditure at RCP boundaries

68. A total of \$619.6m or 70% of all renewals costs are driven by what Ergon describes as "essential end-of-life renewal decisions".³⁸

³⁸ 07.00.01 Asset Renewal Expenditure Forecast Summary, page 43



- 69. We note Ergon's continuing commitment to stronger predictive forecasting capability, its CBRM programs and investment in network monitoring and data collection. However, in a number of asset categories we observed step changes in program structure where one program disappears only to be replaced by another. These step changes appear more often than not to coincide with RCP boundaries.
- 70. In Section 7, we observe that repex program levels and timings in particular do not seem to result from the application of a CBRM methodology. There is evidence that programs are planned to occur within RCPs, without explicit justification for those timing assumptions. This does not reflect sound engineering and asset management practice and tends to undermine the credibility of claims regarding expenditure drivers and risk-based prioritisation.
- 71. We observe that the step changes in proposed expenditure for the forthcoming RCP, relative to the current RCP, appear to be aligned with the RCP revenue reset cycle. This does not accord with needs-driven asset management practice.

3.2.4 Risk management

Bias towards over-estimating risk

- 72. Ergon has established a risk management framework which consists of a tiered structure of policy, standard and guidelines documents that set out Ergon's corporate and operational requirements, including reporting and escalation. In support of the framework, Ergon has developed a governance structure comprising review committees with responsibility for review of risks at all levels in the business.
- 73. We note that Ergon is in the process of documenting 'risk appetite' statements. Where risk appetite statements are not available, Ergon relies on risk consequence tables and application of a risk tolerability scale.³⁹ Ergon applies the ALARP principle to its tolerability scale (as shown in Figure 9 below) to guide the actions to be taken by the business.

³⁹ STCR001 Standard for Corporate risk management, page 24 states that "To date, risk appetite statements have been developed for the following risk areas: Employee Health & Safety, Environmental & Cultural Heritage, and Procurement and these have been reviewed and approved by the Ergon Energy Board and communicated relevant areas of the organisation."



Figure 9: Risk tolerability criteria

| | RISK T | RISK TOLERABILITY CRITERIA, APPROVAL & ACTION REQUIREMENTS | | | | | | |
|---------|--|--|---|---|---------------------|---|---|--|
| | LEVEL of RISK APPROVAL POSITION Extreme - Intoleral (stop exposure immediate | | RISK APPROVAL POSITION | ACTION REQUIREMENTS | | | | |
| | | | e - Intolerable sure immediately | e Immediate action required, needs active management - Introduce new or changed risk controls to reduce the RESIDUAL level of risk to the Tolerable Range. | | | | |
| | High Security General Manager Approval (required to continue High RESIDUAL risk o all o all (required to continue High Residual risk (required to continue (required to continue (requir | Executive General Manager Approval | Needs active management - introduce new or changed risk controls based on Cost-Benefit Analysis and ALARP to reduce level of risk. | | | | | |
| | | High INHERENT Risks and above to be reported monthly to Risk & <u>Monthly Report</u> Assurance for inclusion in a Consolidated Business Unit / Corporate Risk Profile. | | | | | | |
| ge | Madium | ARP anaged t oracticab | Group / General Manager Approval | Needs regular monitoring - monitor risks in conjunction with review of the effectiveness of the existing controls. Introduce new or changed risk controls based on Cost-Benefit Analysis and ALARP. | | | | |
| e Ran | medium | AL/ range m sonably p | Medium RESIDUAL risk exposure) | Monthly Report Medium INHERENT Risks and above to be reported monthly to Business Unit EGM for inclusion in Business Unit Risk Profile. | | | | |
| olerabl | Low | tisk in this r reas | isk in this reas | lisk in this reas | lisk in this rea | Line Manager Approval (required to continue | Needs control review - monitor risks in conjuction with review of existing control procedures. | |
| Ĕ | | E) | Low RESIDUAL risk exposure) | Monthly risk review at workgroup level of all Low risks and above. | | | | |
| | Very Low | No Approval Required | | Periodic review of the risk and effectiveness of the existing controls. | | | | |

Source: STCR001 Standard for Corporate risk management

- 74. The risk framework documents include requirements for the consideration of three risk levels: (1) inherent risk; (2) residual risk after treatment or application of risk controls; and (3) target risk. As discussed in sections 6 and 7, we did not find consistent application of this tiered risk assessment.
- 75. Ergon has developed a number of risk management processes from the core risk management model for "*specialist work areas*" including Network Risk to be applied with "*risks associated with all projects and programs that are to be considered for inclusion into Ergon Energy's Capital Program of Works*".⁴⁰
- 76. Ergon states that "Semi-Quantitative risk assessment is to be used as a minimum for network risk based assessments, to estimate the likelihood of the nominated consequence occurring".⁴¹ However, we observed that the standard and guideline appear to have been applied to augmentation capex only. As discussed in section 7, the risk assessment for repex includes a qualitative assessment only.
- 77. For network risk assessments, Ergon has mapped a range of risk scores that result from evaluating semi-qualitative risks against a 6x6 assessment matrix and applies these to the tolerability scale shown above.⁴² In addition, detailed consequence tables for each risk category provide guidance for Ergon's risk assessments.
- 78. Ergon provided a copy of the maintenance risk register that is consistent with the types of information we expect to see regarding risks, controls and ratings.

⁴¹ STMM002 Network Risk Standard, page 9

⁴⁰ STCR001 Standard for Corporate risk management

⁴² STMM002 Network Risk Standard, page 12



79. Specific to repex programs, we consider that application of the corporate risk assessment criteria (for likelihood and consequence) appears to result in a bias towards over-estimation of risk. In the absence of a top-down challenge to calibrate and/or downgrade the project and program risk assessments, we consider that this is likely to contribute to an elevated repex activity forecast.

Reactive management of risk

80. As described in section 7, we have reservations about the completeness of Ergon's analysis supporting forecast expenditure. An example is the acceleration of the feeder re-conductoring program. There was a delay in response and necessary acceleration of works (initially HV and now the LV re-conductoring program) arising from a revised risk analysis. This is suggestive of a reactive approach to risk management and potential deficiencies in the timeliness and completeness of Ergon's analysis.

3.2.5 Business targets and dashboards

Performance measurement

81. Ergon provided a sample of its performance reports and dashboards. We note that performance is reported regularly providing a range of KPIs with actual, forecast and target performance and status of its works delivery program⁴³ reported to the Board and committees as shown in Figure 10 below. From the information we reviewed, it appears that adequate measures are in place to report, monitor and measure RP augex and repex program performance and delivery.



Figure 10: Board Chief Executive Overview Reporting

Source: 1403-09 Chief Executive Overview and Finance Report - February 2014, page 2

⁴³ 1407-27 Investment and Works Delivery Report - June 2014



Allocated Shared Costs

- 82. It is difficult to reconcile the step-change increase in overhead costs implicit in Ergon's forecast and which is markedly higher than the indirect cost ratios for the past decade.
- 83. Ergon advised that "its continual focus on efficiency and effectiveness has included contracting its business head count by 17.5% since April 2012".⁴⁴ Ergon has also stated that its operations restructure is targeted to deliver a headcount reduction of 595 over four years.⁴⁵ This "is consistent with Ergon's focus on headcount reductions across the organisation and managing staff movements with internal resources".⁴⁶
- 84. In Figure 11 below, we note the Delivery Plan resources required to deliver the works program showing both internal and external contracted resources. We note that the internal resource allocation is a constant for the whole five year period. This appears to conflict with the headcount reduction referred to above, and perhaps explains the increasing capex on-cost proportions that we noted in section 2.4.



Figure 11: Ergon Resource Allocation 2010 - 2020

Source: 07.00.10 Deliverability Plan, page 39

85. We observed no projected headcount reduction for the forthcoming RCP in either the delivery plan (for internal hours) or reduction in total allocated shared cost to capex. Rather, we observed that the shared costs allocated to capex reflect an increasing proportion of reported total capital expenditure.

Summary

86. We find it difficult to reconcile the delivery plan internal service hours in Ergon's RP with the increasing shared cost allocation of overheads to capex and the forecast reductions in organisational headcount. This may suggest falling productivity and cost inefficiency in delivering the forthcoming RCP program.

^{44 0}B.01.01 2015 Regulatory Proposal, page 70

⁴⁵ 07.00.10 Deliverability Plan, page 16

⁴⁶ 07.00.10 Deliverability Plan, page 28



3.3 Concluding remarks

- 87. Ergon provided supporting information to demonstrate an iterative top down challenge process. We observe that this process appears to have delivered material reductions in its initial bottom-up forecast of capital expenditure requirements. However, we did not see evidence to demonstrate that Ergon's capex was constrained to a prudent and efficient level. Rather, it appears to be strategically positioned to meet capex expectations based significantly on a CPI price path objective.
- 88. Whilst Ergon considers that the capex program it has proposed represents a level of risk at the upper end of its program options, it has not demonstrated that the iterative process reflects an optimal risk/cost position to achieve a prudent and efficient level of expenditure and its internal documents show lower capex forecasts than it has proposed to the AER. In the absence of a top-down challenge to calibrate and/or downgrade the project and program risk assessments, this may contribute to an elevated level of proposed expenditure activity.
- 89. We observed step changes in elements of Ergon's expenditure that do not appear to result from application of a CBRM methodology or trend data and appear to be more aligned with RCP revenue reset periods. When considered alongside examples of a reactive management approach, the completeness of Ergon's analysis and timing is brought into question.



4 Sourcing, Procurement, Deliverability and Efficiency

4.1 Overview

- 90. In this section, we summarise and assess the methodologies and practices that Ergon states it has in place to ensure that the proposed 2015-20 RCP program of works can be prudently, effectively and efficiently delivered.
- 91. Ergon identified the key working elements of the delivery model to include: (a) Master Works Planning and Resource Forecasting; (b) a two year rolling works planning and resourcing plan; (c) Scheduling, Controlling and Closing; and (d) Measurement, Analysis and Improvement phases.⁴⁷
- 92. Ergon advised that the Works Management System implemented uses a proven set of processes to enable a successful delivery of the works program. Ergon states that "*it continues the journey towards a mature works management system*," which "*is being embedded in Ergon Energy*'s day to day operations".⁴⁸

4.2 Assessment

4.2.1 Program Deliverability

93. Ergon has a documented Delivery Strategy Plan for its proposed portfolio of work as set out in the Regulatory Proposal. Ergon states that "*it is in a good position to successfully deliver the 2015-2020 work program*".⁴⁹ Ergon advised that the augex and repex programs will be delivered with a combination of its own staff and external

⁴⁷ 07.00.10 Deliverability Plan, page 23

⁴⁸ 07.00.10 Deliverability Plan, page 49

⁴⁹ 07.00.10 Deliverability Plan, page 11



service providers. The stepped contract strategy and planning approach is used to determine the "optimal amount of work to deliver the Program of Work (PoW)" and "establish the optimal contract structures".⁵⁰

- 94. We note that Ergon is seeking to improve the efficiency and effectiveness of the delivery of its program of works. Ergon stated that "*real reductions in the cost of work*" have been enabled "*by an aggressive pursuit of a number of work delivery improvement initiatives,*" while "*ensuring the right focus and reducing the overhead burden*".⁵¹
- 95. Ergon stated that it will make use of competitive procurement practises and outsourcing where value for money is demonstrated. Ergon identified 38 works and services initiatives in its network service delivery plan.⁵² Ergon stated that improvements and savings generated from these initiatives "*have been considered and are accounted for in the Resourcing Strategy for 2015 – 2020*^{7,53}
- 96. The works program represents an average of 4.6 million hours of work annually and an effective reduction of 2% in the level of activity in the baseline year of 2012 2013.

Figure 12: Delivery Plan Resourcing

8.2.1 The 2015-20 Delivery plan - allocation of work

Ergon Energy has the internal supply (normal time) to meet an average of 57% of the program of work. Table 3 below shows how the increase in the work plan for the next regulatory period is effectively managed by utilising external supply.

| | FY2015/16 | FY2016/17 | FY2017/18 | FY2018/19 | FY2019/20 |
|--|-----------|-----------|-----------|-----------|-----------|
| Demand | 4.61 | 4.70 | 4.49 | 4.57 | 4.61 |
| Internal Supply | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 |
| Current External | 1.35 | 1.28 | 1.16 | 1.13 | 1.17 |
| Residual subject to resource levers | 0.66 | 0.82 | 0.73 | 0.84 | 0.84 |

Table 3 - Supply vs demand and ability to adapt to changes

Source: 07.00.10 Deliverability Plan page 11

- 97. We observed changes in mix between the work programs undertaken in the current and forthcoming periods. When questioned, Ergon was confident that the contractor panels in place will accommodate this changed focus and notes that many of the projects utilise the same internal resource skills.
- 98. As discussed in Section 3, Ergon provided a sample of its performance reports and dashboards. We note that performance is reported regularly to the Board and its committees, providing a range of KPIs with actual, forecast and target performance

⁵⁰ 07.09.25 Contract Strategy EGM overview, page 7

⁵¹ 07.00.10 Deliverability Plan, page 11

⁵² 07.00.10 Deliverability Plan – Section 9.1 Initiatives Summary, page 43

⁵³ 07.00.10 Deliverability Plan, page 17



reported. Measurable performance KPI's and financial reporting is evident on investments, works delivery and associated risks, works management and delivery.⁵⁴

- ^{99.} The Major Projects Group has a prime responsibility for: (a) large specified capital works with a value greater than \$5m; (b) major customer initiated works; and (c) beta-program capital works valued at less than \$5m. Category (c) above is deemed to be beyond the delivery capacity of internal resources and thus is suitable for external delivery. Ergon advises that "*this approach provides flexible cost-effective mechanisms to provide delivery continuity for large programs of work which can be significantly disrupted or delayed by the disaster response requirement of internal resources and ensure a timely response to resource demand levels*" beyond the capacity of internal resources".⁵⁵
- 100. Overall, we are satisfied with Ergon's assessment that the proposed program of augex and repex is deliverable.

4.2.2 Procurement

- 101. Ergon stated that it has procurement governance processes, policies, principles and practices in place to ensure that contractual arrangements at all times reflect 'arm's length' terms. Ergon stated that three distinct category streams: (1) Construction & Contractors; (2) Corporate & Indirect; and (3) Materials were established to focus on 'similar spend' groups and align to key business and operational functions.⁵⁶
- 102. Ergon advised that: (1) "each of the category streams is led by an appropriately qualified manager;" (2) "agreements are established via competitive processes to meet business requirements and deliver value for money;" and (3) "the selection, evaluation and award process is supported by the engagement of relevant subject matter experts." Further, each of Ergon's 'high value and strategically critical' suppliers are managed by specialists within each category stream.⁵⁷
- 103. Ergon stated that it sources materials from a range of suppliers "that have proven record of delivering materials at the most effective cost, quality and timeliness."⁵⁸
- 104. Ergon has utilised period contracts for some of its key outsourced maintenance and inspection requirements. We note that Ergon also has "a range of preferred supplier arrangements in place for its materials inventory items which have undergone competitive tendering processes to ensure sustainable procurement and the achievement of optimum value from supply markets".⁵⁹
- 105. In the considerable majority of cases, work is outsourced through pre-qualified design, construction and maintenance contractor panels. Ergon advised that: *"this creates agility to address shorter term changes in the resourcing demand while ensuring that*"
- ⁵⁴ 1407-27 Investment and Works Delivery Report June 2014; 1403-09 Chief Executive Overview and Finance Report - February 2014
- ⁵⁵ 07.00.10 Deliverability Plan, page 30
- ⁵⁶ 07.00.10 Deliverability Plan, page 53
- 57 07.00.10 Delivery Plan, pages 53-54
- ⁵⁸ Final Master Pack AER -EMCa Review Sessions v2 day 1 presentation, slide 95
- ⁵⁹ 07.00.10 Delivery Plan, page 55



energy market consulting associat

the contractor can meet minimum performance standards and deliver at a market-tested price".⁶⁰

- 106. From time to time, Ergon "tests the open market with a public tender in an effort to validate whether value for money is being achieved with contractors. Similarly, Ergon Energy undertakes closed tenders with its prequalification panel contractors from time to time for the same reason."⁶¹ Ergon advised that open-market tenders have achieved cost reductions and performance efficiencies.⁶²
- 107. However Ergon, advised that it did not test the market where the business inputs were sourced from related parties (e.g. SPARQ) as external/alternative suppliers would not respond. These areas are reliant on independent benchmarking assessments.⁶³
- 108. In consideration of the advice received, and information provided, we are satisfied that Ergon's procurement governance, processes, polices and controls in relation to capex meet acceptable industry standards.

4.2.3 Labour Sourcing

Overview

- 109. We note that up to 30% of Ergon's delivery capacity can be provided by the external market, depending on demand.⁶⁴ Ergon advised that different pricing mechanisms are utilised within the above-mentioned contract formats to ensure value for money. The mechanisms include: (a) Fixed Price Lump Sum; (b) Schedule of Rates including hourly rates; and (c) Cost Plus under the Alliance arrangements. Ergon states incentive regimes also exist for a number of these contracts.
- ^{110.} Ergon advised that a variety of contract engagement methods are utilised and "*in the considerable majority of cases, work is outsourced through pre-qualified panels*".⁶⁵
- 111. In 2011, Ergon formed a Major Projects group to provide enhanced delivery of larger and more complex projects and programs. Ergon stated: "The group is growing their capability to effectively deliver project-based contracts through collaborative partnerships, preferred contractor panels and the open market".⁶⁶
- 112. Ergon advised that "as part of its delivery strategy, Major Projects manage the Substation Program Agreement (SPA) alliances, which have delivered an average of \$30M per annum, with a peak of \$50M since this delivery mechanisms initiation".⁶⁷

- ⁶³ 0A.02.03 Huegin Ergon Energy Category Analysis Benchmarks: Ergon's IT "cost per user" is mid-range compared to other DNSPs.
- 64 07.00.10 Deliverability Plan, page 29
- 65 07.00.10 Deliverability Plan, page 30
- 66 07.09.26 Deliverability Plan -Major Projects, page 10
- ⁶⁷ 07.00.10 Deliverability Plan page30; and 07.09.26 Deliverability Plan Major Projects, page 12

⁶⁰ 07.00.10 Delivery Plan, page 30 & 55; 07.09.26 Deliverability Plan - Major Project, page 10

⁶¹ 07.00.10 Delivery Plan, page 56



SPA replacement

- 113. As part of its delivery strategy for Major Projects, Ergon developed the Substation Program Agreement (SPA) alliances. Ergon advised that this strategy has delivered an average of \$30m per annum (with a peak of \$50m) since inception.
- 114. The Substation Program Agreement (SPA) is a core element of the documented 2015-2019 major projects delivery strategy. Two independent reviews have been conducted to initiate actions to improve its value and performance.⁶⁸



116. The ability and confidence of Ergon to accommodate a change in its delivery strategy of this nature suggests that there is sufficient depth of resources and capacity available to Ergon to absorb such a fundamental change.

EBA

- 117. Ergon advised that its Enterprise Bargaining Agreement (EBA) provisions provide employment security for all employees for the tenure of their employment. Under this agreement, Ergon's ability to reduce workforce will be limited to employee-initiated separation rates and maintenance of core technical skill capabilities. Nevertheless, Ergon has delivered headcount reductions by managing staff movements with internal resources.⁷⁰
- 118. Restrictions have been in place for a number of years on the use of contractors in undertaking work on the high voltage network. There are specified consultation requirements that must be followed when contracting out "core work". Ergon stated that priority is given *"to fully utilising available internal resources first and maintaining EEUCA commitments*".⁷¹
- 119. We note that Ergon has been able to implement flexible cost-effective contract panels to deliver continuity for large programs of work and timely response to resource demand levels beyond the capacity of internal resources. Ergon advised that competitive tendering within contract panels and for specific contract opportunities has delivered cost efficiency and productivity gains.
- 120. The EBA specifies that contract resources are entitled to rates of pay and allowances that, in aggregate, are no less favourable than those paid at Ergon. We questioned Ergon on its constraints for payment of contractors. Ergon advised that, while

⁶⁸ 07.09.26 Deliverability Plan - Major Projects page 12; and 07.00.10 Delivery Plan, page 30

^{70 07.00.10} Deliverability Plan, page 28

⁷¹ 07.09.25 Contract Strategy EGM overview, page 7


contractors used equivalent labour rates, benefits were delivered by their ability to compete for tasks and the productivity arising from how they utilised the rates and factored them into costs. Ergon is able to utilise contractors to effectively balance resourcing requirements. However, the EBA does impose a level of cost inefficiency arising from the constraint on the wider use of contractors and inflexible pay scale requirements.

Summary

121.

- 122. We are satisfied that the EBA is not a material constraint to the deliverability of the RP. Nevertheless, the EBA does impose cost inefficiencies arising from its constraints on the wider use of contractors and payment terms of engagement.
- 123. Ergon provided evidence that it has worked effectively within the bounds of the EBA to implement flexible cost-effective contract panels to deliver continuity for large programs of work. Ergon claims to be capable of a timely response to resource demand levels beyond the capacity of internal resources.

4.3 Concluding remarks

- 124. We are satisfied that Ergon's deliverability strategy is reasonable and that its proposed program of augex and repex is deliverable.
- 125. We consider that Ergon's procurement governance, processes, polices and controls to be generally consistent with industry standards.
- 126. We are satisfied that the EBA is not a material constraint to the deliverability of the RP. Ergon has been able to utilise contractors to effectively balance resourcing requirements, including the construction of flexible contract panels for larger programs of work.



5 Forecasting Methodologies

5.1 Overview

- 127. In this section, we summarise and assess the methodologies that Ergon used to forecast its augex and repex requirements. We consider this in three parts:
 - The methodologies used to forecast required augex activities;
 - The methodologies used to forecast required repex activities; and
 - The methodologies used to estimate the costs of those activities.
- 128. Ergon described its capex forecasting methodology in section 5.2 of its 2015-20 Regulatory Proposal. In summary, Ergon:
 - Develops initial category-level forecasts, using the methods summarised in the next subsections;
 - Consolidates the category-level forecasts, in real terms and with overheads allocated, into a forecast for the final two years of the current RCP and the five years of the next RCP;
 - Determines revenue and pricing outcomes and assesses the capex program against perceived customer and stakeholder expectations in regards to price and reliability, compliance and deliverability; and
 - Undertakes further review of the forecasts, including: (1) comparison with AER augex and repex model outputs; (2) independent external reviews; (3) trend analysis; (4) detailed project reviews; (5) technical assessments and reviews; and (6) reviews against project planning governance and documentation requirements.



5.2 Assessment

5.2.1 Augmentation activity forecasting

Demand forecasting

- 129. Our assessment of Ergon's demand forecast is provided in section 6. In the current section, we consider only the methodology by which Ergon has developed its proposed augmentation requirements from that demand forecast. We also take as a given the planning, reliability and security criteria that Ergon applied.
- 130. Ergon has applied one of two augex forecasting methods as described below, depending on whether the assets are sub-transmission or distribution.

Sub-transmission forecasting

- 131. Ergon sets out a 13-step process for sub-transmission augmentation in its Corporation-Initiated Augmentation (CIA) Expenditure Forecasting supporting document.⁷² We have synthesised these into the following statements of process:
 - Determination of spatial demand forecasts to the sub-transmission level, followed by network modelling to identify future constraints and the conditions that may cause them;
 - A deterministic assessment to identify loads exceeding plant ratings and forecasts outside of statutory voltage limits, followed by a 'safety net' assessment based on criteria agreed with the Queensland regulator and involving consideration of restoration times under a variety of operational restoration options (such as nonaugmentation options);
 - Identification of solution options to meet deterministic criteria;
 - Determination of the probabilistic cost of unsupplied energy, based on estimates of the annual energy at risk, the VCR, the probability of failure and estimated restoration time;
 - Identification of solution options to meet probabilistic and deterministic criteria;
 - Evaluation of the options, primarily using cost benefit analysis to identify the preferred option; and
 - Preparation of a business case for what Ergon refers to as the 'parent option', which may have component 'child' sub-options, such that a range of measures (including Demand Management and temporary solutions) are considered relative to a permanent augmentation.
- 132. In describing this process at the on-site meetings, Ergon referred to augmentation as the "*option of last resort*". We assessed for evidence of this intent in practice as part of our program and project reviews.

⁷² Supporting document 07.00.02



Distribution forecasting

- 133. Ergon sets out an eight-step process for forecasting distribution augmentation capex, which we summarise as follows:
 - Determination of spatial peak demand forecasts based on actual peak demands and forecast growth rates at the zone substation level, and which are applied to the distribution feeders;
 - Network modelling to assess the forecast against technical voltage limits and plant ratings;
 - Network risk assessment based on likelihood/consequence and assessment against a 'Risk Tolerability matrix'. Ergon states that "for risk in the tolerable range, the aim is to reduce risks to As Low As Reasonably Practicable (The ALARP principle)";⁷³ and
 - Development and costing of identified solutions for collation into a Program of Work (POW).
- 134. At the zone substation level, Ergon presents the following distribution of annual base summer growth. The figure below shows that, while aggregate growth may be relatively low, there are expected to be pockets of higher regional growth.⁷⁴



Figure 13: Distribution of Annual Base Summer growth

Source: On-site meeting slide pack, page 130

135. Distribution augex that is not directly growth-related is forecast on trend assumptions. This includes reactive issues such as addressing customer voltage complaints, small urgent works and addressing overloads.

⁷³ Ibid, page 49

⁷⁴ On-site meeting slide pack, page 130. It should be noted that high growth does not in itself imply an augmentation requirement, since this also depends on current capacity utilisation



General observations

136. Ergon has compared its augex forecast with outputs from the AER's augex model. After adjusting for the \$176m of WIP, Voltage and PV expenditure, Ergon concludes that its proposed augex is \$45m less than the augex model output, as shown in Table 5 below.

| Comparison of Augex to Proposed Augmentation | | | | | | |
|---|---------|---------|---------------------|---------|---------|-------|
| Year | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
| Augex Output | \$72 | \$72 | \$72 | \$71 | \$71 | \$358 |
| Total Augmentation | \$112 | \$111 | <mark>\$10</mark> 9 | \$79 | \$79 | \$490 |
| WIP, Voltage and PV | \$68 | \$39 | \$24 | \$23 | \$23 | \$176 |
| Total Augmentation (less WIP, Voltage and PV) | \$43 | \$73 | \$85 | \$56 | \$57 | \$314 |
| Augex – Augmentation | \$29 | -\$1 | -\$14 | \$16 | \$15 | \$45 |

Table 5: Comparison of Ergon augex forecast to AER augex model

Source: On-site presentation slide pack, page 138

- 137. We note that: (i) we have not validated the Augex model outputs proposed by Ergon; and (ii) we have not assessed Ergon's claim that the Voltage and PV expenditure (which appears to comprise over \$130m)⁷⁵ is not growth-related and should therefore be excluded from the comparison with the AER's Augex model output. Further, this amount is large and should be assessed using other means prior to inclusion.
- 138. Ergon claims to have addressed the following issues that the AER raised in its 2010 review of augex (including reliability), namely:⁷⁶
 - *"Maximum demand forecast too high;*
 - Do not demonstrate efficiency of preferred option;
 - Cannot reconcile capital expenditure forecasts to plans;
 - Do not demonstrate prudence / efficiency of expenditure, including volumes, benefits and timing; and
 - Overlap with other funding allowances."

Concerns regarding the risk assessment process

- 139. Ergon states that it has used its risk assessment framework to assess distribution augmentation projects. We note that the ALARP concept appears to have been applied not only to risks at the 'High' to 'Intolerable' level, but also to 'Low' risk considerations. This exhibits a degree of engineering conservativism that would naturally lead to overforecasting of activity requirements.
- 140. The ALARP principle allows for risks to be mitigated to the point where the cost is 'grossly disproportionate' to the benefits. However, because it applies a considerably

⁷⁵ Estimated by reducing the WIP, Voltage and PV total augex of \$176 in Table 5 by \$42m corresponding to the estimate for WIP in section 6, Table 7

⁷⁶ RP, table 49



lower cost hurdle than is normally required in a straightforward cost/benefit analysis, ALARP is most applicable to high or intolerable risks, leaving standard cost/benefit analysis as the preferred tool for the majority of risk assessments. We consider this further in our project-level assessments in section 6.

Inclusion of Demand management⁷⁷

- 141. Consideration of DM and non-network solutions appears to be incorporated into Ergon's decision processes for augmentation capex at the times that those augmentation decisions are required. Ergon claims that augmentation is a last resort in its augmentation decision process. We found evidence to support this in our project and program reviews (see section 6).
- 142. We are less convinced that targeted DM opportunities have been fully taken into account in producing Ergon's proposed augex forecast. On balance, there are likely prudent deferrals as DM, operational solutions and non-network solutions are invoked over the period and, while it is difficult for Ergon or for a reviewer to identify these at an early stage, they should be allowed for at an aggregate portfolio level.
- 143. We do not consider that the allowances for general DM in the demand forecasts are sufficient to take account of the targeted DM opportunities that will become more evident closer to the time when augmentation is otherwise required. However, we do consider that it is particularly important to allow for these given the very low growth scenarios. With high demand growth, a misjudgement on augex may simply lead to a timing regret. With minimal demand growth, such misjudgement may lead to an augmentation that is never required and which effectively becomes a stranded asset.
- 144. We consider it likely that the balance of probability is towards some opportunity for prudent deferral of some proposed growth expenditure on this basis.

Distribution augex forecasts are based on the medium demand forecast

145. We note that Ergon states in the RP that its expenditure forecasts for sub-transmission augex are based on the low demand forecast. This contrasts with Ergon's advice in the on-site meeting that the zone substation forecasts are based on a medium demand forecast. We were also advised that these forecasts are 'stretched-up' by 1% to 2% (to reflect the "trim factor"), the effect of which is to forecast 0.25 to 0.4% p.a. higher growth than the aggregate of zone substation forecasts.

Forecasting method for PV and "unspecified works" has not been described

146. Ergon has proposed augex expenditure of over \$120m to address issues with PV and also for "unspecified works". Ergon has not described the method by which it arrived at these forecasts. In the absence of this specific information, we assessed for justification as part of our project and program reviews in section 6.

Consideration of recent changes to the Value of Customer Reliability (VCR)

147. AEMO has recently reduced the planning value of VCR. We asked Ergon what effect this would have, and were informed that it would likely be small. Ergon advised that where VCR was nominated as the driver of project expenditure, the justification

⁷⁷ We assessed the inclusion of demand management in Ergon's augex plans only. It is not within our scope to consider opex cost impacts or the prospective net benefits of Ergon's DM program.



included other drivers. We have confirmed this in our review of a sample of augex projects and accept Ergon's conclusion that a change of VCR value would have little effect.

Summary

- 148. We consider that Ergon has evidenced forecasting methodologies for its growth-related augex that generally align with industry practice. We note that its methodologies may not have fully accounted for future DM and non-network solutions that Ergon's own augex decision-making process will uncover.
- 149. We consider that Ergon's application of its risk framework for the purpose of this forecast may have a bias towards inclusion of lower risk projects. On balance, we consider that Ergon will find opportunities over the next RCP for prudent deferral of some of the proposed growth augex.
- 150. Ergon has not described satisfactorily its methodology for forecasting non-growth augex, which is a considerable proportion of total augex. We assessed this component, based on Ergon's program and project documentation. We describe the results of our assessment in section 6.

5.2.2 Replacement activity forecasting

- 151. Ergon uses a combination of run-to-failure and proactive refurbishment and replacement asset management strategies and seeks to forecast expenditure that replicates these strategies. It uses a range of forecasting methods specific to each asset type, classified as follows:
 - Discrete Analysis;
 - Condition based Risk Management (CBRM); and
 - Simple Predictive Modelling.

152. Ergon applies these to the different asset types as set out in Table 6 below.



Table 6:Repex forecasting approaches by asset category

| ~ | - | | | |
|--|-------------------------------------|---|--|--|
| Asset type | Usual asset replacement approach | Replacement forecasting approach for 2015-20 Capex works | | |
| Air Break Switches | Run-to-failure | Simple Predictive | | |
| Capacitor Banks | Proactive | CBRM | | |
| Communications (backbone system) | Proactive | Discrete Engineering Review | | |
| Communications(Other) | Run-to-failure | Simple Predictive | | |
| Conductors | Run-to-failure | Simple Predictive | | |
| Current Transformers | Proactive | CBRM | | |
| DC System | Proactive | Discrete Engineering Review | | |
| Distribution Transformers | Run-to-failure | Simple Predictive | | |
| Distribution Other Assets (Fuses and Spreaders) | Run-to-failure | Simple Predictive | | |
| Gas Break Switches | Run-to-failure | Simple Predictive | | |
| Lighting | Proactive | Simple Predictive | | |
| Pole Tops (Distribution) | Run-to-failure | Simple Predictive | | |
| Pole Tops (Subtransmission) | Proactive | Discrete Engineering review | | |
| Poles | Run-to-failure | Simple Predictive | | |
| Protection | Proactive | Discrete engineering review | | |
| SCADA | Proactive | Discrete Engineering Review | | |
| Reclosers | Run-to-failure | Simple Predictive | | |
| Revenue Meters (ACS) | Proactive | Simple Predictive | | |
| Services | Run-to-failure | Simple Predictive | | |
| Static VAR Compensators | Proactive | CBRM | | |
| Underground Cables | Replace on fail | Simple Predictive | | |
| Voltage Transformers | Proactive | CBRM | | |
| Zone Substation Circuit Breakers | Proactive | CBRM | | |
| Zone Substation Isolators | Proactive | CBRM | | |
| Zone Transformers and Reactors | Proactive | CBRM | | |

Source: Supporting document 07.00.01 Asset Renewal Expenditure Forecast Summary, table 8

- 153. Ergon has taken steps to independently verify its models and their predictive capabilities. For CBRM, Ergon commissioned EA Technologies to compare asset failure rates from its models with actual failure rates and back-cast expenditure to recalibrate the models. Ergon also commissioned Parsons Brinckerhoff to review and recalibrate its lines defect management model.
- 154. Ergon applies an overall capex top-down challenge process (summarised in section 3). This includes assessing for different options and their timing on a risk basis and assessing the repex program against repex model outputs, as illustrated in the diagrams below (Figure 14 and Figure 15).



Figure 14: Change in risk over time



Source: Change in risk over time is from ANSWER_AER Ergon035_15



Figure 15: Comparison of repex model and repex expenditure forecasts

155. Ergon claims to have addressed concerns raised by the AER in its 2010 review of repex - namely:78

- "Asset ages overstate capital expenditure requirements;
- Models use outdated data and have internal inconsistencies; and
- Volumes do not use suitable data." •

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⁷⁸ RP, table 49



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Bottom-up methodologies appear fit for purpose

156. We note the use of different methodologies for forecasting required activity levels. We consider these to be generally appropriate for each asset class. In our project and program reviews, we consider the application of these methodologies to the forecasting of the relevant project and program requirements.

Top-down challenge process appears to have led to a more prudent program than bottom-up build alone

- 157. Ergon used a top-down challenge process which it described more fully in a response to our information request.⁷⁹ We observe that this process led to significant reductions between the first bottom-up plan and the final proposed plan. The significant rationale that we observe as leading to reductions in the forecast include:
 - Smoothing for resource availability;
 - Refinement of the initial forecasts, by various Subject Matter Experts;
 - Assessment as "critical", "mandatory" or "value-add";
 - Prioritisation based on NPV/cost ratio and risk/cost ratio;
 - Assessment against the strategic objectives of the Board; and
 - Re-assessment based on later information regarding 2014/15 deliverability.
- 158. From a methodology viewpoint, this challenge process appears to have been effective in iterating towards a plan that is more prudent and efficient than the initial bottom-up build. From our project and program reviews in sections 6 and 7, we form a view as to whether the application of this challenge process has resulted in prudent and efficient outcomes.

Top-down repex model appears to validate the proposed expenditure level

159. It is not within our scope to consider the validity or otherwise of the repex model output that Ergon presented. However, if the outputs are valid, then they appear to show that the proposed repex program is within the bounds indicated by the repex model, whatever calibration is used.

Concerns regarding the risk assessment process

160. As with augex, we note from the risk matrices that the ALARP concept appears to have been applied not only to risks at the 'high' to 'intolerable' level, but also to 'low' risk considerations. This exhibits a degree of engineering conservativism that would naturally lead to over-forecasting of activity requirements. The ALARP principle allows for risks to be mitigated to the point where the cost is 'grossly disproportionate' to the benefits. However, because it applies a considerably lower cost hurdle than is normally required in a straightforward cost/benefit analysis, it is most applicable to high or intolerable risks, leaving standard cost benefit analysis as the preferred tool for the vast

⁷⁹ ANSWER Ergon031_5_CONFIDENTIAL; see our description of this process in Section 3: Governance and management



majority of risk assessments. We make observations in relation to the application of the risk framework in our assessment of repex projects and programs in section 7.

Program stability is a concern

- 161. In reviewing repex trends at the category level, we observe some significant step changes coinciding with the commencement of the next RCP. In the on-site visits, we were advised that certain work would be undertaken if 'approved' by the AER, but that if the AER did not approve such work then it may not be undertaken.
- 162. This regulator-driven view of expenditure prioritisation is not consistent with the NER, nor is it consistent with good engineering or management practice. It leads us to consider the possibility that Ergon may have presented certain expenditure programs as 'ambit claims' on the assumption that the regulator will disallow some. Therefore, and notwithstanding the apparent use of appropriate forecasting methodologies at the bottom-up category level, we paid particular attention to the application of those methods and their outcomes in order to advise in accordance with the NER criteria.

Summary

163. We remain concerned that Ergon's risk framework may have led to an over-estimation bias through inclusion of low risk projects without adequate justification. We have some concerns about the stability of the application of Ergon's repex forecasting methodologies, with evidence of step changes coinciding with the RCPs and programs of work 'shoe-horned' into regulatory cycles.

5.2.3 Cost Estimation

Overview

- 164. In this section, we summarise and assess the methodologies and practices that Ergon stated that it has in place to ensure cost estimates are prudent and cost efficient.
- 165. Ergon uses the Ellipse Enterprise Resource Planning (ERP) system to develop, monitor, analyse and review capital investments over the investment lifecycle.⁸⁰
- 166. Ergon develops cost estimates for all major projects (i.e., greater than \$1 million) when there is certainty around the constraint, scope, location and timing of the investment. Ergon's estimating system is designed such that, as each specified investment progresses through Ergon Energy's Gated Governance framework (obtaining financial approval for investments), the estimate progressively undergoes review and refinement and is updated accordingly.⁸¹
- 167. These investments begin with one or more standard estimates. Standard estimates are ready-made estimates based on standard designs and drawings. Estimating specialists create the standard estimates and update these when standard designs change. The repository for these estimates is located in internal IT systems.⁸²

- ⁸¹ 0B.01.01 2015-20 Regulatory Proposal, page 111
- 82 0B.01.01 2015-20 Regulatory Proposal, page 111

⁸⁰ 07.00.09 Unit cost methodologies summary, page 6



- 168. As a specified project progresses, it moves through five different phases and the estimating system supports the management of this progression. The five phases are Pre-Concept, Concept, Development, Implementation and Finalisation.⁸³
- 169. Where there is some uncertainty in the investment scope, location, or if the investment involves significant volumes of recurrent work, Ergon will develop an expenditure forecast based on a prediction of volumes multiplied by a unit cost. Subsequently, Ergon will apply one of the following three approaches:⁸⁴
 - Historical average cost program estimates when future activities and costs are expected to reflect the historical activities and associated costs;
 - Bottom up program (product) estimates where historical data is not available or where data is not reflective of future activities or costs; and
 - Application of uplift factors where Ergon's delivery plan indicates the work will be outsourced to contractors,⁸⁵ appropriate mobilisation and cost uplift factors are applied.

Approach used for the current RCP

- 170. Ergon has a Unit Cost Methodologies Summary⁸⁶ document, that seek to: "explain and justify the methodologies applied by Ergon Energy to develop unit cost estimates for its Standard Control Services (SCS) and Alternative Control Services (ACS) for the next regulatory control period ..."
- 171. Ergon advises that the Unit Costs Methodologies document guides its current adopted practice. It states:
 - "For both investment types (projects/programs) the cost estimates are based on scopes of work that are verified by subject matter experts in the field that they pertain;
 - exclude the cost of borrowings, unknown costs, and uncertainty allowances;
 - are created by estimating specialists that update the Ellipse ERP estimates when the standard designs change;
 - are reviewed, refined and revised as each specified investment progresses through Ergon Energy's gated governance methodology to obtain financial approval for investments; and
 - are the most current estimate based on each project's lifecycle of development, given that Ergon Energy's specified projects may be at various lifecycle phases as at the time of this regulatory submission."⁸⁷

- ⁸⁶ 07.00.09 Unit cost methodologies summary
- ⁸⁷ ANSWER_AER Ergon 033_Final Question 11

⁸³ 0B.01.01 2015-20 Regulatory Proposal, page 112

^{84 0}B.01.01 2015-20 Regulatory Proposal, page 112

⁸⁵ In its RP, Ergon state that 17% of its work is outsourced to contractors



- 172. Ergon advised that specified projects may be at various life-cycle phases, whereby "*the* estimates used in its regulatory submission are the most current estimates based on each project's lifecycle of development".⁸⁸
- 173. Ergon advised that "its estimating practices have undergone a process of continuous improvement over the course of the current regulatory control period".⁸⁹
- 174. Ergon provided comparisons across other DNSPs of various asset replacement unit costs. Refer to Figure 16 below. We are advised that this material is drawn from RIN data and has been supplied to Ergon by Huegin. Ergon's observation is that it "appears to perform relatively well against other DNSPs in terms of its asset unit cost replacement, noting the inherent limitations associated with unit rate benchmarking".





Source: AER_Ergon033 Supplementary Average Unit Replacement

175. Comparison of the average unit replacement cost of individual assets contained in the Huegin 2014 benchmarking study is shown in Figure 17 below.

⁸⁸ ANSWER_AER Ergon 033_Final Question 11

⁸⁹ ANSWER_AER Ergon 033_Final Question 11



Figure 17: Comparison of replacement cost of individual asset types

Replacement Capex (average replacement costs)

To compare the replacement cost of individual asset types, the total replacement expenditure can be divided by the assets replaced for an average item replacement cost by asset class. Even at this level, however, cost factors remain unaccounted for assets in dense urban areas often attract more access costs and different voltage and ampere ratings influence unit costs significantly. So differences in costs at this level may simply reflect location and design influences.



Source: 0A.02.01 Huegin - Ergon Benchmarking, page 26

176. Benchmarking studies indicate that Ergon's costs are within the benchmarked range of costs and do not indicate bias.

Contingency Allowances

177. We are advised that Ergon excludes the cost of borrowings, unknown costs and uncertainty allowances. We are satisfied that this approach would address any bias that may arise by aggregating the contingency allowance on the RP program of work.

Summary

178. We are satisfied that the framework and methodology applied by Ergon to cost estimation is reasonable.

5.3 Concluding remarks

- 179. We consider that Ergon's expenditure forecasting methodologies largely align with standard industry practice. However, we consider that its risk methodologies would tend to lead to a degree of over-estimation bias, with inclusion of some low risk projects that may not be sufficiently justified. We also note that its methodologies may not have fully accounted for future DM and non-network solutions that Ergon's own augex decision-making process will uncover.
- 180. We also do not observe a defined methodology for forecasting non-growth augex, and have relied on our experience in our program assessments described in section 6 of our report.
- 181. In its augex program, we observe that Ergon will likely find opportunities over the next RCP for prudent deferral of some of the proposed augex projects.



182. In its repex program, we observe some significant step changes in the mix of work and which tend to align with RCPs. This may indicate a lack of stability in the application of Ergon's forecasting methods.



6 Proposed Augex

6.1 Overview

Expenditure summary

- 183. For the current RCP, actual augex is below the AER allowance. Ergon advised that this is due to lower demand than forecast, changes in planning standards, increased demand management and PV uptake and a change in strategy that is driven by the shareholders expectations.⁹⁰
- 184. In this section, we provide an assessment of the application of Ergon's governance and management and forecasting methodologies to the projects and programs proposed within the augmentation expenditure category. We did not review any proposed contingent projects.

Drivers of augmentation capex

- 185. Ergon has progressively moved away from the ENCAP security criteria following the introduction of the safety net and value of customer reliability (VCR) based approaches defined in the Distribution Authority (DA). Ergon confirmed that the forecast expenditure aligns with the requirements of the DA effective 1 July 2014.
- 186. In response to changing shareholder expectations, Ergon developed new security criteria which has two principal components:
 - a component that is based on a VCR-based approach for reliability based investment; and

⁹⁰ The expectations of shareholding Ministers underwent changes during this regulatory control period. In March 2012, a new government was elected in Queensland and this brought with it changes in shareholder expectations for Ergon Energy. In particular shareholding Ministers in a letter to Ergon Energy on 6 September 2012 stated expectations that the business would position itself so that in the next regulatory control period, the network price for electricity will not increase greater than the CPI



- a safety net component, to ensure a basic level of network security, covering mandatory investment.
- 187. As a result of the changes in the Security Criteria, Ergon noted that there has been a change in the ratio of investment between Sub-transmission and Distribution.
- 188. We noted statements in the supplied information and in our meetings with Ergon that refer to legacy issues such as: "It is important to remember that Ergon Energy was formed from 6 regional boards with different planning and construction practices. This results in variation between regional constraints and augmentation requirements."⁹¹ We understand that the merger of the regional boards into Ergon occurred circa 2000. Accordingly, we would not expect legacy issues to have a material impact on expenditure forecasts for the period 2015-2020. However, reference to this condition suggests that legacy conditions may have impacted the expenditure forecasts.

Program overview

189. Ergon's proposed augmentation capex is shown in Table 7 below. We note that there is a difference between the total augex (direct costs) sourced from the supporting information provide by Ergon and the data supplied from the RIN. We have used the supporting information in our assessment since it directly relates to the projects and programs within the scope of our review.

| | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
|----------------------|---------|---------|---------|---------|---------|-------|
| Sub-transmission | 46.3 | 50.3 | 48.4 | 18.6 | 19.7 | 183.3 |
| VCR | 13.9 | 17.6 | 25.4 | 0.1 | 0.0 | 57.1 |
| Safety Net | 7.3 | 13.5 | 8.8 | 2.0 | 1.8 | 33.4 |
| Technical Compliance | 7.2 | 13.8 | 6.5 | 16.1 | 17.8 | 61.4 |
| Powerlink | 14.8 | 4.3 | 7.3 | 0.5 | 0.0 | 26.9 |
| Property Acquisition | 3.0 | 1.1 | 0.4 | 0.0 | 0.0 | 4.5 |
| Distribution | 65.3 | 61.1 | 60.4 | 60.0 | 59.6 | 306.5 |
| Unmodelled | 17.1 | 16.6 | 16.0 | 15.5 | 15.0 | 80.2 |
| PV augmentation | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 40.6 |
| Modelled | 14.2 | 22.0 | 32.7 | 32.8 | 33.8 | 135.5 |
| Works in Progress | 24.2 | 12.7 | 2.0 | 1.9 | 0.9 | 41.7 |
| Transformer upgrade | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 8.4 |
| Quality of supply | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 6.5 |
| Reliability | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 5.5 |
| Total | 114.0 | 113.8 | 111.3 | 81.1 | 81.6 | 501.7 |

 Table 7:
 Augex summary by category (direct costs), \$m - real 2014/15

Source: Ergon expenditure summary documents

190. The expenditure profile is characterised by a larger percentage of work in progress in the first few years of the RCP.

6.2 Assessment

191. The following subsections provide our assessments on the material components of Ergon's proposed augex. We used these assessments to evidence any systemic issues as reported in our key findings.

⁹¹ Onsite presentation, An Overview of Our Regulatory Proposal 2015-2020, slide 142

6.2.1 Demand forecasting

How Ergon has forecast demand

192. Ergon prepares a bottom-up forecast for each individual zone substation (i.e., spatial maximum demand forecasts) based on its knowledge and understanding of its customer base and its assessments of future growth in the communities supplied from each zone substation. The forecasts produced for all zone substations are aggregated to bulk supply substations and connection points.

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- 193. Forecasts are subsequently aggregated to a system level and reconciled to a top-down forecast of system maximum demand. Ergon's system maximum demand forecast is derived using an econometric model, but includes some "post-modelling" adjustments (such as to take account of expected further growth in PV).
- 194. Ergon adjusts the aggregated zone substation (spatial) forecasts to reconcile to the system maximum demand forecast. At the onsite meeting, Ergon advised that it increased the spatial forecasts by around 1% to 2% in aggregate (i.e., the sum of the spatial forecasts before adjustment was lower than the system forecast determined from its econometric modelling).
- 195. Since the last regulatory review process, the forecasting methodology has been changed to incorporate recommendations from both the AER and joint working studies undertaken by Ergon with Energex. In particular, Ergon has taken measures to address the need for a "Load Forecast System Maximum Demand" process that delivers a topdown system maximum demand forecast to reconcile the bottom-up forecasts.

Ergon's demand forecast and our observations

196. As shown in Figure 18 below, Ergon's maximum demand during the current regulatory control period has remained steady overall. However, Ergon's "medium growth" forecast is for average growth in system peak demand over the next five years of 1.3% to 1.5% per year.



Figure 18: Ergon - Forecast system peak demand growth scenarios (2014)



Source: 07.00.02 CIA Expenditure Forecast Summary

- 197. A key driving input to Ergon's growth forecast scenarios is Ergon's assumptions for gross state product⁹² and its assumed relationship with demand growth. In its CIA forecast expenditure summary, Ergon states that it has "*used the load forecast associated with the low economic growth scenario to formulate the augmentation program of works for the 2015-20 period*".⁹³ Similarly, Ergon's RP states that the "*submission is based on a low growth scenario*".
- 198. In contrast, we note Ergon's advice at the on-site meeting that the reconciliation adjustment it made to the zone substation spatial forecasts was based on the medium demand scenario.⁹⁴ This variation in approach is not documented in the RP or its CIA expenditure forecast summary. The apparent result is that at least its distribution-level forecasts are based on a medium growth scenario.
- 199. Having regard to this, we requested analysis for an alternative scenario of zero forecasted growth. Ergon advised that the total percentage of the specified DNAP that is related to growth during the 2015-2020 period is approximately 31% or \$42.3m.⁹⁵

Summary

200. We found that Ergon increased the spatial forecasts by around 1% to 2% to account for its top-down econometric model based forecast. We consider that the 31% growth related expenditure component of the forecast appears high. We took this into consideration when reviewing the sample of sub-transmission and distribution projects.

- 93 07.00.02 CIA Expenditure Forecast Summary, pages 20-21
- ⁹⁴ On site meeting day 2
- 95 AER Ergon 041 (31) Growth DNAP BEH (3), page 2

⁹² The gross state product referenced to 5220.0 Australian National Accounts: State Accounts and Australian Bureau of Statistics GSP data set

6.2.2 Demand management

Overview

201. Ergon has a significant demand management (DM) program, which is largely funded from opex. It is not within our scope to consider opex cost impacts or the prospective net benefits of Ergon's DM program. However, we did seek to ensure that the benefits of the DM program are included in Ergon's augmentation capex proposal.

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- 202. In its RP, Ergon reports on its DM program over the current RCP as follows: "We reduced demand ... through initiatives aimed at constrained areas of the network. As we entered 2014-15, the final year of the current regulatory control period, we surpassed our five-year demand management target, delivering 126MVA in demand reductions, which deferred or avoided \$644 million in capital investment".⁹⁶
- 203. Ergon has estimated the reduction in peak demand that it considers will be achieved as a result of DM programs proposed for the forthcoming RCP. Refer to Table 8 below.

 Table 8:
 Ergon Peak Demand Reduction Targets (MVA) for 2014/15 – 2018/19

| Table 10: D | emand Re | eduction T | argets |
|-------------|----------|------------|--------|
|-------------|----------|------------|--------|

| Additional Demand Targets | 2014-1 | 15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | Total |
|--------------------------------------|--------|------|---------|---------|---------|---------|-------|
| Broad-based, Smart Network Programs | | 3.3 | 2.5 | 3 | 3.5 | 4 | 16.3 |
| Safety net risk mitigation | | 2 | 2.4 | 3.4 | 4.2 | 4.6 | 16.6 |
| Network Constraint targeted programs | | 9 | 8.1 | 10.5 | 9.4 | 10.2 | 47.2 |
| Total Additional Demand | | 14.3 | 13 | 16.9 | 17.1 | 18.8 | 80.4 |

Source: Ergon Energy Demand Management Overview 2015-2020, page 42

- 204. We confirmed that Ergon's demand forecasting methodology accounts for these savings at the aggregate level through an explicit reduction to its econometric system peak demand forecast model. Therefore, these reductions are effectively accounted for within the aggregate spatial demand forecasts.
- 205. We are less confident that Ergon has accounted in its augex forecast for the impact of targeted reductions that, under Ergon's augmentation planning process, will be sought in order to defer or even avert the need for specific augmentations. Whilst it is not realistic to identify the specific DM-driven deferrals, we consider that Ergon will find and take advantage of such opportunities under its augmentation planning process and so on the balance of probabilities, we consider that it will be able to incur less growth capex than it is forecasting at this time. We note the zero-growth DNAP component referred to in the subsection above.

Summary

- 206. We find that Ergon has accounted for its DM savings in its aggregate level forecast and, by implication, in its adjusted spatial forecasts.
- 207. We are less confident that Ergon has accounted in its augex forecast for the impact of targeted reductions that, under Ergon's augmentation planning process, will be sought

⁹⁶ RP, page 100



in order to defer or even avert the need for specific augmentations. On the balance of probabilities, we consider that it will be able to incur less growth capex than it is forecasting at this time.

6.2.3 Sub-transmission

Ergon's strategy for sub-transmission augex

208. Ergon's sub-transmission augex has three principal expenditure drivers (VCR, safety net and technical compliance) that reflect the security criteria. Two additional categories (Powerlink and property acquisition) make up the remainder of the expenditure forecast.

Expenditure trends

- 209. The overall augex forecast of \$183m is comprised of 23 existing projects which total \$39.7m (works in progress) and 31 new projects which total \$143.6m.97
- 210. The augex forecast represents a substantial reduction from actual augex spend in the current RCP. Larger proposed expenditures in the first three years of the forthcoming RCP are primarily due to projects already underway.

Alignment of expenditure and strategy

- 211. Across the sub-transmission program, the network risk assessment values ranged from 0 to 36. However, only 32 projects (59%) had numerical values included in the program.⁹⁸ Other projects had blank fields or used labels such as 'Program' or 'Exempt' in place of a risk value. It was not evident whether the risk score was developed and/or was a determinant in the selection of these projects.
- 212. Ergon states that the augex program is reviewed annually. During our onsite review, Ergon presented examples to demonstrate where augmentation had been deferred or cancelled as a result of its annual review process. During the onsite sessions, Ergon noted examples of expenditure deferral through demand management initiatives. During our demand forecasting, demand management and project reviews, we endeavoured to establish the extent to which the impact of such initiatives were considered in the 2015/20 forecast. On the balance of probabilities, we consider that Ergon will find opportunities to prudently defer some expenditure that is currently included in its proposal.

Value of customer reliability

213. Of the sub-transmission program, 12 projects are identified in the VCR expenditure category with seven existing (total \$7m) and five new (total \$50m) projects.⁹⁹ Of the new projects, the Asset Management expenditure driver was nominated as security of supply or plant rating, with the exception of the "Construct Toogoom Substation -Modular 3 11kV feeders" project. A single project: "Reinforce supply to Gayndah" represents 72% (\$41m) of the associated expenditure.

- 98 Ibid
- 99 Ibid

⁹⁷ Ergon Energy, 07.02.03 Subtrans network augmentation plan



- 214. Ergon has implemented a value of VCR based on the 2007 Vencorp metrics. Ergon advises that they are working with AEMO regarding its review of VCR and its applicability to Queensland customers.
- 215. In the onsite review, Ergon stated that they had undertaken sensitivity analysis which confirmed that the value of VCR did not advance any projects in the forecast. Ergon advised us during the onsite session that secondary drivers such as security limit breach were evident in projects where VCR was indicated as being the primary driver (i.e., so the projects would remain in the forecast even if VCR were to be revised downwards).

Reinforce supply to Gayndah (66kV network)

- 216. We undertook a review¹⁰⁰ of the *"Reinforce supply to Gayndah"* project. This project represents 72% of the expenditure in the VCR sub-category for new projects.
- 217. The purpose of this project is to strengthen the 66kV network in the Gayndah area. This includes the feeders for Degilbo, Eidsvold, Gayndah and Mundubbera, as well as the supply to Mt Rawdon gold mine.
- 218. In 2014, Ergon estimated the total project capital cost at \$65.4m, including all Ergon overheads and a 15% contingency allowance,¹⁰¹ with \$24.7m of this total scheduled for 2016/17.
- 219. The 2014 scope of the project includes: (a) provision of a further 66kV feeder bay at T131 Isis BSP for an estimated \$1.47m; (b) construction of 38km of 66kV single circuit concrete pole NEON line form T131 Isis BSP to the future Dallarnil 66kV switching station site for an estimated \$24.0m; (c) rebuild the 12 km Dallarnil-Degilbo Tee line section with 66kV single circuit concrete pole NEON line for an estimated \$7.6m; and (d) rebuild the 51.5km Degilbo Tee-Gayndah line with 66kV single circuit concrete pole NEON line for an estimated \$32.3m.
- In the June 2012 report by System Development, entitled 'Gayndah 66kV Network Augmentation', this project was scheduled for completion by 30 November 2014.
 However, the report has obviously since been updated as the capital works funding allocation table shows project completion in 2016/17.
- 221. The timeline for the project portfolio for the Gayndah 66kV Network Augmentation is shown in Figure 19 below. We assume that the proposed \$24.7m included in the 2015/20 RCP relates to project number WR292085 and includes a 15% contingency sum.

¹⁰⁰ Our review included reference to Attachment 12_ISIS RWR Gayndah network aug'n V4 - Planning Report ND227.pdf - 16 pages and Attachment 13_Isis Gayndah 66kV Subtransmission Constraint Review.pdf

¹⁰¹ Attachment 12_ISIS RWR Gayndah network aug'n V4 - Planning Report ND227.pdf, page 7



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| Figure 19: | Proiect Timeline | - Gavndah 66kV | network augmentation |
|------------|------------------|----------------|----------------------|
| | | | |

| Project: | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 |
|--|-----------|-------------|--------------|-------------|--------------|
| WR 183596 – Construct 38km of 66kV SCCP NEON line from T131 Isis BSP to future Dallarnil 66kV switching station site | \$208,812 | \$349,202 | \$17,858,518 | \$5,738 | |
| WR 306794 – T131 Isis – Install one new 66kV feeder bay | \$31,488 | \$1,003,031 | \$638,267 | | |
| WR 292160 – Rebuild the 12km Dallarnil-Degilbo Tee line section as 66kV SCCP NEON | | | \$1,309,572 | \$2,829,852 | |
| WR 292085 - Rebuild the 51km Degilbo Tee-Gayndah line as 66kV SCCP NEON | | | \$535,584 | \$890,988 | \$24,682,272 |

Source: Attachment 12_ISIS RWR Gayndah network aug'n V4 - Planning Report ND227.pdf - page 9

- 222. The Gayndah substation sits at the heart of this sub-network. It is supplied by two 66kV feeders: the Isis-Mt Rawdon Tee-Gayndah line; and the Childers-Degilbo Tee-Gayndah line.
- 223. The total loading over the four subs was 17.8MVA in 2013/14 and is projected to grow at 1.14%pa. The load history provided shows a drop of 21% in 2010/11 which is not explained. Since that time, there has been a small but steady growth recorded. The load forecast table in the report '*Isis Gayndah 66kV Sub-Transmission Constraint Analysis*' shows zero growth from 2015 to 2024.
- 224. Ergon's Security of Supply (SoS) criteria indicates that N-1 line capacity should be provided as the peak load exceeds 15MVA. This excludes the Mt Rawdon supply as the contract requires N security as it is considered to be a sheddable load (11MW).
- 225. The key driver for this project is the inadequate rating and poor condition of the Childers-Degilbo Tee-Gayndah line. This is rated with a Summer Noon Emergency Rating of 18.0MVA with a normal rating of 12.0MVA. This is insufficient to carry the current year forecast peak load in the event of a trip of the Isis-Mt Rawdon Tee-Gayndah line. The line is only rated for 50°C and has been assessed to have significant minimum clearance issues. The line is reported to be extremely brittle. This is a safety risk. There appears to be fair evidence to support these claims. Conductor samples are scheduled to be taken after the 2014/15 peak summer load period.
- 226. Analysis of the VCR drivers show impacts of up to \$6.5m/yr based on reliability data over the past four years when the performance appears to be deteriorating fairly rapidly. Whilst this VCR may seem low to justify the full suite of projects, Ergon has established that the probability of outages occurring is high. For example, Ergon state that: "feederstat data shows since mid-2003 approximately 4.984 Million customer minutes have been lost as a result of unplanned outages on the network. It is concerning to note that 4.879 Million of these customers minutes have occurred since January 2010".¹⁰² This means that the annual VCR based cost could be expected to be incurred. Therefore, the PV of these costs should be sufficient to justify these projects. This provides sound financial support for this project.
- 227. In conclusion, this is a major project which appears well-justified to proceed. On the evidence provided, this project should be completed early in the regulatory period. It is

¹⁰² Attachment 13_Isis Gayndah 66kV Subtransmission Constraint Review.pdf Section 3.8.1



not clear if the 15% contingency allowance has been removed prior to the inclusion of the proposed \$24.7m component in the 2015/20 forecast.

Safety net standards

- 228. The safety net standards provide a minimum security level for the network, accounting for low probability, high impact events on the network. Of the sub-transmission program, 13 projects are identified within the technical compliance category (3 existing and 10 new).¹⁰³
- 229. Of the new projects identified for the RCP, the Asset Management expenditure driver was nominated as either 'security of supply' or was a blank field. We undertook a review of the Emerald Zone substation project, representing 21% (or \$7m) of the expenditure in the safety net sub-category.

Emerald zone substation project

- 230. With forecast growth of over 2.5% per annum and the confirmed connection application for an additional single 25MVA load, Ergon is proposing a growth-driven augmentation project for the Emerald distribution network.
- 231. Emerald's current maximum demand is 39MVA. Ergon has identified an additional 66 kV feeder capacity as being required to meet future electricity demand in the Emerald area. The capital cost of this project is \$7m.
- 232. Ergon has compared its 66kV feeder option with a non-network solution that features a 40MW diesel generator plant based on a long-term network support contract. Analysis concluded that the diesel generator option had a -\$20.1m present value compared to the network option.
- 233. On the basis that the new 25MVA load is firm, we conclude that the proposed augmentation is adequately justified.

Technical compliance

234. For the sub-transmission program, 17 projects are identified in the technical compliance category (5 existing and 12 new).¹⁰⁴ Of the new projects identified, the Asset Management expenditure driver was nominated as 'security of supply' or 'plant rating'.

Reinforce supply to Gracemere

- 235. We undertook a review¹⁰⁵ of the '*Reinforce Supply to Gracemere*' project, representing 18% (or \$11m) of the expenditure in the technical compliance sub-category.
- 236. Gracemere town is located 9km southwest of the city of Rockhampton, with a relatively low level of industry. It is experiencing rapid growth with census figures of 5,061 in 2006 and 8,401 in 2011. The town electrical load is predominantly supplied from the Malchi zone substation (ZSS). The network planning report dated March 2013 stated

104 Ibid

¹⁰³ Ergon Energy, 07.02.03 Subtrans network augmentation plan

¹⁰⁵ In the course of our review we referred to Attachment 8_Gracemere Subtransmission Project Assessment.pdf and GHD-HM_RWR_Gracemere Area Supply_2013-03-15_V 2 0 (As sent) (2).pdf



that the load at Malchi would reach 18.2MW by the summer of 20/21 and that, in addition to breaching Security of Supply criteria, additional 11kV feeder capacity would be required in the southern Gracemere area in the near future.

- 237. Various solutions to this issue have been proposed in recent years. This makes it difficult to reach a clear conclusion regarding whether the project is justified in its currently proposed form.
- 238. The March 2013 report went into considerable detail regarding various system constraints and the evaluation of various options. The report concluded that the preferred option included a new double circuit 11kV line from Malchi to the Gracemere residential precinct by 2013/14, duplication of the 66kV supply from Egans Hill to Malchi and replacement of the two 10MVA transformers with two 32MVA transformers by 2015/16, and provision of a second double circuit 11kV line from Malchi to the Gracemere residential precinct by 2018/19. The total estimated capital cost was \$21.5m.
- 239. The most recent document provided by Ergon was a copy of a presentation to the Central AER Project Decisions Meeting on 15 August 2014. This document provides a completely different solution. There is a concise overview of the background and the preferred option, without providing sufficient detail of the constraints, solutions and recommended options to enable the Board to make a clear decision.
- 240. The recommended option includes a number of changes to rearrange feeders at the Rockhampton South ZS, the establishment of a generation site (unspecified capacity and location) in 2017/18, building of a SKID mounted 10MVA substation, 3 x 11kV feeders and 6.6km of 66kV line in 2018/19, and building the Gracemere substation with 1 x 20MVA T3 transformer and recovering the SKID in 2029/30. This project has a net present cost of \$28.0m.
- 241. In our view, the second option appears to be simpler. It has the advantage of deferring a considerable amount of expenditure. However, the outcome is a significantly higher cost (which cannot be justified on the basis of the limited information provided).

South Mackay Zone substation reinforcement project

- 242. Ergon has proposed to construct a 20MVA transformer-ended substation at Ooralea. This will improve the supply capability to South Mackay areas of Paget and Baker's Creek. Ergon indicated that these areas are experiencing strong growth, primarily driven by industrial and commercial loads.
- 243. The new substation is required by 2019/20 under a high growth scenario. Under a lowgrowth scenario, the investment can be deferred until 2022/23 via renewal of existing generation contracts and with the introduction of a demand-side management program.
- 244. The scope of the project works included in the 2015/20 RCP 106 is:
 - Construction of Ooralea Substation as a 66/11kV, 1x20MVA transformer-ended substation at \$5,290,052;

¹⁰⁶ AER-Ergon035(15) Additional Attachment DPC201417 South Mackay Study, page 35



- Construction of two 66kV feeder bays at Racecourse Mill at \$2,560,000;
- Construction of a 66kV line from Racecourse Mill to Ooralea at \$739,000;
- Construction of two distribution feeders to provide supply to the Hastings and Industrioplex area; Ooralea 1 at 1.6km to switch ABS582950, Ooralea 2 at 0.2km to the existing Racecourse feeder at a cost of \$572,099;
- Reconductor or replace the line between LKS418 McEwans feeder (1.2km) at \$156,899; and
- Further works totalling \$202,941 are planned for the 2020/25 RCP.
- 245. This analysis does not perfectly match the project expenditure breakdown supplied by Ergon in 07.02.03 (which shows three sub-projects totalling \$8.5m for the RCP). However, we consider this variance to be immaterial.
- 246. An interesting aspect of this project is the opportunity to better manage power factor at this location. Power factor is a reasonable measure of how efficiently a consumer uses network capacity. Inductive loads such as compressors, motors and fluorescent lighting can draw reactive energy, which increases network capacity requirements.
- 247. The following chart reproduced from Ergon's business case for the South Mackay project shows how the peak demand (in kVA) is a function of the real component (kW) and the reactive component (kVAr). If the reactive component was eliminated entirely, then kVA would equal kW (i.e., unity power factor).



Figure 20: Weekly peak demand for South Mackay 33/11kV Substation (Nov 2013)

Source: AER-Ergon 035(15) Additional Attachment DPC201417 South Mackay Study.pdf, page 4

248. The figure above clearly shows that an increase in reactive load (kVAr) is driving the peak demand. If this were corrected at the source (i.e., at the customer connection rather than at the zone substation) additional capacity would be released through the distribution system to the zone substation.



- 249. The documentation we reviewed suggests that, rather than managing power factor at the point of energy use, Ergon intends to build power factor correction at the zone substation level. It is likely to be more efficient to provide incentives for consumers to manage power factor at the point of use. Using point-of-use power factor correction, combined with Ergon's generation contracts and DSM program, should defer the need for the investment requirement beyond the 2015/20 RP.
- 250. The documentation that Ergon has provided to support this project did not provide a clear justification for its inclusion in the proposal. Because of this, we consider that the proposed expenditure should be reduced to include only the capital required for the verified DSM solution.

New 11kV network at AVOCA Distribution augmentation project

- 251. This project is part of a wider suite of projects that includes the establishment of a new 66/11kV Substation AVOCA. The proposed 11kV network will connect into the new substation. The distribution works include re-conductoring of the networks backbone to current standards, providing feeder exit cables rated for future load growth and provide feeder tie ability for reliability and load growth. The estimated cost of the works is \$4.5m.
- 252. Ergon has provided information and analysis to support its growth projections (1.6%/yr) for the region. The assumptions and analysis appear reasonable.
- 253. We were provided with the Distribution Planning Report for the new 11kV AVOCA distribution network, but have not seen project approval papers and a business case. On the basis of the information that we reviewed, the project appears to be justified.

Summary

- 254. Ergon has proposed a forecast sub-transmission capital expenditure that represents a substantial reduction from actual augex spend in the current RCP. The forecast is dominated by larger expenditures in the first three years of the forthcoming RCP totalling \$39.7m (22%) for work in progress.
- 255. We observed a lack of alignment between the information provided to support the forecast expenditure and the expenditure summaries provided. We also observed that the change control on project information was not evident, which hindered our review of the information provided.
- 256. We note that the risk assessment provided in the summary expenditure was not consistently applied across the portfolio, and it was not evident if this was a determinant in the selection of these projects.
- 257. We found examples of additional options that could be explored by Ergon, such as the prospective opportunity to mitigate or defer the need for some projects via consideration of alternatives such as demand management and through the enforcement of power factor compliance requirements. We also raised a concern over the inclusion of contingency allowances in one project. However, despite the lack of clear information supporting these projects, we consider that there was evidence of a clear driver for their inclusion in the program. We consider that there is some possibility for deferral, particularly where the forecasted demand increases being considered are slower than expected, including the timing of large block loads.



6.2.4 Distribution

Ergon's strategy for distribution augmentation

- 258. The distribution network augmentation plan (DNAP) is based on an assessment of existing constraints in the distribution network and future demand forecasts. The dominant drivers of DNAP are stated as: (1) the existing constraints of Ergon Energy's distribution networks; and (2) managing future growth and penetration of photovoltaic systems.
- 259. The DNAP is structured into five program categories; the two main programs are specified/modelled augmentation and unspecified/unmodelled augmentation.

Expenditure trends

- 260. We note the relatively high level of "Work in Progress" at \$42m. We observe that \$53.7m of expenditure has a constraint year nominated in the current RCP, and \$3.6m of expenditure in year 5 of the RCP or later.¹⁰⁷
- 261. Where expenditure has been deferred from the current RCP into the forthcoming RCP due to existing constraints, this reflects a risk approach that, if applied to the modelled information, would defer some portion of proposed expenditure to the subsequent RCP.

Application of network risk assessment

262. We reviewed the network risk assessment values included in the summary of the program¹⁰⁸ and observe that the program includes a 'year of constraint project risk' and an 'end of period project risk'. We note that \$95.9m of expenditure has an 'end of period project risk' of 36 by the end of the RCP. We understand that Ergon would define this risk as 'intolerable'. This outcome casts some doubt on the application of the network risk assessment process, since many of these projects and programs would reflect an intolerable risk assessment.

Distribution Network Augmentation Plan (DNAP).

- 263. Ergon separates its distribution network augmentation into: i) specified DNAP (modelled) projects where constraints are known and forecast; and ii) unspecified DNAP (un-modelled) projects which account for the reactive needs of the network to unforeseen constraints. We note that Ergon has included \$136m in its proposal for specified projects and \$80m for unspecified projects.
- 264. We note that Ergon has adopted a change in strategy to identify constraints on its distribution feeders. Feeder constraints which were previously modelled based on the rating of the feeder exit cable and CB at a feeder level are now based on the rating of feeder sections. This means that the models are more sensitive to the accuracy of available network data.
- 265. For the identified distribution feeder capacity and voltage constraints, Ergon apply a standard works estimate to compile the forecast expenditure based on anticipated

¹⁰⁷ Ergon Energy, 07.02.02 Distribution network augmentation plan

¹⁰⁸ Ergon Energy, 07.02.02 Distribution network augmentation plan



constraints. In our onsite meeting, Ergon stated that a large part of the forecast was driven by existing constraints in network capacity and voltage.

266. Ergon state that whilst there have been changes to the security criteria at the subtransmission level, the security criteria at the distribution level remains at 75% maximum utilisation under system normal conditions. Ergon has adopted a planning approach that imposes a further risk assessment which effectively defers augmentation to account for variability in demand. Ergon estimates this to correspond with 85% utilisation for urban feeders.

West Warwick new 11kV feeder distribution augmentation project

- 267. The business case contract value for this project is \$1.08m.
- 268. Of the two feeders supplying West Warwick substation, the 350kM long Sandy Creek feeder is required to meet the main Warwick residential growth. There are currently voltage and capacity issues with the network in this area.
- 269. With the forecast load, West Warwick average feeder utilisation will be 80%. This will breach the applicable security criteria that require a maximum utilisation of 75% under system normal conditions for urban distribution feeders.
- 270. The compliance risks of breaching the security criteria is the sole driver for this project. Whilst the business as usual 'do nothing' option has some risk of prolonged outages, this is insufficient on its own to justify the proposed investment. However on the basis of the compliance breach risks and the current voltage and constraint issues, this project appears to be justified and is supported by the business case documentation. The documentation reviewed for this project did not reveal any systemic issues.

Four additional feeders from Pt Vernon and an upgraded Pialba feeder (DPS21004)

- 271. This project has an estimated cost of \$3.3m. There are two drivers for this project:
 - identification of an issue concerning the bedding material for some existing buried cables; and
 - strong feeders are required to meet development in the area.
- 272. The planning report for this project notes that, where overhead solutions can be used, the costs can be significantly reduced. The planning report states the following: "*Please note it has been assumed that approximately 700m of UG cable will be required to create this feeder. In reality, it may be possible to build the majority of this length with overhead*".¹⁰⁹ This indicates a possible systemic issue that Ergon will include the highest estimate value in its planning estimates despite having prior knowledge that costs are likely to be lower.
- 273. We note that the cost estimate for the 700 metres of underground cable is \$556k which is 17% of the total project estimated cost. We also note the inclusion of a \$200k 'contingency' estimate to re-tension sections of Dundowran and Susan River

¹⁰⁹ 050(5)-Appendix 1-POVE RWR.pdf section 9.1.1



Feeders.¹¹⁰ The planning report states that this cost 'may' be needed if clearance issues are found. Whilst not strictly a 'contingency' sum, the effect of including such items across the portfolio of projects would be to introduce an overestimation bias. We found no evidence that this contingency was removed prior to including the cost in the augex forecast. We consider that this project planning report indicates an over-estimation bias in the order of 6%.

Bohle Supply Area Network Optimisation

- 274. The estimated project cost is \$690k.
- 275. Ergon expect that the Bohle area in the northern section of Townsville will continue to experience growth. The network supplying this area is currently at its constraint limits. Ergon continues to receive applications from new developments in this area
- 276. Increasing loading on cables will lead to shorter lives and possible failure.
- 277. Whilst project documentation reviewed is only at the planning stage, no systemic issues were identified.

Unspecified distribution augmentation projects

- 278. We understand that the unspecified component relates to managing issues such as customer voltage complaints, small urgent works, pole removals and overloaded distribution transformers. Ergon state that the "*timing for this 'unspecified' component is determined on a 'find as we go' approach. It is not based on the above forecasting modelling analysis, but rather on a projection of the historical level of expenditure for this kind of activity.*"¹¹¹
- 279. Ergon has included \$80m of unspecified projects based on historical spend for the 2009-2013 period. Ergon state that this augmentation is required to address 'operational' constraints and issues seen in the LV network which are not anticipated, forecasted or planned. Whilst Ergon state that "*Reactive/Unmodelled Augmentation requirements have been forecast by looking at historical spend and reducing this to account for potential overlaps with other program areas*",¹¹² we consider that this does not reflect the significant changes in the demand forecast and energy use patterns. We expected to see modelling and analysis provided in support of the underlying drivers of this expenditure to justify the forecast, and in the absence of this justification consider, on the balance of probability that the estimate may be elevated.

Photovoltaic driven

280. We note that an extensive model has been developed based on a number of econometric factors, including an assumption of a low take-up rate for PV. To understand the impact of the model on the forecasts we have reviewed the corresponding forecast for PV by region.

¹¹⁰ 050(5)-Appendix 1-POVE RWR.pdf section 9.1

¹¹¹ 07.00.02 Forecast Expenditure Summary – Customer Initiated Augmentation, page 54

¹¹² 07.00.02 Forecast Expenditure Summary – Customer Initiated Augmentation, page 46



Photovoltaic augmentation central

- 281. Ergon has identified voltage issues developing on its distribution network due to the significant increase in connections of inverter photovoltaic equipment. In response to this issue, Ergon considers that there is a "need for a switch in approach to a lowest cost, broad scale solution for use on all networks affected by customer photovoltaic connections forecasted to be between 7.4-12.9% of Ergon Energy LV networks by 2020".¹¹³
- 282. Ergon has developed low, medium and high forecasts for the expected new PV installations based on its monitoring of the number of historical connections. Ergon's estimates have been developed through an assessment of the net benefits to consumers of changing to PV (Inverter Energy Systems) taking into account the removal of Government subsidies. Figure 21 below provides the resulting estimates.



Figure 21: Projected number of Inverter Energy System (IES) installations

Source: Attachment 14_07 02 12 Distrib Network Impacts Photovoltaic Connections....pdf, page 11

- 283. Currently, Ergon has allocated the cost of network augmentation attributed to inverter energy systems to "*unspecified augmentation budgets*".¹¹⁴ Ergon's strategy for the future management of the voltage issue includes the following actions:
 - enforcement of owners of inverter energy systems to comply with 'Ergon Energy's Connection Standard for Small Scale Inverter Energy System up to 30kVA' for all new systems. Ergon considers that this will significantly reduce the growth of inverter energy attributed issues in its low voltage networks;¹¹⁵
 - implementation of voltage management that is focused on networks with photovoltaic systems. The objective of voltage management is to reduce the number of networks with voltage outside statutory limits and thereby reduce additional network

¹¹⁴ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf Section 6, page 10

¹¹³ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf, page 5

¹¹⁵ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf, page 6



augmentation. Ergon has forecast the anticipated cost of implementing voltage management on the sections of networks forecast to have voltage issues related to inverter energy systems at \$13.0m (net of overheads);¹¹⁶

- installation of low voltage STATCOMs as a low cost alternative to traditional network augmentation for sections of the network requiring augmentation and where voltage management has proven to be successful in managing network issues attributable to inverter energy systems; and
- for the remaining networks where constraints limit the connection and operation of inverter energy system related issues, and where low voltage STATCOMs cannot be installed, Ergon will implement augmentation solutions including low voltage regulators and transformers and/or conductor replacements.
- 284. Analysis undertaken by Ergon found that the cumulative cost (by 2020) for implementing strategies to manage inverter energy system issues on its networks will be between \$39.2m to \$90.1m of capital expenditure and \$13.0m of opex for implementing voltage management. Ergon considers this to be the most cost-effective way to address the issues.¹¹⁷ However, on the assumption that all transformers that breach available connected capacity are subject to augmentation, Ergon estimated that the cumulative cost to implement its strategy will be between \$71m and \$136.3m (by 2020). Ergon stated that this level of expenditure implies that it would need to spend \$450 \$550 in network augmentation costs per inverter energy system connected to the distribution network.¹¹⁸
- 285. Ergon has anticipated that issues will arise on its medium voltage networks, but currently has no defined strategy to address them. It is envisaged that measures such as restriction of photovoltaic export capacity, at medium voltage feeder level, will be required "as part of inverter energy system assessment process, and photovoltaic penetration checks … to be included as part of inverter energy system connection assessments".¹¹⁹ Ergon anticipates that additional augmentation at the medium voltage network level may also be required.
- 286. From the documentation provided and our discussions with Ergon staff, we are convinced that there is a significant and potentially costly issue arising from growth in inverter energy system connections. What we have not seen is a convincing business case that includes economic analysis to support the total potential augmentation investment required to address the issues.
- 287. Some of the forecast expenditure could have been avoided by earlier enforcement of the 'Connection Standard for Small Scale Inverter Energy System up to 30kVA'. Ergon forecasts that future enforcement will significantly reduce the growth of inverter energy attributed issues in its low voltage networks. Yet, it is unclear how forecast augmentation costs have taken this into account. This implies that, had Ergon

¹¹⁶ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf, page 6

¹¹⁷ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf, page 7

¹¹⁸ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf, section 9.3, page 30

¹¹⁹ Attachment 14_07 02 12 Distr b Network Impacts Photovoltaic Connectionspdf Section 8, page 27



managed compliance requirements (such as requiring inverters to cut off when terminal voltage exceeded limits), there would be little need for the proposed augmentation.

288. The documents indicate that problems on the medium voltage networks may constrain the connection and operation of inverter energy systems. In turn, this will reduce the issues faced on the low voltage networks. We have not seen any analysis that takes this into account when forecasting the augmentation capex required in the 2015/20 RP.

Summary

- 289. For distribution projects, Ergon has provided planning report documentation. This indicates that most projects are in the planning stage. Notwithstanding, the documents do provide a reasonable level of information regarding the drivers, options analysis and cost estimates. We assumed that these costs were used by Ergon to form its distribution augmentation forecast for the RIN.
- 290. We observed that a number of the projects are dependent on demand growth occurring in specific locations and that each is dependent on specific new large loads connecting during the RCP. When aggregated, it would be reasonable to make some adjustment to reflect the level of probability that not all regional demand growth will occur within the forecasted timeframe. We expect that this would/should occur through the top-down adjustments made to the zone substation demand forecasts.
- 291. The documents viewed indicate that, at the planning report stage, Ergon is producing higher cost estimates than seems reasonable. We found comments in planning documents such as: *"in reality, costs will be significantly lower."* ¹²⁰ We also observed that demand management options are considered as a separate option to the proposed option. Whilst it is appropriate to consider DM options, a hybrid option of demand management and deferred augmentation may produce a lower cost approach.
- 292. We consider that the aggregated bottom up forecast will have excessive costs over that which is efficient and prudent.
- 293. There is a clear need for proactive management of inverter energy systems. The strategy proposed by Ergon seeks to address legacy and future compliance issues and apply low cost augmentation options prior to committing to more expensive reinforcements. This aspect of the strategy is sound. Our key issue is with the robustness of the business case for this scale of investment. We consider that Ergon has not made the case to support the substantial proposed augex program for inverter systems.
- 294. Based on the size of the unspecified program, and in the absence of supporting analysis, we consider that the forecast is likely to be higher than the level that a prudent and efficient operator will incur.

6.2.5 Power Quality

Ergon's strategy for power quality monitoring

295. Ergon has stated its Power Quality monitoring strategy to "*provide the monitoring* capability to ensure timely identification and remediation of quality of supply excursions

¹²⁰ 050(5)-Appendix 1-POVE RWR.pdf section 1.9.1



from Ergon Energy's Quality of Supply standards and to build its capability to report on momentary supply interruption performance in the future,"¹²¹ and the corresponding capital expenditure to "*identify* and deliver works to comply with mandatory quality of supply obligations in accordance with existing statutory requirements and future regulatory performance standards and targets".

Expenditure trends

296. The forecast expenditure profile is flat across the RP at \$1.3m per annum. This represents a reduction from the current RCP of an average annual expenditure of \$16m for reliability and power quality.

Alignment of expenditure and strategy

- 297. Ergon has targeted to extend the network monitoring of power quality parameters in the current period for approximately 67% of the network feeders. Ergon reports that "data that is being returned from these installations is being monitored and is reported internally to allow proactive remediation of emerging quality of supply issues and to support augmentation investment decisions."¹²²
- 298. The major driver of expenditure is the Power Quality strategy¹²³ to support the expansion of the existing quality of supply performance monitoring. A significant driver appears to be improving the coverage of existing monitoring and building capability to meet a future expectation of compliance with MSS targets (such as to accurately report MAIFI in all parts of its network).
- 299. The strategy aims to install 1,120 power quality monitors across its three phase and SWER distribution feeders, together with 100 power quality analysers at its zone substations. The strategy lists a number of economic benefits; however, there is no financial analysis provided to confirm how the benefits were considered.
- 300. We note that Ergon's 'Power Quality Monitoring Strategy' will guide distribution network augmentation capital investment, to target network augmentation at the distribution level.

Summary

301. We have not identified any systemic issues in our review of Ergon's power quality augex and consider that, on balance, we are satisfied that the proposed expenditure is aligned with what we would expect to see in an efficient and prudent expenditure forecast.

¹²¹ Ergon state that the strategy is to provide improved network monitoring and data warehousing to assist in achieving performance within the tolerances of the Queensland Electricity Regulations and the National Electricity Rules.

¹²² 07.00.05 Forecast Expenditure Summary – Reliability and Quality of Supply, page 19

¹²³ Ergon Energy, Power Quality Monitoring Strategy 2012 - 2020



6.2.6 Reliability

Ergon's strategy for reliability improvement

302. Ergon developed a revised reliability improvement strategy with the assistance of its consultants, including developing an understanding of the long term average trends and to assess the gap between the underlying reliability performance and the MSS limits. The increased focus on reliability in the current RCP was determined in order to meet MSS compliance by 2015 as a strategic imperative.

Expenditure trends

303. The forecast expenditure profile is flat across the RP at \$1.1m per annum, corresponding with proposed expenditure for the worst feeder improvement program. This represents a reduction from the current RCP of an average annual expenditure of \$16m for reliability and power quality expenditure.

Alignment of expenditure and strategy

- 304. Ergon's reliability performance is currently under the respective MSS targets. Ergon stated that "continuation of the existing and in-progress programs is forecast to result in a gap between inherent performance and the MSS limit that will accommodate future statistical performance variation and discharge Ergon Energy's 'reasonable endeavour' obligations associated with the MSS under the Distribution Authority until at least 30 June 2020".124
- 305. Ergon advised that reliability expenditure has been reduced from the current RCP, including removal of key programs in response to feedback gathered from the consumer engagement process and that expenditure is only forecast for the improvement program for the Worst Performing distribution feeders as prescribed within the Distribution Authority.
- 306. Due to "a significant focus on reliability investments in the current regulatory control period," Ergon state that its forecast "is significantly lower than the corresponding amount in the past and current regulatory control period".125
- 307. As part of the introduction of the new Distribution Authority on 30 June 2014, Ergon is required to undertake an improvement program for the worst performing feeders. The assessment criteria is defined within the Distribution Authority.
- 308. Ergon stated that: "Distribution feeders will be prioritised for inclusion in the program based on the ratio between of the feeder's three year average SAIDI performance and the applicable MSS limit described within the Distribution Authority."126
- 309. The Distribution Authority, section 11.1¹²⁷ states that: "The purpose of the improvement programs is to enable customers with the worst reliability outcomes to benefit from

¹²⁴ 07.00.05 Forecast Expenditure Summary – Reliability and Quality of Supply, page 15

¹²⁵ 07.00.05 Forecast Expenditure Summary – Reliability and Quality of Supply, page 24

¹²⁶ Ergon Energy, 07.05.01 Engineering report worst performing feeder program, page 9

¹²⁷ Department of Energy and Water Supply, Queensland Government, Distribution Authority No. D01/99 issued to Ergon Energy Corporation Limited



tailored reliability improvement measures, where prudent opportunities to do so exist." Ergon has developed a guideline for applying the assessment criteria that includes consideration of a 'prudency test' to develop its recommended improvement program, where '*No Action remains a valid option*'.¹²⁸

310. Ergon used a sampling approach to determine the average cost of distribution reliability improvement projects and applied this to the nominated feeder projects to formulate the forecast. Ergon sought to spread the improvement projects across the RCP "*in order to minimise volume related cost escalation.*"

Summary

311. We have not identified any systemic issues in our review of Ergon's reliability augex and consider that, on balance, we are satisfied that the proposed expenditure is aligned with what we would expect to see in an efficient and prudent expenditure forecast.

6.3 Concluding remarks

- 312. Ergon has proposed a significant reduction in augex for the 2015/20 RCP to reflect reductions in demand, changes in planning standards; increased demand management and PV uptake. We found evidence to support this proposed reduction.
- 313. We summarise our assessment of systemic issues and resultant biases in section 6.3.1 below, then describe the implications of this assessment regarding Ergon's proposed augex in section 6.3.2, as required by our terms of reference.

6.3.1 Systemic Issues leading to over-estimation

- 314. We consider that the systemic issues identified in our review reflect a bias towards the over-estimation of forecast expenditure. The impact of this bias is demonstrated in the sub-transmission and distribution expenditure programs, where we found that the proposed level of augmentation capex for the next RCP:
 - has not been adequately linked to a prudent needs-driven analysis, including efficient timing of expenditure and connection of new loads;
 - has not been adequately supported by cost-benefit analysis, robust options analysis and appropriately-applied risk assessment; and
 - includes estimates that have led to a higher level of expenditure than may be required.
- 315. We also found that the absence of documentation has, in some cases, hindered our assessment of Ergon's augmentation capex proposal. This raises further concerns regarding the prudency of the forecast.

¹²⁸ Ergon Energy, 07.05.01 Engineering report worst performing feeder program, page 10


6.3.2 Assessment of prudent and efficient level of expenditure

Aggregate impact

- 316. We consider that the systemic issues identified reflect a bias towards cost and risk overestimation that is likely to exist across Ergon's total augmentation capex forecast. We reviewed a sample of projects to find supporting evidence of the systemic issues identified in our governance level review. Based on our assessment, we estimate the aggregate impact of these systemic issues on proposed augmentation capital expenditure to be in the order of 5% to 15%.
- 317. Table 9 below summarises the range of identified assessment impacts for each of Ergon's categories of augmentation expenditure.

| Augmentation capex | Impact of systemic issues |
|--------------------|---------------------------|
| Sub-transmission | 0% - 5% |
| Distribution | 10% - 20% |
| Power quality | not applicable |
| Reliability | not applicable |
| Total | 5% - 15% |

Table 9: Impact of systemic issues by expenditure category

Source: EMCa analysis

- 318. We consider that Ergon's proposed augmentation expenditure, proportionately reduced by this amount, is representative of the prudent and efficient expenditure level that Ergon will reasonably require in the forthcoming RCP.
- 319. It is our view that Ergon can and is likely to manage this lower level of expenditure through project re-prioritisation and prudent deferral of lower-risk projects. There may also be an opportunity to explore alternative treatments to address identified risks. We consider that this level of adjustment reflects a prudent and efficient outcome and is achievable.

Sub-transmission

- 320. In many cases, our assessment was hindered by the lack of clarity and consistency of the information provided to support the forecast. This finding is supported by our program assessments.
- 321. Our assessment of the impact of the systemic issues upon the sample of project expenditure included a number of aspects:
 - We considered opportunities for optimisation across the portfolio, including the potential for project deferrals, greater tolerance to risk and the timing of proposed expenditure. We found that:
 - i. The Technical Compliance category is most likely to experience some program slippage or deferral; and
 - ii. As this slippage works its way through the RCP, we expect that it will result in up to 50% of the Technical Compliance expenditure forecast for 2019/20 being deferred into the subsequent RCP.



- We considered opportunities to review the scope and/or impact of alternate solutions in the forecast. Whilst we identified examples where alternate options might be examined, we did not consider that the aggregate impact of these changes would result in a material change to the program.
- We considered the impact of the general lack of consistency and alignment in documentation (including incomplete risk assessments) and whether this might have contributed to an over-estimation bias in the forecast. We conclude that, whilst we are concerned at the general quality of the information we reviewed, we considered the opportunity for further reduction of the forecast to be low.
- 322. In summary, it is our view that the probable over-estimation of required subtransmission capital expenditure in the forthcoming RCP is in the order of 0% to 5%.

Distribution

- 323. Ergon's planning documents generally provide an overview of the drivers, options analysis and cost estimates. However, we found numerous examples where the documentation was insufficient to justify the proposed expenditure. Despite the topdown assessment undertaken by Ergon, we consider that some projects have been included based on the aggregated bottom-up forecast with insufficient challenge. Where this occurred, excessive costs have been included in the forecast.
- 324. Our assessment of the impact of the systemic issues upon the sample of project expenditure included a number of aspects:
 - We considered opportunities for optimisation across the portfolio, including the potential for project deferrals, greater tolerance to risk and the timing of proposed expenditure. We identified the potential for prudent deferrals to:
 - i. reflect the sensitivity of the forecast to connection of large new loads; and
 - ii. account for the over-estimation of the risk assessment and timing of the proposed expenditure.
 - We considered the impact of the absence of supporting justification for the underlying drivers of program expenditure and which characterise Ergon's 'find as you go' approach based on historical trends. We also considered opportunities to review the scope and/or impact of alternate solutions in the forecast as follows:
 - i. Based on the size of the unspecified program, and in the absence of supporting analysis, we consider that the forecast is likely to be higher than a prudent review might indicate given the prevailing economic and market conditions and the forecast can reasonably be reduced; and
 - ii. We consider that Ergon has not provided sufficient justification for the \$41m augmentation program for inverter energy systems and has not enforced voltage compliance requirements. We consider that an adjustment in the order of 50% would appropriately account for the lack of program justification in this sub-category.
- 325. In summary, it is our view that the probable over-estimation of required distribution capital expenditure in the forthcoming RCP is in the order of 10% to 20%.



Power Quality

326. It is our view that the forecast power quality expenditure reasonably reflects a prudent and efficient level of expenditure.

Reliability

327. It is our view that the forecast reliability expenditure reasonably reflects a prudent and efficient level of expenditure.



7 Proposed Repex

7.1 Overview

Expenditure summary

- 328. According to the information supplied in the RIN, Ergon has proposed total direct replacement capex¹²⁹ of \$883m for the 2015/20 RCP. This is a decrease of \$139m compared to the repex initially sought by Ergon in its 2010/15 proposal, and an increase of \$29m compared to actual/forecast direct replacement capex. We discuss the increase relative to the current RCP for direct and for total (direct and indirect) replacement capital expenditure in section 2, and the movements across the period.
- 329. In this section, we provide an assessment of the application of the governance and management and forecasting methodologies to the projects and programs proposed within the replacement expenditure category.

Drivers of replacement capex

330. Ergon state that the key drivers of its repex forecasts are compliance requirements, addressing identified safety risks and replacing assets that have reached the end of their useful life.

Program overview

- 331. Ergon's proposed replacement capex is shown in the table below. We note that there is a difference between the total repex sourced from the supporting information provided by Ergon and the data supplied from the RIN. We used the supporting information in our assessment that directly relate to the projects and programs within the scope of our review.
- 332. Table 10 below provides a breakdown of the proposed repex for 2015/20, to which our assessment that follows applies.

¹²⁹ Ergon refers to repex as 'asset renewal capital expenditure'



Table 10: Asset renewal capex - Standard Control Services (direct costs) - \$m real 2014-15

| \$m , \$2014/15* | Total for | 2015-2020 |
|--|-----------|-----------|
| Line Defects Remediation | | 330.2 |
| Overhead and underground plant and equipment | | 1.8 |
| Overhead feeder circuits | | 232.1 |
| Zone and bulk supply plant and equipment | | 160.9 |
| Earthing systems | | 43.6 |
| Protection and control systems | | 33.8 |
| Underground feeder circuits | | 2.4 |
| Auxiallary substations components | | 22.9 |
| Telecommunications | | 56.0 |
| Total | | 883.7 |

Source: Ergon - 07.00.01 Asset Renewal Expenditure Forecast Summary (escalated from \$2012/13 using 2.5% CPI)

Asset replacement strategy

- 333. In the documentation provided by Ergon and during our onsite sessions, the development of the asset replacement programs and expenditure forecast was described using two broad-based approaches:
 - proactive refurbishment and replacement; and
 - run-to-failure refurbishment and replacement.
- 334. Ergon determines which approach is used for a particular asset class through the application of its Asset Replacement Decision making Process.¹³⁰
- 335. The run-to-failure approach is chosen when the risks of in-service failure do not exceed any advancement costs/risk associated with proactive asset replacement. If this is the case, the assets are subject to periodic inspections with defects addressed and assets replaced on failure. Assets that are not covered in the run-to-failure approach are identified for replacement through the proactive limb of the decision making process.

Condition Based Risk Management

- 336. Under the proactive approach, Ergon determines if an asset replacement is necessary through periodic condition monitoring, Condition Based Risk Management (CBRM) or equivalent models and engineering assessments. The decision process includes steps where asset maintenance and life extension options are considered prior to replacement (i.e., providing for opex/capex trade off).
- 337. The CBRM model had been installed in 2010 with data on substation assets being completed in 2012. Ergon informed us that asset data had improved considerably over the 2010/15 RP. This is evidenced in the EA Technology final report¹³¹ to Ergon that indicates the progress made by August 2011 in populating the CBRM model. The asset health ratings produced by the CBRM model allow Ergon to identify and prioritise assets that require replacement. The output schedules are then subject to technical

¹³⁰ 07.00.01 Asset Renewal Expenditure Forecast Summary, page 23

¹³¹ CBRM EA Final Report NRT V1.0, August 2011



review to provide for smoothing of work schedules and application of engineering judgement.

- 338. In 2010, EA Technology advised Ergon that investment in CBRM would deliver "significant financial and governance benefits to Ergon. There are also outcomes with respect to staff and public safety and customer benefit".¹³²
- 339. The business case for investment in CBRM includes the statement by EA Technology that: "On successful completion of the CBRM project, Ergon Energy will have in place the methodology, data and knowledge to effectively manage the network refurbishment program and provide reliable and defensible information for regulatory submissions which will result in:
 - Increased reliability of the network;
 - Improved project ranking for the refurbishment of network assets; and
 - Economic benefits to Ergon Energy through reduced refurbishment spend."133
- 340. We expect that the above benefits would by now be realised and taken into account when forecasting the 2015/20 repex. Following the implementation of the CBRM model, EA Technologies considered that: "*In the face of increasing scrutiny and sophistication from the AER, these tools provide the foundation for the presentation of a robust business case for replacement and reinforcement, provided they are driven with solid and auditable data.*"¹³⁴
- 341. In its 2013 report to Ergon, EA Technology provides an assessment and recommendations on actions to improve the CBRM models performance. The following statement is included in the report: "Asset failure rates and average lives are a building block of CBRM. The values used in the models should be based on the data generated for the RIN. Where it is necessary the RIN data be modified for use in CBRM, specific reasoning should be given."¹³⁵
- 342. Our understanding from the information provided is that Ergon should have used its CBRM model outputs to populate the RIN. From our review of the total repex profile this appears to be the case. We take this view because:
 - the improvement in asset management practices appear to have produced significant reductions in expenditure during 20110/15 RP from that initially planned; and
 - total repex for the 2015/20 RP is consistent with the actual/forecast total repex for the 2010/15 RP.
- 343. When systemic failure modes emerge for specific assets and historical performance or condition models do not provide sufficient indications of future performance, Ergon undertakes discrete analysis to prepare the forecasts. An example of Ergon's use of

- ¹³⁴ CBRM EA Final Report NRT V1.0, page 123
- 135 J000107 CBRM Review Report V2.0, page 11

¹³² Business Case – Implement CBRM Ver 0.4, page 10

¹³³ Business Case – Implement CBRM Ver 0.4, page 14



discrete analysis is for the 7/.064 Copper Conductor replacement program where an electric shock incident has led to a targeted replacement program.

High level observations on repex

- 344. At our onsite we requested (but did not receive) information demonstrating that a risk assessment was undertaken and that considers the deferral of work to accommodate cyclone restoration costs. In the absence of this information, our view is that the original forecast for the 2010/15 RP is likely to have included work that would not have been included in an efficient and prudent forecast. Since that time, Ergon has invested in CBRM models and it would appear that this investment is allowing the business to produce a repex forecast that is supported and justified on the basis of asset health, with replacement prioritised on risk.
- 345. Given the EA Technology recommendations relating to the calibration of CBRM data and RIN data, we would expect the RIN data to reasonably reflect CBRM modelled outputs. We tested this expectation when we undertook reviews of individual asset classes.
- 346. Whilst it is appropriate to include a discrete assessment that, in effect, overrides CBRM outcomes, we have concerns that the use of this discretion may lead to a more reactive approach than is appropriate. This is discussed further in the following reviews of specific asset categories.
- 347. From the repex profile between 2008 and 2020 provided in Section 2, a marked adjustment of repex occurred in 2013/14. Whilst this may to some extent be due to extended and more accurate asset information, and the application of improved asset management practices, other factors are more likely. These other factors include reaction to specific events (such as cyclones) and financial constraints.

7.2 Assessment

348. The main components of proposed repex, and the movements between actual prior RCP expenditure and Ergon's proposed expenditure, are outlined in section 2. The following subsections provide summary briefings on the material components of proposed repex. These are used to evidence systemic issues reported in our findings.

7.2.1 Defect management

Ergon's strategy for defect management

- Ergon has proposed the Asset Inspection and Defect Remediation Program (AIDRP)¹³⁶
 "to minimise risks associated with asset failure." The defect management program is the largest part of Ergon's line maintenance strategy.¹³⁷
- 350. The defect management policy document and manual outlines three levels of defects, and the timeframe for defect remediation following the inspection program.

¹³⁶ Also referred to as the Asset Inspection and Defect Management (AIDM) program

¹³⁷ 07.01.01 line defect management method



Expenditure profile

351. Proposed repex for defect management over the forthcoming RCP is depicted below. The forecast is dominated by the forecast correction of P1 and P2 defects.

| Tabla 11. | Defect management | t ovnondituro | broakdown |
|------------|-------------------|---------------|------------|
| IADIE I I. | Delectmanagement | expenditure | DIEakuOWII |

| \$m | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Total |
|-----------------------------|---------|---------|---------|---------|---------|-------|
| P1 and P2 defects | 45.2 | 51.7 | 40.9 | 40.2 | 46.3 | 224.4 |
| Post -natural disasters | | 8.6 | | 8.6 | | 17.2 |
| major items fail in service | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 72.7 |
| Total | 59.8 | 74.9 | 55.4 | 63.4 | 60.8 | 314.3 |

Source: 07.01.01 Line asset defect management method, Table 64¹³⁸

352. From the table above, the most significant component of the defect management program is the P1 and P2 defects that arise from inspection.

Assessment

- 353. Ergon has developed a defect management model to forecast line defects based on historical rates. The model incorporates engineering input and review. We observe that the forecast is primarily based on the assumption that historical averages are reflective of expected future expenditures.
- 354. We note that Ergon's forecast defect refurbishment program expenditure is lower than its historical expenditure due to lower forecasts of unit rates and the quantity of forecast defects.
- 355. We also note that a lower allowance for post-natural disaster repairs has been included as a result of the inclusion of parametric insurance.¹³⁹ The insurance is intended to cover the '*most severe cyclonic wind events*' such as cyclone Yasi and not smallmedium size cyclonic events. Ergon has included in its asset renewal capital expenditure forecast an allowance of \$8.6 million per event, based on historical costs. These costs are allocated to the years 2016-17 and 2018-19.¹⁴⁰
- 356. Ergon state¹⁴¹ that: "*major restoration works associated with Cyclones Anthony (2012), Yasi (2011), Oswald (2012), and the flooding around the Bundaberg and Southern regions of Ergon Energy*"¹⁴² was a key driver of increased expenditure leading to exceeding the AER allowance by \$10 million (1.5%) for repex. We expect that the impact of major events such as cyclones and flooding would create additional work that would place pressure on the resources planned to deliver the asset replacement work for Ergon.
- 357. Ergon also states that it "absorbed the costs incurred from Yasi¹⁴³ within its existing allowances, as well as trying to complete and/or reprioritise other programs to maintain

- ¹⁴¹ 07.00.01 Forecast Expenditure Summary Asset Renewal
- ¹⁴² In Ergon Energy's Revenue Proposal (page 100), cyclone Ita (2014) was also cited
- ¹⁴³ In Ergon Energy's Revenue Proposal (page 94), Ergon state that they have 'absorbed costs associated with Cyclone Yasi and Oswald'. The allocation across opex and capex is not provided.

¹³⁸ The assumption of base dollars has not been provided in the document

¹³⁹ Management plan Line defect

^{140 [}Ref 07.01.01] Line defect, page 74



and/or replace network assets as needed" and "despite exceeding the renewal allowance in each of the first three years of the current regulatory control period, it is forecast that Ergon Energy will materially meet the total renewal allowance for the period."

- 358. We note the steps taken by Ergon to identify expenditure relating to significant events including implementing alternate risk treatments such as insurance. In our onsite review meetings, and its supporting information, Ergon advised that it had deferred a proportion of its repex program due to its response to recent cyclones. We understand that, due to the location of Ergon's network assets, it needs to regularly respond to significant events including cyclones. We expected to see, and have not been provided with, evidence of how the deferment of repex had impacted the level of risk on the network. In the absence of this information, we consider that the ability to defer repex places a level of doubt on whether the forecast expenditure is prudent.
- 359. Within its defect management model, Ergon has made adjustments to forecast defect rates. We did not observe any supporting analysis for the selection of these forecast defect rates, other than the SME statements relied upon for some condition types. Ergon indicate that the forecast quantities have generally reduced. However, analysis of forecast volumes show increases in some instances. We would expect to see condition data, trend analysis and discussion of management strategies associated with this expenditure. We also would expect to see how improvements to inspection processes (i.e., use of ROAMES) changed the volume and expenditure forecasts.
- 360. The relationship between the line defect management program and specific replacement programs (which we would consider includes proactive replacement of a number of assets as a part of the program), was not clearly evident. For example, the existence of targeted replacement programs for service cables is acknowledged but the impact on the forecast is not clear. Ergon does not provide any modelling of the change in defects to determine the net effect of the targeted replacement programs. Instead, Ergon state: "*To account for all of these influences a conservative factor of 30% increase has been entered into the model for both P1 and P2 defects for deteriorated service*".'¹⁴⁴ In our view, this position has not been supported by analysis, and may over-estimate the likely increase in defects.
- 361. We note that the assumed annual average defect rate is 780 per annum. Over the forthcoming RCP, this increases to an annual average of 906 (noting that variation within the period is most likely due to the inspection cycle). However, we also note that the targeted program should see these volumes decrease and would therefore expect to see the forecast supported by analysis. In the absence of analysis, we suspect that the forecast may over-estimate the likely increase in defects.
- 362. To account for the costs of outsourcing a portion of the P2 defect remediation works, a contractor uplift factor of 1.1% was applied to the bottom-up standard unit rate estimating approach for some components. Ergon notes that actual unit costs are expected to be higher than those reflected by the uplift factor. Ergon advised that it has initiated a review of the historical increases in the costs associated with the use of contractors to reduce the average unit rate. However, we have not seen evidence of application of this in the forecast (and note the uplift factor has been retained).

^{144 070101} line effect management, page 64



363. Ergon states that it undertook an external review of the lines defect management model in 2013, with a further external review planned for 2018. We have not seen how the results of these reviews have been incorporated into the model as part of its ongoing development.

Distribution earth defect management

- 364. Separate to Ergon's defect management model, Ergon proposes a distribution earth defect management strategy to manage its compliance with the Code of Practice Works with regards to Distribution Earth Defect Thresholds.¹⁴⁵ The strategy is based upon changing the voltage threshold to be 1.5 times higher than that which is stipulated in the Electrical Safety Code of Practice 2010 Works. We were advised this level was consistent with Ergon's assessment of industry practice.
- 365. Ergon's options analysis recommends compliance over an 8-year stage process (option 3) to manage the network safety risk as the lowest cost. We understand that Ergon "believes there is a low risk of not receiving ESO approval for the Code variation" ¹⁴⁶ and the forecast has been assembled on this basis. A risk assessment is not provided between options.
- 366. We note however that "Ergon Energy would continue to design assets to achieve Code compliance but maintain to 1.5 times"¹⁴⁷ and that "analysis of EG-0 and AS/NZS 60479.1 suggest that the 20V limit is now considered very conservative".¹⁴⁸ We consider that there is opportunity to consider changes for its design assets also.

Summary

- 367. Ergon's defect management program represents a significant part of the repex expenditure. We note the reduction to the forecast from the current RCP. This may indicate improving data and systems and opportunity for continued development.
- 368. We note the approach to earth defect management proposed as indicative of prudent decision making. This approach could be strengthened by an assessment of risk for each of the options considered.
- 369. We identified areas of the forecast, with supporting evidence, that suggest an overestimation bias may be present.

7.2.2 Overhead Conductor

Ergon's strategy for overhead conductors

370. For the Distribution overhead conductors, Ergon proposed a combination of targeted programs for connector, splice replacement, feeder re-conductoring and installation of LV spreaders in addition to the management of defects identified from inspection.

- 147 Ibid
- ¹⁴⁸ Ibid

¹⁴⁵ 07.01.04 Modification to distribution earth defect thresholds

¹⁴⁶ 07.01.04 Modification to distribution earth defect thresholds, page 16



Ergon identified small copper conductor as being at risk, and prioritised its replacement as a part of the LV Risk Mitigation Program which commenced prior to this RCP.

371. Ergon developed a feeder re-conductoring program¹⁴⁹ to "arrest the emerging safety risk to the public by replacing, in order of priority, that conductor which might result in adverse outcomes, restore the resilience of the network during adverse weather events when these degraded conductors are more likely to fail, become grounded and cause loss of supply, and ensure public confidence around the safety and security of Ergon Energy's overhead conductor network which might be tarnished if the prevalence of incidents were allowed to rise."

Expenditure trends

372. Repex for conductors over the prior, current and forthcoming period is depicted in Figure 22 below.



Figure 22: Ergon conductors repex compared with historical spend

- 373. The forecast expenditure reflects a step increase from 2013-14 levels and again in 2014-15, corresponding with an increase in expenditure for LV conductors for the first four years of the RCP.
- 374. We understand that the remaining expenditure corresponds with continued 11kV conductor replacement, albeit at lower volumes until 2019-20, and contributions from other related programs where conductor is replaced as a part of other works.

Alignment of expenditure and strategy

375. Following options analysis and risk assessment for its re-conductoring program, Ergon concluded that removing the 7/0.064 copper conductor in conjunction with other control measures on the LV was required. We note that the proposed LV conductor treatment

Source: Ergon RIN data

^{149 7.01.02} Eng Rpt Dist Feeder Recon Program



reflects a change in strategy from the current RCP (which is focused on HV conductor treatment).

- 376. The review of an electric shock incident in 2013 resulted in escalation and presentation to the company's executive and Board of the incident. This led to a number of actions including: a review of the associated electric shock risk from LV conductor; inclusion of the LV conductor failure risk on the corporate risk profile; and development of a LV conductor replacement program in the forecast.
- 377. Ergon advised that this asset contributed to a fatality in 2007. We were not able to ascertain Ergon's response prior to the incident in 2013. We note that, despite the consequence rating for Health and Safety Risk being "Catastrophic" in all assessed options (due to assessed risk of staff or public fatality), minimal LV replacement has occurred in the current RCP.
- 378. We observe that Ergon has unassisted conductor failure rates that have been decreasing from 2009-2010 levels.¹⁵⁰ We note that the DEE data reflects high voltage incidents and that the long term trend of LV incidents is not provided. Ergon applied the same trend information to the LV conductors, concluding the same effects of coastal corrosion on the LV as exists on the HV. We note that, of all DEEs, 42% are within 30kms of the coast. For copper conductor DEEs, 50% occur within 30 kms of the coast. Yet Ergon conclude that "proximity to the coast is a key factor in conductor failure and that a re-conductoring program should be developed with the proximity to coast in mind".
- 379. We also note that of the small conductor population, a greater proportion is installed on HV networks. This is consistent with Ergon's historical expenditure averaging 262.6 circuit kilometres per year, where approximately 94% of the conductor replacement was focused on the HV.
- 380. We consider that the options analysis is limited. Ergon appears to have limited the number of variables in its analysis, thereby limiting the potential options for consideration. We would expect to see greater consideration of asset condition based on available data, and risk including alternate treatment options. We would also expect to see consideration of the impact on HV conductor risk as a consequence of the bias to LV conductor risk as proposed.

Summary

- 381. We have reservations about the completeness of Ergon's analysis supporting the forecast expenditure. However, the purported focus of Ergon's conductor replacement program to replace small copper conductor due to the associated elevated risk level is consistent with industry practice.
- ^{382.} We consider this program is an example of the reactive approach to risk described in section 3 and that may over-ride the benefits associated with a CBRM approach.

¹⁵⁰ Reconductor program Table 20 and Figure 13 show the unassisted and assisted DEEs caused by conductor being grounded or low



383. The alignment between the treatment of risk, prudent timing and expenditure profile has not been adequately explained. Accordingly, we consider that the justification for the forecast expenditure is not proven.

7.2.3 Transformers

Ergon's strategy for transformers

- 384. Ergon's strategy for power transformers, includes a combination of targeted replacement, run-to-failure supported by refurbishment of removed transformers and strategic spare based on CBRM modelling.¹⁵¹
- 385. For distribution transformers Ergon manages defects as a part of its defect management program including replacement under the failed in service program.

Expenditure trends

386. Transformer repex over the prior, current and forthcoming RCPs is depicted in Figure 23 below.



Figure 23: Ergon transformers repex compared with historical spend

- 387. The forecast expenditure is broadly consistent with the historical average. A reduction in pole mounted expenditure is offset with a reduction in 33kV and 66kV transformer replacement.
- 388. During our onsite meeting we asked Ergon to provide an explanation of changes in the make-up of asset categories within the RIN data (such as the increase in expenditure

Source: Ergon RIN data

¹⁵¹ 07.01.05 engineering report for power transformer replacement and refurbishment



for pole mounted <=22kV; <=60kVA multiple phase transformers). We have not been provided with this explanation.

Power transformers

- 389. We note that the program summary document includes reference to three asset classes being power transformers, ground mount regulators and reactors; however, only power transformers were included in the discussion. For power transformers, the strategy and program documentation does not appear to differentiate between voltage or size of asset between 11 and 132kV.
- 390. Options analysis was undertaken in response to the broad CBRM modelling applied to power transformers. The recommended option proposes replacement of 5 transformers per year. Supporting the recommended option is the refurbishment of 20 transformers, replacement of 55 transformers as 'failure in service' and purchasing strategic spares. Supporting analysis for these quantities is not provided, nor do they form part of the options analysis. The CBRM modelling is cited as the source of the recommended option; this is only provided in aggregate.
- 391. We expected to see a greater level of analysis of condition of this asset category, including presentation of the changing HI over time for sub-categories of this asset class. In the absence of this analysis being provided, our review of Annex B¹⁵² suggests that several power transformers with a low HI (less than 4) at year 10 appear to have been included in the replacement plan.

Distribution transformers

392. Ergon nominate a run-to-failure asset management approach. Ergon identifies defects through the Overhead and Underground Line Inspection Program and these are remediated as part of the Defect Refurbishment Program. For example, distribution transformers without LV fuses are being recorded as a defect, and LV fuses installed as part of the remediation work.

Summary

393. We found evidence of the application of CBRM to power transformers, consistent with the asset management approaches for sub-transmission and distribution transformers. However, the analysis was insufficient to support the proposed forecast. Accordingly, we consider that the justification for the forecast expenditure is not proven.

7.2.4 Switchgear

Ergon's strategy for switchgear

- ^{394.} For circuit breakers and switchboards, Ergon proposes a mixture of programed (based on risk), targeted (based on safety and operability of the network), Failed in Service replacement.¹⁵³
- 395. For 11kV air break switches, Ergon promote the use of gas switches in preference to air break switches. Ergon manages its existing ABSs using a combination of inspection

¹⁵² 07.01.05 Engineering report for power transformer replacement and refurbishment

¹⁵³ 07.01.17 Engineering report - Circuit breaker and switchboard replacement and refurbishment

based assessment, preventative maintenance and targeted replacement. Ergon has had a targeted replacement program in place for some air break switches to target insulator failures.¹⁵⁴

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^{396.} For LV switchgear, defects are managed as a part of the defect refurbishment program. LV transformer fuses are being installed to mitigate LV clashing as part of the LV fuse and spreaders program.¹⁵⁵

Expenditure trends

397. Switchgear repex over the prior, current and forthcoming RCPs is depicted in Figure 24 below.



Figure 24: Ergon switchgear repex compared with historical spend

398. The forecast expenditure reflects a reduction from the historical average across the current RCP driven by a reduction in expenditure on 11kV switches. The RIN also shows an increase in forecast expenditure for 66kV circuit breakers.

Alignment of expenditure and strategy

399. The volume of replacement and timing has been determined from a combination of CBRM modelling and SME review. The CBRM model output has been used as a reference case for options analysis. However, this did not include the HI outcomes to assess risk between options.

¹⁵⁴ 07.09.05 management plan overhead and underground plant and equipment

¹⁵⁵ 07.09.05 management plan overhead and underground plant and equipment



Distribution switchgear

- 400. Ergon identifies defects through the Overhead and Underground Line Inspection Program and these are remediated as part of the Defect Refurbishment Program.
- 401. Ergon identified a small residual component of RMU replacement, relating to isolator refurbishment for ABB RMUs that will continue into the RCP as a part of the defect management program.
- 402. Ergon provided an age profile as the basis of condition information for RMUs and other assets in its condition information. We did not observe any condition or defect analysis.

Sub-transmission switchgear

- 403. Ergon proposes to undertake programed and targeted replacement of circuit breaker and switchboard assets. Ergon nominated a number of specific problematic circuit breaker types that it plans to address via targeted replacement programs.
- 404. The forecast includes "a mixture of programed (based on risk), targeted (based on safety and operability of the network), Failed in Service replacement and provision of spares has been agreed among Ergon asset Management professionals".¹⁵⁶ Whilst the CBRM risk model and input data was provided, the HI scores and basis for volume of spares and replacement of problematic CBs was not provided.

Summary

405. We found evidence of the application of CBRM to switchgear, but did not find sufficient analysis to support the proposed forecast. Accordingly, we consider that the justification is insufficient to support the forecast expenditure.

7.2.5 Service lines

Ergon's strategy for service lines

406. Ergon has proposed a condition based approach including continuing the line inspection processes and monitoring program, community safety messages for its service lines and including targeted replacement programs of problematic assets: 'figure 8' colour coded, neutral screened and XLPE service cables.

Expenditure trends

407. The repex for service lines over the previous, current and forthcoming RCPs is depicted in Figure 25 below.

¹⁵⁶ 07.01.07 Engineering report circuit breaker and switchboard replacement and refurbishment



Figure 25: Ergon service lines repex compared with historical spend



Source: Ergon RIN data

408. The forecast expenditure reflects a step increase from 2014-15 levels corresponding with an increase in expenditure for residential service lines.

Alignment of expenditure and strategy

- 409. Ergon has proposed a managed program to replace all 'figure 8' colour coded services.¹⁵⁷ Evidence of asset failure, poor condition and results from inspection and audits were provided to support the proposed program. However, the sample size for figure 8 services appeared low (being 30 of the estimated installed population of 55,200)¹⁵⁸. Ergon state that whilst the defect rate was high for this sample size, the majority of deteriorated services (80%) were in one location (Longreach). The proposed program includes a full replacement program.
- 410. The reported failures of service cables leading to electric shock incidents is 12%. Data was not gathered to identify the contribution by figure 8 services over time. Ergon states that there has been at least one reported electric shock from this cable type. Ergon does not have defect data specific to this cable type.
- 411. Ergon has reviewed its risk controls and determined that the "*service inspection process is sound and is being followed most of the time.*"¹⁵⁹ This is deemed to provide a reasonable method of risk mitigation.
- 412. Ergon states that the "results of 160 audits of 'figure 8' colour coded service indicate that insulation of about 30% of these services has deteriorated leaving the live

¹⁵⁷ 07.01.11 Colour coded service replacement engineering report

¹⁵⁸ 07.01.11 Colour coded service replacement engineering report, page 23

¹⁵⁹ 07.01.11 Colour coded service replacement engineering report, page 17



conductor exposed," whereas the data provided in Table 3 indicate that this is closer to 6%.

413. The basis of this dedicated program appears to respond to an assessment of 'High' safety risk and not the analysis presented. Other programs in this category have a 'Medium' risk assigned when considering the current control measures. Ergon states that 'Deteriorating service cables are a recognised risk on Ergon Energy's Asset Management Risk Register' and this may be driving this investment rather than a comprehensive analysis and risk assessment.¹⁶⁰

Neutral screened service cable

414. Ergon has proposed a further program for targeted replacement of neutral screened service cables as "*there is currently insufficient evidence to justify a large-scale program to replace all neutral screened services*".¹⁶¹ Ergon rated the risk as 'Medium' for this asset, despite having more data relating to electric shocks and defects.

XLPE service cables

415. Ergon proposes a targeted replacement program of high risk cables corresponding with locations with an extreme average noon clear sky UV index, being Far North region. In the options analysis, Ergon states that it "*has not experienced any failures of this type of customer service cable and has very little evidence that the service cable will degrade at an accelerated rate*".¹⁶²

Summary

- 416. Our analysis indicates that there is insufficient demonstration of a needs based assessment of the proposed forecast.
- 417. We consider that the assumptions applied by Ergon have resulting in an inflated forecast expenditure for its figure 8 service cable replacement, whereas the other programs appear reasonable.
- 418. We consider that there is evidence of conservative risk assessments, with a bias to include projects and programs into the forecast that may otherwise have been reviewed as a consequence of a more rigorous top-down challenge process.

7.2.6 Poles

Ergon's strategy for poles

419. Ergon Energy actively manages poles using a condition-based approach,¹⁶³ including visual inspection, serviceability assessment, and treatment. Defects are managed by the Line Defect Refurbishment Program or failed in service program.

- ¹⁶² 07.01.18 XLPE service cable, page 17
- ¹⁶³ Management plan overhead feeder circuit

¹⁶⁰ 07.01.11 Colour coded service replacement engineering report, page 10

¹⁶¹ 07.01.14 Neutral screened low voltage overhead, page 24



Expenditure trends

420. The repex for poles over the prior, current and forthcoming RCPs is depicted in Figure 26 below.





421. The forecast expenditure reflects a step reduction in the historical average over the current RCP primarily driven by reduction to 11kV and 22kV wood pole replacement.

Alignment of expenditure and strategy

- 422. Ergon has adopted a run-to-failure asset management approach for distribution poles to minimise life-cycle costs. The forecasting methods include simple predictive for distribution and discrete engineering review for sub-transmission, based on condition assessment. The result of inspection are captured as defects against the criteria defined in the '*Lines Defect Classification Manual*'. When that criterion is exceeded, the pole is classified as unserviceable, and tasks initiated for replacement or reinstatement (pole nailing).
- 423. Ergon's pole lifecycle plan¹⁶⁴ states that "there is no aged replacement program for poles. The majority of pole replacements are associated with other works such as network augmentation. Poles are also replaced systematically based on condition or as they fail."
- 424. Ergon states that "based on the age profile of the wood poles … 19.05% of all wood poles pre-date 1970 and are approaching their end of life (EOL) period, which averages between 40-50 years from AS/NZS 7000:2010." Ergon assumes an expected extension of pole life due to reinforcing or reinstatement techniques to be 15-20 years.

Source: Ergon RIN data

¹⁶⁴ 07.09.02 Management plan overhead feeder circuit



425. Ergon states a current three year rolling average reliability against incidence of failure of 99.9966% against a target of 99.99%. This corresponds to an average unassisted pole failure rate per annum of 27 poles (within the legislative target).

Summary

- 426. We observe a reduction in forecast expenditure that we infer reflects a change in strategy following consideration of the current level of risk and performance of this asset category described in the supporting information.
- 427. We have not identified any systemic issues evident in our review of this asset category.

7.2.7 SCADA, network control and protection system

Ergon's strategy for SCADA, network control and protection

428. For protection assets, Ergon has a program to replace protection assets based on condition, obsolescent technology. Ergon has stated a "*preference towards integration of protection assets with other secondary systems in a substation environment.*"

Expenditure trends

429. Switchgear repex for the prior, current and forthcoming RCPs is depicted in Figure 27 below.





Source: Ergon RIN data

430. The forecast expenditure reflects an increase from 2014-15 levels corresponding with increasing expenditure in field devices, with communications assets and site infrastructure continuing at 2014-15 levels before decreasing later in the RCP.



Protection relay replacement

- 431. Ergon assume a protection relay expected life of approximately 40 years for electromechanical relays and approximately 20 years for both static and numeric relays. On that basis, Ergon forecasts that 12% of the operational protection relays have exceeded their life expectancy.
- 432. Ergon advises that "the total percentage of the relay population older than their life expectancy (i.e. overdue) is used as a measure of the heightened risk carried by Ergon Energy in this regard." Ergon forecasts that the number of relays exceeding the life expectancy at the end of the RCP will be 19% as the 'business as usual' case.
- 433. Ergon includes reference to 24% of the protection relay population as being problematic.
- 434. The recommendation is to adopt Option 1 Accelerated Relay Replacement, for a planned annual replacement of protection relays that will reduce the number of protection relays at end of life from 12% to 7% at the end of the RCP and address the problematic types.
- 435. Ergon has considered a number of options, and presented a risk assessment against those options. We note the risk assessment is rated as 'High'¹⁶⁵ and assumes catastrophic (death of an employee) and possible likelihood for a primary protection failure event. Whilst the risk after treatment of the catastrophic event reduces to 'Medium', the risk of injury reduces to 'Low'. The risk, after treatment, of a catastrophic event is the same across all considered options which raises concerns regarding the application of the risk framework and potential overestimation of risk.

Summary

436. Ergon has identified a need for expenditure to address the aging protection relay population, however did not provide sufficient justification for the change in performance and risk levels for the proposed forecast expenditure given the current age and condition of the protection relay population.

7.2.8 Pole top structures

Ergon's strategy for pole-top structures

- 437. Ergon's strategy for distribution pole tops¹⁶⁶ uses a condition based approach including visual inspection, management of defects (within its line defect refurbishment program) and replacement of failed assets (within its failed in service program).
- 438. Ergon's strategy for sub-transmission pole-tops is based on targeted replacement based on assessment of the sub-transmission feeder pole top refurbishment index "*to arrest the degradation of sub-transmission feeder pole tops*".¹⁶⁷

¹⁶⁵ 07.01.06 protection relay replacement

¹⁶⁶ 07.09.02 Management plan overhead feeder circuit

¹⁶⁷ 07.01.03 Engineering report sub-transmission lines refurbishment



Expenditure trends

439. Repex for pole-top structures over the prior, current and forthcoming RCPs is depicted in Figure 28 below.



Figure 28: Ergon pole-top structure repex compared with historical spend

440. Forecast expenditure reflects a step increase from 2014-15 levels corresponding with an increase in expenditure for 11kV, 33kV and 66kV pole top structures over the RCP.

Distribution pole-top replacement

- 441. Ergon has adopted the same reliability measure used for poles to monitor the unassisted failure rate of cross arms. Ergon is currently meeting the target with 99.9942% reliability performance, corresponding with an average unassisted failure rate of 69 crossarms per annum, against a target level of 99.99%.
- 442. We note from the figure above that the forecast expenditure for distribution crossarms is similar to the historical average and includes treatment of problematic laminated wood crossarms included as part of its inspection and defect management program.

Sub-transmission pole-top replacement

- 443. In response to improving safety and reliability of sub-transmission lines, Ergon reevaluated its management strategy. On the basis of improved data from its asset inspection and defect management program, Ergon determined it was imprudent to continue its line rebuild projects and has proposed an expanded pole-top replacement program in its place.
- 444. Ergon propose a targeted sub-transmission line pole top replacement program for feeders identified from its sub-transmission feeder pole top refurbishment index. The pole top refurbishment index is a composite index that ranks poor performing feeders on the basis of historical asset defects, asset related reliability, forced maintenance

Source: Ergon RIN data



costs and dangerous electrical event information. Ergon has sought to develop a program "*targeted to those feeder assets experiencing the most asset failures and asset deterioration represented by the worst index ranking*," reflecting the characteristics of end of life, and compensating for known deficiencies in its inspection program.

- 445. Pole top replacement is targeted to feeders that fall under the knee-point of the index curve, presumably a subjective assessment. Ergon indicates that the combined index will be recalculated annually, the size of the program appears to have been determined based on a resource constraint. Sensitivity analysis against risk or improving performance to determine the most efficient quantity of this program has not been provided. The program has not included a specific risk assessment for this program.
- 446. We note in the options analysis, specifically in relation to condition based replacement that "*Ergon Energy does not record and manage pole top condition*". We consider this to be in contrast to the declared strategy to move to CBRM, and the description of the asset management approach "*Proactive refurbishment/replacement based on significant inspection and testing program or systemic study of failure modes.*"¹⁶⁸ Comments regarding improved data on its sub-transmission asset pole fleet and use of condition data as an input to the development of the pole top refurbishment index also appear to support use of condition information to develop the forecast.
- 447. In its options analysis, Ergon states that the asset inspection and defect management program provides effective management of pole serviceability as demonstrated by the pole reliability index. However, recent failures have demonstrated it is ineffective for managing pole-tops due to the reliance on ground based inspections.

Summary

448. We consider that the development of a targeted program to manage sub-transmission pole tops is reasonable. However there is insufficient analysis provided to conclude that the proposed program reflects the optimal timing, volume and cost for subtransmission pole-top replacement.

7.2.9 Other

- 449. Forecast expenditure is broadly consistent with the historical average of the current RCP, with the exception of 2017-18 which is dominated with a single project expenditure for replacement of a SVC.
- 450. We have not identified any systemic issues in our review of this asset category.

7.2.10 Underground cables

- 451. Forecast expenditure reflects a step increase from 2014-15 levels corresponding with an increase in 11kV underground cable expenditure over the RCP.
- 452. We have not identified any systemic issues in our review of this asset category.

¹⁶⁸ 07.00.01 Asset renewal expenditure forecast summary, Table 5

7.3 Concluding remarks

- 453. We find that Ergon has developed a bottom-up repex program that is broadly based upon identified focus areas. However, Ergon is seeking to include increasing levels of repex in some of its programs, for which we found insufficient justification.
- 454. We found the following issues in a large number of programs that we reviewed that we consider undermine the prudency and efficiency of the forecast:
 - i. Insufficient project / program analysis to support the timing / volume of activity;

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- ii. A bias in replacement programs towards bulk replacements of targeted asset categories proposed to occur within the next RCP, with insufficient justification for choosing this time period;
- iii. Application of risk assessments that appear to result in a reactive approach to identified issues, and that promote a bias to include programs in the forecast;
- Step changes in expenditure, that are not the result of a CBRM methodology or RCP trend data but appear to be more aligned with RCP revenue reset periods; and
- v. Lack of identified condition data from which to make informed asset management decisions using condition and CBRM tools.
- 455. In summary, our analysis of a sample of repex expenditure programs supports the issues identified from our analysis of Ergon's governance and management framework and its forecasting methodology, namely (i) the top-down challenge process appears to have embedded a level of conservatism towards risk, (ii) hallmarks of expenditure being matched to RCP regulatory cycles; (iii) insufficient evidence of the establishment of an optimal risk/cost position for the portfolio; and (iv) absence of robust risk assessment in accordance with the risk framework.