Submission to the AER on its Preliminary Determination

Asset Renewal

Summary

This document sets out Ergon Energy's response to the Australian Energy Regulator (AER) on Asset Renewal Expenditure.

Ergon Energy rejects the AER's decision due to:

- **Disagreement with findings of insufficient justifications by AER's consultant EMCa**
- **Disagreement with the findings and decisions made based upon the AERs repex modelling. The repex models are based upon estimated age data. The repex models have a number of significant limitations and the AER has made several invalid assumptions in its approach and use of the models.**

Ergon Energy has identified errors in the reset RIN data originally provided and a revised forecast has been provided with this submission.

Ergon Energy has identified errors made by the AER in its calibration and use of the repex models.

Ergon Energy is concerned that the AER has not adequately considered the NEO in its decisions about repex expenditure.

Outcomes

In the light of above, Ergon Energy recommends that the AER accept Ergon Energy's submission forecast in entirety, and also approve an additional forecast allowance to resolve a large volume of conductor regulatory clearance infractions.

It should be noted that the dollars presented in this document are in 2014/15 real $ and are in reference to the direct costs and cost escalations that applied in Ergon Energy's Draft Proposal.

Cost escalations have changed for Ergon Energy's Revised Proposal forecasts, and for these please refer to 07.00.01 Forecast Expenditure Summary Asset Renewal 2015 to 2020 that has been updated for our revised proposal.

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Introduction

On 29 April 2015, the Australian Energy Regulator (AER) released its Preliminary Determination on Ergon Energy's Regulatory Proposal for the regulatory control period commencing on 1 July 2015 and ending on 30 June 2020.

This document details our response to the AER's Preliminary Determination and stakeholder comments on Replacement Expenditure. We have provided clarifications to our Regulatory Proposal and its supporting documents to reflect these positions. In addition, we have updated [our forecasts / methodology/documentation in light of an obligation to resolve a recently identified regulatory clearance infraction issue.

Ergon Energy has structured this document in the following manner:

- Section 1 summarises the AER's Preliminary Determination in relation to Replacement Expenditure.
- Section 2 outlines issues raised by stakeholders since the lodgement of our initial Regulatory Proposal, both through our own consultation process and the AER's
- Section 3 provides our response to the positions adopted by the AER's consultant, Energy Market Consulting associates (EMCa)
- Section 4 provides our response to the positions adopted by the AER
- Section 5 summarises our revised proposal repex forecasts
- Section 6 sets out the changes we have made to our supporting documents in response to the AER's Preliminary Determination.

1. AER's Preliminary Determination

Attachment 6 of the AER's Preliminary Determination details its positions on Replacement Expenditure. The following sections summarise these positions and the AER's rationale.

1.1. AER Preliminary Decision

> We do not accept Ergon Energy's proposed repex forecast of $894 million ($2014–15), excluding overheads. We have instead included in our substitute estimate an amount of $675 million ($2014–15), excluding overheads. Our estimate is 24 per cent lower than Ergon Energy's revised proposal. This reduction reflects the outcomes of our predictive modelling and evidence that Ergon Energy has a bias towards conservative risk assessment and has programs of expenditure which are not adequately justified.
>
> We are satisfied our alternative estimate reasonably reflects the capex criteria. It includes:
>
> 1. $271 million for pole and overhead conductor replacement, which is consistent with Ergon Energy's proposal.
>
> 2. $178 million of expenditure for the four remaining modelled asset categories.
>
> 3. $225 million for assets we consider that are not suitable for predictive modelling. This consists of $126 million for the SCADA, $61 million for pole top structures and $38 million for assets classified by Ergon Energy as 'other'.

The AER was not satisfied that Ergon Energy proposed total forecast capex reasonably reflected the capex criteria[1].

The AER advised it employed a number of techniques in reviewing total expenditure.[2] These included:

- Economic Benchmarking
- Trend analysis
- Expenditure Category Analysis
- Predictive Modelling
- Technical Review

[1] AER Preliminary Decision Attachment 6, section 6.1, page 8
[2] AER Preliminary Decision Attachment 6, Appendix A page 34

The AER advised it employed several assessment techniques in reviewing repex expenditure[3]. These included:

- analysis of Ergon Energy's long term repex trends
- predictive modelling of Ergon Energy's assets in commission; and
- technical review of Ergon Energy's approach to forecasting, costs, work practices and risk management
- consideration of various asset health indicators.

The AER stated[4]

> *Having examined Ergon Energy's proposal, we formed a view on our alternative estimate of the capex required to reasonably reflect the capex criteria. Our alternative estimate is based on our assessment techniques, explained in section 6.3 and appendix B. Our weighting of each of these techniques, and our response to Ergon Energy's submissions on the weighting should be given to particular techniques, is set out under the capex drivers in appendix B.*
>
> *We are satisfied that our alternative estimate reasonably reflects the capex criteria.*

Ergon Energy challenges these outcomes, as detailed in Section 3 and 4.

1.2. Trend Analysis

The AER advised[5]

> *we have drawn general observations from the historic trend analysis and benchmarking in relation to repex, but we have not used trend analysis to reject Ergon Energy's forecast of repex or develop our alternative estimate*

The AER observed that[6]

> *Ergon Energy's repex spend since the early 2000s is highly variable with its proposal for the 2015−20 regulatory control period is above the long term average repex.*

The AER acknowledged that[7]

> *When considering the [long term repex] trend we acknowledge there are limitations in long term year on year comparisons of replacement expenditure. In particular, we are mindful that:*
>
> - *Ergon Energy's regulatory reporting has been subject to varied definitions of replacement expenditure across time.*
> - *There are natural variations in a distributors replacement needs over time. Such variations can be a result of a lumpy asset age profiles or changes in relevant regulatory obligations.*

Ergon Energy generally accepts the AERs intent. Ergon Energy is concerned that the AER has not had due regard to this approach in establishing its findings, particularly in relation to natural and appropriate variation of overall repex expenditure over the long term.

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[3] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 67
[4] AER Preliminary Decision Attachment 6, Appendix B1 page 40
[5] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 67
[6] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 70
[7] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 70

1.3. Expenditure Category Analysis

The AER has employed this approach to[8]

> *compare expenditure across service providers, and over time, for various levels of capex:*
>
> - *overall costs within each category of capex*
> - *unit costs, across a range of activities*
> - *volumes, across a range of activities*
> - *asset lives, across a range of asset classes which we have used in assessing repex.*
>
> *Using standardised reporting templates, we have collected data on … repex, …. for all distributors in the NEM. The use of standardised category data allows us to make direct comparisons across distributors. Standardised category data also allows us to identify and scrutinise different operating and environmental factors that affect the amount and cost of works performed by distributors, and how these factors may change over time.*

Ergon Energy disagrees with the AER that they have collected standardised category data. Ergon Energy asserts that a considerable volume of data has been estimated or omitted or interpreted differently by the different service providers. While the intent is reasonable, Ergon Energy asserts that the level of standardisation is insufficient to achieve the intended result.

1.4. Predictive Modelling

The AER employed a predictive model known as the repex model. The data used in the model comprised of data provided by Ergon Energy via a series of Regulatory Information Notices (RINs) and calculated benchmark information derived from data collated via similar requests to other DNSPs.

The AER advised[9]

> *We modelled six asset groups using the repex model. These were poles, overhead conductors, underground cables, service lines, transformers and switchgear. ….. In total, the assets modelled represent 66 per cent of Ergon Energy's proposed repex.*

Ergon Energy contends that the AER has made a large number of assumptions in its use of the repex model. Ergon Energy disagrees with these assumptions and hence the AERs findings. Ergon Energy asserts that the use of these incorrect assumptions has led to inappropriate decisions regarding repex forecasting and hence funding allowances that are incompatible with the NEO.

1.5. Technical Review

The AER employed Energy Market Consulting Associates (EMCa) to perform a (limited) technical review of Ergon Energy's repex forecasts and proposals.

In summary, the AER has stated that EMCa found that[10]

- *Ergon Energy's proposed forecast is not reasonable and exhibits a degree of upwards bias reflecting cost and risk over-estimation. Further, a CPI price objective driving the top-down governance of Ergon Energy's expenditure forecast does not provide a meaningful*

[8] AER Preliminary Decision Attachment 6, Appendix A.3 page 36
[9] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 72
[10] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 80

discipline that would lead Ergon Energy to a prudent and efficient capex level. EMCa considered Ergon Energy's repex forecast was likely to have excessive costs over that which is prudent and efficient.

- *Ergon Energy's costs and work practices are reasonably prudent and efficient, within the bounds of reasonableness as referred to in the NER.*
- *Ergon Energy's risk management framework has elements that are likely to have led to a degree of engineering conservatism contributing to a degree of upwards bias in Ergon Energy's forecast.* [11]

Ergon Energy challenges all of these findings, as discussed in Section 3 and 4

2. Stakeholder comments

Stakeholders have raised a number of concerns in relation to Ergon Energy's capex proposal since the lodgement of our initial Regulatory Proposal on 31 October 2014. The Consumer Challenge Panel (CCP) also highlighted issues relating to the proposal. This section outlines and discusses these concerns.

2.1. AER consultation

The AER has noted[12]

> Submissions on Ergon Energy's proposal also considered that Ergon Energy's proposed repex for the 2015–20 regulatory control period was higher than necessary:
>
> - The Chamber of Commerce and Industry Queensland (CCIQ) submitted the proposed levels of repex appear very high. Particularly, in light of the substantial replacement capex programs performed during the previous regulatory periods as well as the asset age and asset utilisation trends it considered were declining. CCIQ stated it would expect to see reductions in repex of around 40 per cent similar to those of our other determinations.
> - The Queensland Resources Council (QRC) noted the ability of many distributors including Ergon Energy to defer previously approved expenditure such as repex when pressured by shareholders. The QRC considered there was evidence demonstrating the inefficiencies of Ergon Energy.
> - Cotton Australia submitted there has been a considerable trend upwards of repex. It was of the view there was a strong case for this and that repex should have peaked as there is now a very consistent trend downwards on the average life of assets. Cotton Australia considered the distributors cannot argue that they need to spend more due to an aging assets base.
> - The Queensland Council of Social Services (QCOSS) submitted it was difficult to understand the justification for Ergon Energy's large repex proposal as it considered there had been a decline in the average asset age for Ergon Energy. QCOSS considered Ergon Energy's proposal needed further scrutiny as replacements should be able to be deferred through corrective maintenance, acceptance of risk of failure, or the fact that assets may not be needed given weak or declining demand and peak forecasts.

[11] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 80
[12] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 73

These concerns are recognised by Ergon Energy. They reflect similar comments made by the Consumer Challenge Panel CCP2 Panel, and are addressed collectively by detailed response to the CCP2 submission.

2.2. Consumer Challenge Panel

Within this section, Ergon Energy will address concerns documented in the *Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals* paper which was published on 30th January 2015.

2.2.1. CCP2 capital expenditure

The CCP2 stated[13]

> *Energex and Ergon are currently facing very different business drivers compared to the circumstances that they claimed to exist when they were awarded record-high capex allowances for the previous regulatory period.*
>
> *In the light of these drivers, it is expected that the networks' capex requirements will revert to long-term historical levels that applied prior to the previous two regulatory periods.*

The CCP2 submission neglects to account for an additional 10-15 years of asset ageing and deterioration, changes to Queensland and National Electricity Regulatory environment and changes to corporate laws and obligations. The CCP2 mentioned drivers affect demand and reliability standards more than repex drivers.

2.2.2. CCP2 capex forecasting methodologies and assumptions

The CCP2 advised[14]

> *The DNSPs forecasts are based on risk averse and overly conservative risk assessments, together with multiple contingency allowances that systematically overstate project risks and cost.*

Generally, Ergon Energy's risk assessments are documented in engineering reports and Business cases associated with each program and provided as part of the proposal submission.

The Queensland Electrical Safety Act 2002 and the Queensland Work Health and Safety Act 2014 require that Ergon Energy undertakes work to specifically mitigate safety risks, unless the cost to do so is grossly disproportionate. Ergon Energy has described its method for determining this cost level. Ergon Energy undertakes rigorous formal Investigations about major asset failures and safety issues, which inform the need for Capex and Opex to mitigate such circumstances. Ergon Energy has provided information about some of these issues to the AER to demonstrate the level of detail and justifications involved.

In establishing its forecasts, Ergon Energy has employed standard estimates for unit rates. These standard estimates include average project allowances that are derived from actual recent historical project performance. In this way, times and cost estimates can be developed that encompass the use of existing standards and designs, regulatory obligations and actual experience within Ergon Energy. Ergon Energy has developed an ongoing review and feedback process to ensure these estimates are reasonable. While actual projects include contingency allowances, the forecast

[13] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 2
[14] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 3

estimates employed in repex forecasting for the submission do not. Ergon Energy observes that EMCa found that of the costs reviewed by them, Ergon Energy's costs were within benchmark ranges compared to other service providers.[15]

The CCP2 has asserted[16]

> *The networks' proposed capex projects are very poorly justified e.g.:*
>
> - *Insufficient justifications of the demand drivers for growth-driven projects*
> - *Insufficient justifications of asset conditions for replacement capex*
> - *Insufficient justifications of reliability drivers and consumers' willingness to pay for reliability-driven capex*
> - *Insufficient justifications of the prioritisations and timing of projects/programs over both the short and long term*

Ergon Energy has provided engineering reports, engineering strategy papers, models and analysis documents that support its proposed submission. Ergon Energy has:

- employed low growth scenarios for its demand driven forecasts
- documented its Asset Inspection and Defect management programs, providing condition history
- employed CBRM modelling techniques for substation assets, employing NPV risk analysis to identify optimum renewal strategies
- employed its discrete modelling where CBRM has not been developed, employing appropriate risk analysis and review to establish its proposed renewal strategies
- substantially reduced reliability capex, except to meet the obligations of our Distribution Authority regarding the worst performing feeders
- employed 10 year forecasts in its CBRM asset modelling specifically to support short and long term prioritisation and timing of projects
- presented a prudent and efficient forecast in its proposal, sufficient to meet the NEO and provide the customers of Queensland with the service levels they expect.

The CCP2 has also stated that[17]

> *The manner in which the networks have formulated and applied their key assumptions in relation to demand, customer forecasts, reliability drivers and materials and labour escalations rates appear to be strongly biased towards overestimating their capex requirements*

Ergon Energy challenges this statement. All of Ergon Energy's proposed repex programs have been supported by detailed documentation, management plans, models reports, engineering reviews and Business cases. Examples from Ergon Energy's proposal include:

- *07.00.01 Forecast Expenditure Summary Asset renewal 2015 – 2020*
- *07.01.01 Line Asset Defect Management Methodology*
- *07.01.02 Engineering Report Distribution Feeder Reconductoring Program*
- *07.01.36 Line Asset Defect Management Model*

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[15] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015 page 41
[16] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 3
[17] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 3

- *07.01.44 Repex Model Mark III Report 2013 – 2014*
- *07.01.46 Lines Defect Classification Manual*
- *07.09.02 Management Plan Overhead* Feeder Circuits

2.2.3. CCP2 – replacement capex

The CCP2 contended that[18]

> *The networks' proposals do not provide any justifications for their major proposed increases, other than some unsubstantiated statements suggesting their assets are aging.*

Ergon Energy has provided information in the following RIN responses that deal with asset quantities and asset age.

- Category Analysis RINs
- Reset RINs

Much of the information is estimated, consistent with prudent asset management policies for data records expected of DNSPs to date.

The proposal document *07.00.01 Forecast Expenditure Summary Asset Renewal 2015 – 2020* details the overall summary of our approach to asset renewal. Ergon Energy has provided over 60 separate and detailed documents that provide justification for the need for this expenditure. Asset renewal capital expenditure is non-demand driven capex, both non-recurrent and recurrent.

Age of assets can be an indicator of degradation. The AER has relied extensively upon this in employing its repex modelling. For low cost large population assets, Ergon Energy employs run-to-failure as a normal practice, superimposed with analysis of systemic failures to identify and resolve significant safety issues by specific programs. For high cost assets, Ergon Energy has employed CBRM modelling or discrete engineering analysis to determine prudent replacement strategies.

The CCP2 paper focuses upon average asset age. This is a misunderstanding of the renewal issue. Ergon Energy's approach to asset renewal doesn't focus upon the average asset age as an indicator of the need for replacement. Instead, it employs extensive condition monitoring to determine end of life. For lines assets this is via visual inspections of each asset. For high cost items, this involves condition analysis and testing. Asset renewal focus is on the more degraded assets, which often (but not always) affects the extremity of any asset age distribution curve rather than the average.

2.2.4. CCP2 – Asset ages

The CCP2 has stated that[19]

> *Furthermore, the networks' proposals have not justified why their "**proposed repex is required to maintain the average age of the network within an acceptable range**" – i.e., they have not identified the system performance outcomes that their major replacement capex programs will deliver. We consider this to be a major deficiency in the networks' repex proposals.*

It is presumed that the CCP2 comments are largely focused on the Energex proposal, as Ergon Energy does not employ system average asset age in any performance metric. System average

[18] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 8
[19] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 9

asset age is naturally volume biased towards the average age of the large quantities of low costs assets outside of substations. Ergon Energy employs condition monitoring for the vast majority of its assets to determine its prudent renewal needs.

Employing the Template 5.2 of the 2013/14 CA RIN, Ergon Energy's network assets have a total age profile as detailed in Figure 1. Some of this data is estimated.

Figure 1 shows that it is apparent that there is no even distribution of asset age. It is also apparent that it is difficult to ascribe a simple mathematical function to describe the distribution.

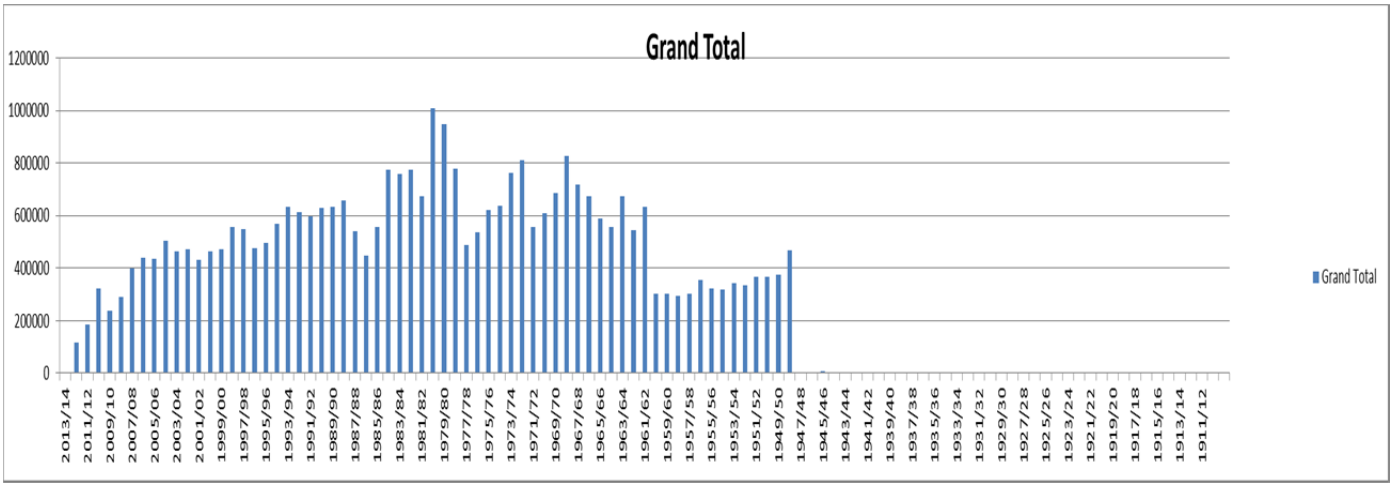

Figure 1 Ergon Energy Total Assets Age Profile

Figure 2 represents the age profile for Ergon Energy's high value assets only. This represents assets that are essentially primary plant assets within substations – including zone substation transformers, circuit breakers, instrument transformers, SVCs and other similar devices.

The Figure 2 graph vertical scale has been adjusted by two orders of magnitude relative to Figure 1 in order to show meaningful indication of the relative quantities.

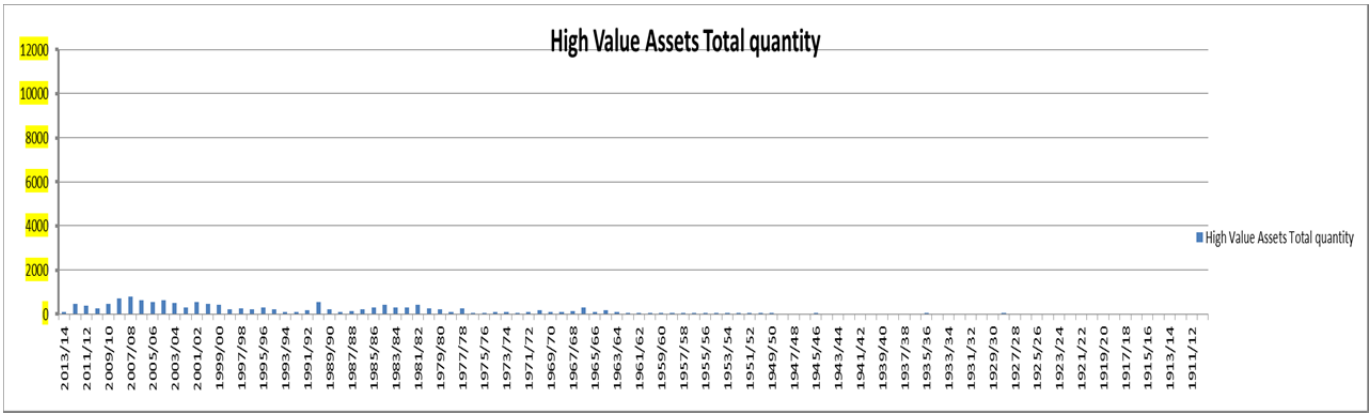

Figure 2 Ergon Energy High Value Assets Age Distribution

Figure 3 represents the age profile for Ergon Energy's low value assets only. This represents assets such as poles, conductor and cable (recorded as a per circuit kilometre), streetlights, services, HV links and fuses, lines type switches, communications, SCADA and protection devices. The scale for Figure 3 is identical to that of Figure 1. Based upon the relative information provided in Figures 1 and 2 this should be of no surprise.

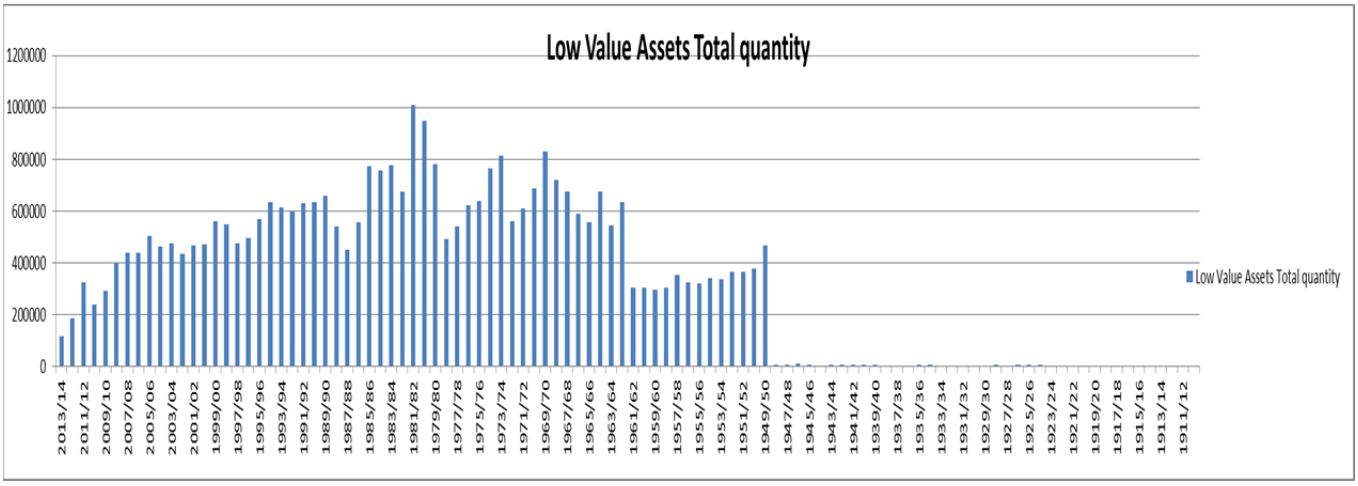

Figure 3 Ergon Energy Low Value Assets Age Profile

In Ergon Energy's proposal, the *07.00.01 Asset Renewal Expenditure Forecast Summary* 2015 – 2020 document details the overall summary of our approach to asset renewal. It specifically details intentions relating to performance outcome, including safety, reliability, and cost effectiveness.

Directly as a result of the CCP2's apparent concern about system average age, Ergon Energy has determined the following (based upon the Template 5.2 of the 2013/14 CA RIN):

- The average age of all assets is 24.47966 years.
- The average age of high value assets is 21.36255 years.
- The average age of low value assets is 24.49847 years.

The ages of all high value assets (substation primary plant) affects the total system average age, measured in years, by less than seven days.

Table 1 and Table 2 provide a summary of some asset class age statistics. There is a clear difference in overall volumes between low value assets and high value assets. Given the basic averaging function, the overall average age result is clearly impacted by and effectively volume weighted towards the relatively low individual cost distribution assets. . The augmentation impacts from projects, driven by the state government reviews, such as the Electricity Distribution and Service Delivery (EDSD) review of 2004 and Electricity Network Capital Program (ENCAP) of 2011, have effectively and substantially involved high value assets within substations. The volumes documented in Table 1 and Table 2 and the differences between Figures 1, 2 and 3 clearly demonstrate the negligible influence this expenditure has had on total average system age.

Table 1 Asset class age data

Asset Class	Asset Value Type	Quantity of Assets	Average Age	Oldest Age Record
Pole Stakes	Low	45,890	10.3	30
Poles	Low	959,560	29.6	69
Overhead Conductor (*cct kms*)	Low	*154,712*	37.7	69
Underground Cables (*cct kms*)	Low	*8,503*	9.1	80
Service Lines	Low	403,053	69	31.7
Zone Substation transformers	High	715	20.0	87
Distribution Transformers	Low	98,114	22	91
Zone substation switchgear	High	5,281	19.7	66
Distribution Switchgear	Low	152,232	16.7	90
Public Lighting	Low	528,913	10.9	42
SCADA & Protection	Low	32,335	14.2	67
Communications	Low	8,820	12.4	26
Other Assets	High	8,441	22.5	80

Table 2 Asset summary age data

Asset Class	Asset Value Type	Quantity of Assets	Average Age	Oldest Age Record
High Value Assets		14,437	21.4	87
Low Value Assets		2,392,133	24.5	91
All assets		2,406,571	24.5	91

Through its proposal documents for each of its proposed asset renewal programs, Ergon Energy has documented why each renewal program is needed and the service performance outcomes that the repex is intended to achieve. Ergon Energy's proposal document *07.00.01 Asset Renewal Expenditure Forecast Summary 2015 – 2020* also discusses this extensively.

A theoretical age discussion relating to refurbishment

Assume that a theoretical asset class has a normal distribution of age. While age distribution of actual assets is driven by a number of practical and historical factors, the use of a Normal Distribution Curve allows demonstration for the purposes of discussion. Further assume that age is the prime determinant for deterioration. In other words, the older the asset, the more deteriorated it becomes. Figure 4 shows such a curve. The curve is centred on the average age of the assets.

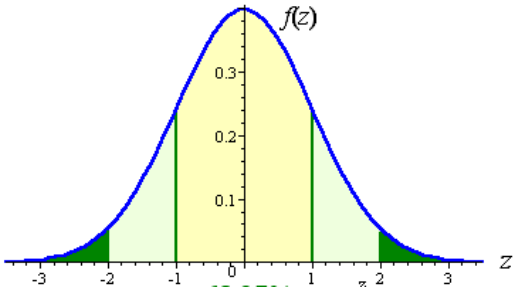

Figure 4 Normal Distribution Curve

Appropriate (prudent) refurbishment would logically look to replace the more deteriorated assets – this with little or no remaining life. In Figure 4, this represents the green area of the right-hand portion of the curve. From a mathematical perspective, this green area under the curve is dependent upon the Standard Deviation, skewness (volumes either side of the average) and kurtosis ("peakiness") of the curve shape rather than the average value.

To return to actual information, Figure 1 provides actual total age profiles. If this represented a single asset class, it would be more likely to be the right hand end of the curve that would be targeted for replacement, rather than the average. This is why Ergon Energy does not use average age of asset classes to decide upon strategies for refurbishment

2.2.5. CCP2 – Asset condition

Ergon Energy notes the comment by the CCP2 which states that[20]

> *Premature replacement of assets on the basis of nameplate age, rather than asset condition, is one of the key drivers of unnecessary network expenditure and unnecessary price increases.*

Ergon Energy does not generally employ nameplate age as a basis for replacement. Ergon Energy employs visual condition information and various testing and modelling techniques relating to asset condition rather than asset age as the sole determinant for replacement.

Ergon Energy notes that the AER's substantial reliance upon repex modelling, which is effectively an age focused modelling and forecasting tool, coupled with its approach to and dismissal of step changes in forecasts may tend to induce service providers to move towards this outcome and ultimately support CCP2's comment.

2.2.6. CCP2 – System utilisation

The CCP2 has stated[21]

> *The significant growth in the networks excess capacity, together with flat/declining load trends, means that their assets will be ageing at reduced rates compared to previous periods. This has not been taken into account in the DNSPs' repex proposals.*

Ergon Energy (and its legacy organisations) has designed its assets such that all equipment operates within their technical envelopes. This means that if current flow remains within designed limits, there will often be negligible degradation of the asset for the period of its economic life. .Excess current flow, such as that experienced during power system faults and short circuits may damage assets or

[20] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 9
[21] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 10

accelerate deterioration markedly, but such energy release is limited by protective devices. Typically such damage is accumulative, with each event shortening the practical life of the asset.

Poles and crossarms are not impacted at all by the energy flow through the conductors they support. Air break switches and links amongst many other assets are designed such that they will not deteriorate at all as a result of the routine energy flows through them. Referring to Table 1, it is clear that any measure relating to total asset counts is substantially biased with assets that do not deteriorate with energy flow. Yet all of these assets deteriorate for other reasons – such as environmentally induced circumstances – e.g. rust, salt air, dust, humidity, wind, wildlife, UV radiation and so on. The various components of an asset may also deteriorate at different rates, dependent upon its construction material, with susceptibility to different deterioration influences. For example, steel will corrode under high salt conditions while cable insulation may deteriorate under high UV radiation exposure.

Overall, electricity demand generally does not substantially impact upon most asset condition. Yet it is asset condition and associated risks that determine the need for asset renewal expenditure. Hence any forecast of lower system demand does not substantially change asset renewal requirements.

The AER has also recognised this in its Preliminary Determination discussion about asset utilisation.[22]

2.2.7. CCP2 – replacement spend in previous periods

The CCP2 has asserted that[23]

> *As outlined by the CCP at the AER Public forum in December 2014, the DNSPs previous replacement capex programs have effectively "pre-installed" a good deal of their replacement capex requirements for the next regulatory period.*

Ergon Energy observes that this is not that case. Ergon Energy has provided a historical discussion about its repex expenditure in proposal document *07.00.01 Forecast Expenditure Summary Asset Renewal*. Its various engineering reports and documents discuss the need for the expenditure in the regulatory control period 2015-2020.

Ergon Energy routinely inspects and monitors the condition all of its assets on a periodic basis. Ergon Energy has developed sets of benchmark standards that clearly define when an asset has deteriorated to the point where it can no longer safely perform its intended function.

These standards were provided as part of its proposal to the AER, in the following proposal documents:

- 07.01.41 Substation Defect Classification Manual
- 07.01.46 Lines Defect Classification Manual
- 07.01.45 Standard for Maintenance Acceptance Criteria

Use of these standards has meant that subjective decisions about the need to replace assets have been largely eliminated. In consequence of implementing these standards, any practice involving "pre-installing" replacement assets is also eliminated. In addition, there is a defined process for amending these standards, with a defined approval hierarchy, and the changes are subject to

[22] AER Preliminary Decision Attachment 6, Appendix B.4.3 page 87-88
[23] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 10

engineering review and certified by RPEQ registered engineers. There is an identifiable audit trail of such changes.

2.2.8. CCP2 – the AERs replacement capex assessment

The CCP2 states[24]

> *On the basis of the above evidence, we assert that the DNSPs have materially overstated their replacement capex needs.*

Ergon Energy challenges this statement. There appears to be little supporting evidence that supports such an argument.

Ergon Energy has not overstated its repex needs.

Ergon Energy asserts it has employed good engineering and operating practice in establishing its forecasts. Ergon Energy has provided over 60 documents that detail the service performance needs, the replacement need and the consequence replacement cost forecasts. Ergon Energy has employed the AERs repex modelling process and performed a top-down review of its total repex expenditure. This was documented in proposal document *07.01.44 Repex Model Mark III Report 2013-2014*. This demonstrated that Ergon Energy's repex forecast expenditures in total and generally for most asset groupings are generally lower than that predicted by model forecasts. This has been achieved through prudent use of CBRM modelling, condition monitoring and assessment, discrete engineering analysis, condition based maintenance regimes and its run-to-failure strategies.

The vast majority of Ergon Energy's assets are managed by some form of condition monitoring. Ergon Energy's asset inspection for lines type assets (i.e. those outside the substation fence and generally high volume, low value assets) includes a periodic site visit to each asset and general assessment of condition against predefined standards. Such visits are required by regulatory obligation which states[25]

> **29 Duty of electricity entity**
> (1) An electricity entity has a duty to ensure that its works—
> (a) are electrically safe; and
> (b) are operated in a way that is electrically safe.
> (2) Without limiting subsection (1), the duty includes the requirement that the electricity entity inspect, test and maintain the works.

Ergon Energy's inspection process is for the most part, a ground based inspection as this represents the most cost-effective approach. This introduces limitations in inspections for elevated or underground assets. Partly to offset these limitations, Ergon Energy reviews the volumes of the various defects identified and the quantities and consequences of failures leading to dangerous electrical events. This ongoing review process has resulted in improvements to inspection programs – such as the introduction of mirrors on extension poles to inspect services, and the use of stabilised binoculars by inspectors. New technology, such as use of LiDAR and computer based interpretation of results, is being developed now, and has further potential for program improvement and cost reductions.

Failures on poles and wires type assets (such as conductor breakages or crossarm failure) often lead to situations where energised assets fall to the ground. These are classed (by legislation) as

[24] Consumer Challenge Panel (CCP2 Panel) Submission on Energex and Ergon Energy Capex and Opex Proposals, 30 Jan 2015 page 10
[25] Queensland Electricity Safety Act 2002, s29

dangerous electrical events, and typically require immediate de-energisation and repair. Logistically, each failure of this type requires diversion of work crews to the scene to make safe and repair. Often, the material repair costs are minimal, with most of the repair cost associated with labour and machinery. While entirely necessary, the whole process is inefficient, as such urgent work cannot be bundled or combined with other work. This also incurs significant mobilisation and de-mobilisation costs.

In recognising and targeting these inefficiencies, Ergon Energy has established systemic failure modes for these assets and developed proposals for specific and targeted programs of work to allow bundling of the work efficiently and proactively to mitigate and as much as practical prevent the dangerous situations from occurring. These targeted proposals for the 2015-2020 regulatory period, include

- 7/0.064 conductor replacement program
- Services replacement programs
- Laminated crossarm replacement program
- Subtransmission pole-top refurbishment program
- Defective connector and splice replacement program
- Low Clearance Conductor mitigation program

High value assets are condition monitored and assessed for deterioration for replacement decisions. Ergon Energy employs CBRM, developed by EA Technology, for this purpose. The CBRM modelling includes age of asset as one component of the decision making. Other components include asset condition, reliability failure consequence, failure safety consequence, failure costs consequence, costs to replace, costs to maintain, environment consequences and costs and other issues. The approach and limitations are also described in AER proposal document *07.00.01 Forecast Expenditure Summary Asset Renewal 2015 - 2020*, and the various related major asset class types engineering reports and business cases, such as *07.01.05 Engineering Report Power Transformer Replacement and Refurbishment Program*.

3. Our Response to the EMCa technical review

In its Preliminary Determination, the AER has advised that it employed EMCa as a consultant to advise about specific elements of Ergon Energy's proposal.[26]

In its report to the AER[27], EMCa were asked to consider a number of specific matters as part of their assessment. This section discusses their findings and conclusions.

3.1. Risk management

EMCa were asked to provide comment about whether Ergon Energy's risk management is prudent and efficient.[28]

EMCa Findings, Item 3. ii. states

> *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.*[29]

The Queensland Work Health and Safety Act[30] imposes a Duty on a person –

> (*a) to eliminate risks to health and safety, so far as is reasonably practicable; and*
> *(b) if it is not reasonably practicable to eliminate risks to health and safety, to minimise those risks so far as is reasonably practicable.*

In this Act, reasonably practicable, in relation to a duty to ensure health and safety[31], means

> *that which is, or was at a particular time, reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters including—*
> *(a) the likelihood of the hazard or the risk concerned occurring; and*
> *(b) the degree of harm that might result from the hazard or the risk; and*
> *(c) what the person concerned knows, or ought reasonably to know, about—*
> *(i) the hazard or the risk; and*
> *(ii) ways of eliminating or minimising the risk; and*
> *(d) the availability and suitability of ways to eliminate or minimise the risk; and*
> *(e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.*

The Queensland Electrical Safety Act 2002 imposes the following obligations upon Ergon Energy as follows [32]

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[26] AER Preliminary Decision Attachment 6, page 23
[27] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page i
[28] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015 page 2
[29] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015 page i
[30] Queensland Work Health and Safety Act 2011, Clause 17
[31] Queensland Work Health and Safety Act 2011, Clause 18
[32] Queensland Electrical Safety Act 2002 Clauses 29 and 30

29 Duty of electricity entity

(1) An electricity entity has a duty to ensure that its works—

(a) are electrically safe; and

(b) are operated in a way that is electrically safe.

(2) Without limiting subsection (1), the duty includes the requirement that the electricity entity inspect, test and maintain the works.

30 Primary duty of care

(1) A person conducting a business or undertaking must ensure the person's business or undertaking is conducted in a way that is electrically safe.

(2) Without limiting subsection (1), the duty includes—

(a) ensuring that all electrical equipment used in the conduct of the person's business or undertaking is electrically safe; and

(b) if the person's business or undertaking includes the performance of electrical work, ensuring the electrical safety of all persons and property likely to be affected by the electrical work; and

(c) if the person's business or undertaking includes the performance of work, whether or not electrical work, involving contact with, or being near to, exposed parts, ensure ensuring persons performing the work are electrically safe.

The Queensland Electrical Safety Act[33] also defines that

(1) ***Electrical risk*** *means—*

(a) in relation to a person, the risk to the person of death, shock or injury caused directly by electricity or originating from electricity; or

(b) in relation to property, the risk to the property of—

(i) damage caused by a cathodic protection system; or

(ii) loss or damage caused directly by electricity or originating from electricity.

(2) ***Electrically safe*** *means—*

(a) for a person or property, that the person or property is free from electrical risk; and

(b) for electrical equipment or an electrical installation, that all persons and property are free from electrical risk from the equipment or installation; and

(c) for the way electrical equipment, an electrical installation or the works of an electricity entity are operated or used, that all persons and property are free from electrical risk from the operation or use of the equipment, installation or works; and

(d) for the way electrical work is performed, that all persons are free from electrical risk from the performance of the work; and

(e) for the way a business or undertaking is conducted, that all persons are free from electrical risk from the conduct of the business or undertaking; and

(f) for the way electrical equipment or an electrical installation is installed or repaired, that all persons are free from electrical risk from the installing or repairing of the equipment or installation.

(3) ***Electrical safety****, for a person or property, means the person or property is electrically safe.*

(4) In this section— free from electrical risk, for a person or property, means that—

(a) electrical risk to the person or property has been eliminated, so far as is reasonably practicable; or

(b) if it is not reasonably practicable to eliminate electrical risk to the person or property, the risk has been minimised so far as is reasonably practicable.

Ergon Energy has documented its general risk assessment process in proposal document *07.09.30 Risk management and Insurance*. In addition, Ergon Energy provided documents in response to Question 31 in follow-up. The documents generally details risk tolerability criteria, and details that in general, risks are managed to ALARP (As Low As Reasonably Practical), with criteria for action and

[33] Queensland Electrical Safety Act 2002 Clause 10

response at the various levels. Appropriately, EMCa has considered this when evaluating all of Ergon Energy's submission.

However, and detailed in the legislation highlighted in this section, the Queensland regulatory environment requires Ergon Energy to employ SFAIRP (So Far As Is Reasonably Practical) principles when assessing electrical safety risks.

R2A Due Diligence Engineers of Victoria has published several discourses about the difference between ALARP and SFAIRP[34], and is reproduced as follows:

> *Whilst the two approaches may set out to achieve the same outcome, that is, to demonstrate due diligence with regards to safety, the implication that having achieved ALARP will forensically satisfy SFAIRP post event is naively courageous. This is simply because the processes required to demonstrate each is different, especially for high consequence, low likelihood events, the ones that are the subject of judicial scrutiny.*
>
> ** ALARP asks what is the risk associated with the hazard and then can that risk be made as low as reasonable practicable.*
>
> ** SFAIRP asks what are the available practicable precautions to deal with the identified issue and then tests which precautions are reasonable based on the common law balance (of the significance of the risk vs the effort required to reduce it).*

As detailed, Ergon Energy is obliged to employ SFAIRP in its assessments of safety risk, which imposes a more demanding mitigation obligation when compared to the ALARP approach. The documents provided by Ergon Energy in its proposal that propose to resolve safety issues specifically employ the SFAIRP obligation and its application in decision making.

Ergon Energy has correctly applied the SFAIRP principle in relation to electrical safety and work health and safety risks and does not accept that it has applied incorrect risk management assessments to its programs of work.

Table 3 **Error! Reference source not found.**lists proposed funded programs, and their associated allocation in reset RIN forecasts, that have employed a SFAIRP assessment.

Table 4 lists proposed funded programs, and their associated allocation in reset RIN forecasts, that have employed an ALARP assessment.

[34] For example "SFAIRP vs ALARP, R Robinson and G Francis, May 2014"

Table 3 Programs with SFAIRP assessment

Proposed Program	Proposal Document Reference	Reset RIN Category
Lines asset defect remediation	07.01.01	Poles Poletops Conductor Underground cables Services Distribution transformers Distribution switchgear
Distribution feeder reconductoring program	07.01.02	Conductor
Subtransmission line refurbishment	07.01.03	Poletop Structures
Modifications to distribution earth defect thresholds	07.01.04	Transformers
Protection relay replacement	07.01.06	SCADA, network control and protection
Substation dc system renewal	07.01.09	Switchgear
Colour coded low voltage overhead customer services	07.01.11	Services
Neutral screened low voltage overhead Services	07.01.14	Services
Defective connector and splice replacement	07.01.15	Conductor
ACQ treated laminated veneer crossarm replacement	07.01.17	Pole tops
XLPE service cable insulation degradation	07.01.18	Services
EDO Fuse Replacement in high fire risk areas	07.01.19	Switchgear
Replacement of non-ceramic fuses	07.01.20	Distribution switchgear
Conductor Clearance to Ground Defect Remediation		Other Assets

Table 4 Programs with ALARP assessment

Proposed Program	Proposal Document Reference	Reset RIN Category
Power transformer replacement and refurbishment program	07.01.05	Transformers
Circuit breakers and switchboards replacement and refurbishment	07.01.07	Switchgear
Instrument transformer replacement and refurbishment	07.01.08	Other assets
Static VAR Compensator (SVC) refurbishment and replacement	07.01.10	Other assets
Capacitor bank replacement	07.01.12	Other assets
Outdoor isolators and earth switches replacement and refurbishment	07.01.13	Services
Cast iron cable pothead replacement	07.01.16	Underground cables
Telecomm network replacements	07.01.22	SCADA, network control and protection
Audio frequency load control replacement	07.01.23	Other assets
RTU replacement program	07.01.26	SCADA and protection

3.2. Proactive repex adjustments

The EMCA assessment observes[35]

> *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.*

In its Preliminary Determination, the AER has stated[36]

> *Once we approve total revenue, which will be determined by reference to our analysis of the proposed capex, the service provider is then able to prioritise its capex program given the prevailing circumstances at the time (such as demand and economic conditions that impact during the regulatory period). Some projects or programs of work that were not anticipated may be required. Equally likely, some of the projects or programs of work that the service provider has proposed for the regulatory control period required may not ultimately be required in the regulatory period. We consider that a prudent and efficient service provider would consider the changing*

[35] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-27120 Final version 8.3, 20/04/2015 page 71
[36] AER Preliminary Decision Attachment 6, page 16

environment throughout the regulatory period and make sound decisions taking into account their individual circumstances.

Ergon Energy challenges EMCa's assertion that the ability to defer repex places a level of doubt on whether the forecast expenditure is prudent. Ergon Energy asserts that changing its repex program to suit prevailing conditions, such as cyclones or a significant systemic failure mode that presents public safety risk, while managing within its overall regulatory budget allowance is demonstrating the appropriate and prudent performance expected by customers.

3.3. Program stability

EMCa has identified that[37]

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.

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.

It is a simple fact of regulation that Ergon Energy seeks and receives approval for a specific level of totex funding for each five year period (pass-through issues not withstanding). During any regulatory period, the AER has confirmed that[38]

the service provider is then able to prioritise its capex program given the prevailing circumstances at the time (such as demand and economic conditions that impact during the regulatory period). Some projects or programs of work that were not anticipated may be required. Equally likely, some of the projects or programs of work that the service provider has proposed for the regulatory control period required may not ultimately be required in the regulatory period. We consider that a prudent and efficient service provider would consider the changing environment throughout the regulatory period and make sound decisions taking into account their individual circumstances.

At all levels, it has long been Ergon Energy's intent to prioritise work as required to suit the totex funding available. Where higher priority work is identified, lower priority work is adjusted to accommodate the more urgent work. For example at the lowest level, a works crew is engaged repairing a de-energised streetlight. Suddenly, a "wires down" situation is reported. The crew is quickly re-tasked to address the immediate high risk safety problem. In the same principle, larger programs of work may also take precedence where a pressing risk becomes evident. Post cyclone restoration is a typical example of this.

In the current regulatory period, a systemic failure mode of a specific brand and type of Air Break Switch was identified that presented significant public safety and staff safety operating risks,

[37] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015 page 37
[38] AER Preliminary Decision Attachment 6, page 16

sufficient to require asset replacement. Ergon Energy adjusted its plans and resources sufficiently to allow focus on this issue and allowed other, lower priority work, to be deferred for a short period.

Ergon Energy has provided the AER a proposal that it believes is consistent with prudent and efficient operating practice. A gross change to this forecast, (for example, as proposed by the AER in its Preliminary Determination), will have significant and far-reaching consequences. Programs of work considered by Ergon Energy to be prudent and efficient, may need to change in scope, timing or execution, resulting in reduced cost programs that sacrifice long term economic efficiencies for short term cost savings or perhaps that result in an increased standing risk level, or that impact overall reliability performance to suit the funding limitations.

Ergon Energy accepts EMCa's apparent criticism about program stability and the ability to defer repex, but asserts that this reflects the mark of a prudent and efficient asset manager. For all of its repex forecasts, Ergon Energy provided supporting documentation demonstrating the need for its major programs of repex work. Despite the suggestion made by EMCa to the contrary, Ergon Energy asserts there were no "ambit claims" made for repex expenditure forecasts.

As most lines assets are only periodically inspected with cycles typically of 4, 6 or 8 years, Ergon Energy actively monitors asset defect and dangerous electrical event quantities over time. Trend variances are reviewed regularly. Where failure trends exhibit a marked rise, investigations are initiated. Events where safety has been compromised are investigated. Where systemic issues are identified, evidence is gathered to determine the root cause, and mitigation measures explored. If safety impacts are involved SFAIRP mitigation principles are employed. If not, ALARP principles are employed.

With much of the asset base managed according to run-to-failure principles, developing or accelerating quantities of asset failure issues are strong indicators that the asset class/type/model is approaching end of life. Systemic asset issues therefore herald a need for targeted renewal programs. Especially near to the end of a regulatory period, a decision may also be made to shift a renewal program or perhaps a significant portion of a program into the following regulatory period.

Mitigation work related to resolving a safety issue does not pause pending a regulatory reset period change, although preparatory works may be arranged to facilitate the intended program timeframes.

3.4. Ergon Energy Cost estimations do not indicate bias

Ergon Energy notes and acknowledges EMCa statement in regards to repex for the 2010 – 2015 regulatory period that[39]

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

Ergon Energy considers this an important statement as it supports the use of such unit rates provided under the RINs and within the repex models.

[39] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015 page 40

4. Our response to the AER's preliminary Determination

The following sections detail our response to the AER's preliminary Determination.

4.1. Repex modelling

4.1.1. General limitations of repex models

At its heart, the repex model evaluates a homogenous group of similar assets and attempts to predict replacement quantities of in-service assets over time, using the asset installed age as a defacto indicator of the degradation of the asset. Statistical analysis can be applied to historical records of actual failures to establish a nominal age for the asset population that is likely to represent genuine end of life. The approach is detailed in the AERs handbook on repex model development.[40]

A typical asset is designed to achieve a specific function. It may be a homogenous asset such as a wooden pole or conductor, or a complex device built from many components, assembled and managed as a single element, such as a circuit breaker, transformer or Static VAR Compensator.

The asset base is therefore complex and requires appropriate and continuous asset management practices to be applied. The physical assets are subject to routine maintenance and inspection and refurbishment processes throughout their intended service lives.

Sudden changes can affect these processes, such as regulatory changes imposing tighter or more restrictive performance obligations; catastrophic failure modes that have safety implications that become evident only after some years of service; premature aging from poor manufacturer or quality assurance; or significant extraneous events such as major bushfires that reveal design limitations.

Such changes are routinely managed through the asset management process, requiring prudent decisions to change inspection and maintenance practices, future designs, and or accelerated refurbishment and replacement.

Such decisions can be significant and lead to significant non-recurring expenses to resolve specific issues and extensive refurbishment or replacement programs to suit the situation.

Repex model forecasting does not accommodate such impacts.

Repex modelling requires that there is sufficient homogenous population base that meaningful statistics can be established. If there are only a handful of items in an asset class, or if there are only one or two failures in the period employed to establish failure history, establishing average and standard deviation age at failure becomes problematic. Hence repex models for SCADA systems are unlikely to produce valid models able to be employed for reliable forecasting.

The accepted practice for calibration of each category in the repex model is to adjust the mean life until the past statistical mean volume over a short period is seen as the output for the current year. The results can be skewed substantially by age outliers or extended life survivors of a population resulting in a value somewhat different to the true mean age. In addition, if the period selected is short, or failure history is incomplete, there will be a dearth of information leading to over-estimation of length of estimated lives. There is no evidence that the AER's selected period is sufficiently long as to avoid these errors.

[40] AER Electricity network service providers Replacement Expenditure model handbook, November 2013 Section 3.1 and 3.2

Repex modelling employs age as a defacto indicator of asset condition/deterioration. The model assumes all assets are operated in the same environment and subject to the same asset management regimes and the same rates of deterioration. The AER recognised this for wooden assets[41] by recognising that timber degradation in Queensland and New South Wales is faster compared to other regions.

Where condition data is recorded, such as for high cost assets, such information can be employed to develop a more objective and specific forecast for replacement. Ergon Energy has employed CBRM for major substation plant to perform this function. It is to be expected that techniques such as CBRM which consider measured condition information, the situational risk associated with the asset, the costs to maintain or replace the asset, and the reliability risk associated with asset failure will provide a better forecast of the need to replace such assets.

For example, a particular safety issue arises that, after investigation, is determined to be a systemic problem for an asset type brand and model – such as an explosive failure issue for a 66kV Circuit Breaker. Ergon Energy's response may include some short term measure (such as de-energising similar devices exhibiting the same symptoms), some immediate maintenance and or refurbishment, and some long term measures, such as replacement. Such long term measures are generally progressed by some level of targeted replacement and appropriately justified, scrutinised under governance processes and if endorsed, implemented. Such programs will be reflected as step changes in forecast budgets or as "lumpy" trends in historical budgets. Ergon Energy asserts that "lumpy" overall expenditure is an indicator of responsible asset management and general expenditure restraint.

Where a new systemic failure mode occurs or a manufacturer initiates a product recall, such as detailed in proposal document *07.01.11 Engineering Report Colour Coded low Voltage Overhead Customer Services*, wherein defective insulation has led to a series of dangerous incidents, a prudent DNSP must respond to resolve and mitigate the circumstance. This has the effect of bringing forward replacement expenditure relative to the repex model forecast, and also appears as a step change in a proposed forecast.

As part of its proposal, Ergon Energy has provided justification of proposed programs of works, which all act to establish material changes in repex forecasts. Many of these step changes have safety drivers, such as discussed above, and are subject to SFAIRP principles in terms of program planning development. Some, especially those relating to major substation plant are as a result of introduction of improved asset management techniques.

Ergon Energy asserts that forecast step changes provide an indicator that a service provider is actively attempting to manage its assets in order to achieve its service obligations. Any approach that unilaterally removes all step changes is at material risk of not meeting the National Electricity Objectives (NEO).

4.1.2. AER Repex models may be inappropriate

The AER has intended to establish a repex model that allows it to forecast repex. It stated

> *When we were formulating the standardised network assets, we aimed to differentiate the asset categorisations where material differences in unit cost and replacement life existed. Development of these asset subcategories involved extensive consultation with stakeholders, including a series of workshops, bilateral meetings and submissions on data templates and draft RINs.*

[41] AER Preliminary Decision Attachment 7, page 215

Despite the extensive consultation, Ergon Energy believes that the roll-up groups developed by the AER do not meet this intent. Given the large number of disparate asset types installed by distribution service providers in each roll-up group, the changes in technology that have occurred over the lives of the different asset types leading to different materials, designs, replacement costs, maintenance needs and strategies, the roll-up groups encompass a too large and disparate variation in unit costs and replacement lives Ergon Energy believes the number of groups necessary to achieve a valid modelling function would be in the order of at least 50-70 and possibly higher.

For example, the AER Guide to repex modelling[42] describes that there is a clear difference between assets that are run to failure and assets that are condition assessed and replaced at the end of "economic" life. This is especially evident with transformers.

Substation power transformers are typically very large, ranging from 1 to over 100MVA and replacement costs are typically in the order of $millions. Ergon Energy has 599 of these assets. Such assets are regularly inspected and assessed for condition to assist in maximising economic life. Substation power transformers are low volume purchases and typically custom built on request.

Distribution transformers are typically small, ranging in size from 5kVA to 2MVA, and are predominantly managed via run-to-failure strategies. Other than visual inspections, condition monitoring is minimal. Ergon Energy has 98,223 of these assets. Distribution transformers are relatively low cost and typically mass produced for the most part.

DNSPs employ different asset management approaches for prudent management of these disparate asset classes. The different asset management approach for these two categories yields different aggregate lives and unit costs.

In establishing the Category Analysis and Reset RINS, the AER state

> *We aimed to differentiate the asset categorisations where material differences in unit cost and replacement life existed.*[43]

In developing its repex models for Ergon Energy's preliminary determination, the AER has combined these disparate classes to produce a transformer repex model clearly weighted towards the distribution transformer class.

In is replacement expenditure handbook[44], the AER states that

> *For example, the typical life of a pole may vary depending on the material (and treatments) using in its construction (e.g. hard wood, soft wood, steel, concrete). It may also vary depending on environmental conditions (damp or dry, or coastal or inland). The unit costs will often vary depending on the voltage level, which reflects the height and diameter of poles. As such, most NSPs will require a number of categories to reflect adequately these variations.*

Ergon Energy agrees with the AER that there is a difference between steel poles, concrete poles and wood poles, their design (driven by location, voltage level etc.). Their failure modes, their construction, their typical asset lives, their unit costs, and even their suitable application in a distribution and subtransmission network are all significantly different. They do not represent a homogeneous population.

The AER stated[45]:

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[42] AER Electricity network service providers Replacement Expenditure model handbook, November 2013
[43] AER Preliminary Decision Attachment 6, Section E.2 page 135
[44] AER Electricity network service providers Replacement Expenditure model handbook, November 2013, page 12

As detailed in our repex handbook, the repex model is most suitable for asset categories and groups with a moderate to large asset population of relatively homogenous assets. It is less suitable for assets with small populations or those that are relatively heterogeneous.

Hence, a single rollup of the defined categorisations, to establish an average unit cost or replacement life becomes nonsensical. In practice, such an approach will be naturally dominated by the largest volume asset grouping. This also means that comparisons between service providers are problematic, and dependent upon historical and regional availability of each asset type. For example, a service provider with insignificant volumes of subtransmission level or Single Wire Earth Return (SWER) level voltages will have an entirely different set of pole categories when compared to a service provider with very significant amounts.

There is also an implicit assumption that the assets operate in the same physical environment. Clearly, assets in, say, Tasmania, which are subject to freezing conditions including ice and snow, will be subject to quite different environments when compared to similar assets located in North West Queensland which are subject to desert heat temperatures and tropical humidity environments. Arguably, these different environments will impact average life of assets.

Comparisons that are drawn between the results of those service providers should therefore be subject to some tolerance adjustments

Ergon Energy contends that such asset groupings as has been driven by the AER (and consulted with service providers for this purpose) fails to meet the AER's own differentiation rules where material differences exist between unit cost and replacement life for the various categories (discussed above).

Given the repex model principles relating to asset differentiation documented by the AER (as detailed above) in their replacement expenditure handbook, Ergon Energy is concerned that the AER approach to grouping of the various asset categories is significantly flawed, results in inappropriate modelling and hence leads to inappropriate value decisions. For example, the maintenance task for confirming adequate earthing is in place has a set of testing benchmark definitions that define what a defect is and requires remediation. Changing these benchmarks (required due to a regulatory obligation) presents as a material step change in regulatory forecasts[46]. This program was included under the transformer grouping in the reset RIN information. The AER's technical consultant found the program proposal was indicative of prudent decision making, yet the reset RIN grouping resulted in an AER finding that adopted a business-as-usual forecast, rejecting all step changes. Hence the substitute forecast by the AER based upon the aged based repex modelling did not even include "prudent" forecasts such as the earth defect remediation work.

Ergon Energy is concerned that use of 2010-11 to 2014-15 data in the AER's repex model is also flawed as it includes one year of Ergon Energy's forecast in the backcast data used as input to the repex model. (Refer to section 4.1.3 below)

Given the express use of the repex model by the AER and the financial impact of decisions derived from the model, it behoves the AER to ensure the model as applied to Ergon Energy is sufficiently robust and appropriate for the purpose by which it was intended. That the models are robust and suitable for this purpose has been assumed, but is unproven. Given the AER decisions arising from the repex models directly affect achievement of National Electricity Objectives (NEO), including safety, reliability and efficiency, Ergon Energy contends that a mechanism is required to establish

[45] AER Preliminary Decision Attachment 6, page 141
[46] Ergon Energy proposal document 07.01.04 Engineering Report Modifications to Distribution Earth Defect thresholds.

and confirm that the model developed for Ergon Energy is sufficiently accurate and robust as to be suitable for the purpose that it was developed.

Ergon Energy notes the comment by the AER that

> *In the future, the AER may consider further standardising on a set of asset categories in order to improve its ability to benchmark between NSPs.*[47]

Ergon Energy suggests that given the AER has identified that asset data collection is not yet standard or uniform, the AER's use of specific component elements of the models, such as unit lives or replacement costs, as a benchmark assessment tool between service providers is inappropriate at this stage of the AER's repex model development.

4.1.3. Fundamental error in repex model input parameters

The repex model is a method of combining statistics on past volumes of asset replacement in a category with age profile data associated with the same category to enable a projection of prospective future replacement volume to be made. The accepted practice for calibration of each category in the repex model is to adjust the model category mean life until the past statistical mean volume over a period, such as the past 5 years, is seen as similar to the category mean life for the current year. Conversion of future volumes predicted by the repex model to future expenditure is a separate step wherein a separate statistical analysis of past expenditure, escalated to the same equivalent year value, derived as a unit cost rate from the total expenditure divided by the total units replaced over the same multiyear period used for the volume statistic.

The repex modelling provided by Ergon Energy as part of its proposal adopted this approach and explored two past periods as scenarios - being a 5 year period from 2009-10 to 2013-14 and a 4 year period 2010-11 to 2013-14.

Ergon Energy notes that the repex models subsequently developed by the AER utilise a single scenario utilising data from the Ergon Energy RIN Templates 2.2 and 5.2 for the 5 year period 2010-11 to 2014-15. A problem with this approach is that the final year of the 5 year period used by the AER, 2014-15 is not yet complete, so the "past" expenditure and volume data has no associated age profile. The last of the 5 years employed in the AER's model is in fact a part of Ergon Energy's forecast. To state this another way, the data provided by Ergon Energy as at 31 October 2014 in its proposal necessarily had to consist of a six year forecast comprising 2014-15 as a year not yet concluded in the current determination period and 2015-16 to 2019-20 the 5 years of the next determination period. Ergon Energy contends that this error has invalidated the AER models.

The misunderstanding by those working on the AER repex modelling was further evidenced in an email request to Ergon Energy in early May 2015 which states:

> *"ERGON*
>
> *As part of the Reset RIN Ergon provided age profile data in Template 5.2.1 for prescribed and nominated repex categories.*
>
> *As part of the revised proposal could Ergon provide an update with age profile data for the year 2014–15 for these same categories (or to match any updated re-categorisations if there will be any as part of the revised proposal)."*

[47] AER Electricity network service providers Replacement Expenditure model handbook, November 2013, section 4.1, page 13

Ergon Energy agrees that the age profile for the year 2014-15 is the correct age profile to use with expenditure and volume data statistics up to the year 2014-15 but this year is not yet concluded. Ergon Energy will produce this data after 1 July 2015 when the year is concluded, and data can be produced in accordance with the AER RIN issued 28 September 2012. This data is required to be delivered by 13 November 2015 (refer paragraph (c) (iii) of the RIN), but will not be in time to suit the revised proposal deadlines.

Ergon Energy contends that a repex model by its nature can only be populated with historic data up to and including the most recently concluded year and recommends that the AER's use of repex models only employ the available historical data.

4.1.4. Use of reset RIN data

The AER has relied extensively upon the Reset RIN data in making its Preliminary Determination.

The AER noted that Ergon Energy has provided a compliant response to its Reset RIN request. [48]

The Reset RIN required Ergon Energy to provide information about asset categories as part of Template 2.2.1. This included expenditure and asset replacement and asset failure volumes of these categories. The RIN recognised that not all of the requested data might be available and allowed estimates to be provided, requiring Ergon Energy to apply best endeavours in determining the volumes and detailing the process and assumptions used to allocate asset volumes.[49]

In both the Category Analysis RIN and the Reset RIN, Ergon Energy submitted "estimated" forecast and historical data, consistent with the requirements of the RINs.

The AER's definition of Estimated Information is as follows[50]

> *Information presented in response to the Notice whose presentation is not materially dependent on information recorded in Ergon Energy's historical accounting records or other records used in the normal course of business, and whose presentation for the purposes of the Notice is contingent on judgments and assumptions for which there are valid alternatives, which could lead to a materially different presentation in the response to the Notice.*

While the AER has employed the RIN data extensively, it has not recognised nor made any allowance for estimating error in its decision making process. In fact, the AER stated that it considered much of this data to be fixed, set and not open to interpretation or scenario testing.[51]

Ergon Energy asserts that, based upon the description of its analysis process,[52] the AER has made a material error in its forecasting analysis by not considering the supplied data may be estimated, and in not considering the sensitivity of the impact that estimating errors are likely to have introduced.

Ergon Energy recognises the benefits of a repex model. By using backcast replacement volumes, the model provides an indication of order of magnitude of forecast replacement volume which can be translated into order of magnitude forecast expenditure by application of unit cost rates developed from backcasts assuming normal age related degradation and end of life.

The RINs allowed DNSPs to add additional rows in any group to allow them to describe their collective assets. In this process, DNSPs were instructed to ensure the sum of individual categories, including any additional category or additional other category or asset refurbishment/life extension

[48] AER Preliminary Decision Attachment 6, page 136, reference actually states "the repex data provided by all distributors was compliant"
[49] AER Regulatory Information Notice to Ergon Energy dated 25 August 2014, Appendix E, Section 5, page 49
[50] AER Regulatory Information Notice to Ergon Energy dated 25 August 2014
[51] AER Preliminary Decision Attachment 6, Section E.5 page 139
[52] AER Preliminary Decision Attachment 6, Section B.4.3 page 67-69

asset category expenditure reconciles with the total expenditure category of the asset group.[53] As a result, the assets and the expenditure categories can differ for each DNSP. The disparate results evident between DNSPs for the same asset groups suggest this is in fact the common situation.

Ergon Energy asserts that it is procedurally and mathematically inappropriate to calculate industry lowest or lowest quartile calibrated benchmark costs based upon the rolled-up asset groups unless the underlying information is based upon the same asset subgroup types.

Despite the above misgivings, Ergon Energy developed a suite of repex models based upon its annual performance RIN backcast data. This is documented in proposal document *07.01.44 Repex Model Mark III Report 2013-2014*.

The AER has selectively utilised combinations of backcast volumes with forecast unit cost rates. This is very problematic where estimated data is involved. This can lead to a "doubling" effect on the result. This arises because Ergon Energy was not able to assign the assets recorded in its asset management system in a one-for-one assignment into the categories prescribed by the AER in Templates 2.2 and 5.2. In order to gain work efficiencies, work is typically much more bundled with costs collected at project level, and not allocated into categories as contemplated by the AER RIN categories. Producing the backcast data and the forecast data to suit the AER categorisation have proven to be quite separate exercises of unbundling physicals and expenditure, the former from past data in the corporate asset management systems and the latter from business cases and proposed budgets. The central tenant observed in doing this work, (and this is an understandable requirement from the AER), is that the data presented in the backcast reconcile with total actual past expenditure and the forecast RIN data reconcile with proposed budgets. Ergon Energy was careful in developing its own version of repex models to reconcile backcast expenditure and its forecast budget.

Because the majority of Ergon Energy's supplied data is estimated, and necessarily so because it is derived from systems not designed and configured with the level of detail now requested in mind, individual budgets and category items are essentially derived to ensure the product of the volumes and unit costs reconcile with expenditure which may be the sum of a number of categories. If there is a mismatch between how the volumes were estimated in the backcast compared with the forecast and, lower average volumes from the backcast are combined with a lower average unit cost from the forecast, a doubling occurs in the product expenditure so produced and the results are invalid. It appears that the AER has made this error as part of its modelling and analysis work.

Ergon Energy has proposed a budget for service replacement $56.1M ($2012-13) which consists of two components:

(a) ongoing service replacement identified from Ergon Energy's Asset Inspection / Defect Remediation program and

(b) an additional three (3) targeted programs to replace problematic service cable types.

This budget contrasts to a backcast of $36.7M ($2012-13, AER calculated) for the years 2010-11 to 2014-15 which appears to be used as the year range selected by the AER from which to extract volume and unit cost statistics for input to their repex model. The AERs repex model utilising the 5 year average volumes as input produces an ongoing volume commensurate with past volumes. The preliminary determination rejected the case to replace the problematic service types and then applied a unit cost derived from the forecast RIN data (refer section 4.2.1 for a discussion about this error) The double up effect of applying the lower repex forecast volume multiplied by the lower forecast unit cost rate produces a draft decision allowance of approximately $17.8M ($2012-13, AER calculated).

[53] AER Regulatory Information Notice to Ergon Energy dated 25 August 2014, Appendix E, Section 5.1(c), page 49

This is manifestly lower than the backcast expenditure on defective services ($36.7M ($2012-13) AER calculated) which is expected to be ongoing and completely ignores the problematic services.

Ergon Energy is concerned that the AER alternate forecasts are flawed as a result of these various issues.

4.1.5. Use of calibrated benchmark data for wooden assets

In Attachment 7-Operating Expenditure, the AER recognised that timber degradation in NSW and Queensland manifest in higher replacement rates. The AER then stated they have taken this into account by using observed replacement rates as the basis for forecast replacement quantities.[54]

In its Attachment 6 – Capital Expenditure, the AER described how it created its repex models, and also its benchmark data[55]. Throughout this repex model description, there is no reference to the use of observed replacement rates as the basis of forecast quantities for the Ergon Energy modelling.

Ergon Energy asserts that any AER repex modelling including wooden assets (chiefly poles and poletops) should have been created and evaluated on this basis.

4.1.6. Rejection of uncalibrated data leading to forecast substitution

The AER developed its own repex models, and via its discourse detailed in section B.4.3 of its Preliminary Determination[56], and most notably Figure B.5 Base case scenario outcome, proceeded to demonstrate that un-calibrated repex models were unable to be used. Section 6 of Ergon Energy's proposal document *07.01.44 Repex Model Mark III Report 2013-2014*, and the AER's discussion about benchmarked uncalibrated and calibrated replacement lives[57] clearly describes the need for and the application of a calibration process[58].

The AER's base case scenario relates to uncalibrated RIN data as submitted by Ergon Energy.

Despite recognition of the need for calibration, in Section B.4.3, The AER states

> *Based on our analysis of the base case scenario outcomes we consider that Ergon Energy's estimated replacement lives are not credible or reliable for the following reasons.*[59]

Ergon Energy understands that the AER has to formally consider the uncalibrated life estimates provided by Ergon Energy and appropriately and formally conclude that the data is not suitable for use for such purposes. However, Ergon Energy rejects the AER's assertion that such rejection is a basis to substitute its own, alternative forecasts without taking into account Ergon Energy's actual proposal, which included analysis of RIN data and calibrated repex models derived from that data.

Based upon the AER's own documentation and advice, Ergon Energy contends the AER has therefore erred in its logic and argument that such rejection is a valid basis for substituting its own forecasts.

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[54] AER Preliminary Decision Attachment 7, page 215
[55] AER Preliminary Decision Attachment 6, sections E.2 through E.6 page 135-141
[56] AER Preliminary Decision Attachment 6, page 67-80
[57] AER Preliminary Decision Attachment 6, page 79
[58] This is further detailed in AER Preliminary Decision Attachment 6, section E.4&5 page 136 through 144
[59] AER Preliminary Decision Attachment 6, page 78

4.1.7. Use of insufficient history to calibrate the repex models

The repex model relies substantially upon historical asset failure data to predict performance of the future. An assumption is made that the historical data is sufficiently extensive as to provide reasonable long term indication of average asset performance.

Asset degradation is subject to various factors, with weather and climatic influences contributing a significant impact to these factors.

If the history sample period is small, and typically smaller than cyclic climatic variations, the repex model risks extensive forecast inaccuracy depending upon when in the climatic cycle the sample is taken. For example[60], the El-Nino Southern Oscillation Index is a climatic cycle of a period of 3-8 years. El Niños often lead to drier conditions, while La Niñas tend to promote rainfall in Australia, and particularly in Queensland. This affects rates of storms, lightning, rain, sunshine, timber rot, corrosion, vegetation growth, vermin, animals and many other influences of asset failure. The current drought, considered to be the worst ever for regional Queensland, directly influences performance of Ergon Energy assets.

Ergon Energy considers that the 4 year data history (and one year forecast) employed by the AER to predict the next 20 years of aged asset failure performance represents just half of a typical climate cycle and given the point in the climate cycle is therefore likely to under-estimate future asset failure performance.

4.1.8. Statistical analysis assumptions used in calibration

A critical assumption of repex model calibration is that there is a normal distribution for the age at failure of a homogeneous population. In the absence of sufficient data to form a reasonable assumption about the shape of the normal curve, the AER has adopted use of square root of the mean life as a defacto standard deviation measure. This is as advised in the AER's repex model Handbook, and hence was adopted by Ergon Energy in providing this information.[61] The handbook notes that the approximation and its use in the longer term should be discouraged, and advises the approximation may overstate the standard deviation.

That the approximation overstates the actual standard deviation is disputed. There is no evidence to support this assumption. This assumption cannot be tested except by validation with extended time historical records, which are clearly not available.

Ergon Energy asserts that when using the approximation for standard deviation, the AER should establish a 'tolerance band' about any involved repex forecast. A service provider's forecast that falls with the tolerance band is likely to be acting prudently and efficiently. Where the AER decides to adopt an alternate forecast, the upper limit of the tolerance band plus any other justified investment forecast should be used.

4.2. Data anomalies

This section discusses errors that Ergon Energy has identified as it has evaluated the AERs preliminary Determination. Some of these are errors made by Ergon Energy in its reset RIN submission. Some of these errors appear to have been made by the AER in its development and use of a repex model based upon Ergon Energy reset RIN data.

All Ergon Energy data errors are associated with the reset RIN template 2.2 forecast data.

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[60] Bureau of Meteorology website – Weather and Climate risk
[61] AER, Electricity Network Service Provider's Replacement expenditure model handbook p19

4.2.1. Ergon Energy Data Errors

Substitution of forecast metering expenditure

Refer to submission document *Submission to the AER on its Preliminary Determination - Ergon Energy Reset RIN Response to Material Issues*, section 4. This details that proposed metering capex expenditure was inadvertently removed from proposed total repex under the assumption that all SCS metering expenditure was related to replacement expenditure. Consequently $39.681 million (for Metering SCS expenditure) was deducted incorrectly from Ergon Energy's total forecast replacement expenditure category prior to proposal submission.

This adjustment has been corrected in *Attachment A - EECL Reset RIN Revision to Template 2.2 Repex* submitted as part of Ergon Energy's revised response.

Services forecast unit rates

Incorrect and very low unit cost rates for services replacement was provided in the Template 2.2 of the reset RIN, which had the effect of grossly inflating the number of services presented in the forecast volume from 38,768 services to 103,131 services. The forecast business as usual volume for 2015-2020 regulatory period is 28,991. The error is detailed in Table 5. Ergon Energy believes the error occurred due to a transcription error at time of RIN preparation.

Asset Type	Unit rate as submitted in reset RIN	Unit rate as amended in reset RIN update
Simple Services	$491	$1,536
Commercial Industrial Services	$1,348	$2,180

Table 5 Services Corrected unit rates for services replacement ($2014-15)

This information has been updated in *Attachment A - EECL Reset RIN Revision to Template 2.2 Repex* as part of Ergon Energy's revised proposal.

Ergon Energy requests the AER review its repex models in the light of this correction.

Protection relay forecast volume

Ergon Energy inadvertently employed an earlier version and significantly higher forecast in its protection relay replacement quantities. This forms part of the data for RIN Table 2.2.1 category "Field Devices", in the group 'SCADA' in template 2.2. Instead of 310 relays intended to be replaced, the reset RIN data detailed 1,001 relays. This resulted in a significantly higher forecast budget of $79.54 million ($2012-13) instead of the correct $24.63 million ($2012-13). The correct amount is as documented in the proposal document *07.01.06 Protection Relay Replacement Engineering Report*.

This information has been corrected in *Attachment A - EECL Reset RIN Revision to Template 2.2 Repex* submitted as part of Ergon Energy's revised proposal.

Ergon Energy requests the AER review its repex models in the light of this correction.

Consequences of the changes detailed in this section 4.2.1

All of Ergon Energy's internal processes to develop the 2015-16 to 2019-20 replacement capital expenditure, which has been developed as 26 internal business cases with expenditure data, were first prepared as a forecast in $2012-13 and then escalated, business case budget row by budget row to $2014-15.

All RIN Template 2.2 Table 2.2.1 expenditure data is also initially prepared as a $2012-13 forecast. This data is then escalated and proportioned to ensure reconciliation with the ($2014-15) aggregate repex budget. Table 6 provides a summary of the effect of these corrections.

For clarity, Table 6 excludes the proposed extra adjustment required to resolve the low conductor defect mitigation.

Table 6 Summary of revisions to reset RIN table 2.2.1

Table 2.2.1 Summary Revisions - Ergon Energy - Proposal - SCS Capex ($'000s $2014-15)					
	Reset RIN Forecast 2015 to 2020 submitted October 2014		Reset RIN Forecast 2015 to 2020 amended submission		Variation
	Expenditure	Replacements	Expenditure	Replacements	%
Poles	$76,201	23,393	$84,691	23,393	11.1%
Pole Tops	$103,009	76,439	$114,504	76,439	11.2%
Conductor	$194,712	2,104	$216,394	2,104	11.1%
Underground	$15,299	146	$17,011	146	11.2%
Services	$56,140	103,181	$62,389	38,768	11.1%
Transformers	$177,231	6,017	$196,887	6,017	11.1%
Switchgear	$70,287	60,910	$78,125	60,910	11.2%
SCADA	$163,237	3,159	$121,454	2,468	-25.6%
Other	$38,211	338	$42,546	338	11.3%
Total	**$894,327**		**$934,008**		**4.4%**

Note: This table is an extract from revised proposal document *Ergon Energy Reset RIN Response to Material Issues*

Document Attachment A - EECL Reset RIN Revision to Template 2.2 Repex submitted as part of Ergon Energy's revised proposal, provides an updated reset RIN Template 2.2 reflecting the above changes, and also the proposed extra adjustment required to support the low conductor defect mitigation.(refer section 4.10.1)

4.2.2. AER Data Errors

It appears that the AER's repex model for transformers has missed one row of data. The second transformer category is "POLE MOUNTED ; > 22kV ; > 60 kVA AND < = 600 kVA ; SINGLE PHASE".

The Ergon Energy backcast shows that 101 items at unit cost rate of $45,002 were replaced for an expenditure of circa $4.6 million during the five year period 2009-14.

In the AER repex model, this row of data has been moved to the bottom of the group and the row removed from calculations.

It is Ergon Energy's view that in the absence of a calibrated model, the average backcast volume should be substituted as reasonable forward forecast.

4.3. Top down restraint

Ergon Energy developed a suite of repex models as part of its proposal based upon the reset RIN data. This calibrated model was documented in proposal document, *07.01.44 Repex Model Mark III Report 2013-2014*. Figure 5 of that document details the overall outcome of the modelling, and is reproduced in Figure 5 below.

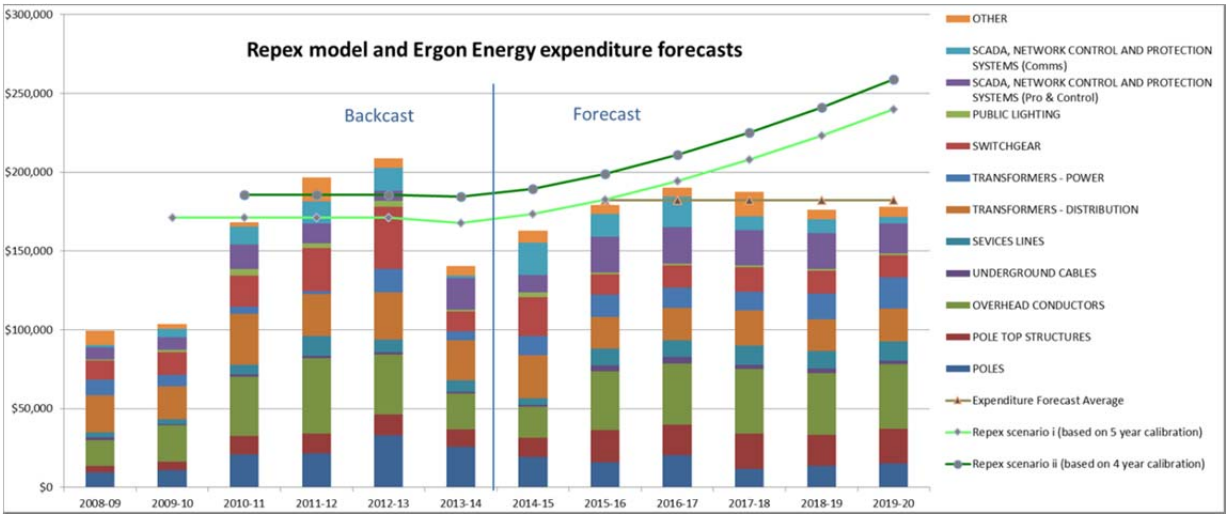

Figure 5 Comparison of the repex models and Ergon Energy' expenditure forecasts by asset group (in 2013-14 real dollars)

In its technical evaluation, EMCa stated

> *<u>Top Down Repex Model appears to validate the proposed expenditure level</u>*
>
> *It is not within our scope to consider the validity 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*[62]

In its Preliminary Determination, the AER stated that

> *In its report, EMCa noted that Ergon Energy's proposed repex appeared lower in total than shown in Ergon Energy's application of the repex model. Despite this EMCa considered Ergon Energy's*

[62] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 36

overall aggregated bottom-up repex forecast was likely to have excessive costs over that which is prudent and efficient.[63]

In its summary totex discussion, the AER stated that[64]:

Ergon Energy's forecast methodology cites the application of a top-down forecasting approach. We have examined the top-down approach used by Ergon Energy and do not consider that it brings sufficient restraint to bear on the overall forecast. This is supported by our consultant Energy Market Consulting associates (EMCa)

While Ergon Energy questions the validity of the RIN data asset categorisation employed by the AER, (discussed in section 4.1 and following sections), Ergon Energy's proposal document, *07.01.44 Repex Model Mark III Report 2013-2014*, section 7.2 to Section 7.4, demonstrates that Ergon Energy reviewed the overall repex model outputs (refer *07.01.44 Repex Model Mark III Report 2013-2014*), discussed the model output trend and made comparisons in relation to the overall repex forecast expenditure proposed. This top-down review and discussion revealed that Ergon Energy's replacement expenditure proposals were generally lower than the repex model outputs, created based upon the datasets as nominated by the AER. Ergon Energy specifically documented how this was achieved in its proposal document *07.00.01 Forecast Expenditure Summary Asset Renewal 2015 – 2020* Section 7.1

Ergon Energy therefore reasonably concludes that its asset replacement expenditure on an overall basis is reasonably constrained and within the bounds predicted by the aged based repex modelling. The review yielded results suggestive that its total proposed replacement forecast reflects the Capex Criteria of the NER and the NEO.

4.4. Asset Health Indicators

The AER documented that[65]:

We have used a number of asset health indicators with a view to observing asset health. Asset utilisation is one such indicator. We have relied on changes in asset utilisation to provide an indication as to whether Ergon Energy's assets are likely to deteriorate more or less than would be expected given the age of its assets. Utilisation in particular is a useful check on the outcomes of our predictive modelling in that unlike the other indicators, and the predictive modelling itself, it is not age based.

And[66]

… we note Ergon Energy has experienced a steady decrease in utilisation levels at its zone substations and HV feeders between 2009−10 and 2013−14 We are satisfied this demonstrates that Ergon Energy's network has significant spare capacity in its network based on past investments to meet expected demand that did not eventuate and due to the higher security standards required under the Distribution Authority. All else being equal we expect a positive correlation between asset condition and lower network utilisation exists for certain asset classes.

The AER also documented its opinion about the impact of utilisation on specific asset deterioration in its Table B.7[67] in the Preliminary Determination

[63] AER Preliminary Decision Attachment 6, page 73
[64] AER Preliminary Decision Attachment 6, page 23
[65] AER Preliminary Decision Attachment 6, page 69
[66] AER Preliminary Decision Attachment 6, page 69
[67] AER Preliminary Decision Attachment 6, page 88

Ergon Energy (and its legacy organisations) has designed its assets such that all equipment should operate within their technical envelopes. This means that if current flow remains within designed limits, there will be negligible degradation of the asset for the period of its economic life. Excess current flow, such as that experienced during power system faults and short circuits may damage assets or accelerate deterioration markedly, but such energy release is limited by protective devices. Typically such damage is accumulative, with each event shortening the practical life of the asset.

Poles and crossarms are not impacted at all by the energy flow through the conductors they support. Assets that employ on-load switching contacts, such as circuit breakers or tap changers may deteriorate over time with normal load switching operations, however other assets are designed such that they will not deteriorate at all as a result of the routine energy flows through them and if the loading remains within the designed technical envelope. Such assets require routine maintenance to ensure the assets achieve their intended economic lives.

Yet all assets deteriorate for other reasons – such as environmentally induced circumstances – e.g. rust, salt air, dust, humidity, wind, wildlife, UV radiation and so on. The various components of an asset may also deteriorate at different rates, dependent upon its construction material, with susceptibility to different deterioration influences. For example, steel will corrode under high salt conditions while cable insulation may deteriorate under high UV radiation exposure.

Overall, electricity demand and utilisation does not substantially impact upon most assets condition. At the discrete asset level, demand history trends, especially where current is in excess of the designed technical envelope, may provide a possible correlation, as overload damage or switching operation impacts to the asset condition will be cumulative over time. However at the high level employed by the AER in its analysis, overall network demand history trends can provide little or no correlation with asset deterioration. Similarly demand forecasts cannot provide any indication of future deterioration. In other words, only an accumulated history of an asset environment, including loading, will determine asset condition. Forecast utilisation, particularly when that forecast is likely to be lower, has negligible impact.

Yet it is asset condition and Ergon Energy's associated risks of delivery of required services that determine the need for asset renewal expenditure. Any forecast of lower system demand does not substantially change asset renewal requirements.

Ergon Energy asserts that any general use of forecast asset utilisation as an indicator of future asset condition is flawed. Ergon Energy is concerned that the AER considers that overall utilisation is a useful check of the outcomes of their predictive modelling. This suggests a substantial difference exists between Ergon Energy's and the AER's understanding of the physical nature of the assets being modelled. It also raises doubt about AER's understanding of the validity and practical limits of its predictive modelling.

Ergon Energy requests that the AER provide further details in its final Determination documenting the validity of its approach and provide a recognised and technical explanation that establishes such a general correlation. Ergon Energy also requests that the AER provide details in its final Determination about exactly where it employed its reasoning about utilisation in forming and supporting its decisions in relation to repex levels.

4.5. Historical Trend Analysis

In its Regulatory Proposal, Ergon Energy wrote[68]:

[68] Ergon Energy Submission 0B.01.01 2015-2020 Regulatory proposal, Section 3.1 Page 94.

Our expenditure profile reflects that from early 2000 Ergon Energy was investing heavily in the network in response to population growth and in an effort to meet our customer's changing expectations around reliability and quality of supply; driven by the uptake of lifestyle appliances. Additional network investment was required from 2004, to meet the higher reliability standards introduced in response to the Electricity Distribution Service Delivery (EDSD) Review.

Ergon Energy notes that this discussion, and almost the entire associated section, is related to augmentation and reliability capex.

In its Preliminary Determination, where the AER has "considered" trends in historical and forecast repex[69], they have quoted the above mentioned Ergon Energy paragraph and related associated contextual information as indicative of historical repex performance. Ergon Energy contends the AER is incorrect in this assumption.

The AER also appears to have incorrectly associated other augex drivers including changes in market condition, demand management initiatives, ENCAP review and changes in security standards to explain changes in repex history.[70] The only valid reference employed by the AER and relating to repex expenditure was related to cyclone Yasi and Oswald cost absorption (a significant contributory source of historical trend variation).

Ergon Energy discussed repex history in its proposal document *07.00.01 Asset Renewal Expenditure Forecast Summary 2015-2020*. The AER was directed to this document in Ergon Energy's proposal[71], but the AER has not documented that it has used or considered the relevant information in evaluating overall historical repex trends.

Ergon Energy notes the comment by the AER that:

We recognise the limitations of expenditure trends, especially in circumstances where replacement needs may change over time (e.g. a service provider may have a lumpy asset age profile or legislative obligations may change over time). In recognising these limitations we have used this analysis as follows:

- *we have drawn general observations from the historic trend analysis and benchmarking in relation to repex, but we have not used trend analysis to reject Ergon Energy's forecast of repex or develop our alternative estimate* [72]

Ergon Energy also notes the comments by the AER in its replacement expenditure model handbook which states that:

In circumstances where the AER is satisfied that the historical replacement levels reasonably reflect prudent and efficient expenditure then this calibrated model could be considered the benchmark model.[73]

Ergon Energy again refers the AER to Ergon Energy's submission document *07.00.01 Asset Renewal Expenditure Forecast Summary 2015-2020*. As the AER employs trend analysis to support the need for a more detailed review[74] of total proposed repex, Ergon Energy prefers that the AER

[69] AER Preliminary Decision Attachment 6, Section B.4.3 Subsection "Trends in historical and forecast repex", Page 6-71
[70] AER Preliminary Decision Attachment 6, Section B.4.3 Subsection "Trends in historical and forecast repex" Page 6-72
[71] Ergon Energy Submission 0B.01.01 2015-2020 Regulatory proposal, Page 88.
[72] AER Preliminary Decision Attachment 6, page 67
[73] AER Electricity network service providers Replacement Expenditure model handbook, November 2013, Section 5.2 page 21
[74] AER Preliminary Decision Attachment 6, page 72

considers information relating to Ergon Energy's repex history when developing its final Determination rather than augmentation or reliability information.

Ergon Energy asserts that if the AER reviews the provided Ergon Energy repex history appropriately, it will, on balance, identify that Ergon Energy repex history reflects prudent and efficient expenditure.

4.6. Upwards bias reflecting costs and risk

In the Preliminary Determination, the AER states that

> *In particular, we engaged EMCa to test whether Ergon Energy's*
>
> - *Repex forecast is reasonable and unbiased*
> - *Costs and work practices are prudent and efficient; and*
> - *Risk management is prudent and efficient*[75]

Broadly on these aspects, EMCa found that

- *Ergon Energy's proposed forecast is not reasonable and exhibits a degree of upwards bias reflecting cost and risk overestimation.*
- *Ergon Energy's costs and work practices are reasonably prudent and efficient within the bounds of reasonableness as referred to in the NER*
- *Ergon Energy's Risk management framework has elements that are likely to have led to a degree of engineering conservatism contributing to a degree of upwards bias in Ergon Energy's forecast*[76]

The AER also stated:

> *We do note that the As Low as Reasonably Practical (ALARP) principle allows for risks to be mitigated to the point where the cost is 'grossly disproportionate' to the benefits. However, we agree with EMCa's assessment that this is applicable to high or intolerable risks, leaving standard cost benefit analysis the preferred tool for the majority of risk assessments.*[77]

As discussed in Section 3.1 Risk management , Queensland law[78] requires a different risk assessment obligation to be undertaken for safety mitigation. The assessment obligation is commonly labelled as "SFAIRP" – So Far As Is Reasonably Practical. Under this obligation, Ergon Energy is bound by tighter and more onerous obligations than those espoused by the ALARP analysis process, including taking action to mitigate lower level risks than those assigned "high" and "intolerable".

Ergon Energy has correctly applied the SFAIRP principle in relation to electrical safety risks, which has led to more mitigation measures and costs that would be attributed as a result of an ALARP approach. Ergon Energy therefore requests the AER review these statements and the various proposal documents, and forecast costs in this light.

Ergon Energy considers that the observed "upwards bias" is nothing more than required and appropriate application of legislative obligations (use of SFAIRP consideration), and results in the need to replace higher volumes when compared to an ALARP consideration.

The AER has stated that

[75] AER Preliminary Decision Attachment 6, page 80
[76] AER Preliminary Decision Attachment 6, page 80-81
[77] AER Preliminary Decision Attachment 6, page 24
[78] Queensland Work Health and Safety Act 2014 and Queensland Electrical Safety Act 2002

We do not accept Ergon Energy's proposed repex forecast of $894 million ($2014–15), excluding overheads. We have instead included in our substitute estimate an amount of $675 million ($2014–15), excluding overheads. Our estimate is 24 per cent lower than Ergon Energy's revised proposal. This reduction reflects the outcomes of our predictive modelling and evidence that Ergon Energy has a bias towards conservative risk assessment and has programs of expenditure which are not adequately justified.[79]

Ergon Energy notes that recommendations contained in the engineering reports provided as part of its submission involving safety risk management repex have been derived using SFAIRP principles and represent prudent expenditure rather than expenditure driven by engineering conservatism and an application of ALARP principles with consequential "upwards bias reflecting cost".

In its Preliminary Determination, the AER stated[80]

We developed industry benchmark unit costs using the data collected from all NEM distributors in the Category Analysis RINS. For model inputs, we used the average, first quartile (below average) and lowest unit costs of all NEM distributors for each asset category…. The outcome when using the first quartile benchmark unit costs was similar compared to Ergon energy's forecast unit costs.

This finding by the AER is consistent with, and materially proves EMCa's assertion (detailed above) suggesting that Ergon Energy costs reflect a reasonable degree of prudency and efficiency.

Ergon Energy therefore contends that in fact its forecasts, which include relatively efficient unit rates, encompass the need for safety related investment, So far As Is Reasonably Practical, and are therefore prudent, consistent with the NEO and do not reflect "upwards bias".

Ergon Energy has also identified a number of inconsistencies in the AER's treatment of various repex programmes, based upon the risk assessment data provided to the AER and wishes to engage further with the AER to better understand the nature of these inconsistencies and discrepancies.

4.7. Modelled repex

4.7.1. Model repex – general lines defect management

Ergon Energy documented its proposed program for general lines defect repair in proposal document *07.01.01 Line Asset Defect Management Methodology*.

Generally, lines assets consist of high volume low costs assets. They are condition monitored by periodic visual inspections, which is a Duty mandated by legislation[81].

The defect management repex expenditure and asset volumes have been allocated into several of the AER reset RIN asset groupings, including 'Poles', Poletops', 'Overhead conductor', 'Underground cables', 'Service lines', 'Transformers' and 'Switchgear'.

EMCa commented that[82]:

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

[79] AER Preliminary Decision Attachment 6, page 10
[80] AER Preliminary Decision Attachment 6, page 79-80
[81] Queensland Electrical Safety Act S29
[82] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 70

primarily based on the assumption that historical averages are reflective of expected future expenditures.

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.

And[83]

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.

Ergon Energy provided the following documents in its proposal submission in support of this analysis

- *07.09.02 Management Plan Overhead Feeder Circuits*
- *07.09.03 Management Plan Underground Feeder Circuits*
- *07.09.04 Management Plan Earthing Systems*
- *07.09.05 Management Plan Overhead and Underground Plant and Equipment*
- *07.09.06 Management Plan Buildings and Sites*
- *07.09.07 Management Plan Street Lighting*
- *07.09.08 Management Plan Metering*
- *07.09.09 Management Plan Vegetation Management and Access Tracks*
- *07.09.10 Management Plan Zone and Bulk Supply Substation Plant and Equipment*
- *07.09.11 Management Plan Auxiliary Substation Components*
- *07.09.12 Management Plan Protection and Control*
- *07.09.13 Management Plan Communication Infrastructure*

It is not clear whether EMCa was given access to or even read these documents. Ergon Energy is therefore concerned that EMCa's technical review may have been superficial.

Ergon Energy's proposal document *07.01.01 Line Asset Defect Management Methodology* details the forecasting methodology and identifies for each asset type, predicted asset quantities. In each case, the reason for the forecast has been provided, as well as commentary about the specific changes made in the forecast.

Ergon Energy considers that EMCa has presented their findings in a fashion[84] that appears to misconstrue and misrepresent Ergon Energy's proposal forecasts for this work.

For example, Section 16.8.16 of Ergon Energy's proposal document *07.01.01 Line Asset Defect Management Methodology* states

Due to recent incidents involving service cable with deteriorated insulation and a greater focus on the service cables in asset inspections an increase in the number of service defects is expected. Between 2008-2009 and 2012-13, the number of deteriorated service defects increased by over

[83] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 71

[84] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 71

100% as shown in Table 39. As a result of the extensive safety risk mitigation focus on service cables, it is expected that the average of the number of defects in 2010-11, 2011-12 and 2012-13 is representative of the future defect trend. Some problematic service cable types are proposed to be addressed by separate rectification programs such as those defined in document Engineering Report XLPE Service Cable Insulation Degradation. These programs intend to replace a small number of the most degraded cables, and monitor the remainder for further degradation. 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 services.

In contrast, Section 16.8.14 of the same document states

In 2010, the voltage level was introduced as one of the criteria for assessment of and prioritisation of missing strap defects as part of the release of the Defect Classification Manual version 2.0. Such defects were recorded incorrectly in some areas over the last several years. As many of the missing strap defects are addressed through inspections between 2010-11 and 2013-14, the rate of discovery of such defects is expected to reduce by about 25% starting in 2014-15 on completion of the first full asset inspection cycle after implementation of the changed defect classification and based on subject matter expert knowledge. Due to improved identification of corrosion, corroded crossarm strap defect quantities are expected to reduce by 25% from the average of annual quantities of such defects between 2010-11 and 2012-13 starting in 2013-14 shown in Table 37.

EMCa provided comment on the former section[85] and no comment on the latter section.

Ergon Energy considers that this apparent selectivity has presented a biased and negative view of Ergon Energy's approach to lines defect management forecasting and planning rather than a balanced technical view.

In its proposal, Ergon Energy has documented each asset type defect identified to date and discussed expectations for increases and (more often) decrease, discussing why the impact is expected. EMCa commented that[86]

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.

EMCa's assessment summary is that[87]

"In our view, this position has not been supported by analysis, and may over-estimate the likely increase in defects."

Ergon Energy challenges this statement. By the use of an apparent selective and non-representative sample as typical representation of the forecast documentation and information provided, the comment appears to reflect a predetermined decision to cast doubt about the forecast rather than provide a balanced view of the forecast.

[85] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 71
[86] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 70
[87] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 71

4.7.2. Modelled repex – poles

Ergon Energy monitors the condition of all of its poles, based upon a periodic inspection regime. Replacement is based upon condition assessment comparing to criteria defined in proposal document *07.01.46 Lines Defect Classification Manual*.

EMCa commented[88]:

> *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.*
>
> *We have not identified any systemic issues evident in our review of this asset category.*

The AER stated[89]

> *The majority of Ergon Energy's pole assets are wood poles (90 per cent). Ergon Energy's calibrated lives for wood poles appear to be shorter than the benchmark average calibrated lives, that is, Ergon Energy appears to have been replacing its wood poles earlier compared to other NEM distributors. When we input benchmark average calibrated lives for all poles categories, along with Ergon Energy's forecast unit costs into the model, the predicted forecast repex for the poles group was closer to but still above Ergon Energy's forecast. In its report EMCa inferred the reduction in Ergon Energy's forecast repex for its pole assets reflected a change in risk and performance of the asset group described in Ergon Energy's supporting information. EMCa did not identify any systemic issues with the poles category. Having regard to the information before us, we consider that Ergon Energy's proposed forecast repex for poles is likely to reasonably reflect the capex criteria and have included this amount of $76 million ($2014–15) in our alternative estimate of total forecast capex.*

While Ergon Energy accepts the outcome of its logic, the AER does not appear to have followed its own intentions as detailed in section 4.1.5 of this document.

Ergon Energy accepts the AERs decision to adopt Ergon Energy's forecasts for this asset class and recommend the AER also accept our revised proposal for this same asset class.

4.7.3. Modelled repex – conductor

Ergon Energy documented its proposal forecast for this asset category in submission document *07.01.01 Engineering Report Distribution Feeder Reconductoring Program.*

EMCa advised[90]

> *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.*

And[91]

> *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*

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[88] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 82

[89] AER Preliminary Decision Attachment 6, page 76

[90] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 19

[91] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 68

analysis to prepare the forecasts. An example of Ergon's use of discrete analysis is for the 7/.064 Copper Conductor replacement program where an electric shock incident has led to a targeted replacement program.

Finally[92],

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.

The AER stated that[93]

We observed that Ergon Energy's forecast unit costs for overhead conductors appear to be higher (in some cases significantly higher) than benchmark average unit costs. When we input benchmark average unit costs for overhead conductors along with Ergon Energy's calibrated lives into the model, the predicted forecast repex for overhead conductors was closer to but still above Ergon Energy's forecast.

And[94]

On balance, we consider that Ergon Energy's proposed forecast repex for overhead conductors is likely to reasonably reflect the capex criteria and have included this amount of $195 million ($2014–15) in our alternative estimate of total forecast capex.

Ergon Energy accepts the AERs decision to adopt Ergon Energy's proposed forecasts for this asset class and recommend the AER also accept our revised proposal for this same asset class.

4.7.4. Modelled repex – transformers

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total two (2) paragraphs[95] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million.

Ergon Energy employs CBRM for substation transformers. Ergon Energy employs run-to-failure strategies for distribution transformers and employs an asset inspection process to identify failures.

Ergon Energy developed a repex model based on these reset RIN categories and provided the results of its modelling, documented in submission document *07.01.44 Repex Model Mark III Report 2013-2014.*

Ergon Energy's transformer repex model established that Ergon Energy's proposed future expenditure was higher (by 12%) than the results of the Ergon Energy's repex forecasts. Ergon Energy considers that given the combined errors implied in combining two substantially different asset classes with a failure rate history of just 4 years, reliable age data for 599 condition monitored substation transformers and estimated age data for 98,223 run-to-fail distribution transformers, the result is well within error tolerance bands. Given this situation, Ergon Energy asserts that the AER's repex models, being derived from this substantially estimated data set, will significantly underestimate any appropriate and prudent forecast.

[92] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 75
[93] AER Preliminary Decision Attachment 6, page 76
[94] AER Preliminary Decision Attachment 6, page 76
[95] AER Preliminary Decision Attachment 6, page 77

The AER stated[96]:

> *As detailed in our repex handbook, the repex model is most suitable for asset categories and groups with a moderate to large asset population of relatively homogenous assets. It is less suitable for assets with small populations or those that are relatively heterogeneous.*

Ergon Energy considers that the combination of power transformers and distribution transformers results in a heterogeneous model because of the different asset management strategies involved, and hence the combined model is unsuitable for use.

The AER has employed its own calibrated repex model for this category, which appears to have calculated a forecast that achieves a significantly lower forecast than Ergon Energy's proposal. In the light of Ergon Energy's model results, and the significant issues highlighted in this section and section 4.1, Ergon Energy questions the validity and accuracy of the AER's models.

In terms of a technical assessment, the AER appears to have relied upon a statement by EMCa to reach its conclusions, stating:

> *In its report EMCa considered Ergon Energy provided insufficient justification to support the proposed repex forecasts in the transformers and switchgear asset categories, ... For these remaining modelled categories [which includes transformers] , given that the calibrated scenario predicted a lower amount of business as usual repex, and that EMCa found Ergon Energy lacked justification for these repex forecasts, we do not consider there is reason to adopt a forecast other than the business as usual calibrated scenario.*

EMCa also noted that[97]

> *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.*
>
> *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 B suggests that several power transformers with a low HI (less than 4) at year 10 appear to have been included in the replacement plan.*

EMCa identified a transformer with a Year 10 index of less than 4 in the proposed Transformer Replacement and Refurbishment Plan. This was also identified by Ergon Energy subsequent to the proposal submission. It represents a data error arising from bulk processing of the transformer oil sampling data. Ergon Energy's governance process had identified the error before any expense was incurred and the proposed specific replacement project was cancelled.

EMCa were critical of Ergon Energy's CBRM based engineering reports as they did not provide indications of health indices changing over time. Ergon Energy's approach, described in various submission documents, is that while health indices represent asset condition, such condition is only part of the picture. Each asset exists in a unique part of the power network, and the position in the network and its related impact upon nearby assets and provision of service are also important

[96] AER Preliminary Decision Attachment 6, page 141

[97] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 76

elements to be considered. For example, a transformer supplying a pump that operates for three months of the year will have a lower risk impact compared to a bulk supply transformer supplying thousands of customers continuously. The former asset may be allowed to run-to-failure, while the latter may need to be replaced pre-emptively when close to imminent failure. Ergon Energy reflected this in its engineering reports, documenting changing risk over time. Ergon Energy asserts that the principles espoused and effectively encoded into the CBRM model, combined with its implementation strategies, achieve prudent and efficient asset management strategies that are entirely consistent with NEO.

For the avoidance of doubt, Figure 6 provides the impact of changing health indices for power transformers, which are routinely generated as part of the CBRM model. It demonstrates that the current health of the population (the Year 0 graph) will slowly degrade over the next 10 years, however with no intervention (left hand side of figure), the degradation will markedly accelerate compared to the proposed replacement process (right hand side of the figure

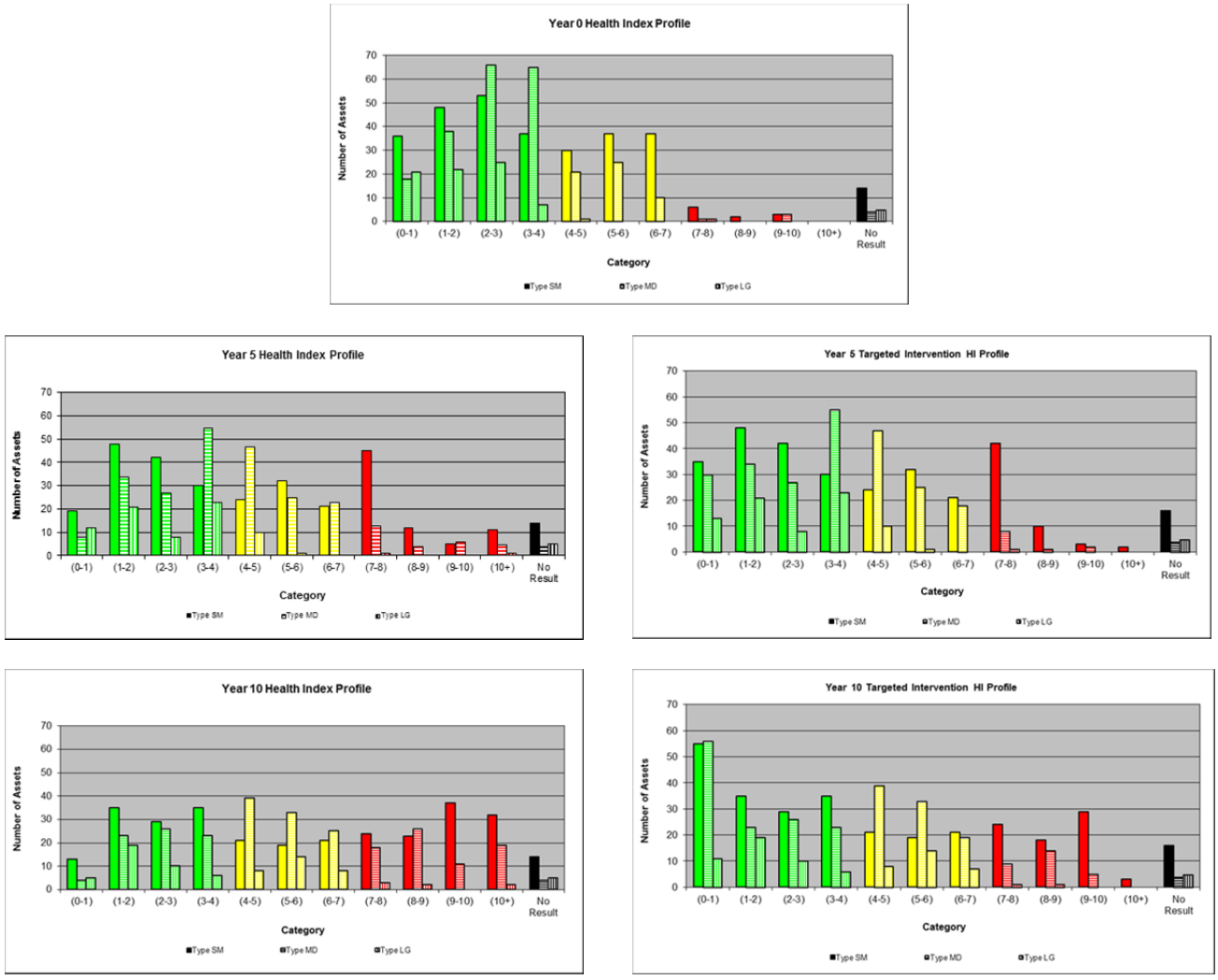

Figure 6 CBRM Substation Power Transformers - HI Comparison - No Intervention vs proposed Intervention

Comparison of the two year 10 charts reveals the intended impact of the proposed repex forecasts. Red represents those assets with poor health index (very poor condition), green with excellent/good

health index (very good condition), and yellow represents fair condition. The targeted intervention chart (right hand side) details expected asset condition following Ergon energy's proposed repex expenditure. The other chart (left hand side) details expected asset condition with no intervention (i.e. only replace on failure). Ergon Energy's strategy to replace highest risk assets also accomplishes replacement of most of the assets with worst condition.

EMCa noted that[98]

> *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.*

While acknowledging EMCa's apparent criticism, Ergon Energy notes that the AER employs a repex model that does not distinguish between the different asset types or even between types with completely different asset management strategies. In this case, Ergon Energy has recognised these assets are all of similar construction, involving some form of insulated winding immersed in oil, contained in a steel vessel with suitable bushings, and are subject to the same asset management strategy. They are expected to have similar lives, and similar asset management issues, and are appropriately modelled together. The CBRM process, which considers condition data, overall risk, network impacts and maintenance costs appropriately accounts for any minor differences.

Ergon Energy 's CBRM modelling, which was only established during the current regulatory period, had recommended a significant replacement volume in the first year – effectively suggesting that Ergon Energy's past replacement volumes were insufficient[99] for optimum service delivery.

EMCa stated[100]

> *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.*

Ergon Energy discussed substation power transformer spares management in its submission document *07.01.05 Engineering Report Power Transformer Replacement and Refurbishment Program.* Ergon Energy has no intention of expanding its spares inventory volume or strategic spares holding but intends to employ its spares inventory to facilitate replacement under this program. Replacement of spares stock then becomes a matter of inventory management supporting long term buying efficiencies, and avoiding overall long term degradation of the spares inventory. Forecast replacement volumes are calculated directly by CBRM, being the sum of forecast failed in service (FIS) volume and planned replacement volume. The information for each of the proposed options was provided to the AER in submission document *07.01.31 B CBRM Data Collecting Tool – TX.*

Contrary to EMCa's statement, Ergon Energy discusses transformer workshop refurbishments in its submission document *07.01.05 Engineering Report Power Transformer Replacement and Refurbishment Program*, section 11.2. As this represents major and ongoing maintenance processes intended to forestall premature failure, it is driven by condition data and opportunistic access rather

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[98] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 76

[99] Ergon Energy proposal document Engineering report Power Transformer Replacement and Refurbishment Program, Figure 7

[100] [100] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 76

than by CBRM modelling. Ergon Energy has made a forecast allowance based upon expected transformer movements during the regulatory period and documented in Annex B of the above mentioned engineering report.

Ergon Energy has reviewed the sensitivity of some of the basic parameters of CBRM as a result of the AERs Preliminary Determination and recent events. The impact of varying these parameters is as follows:

- Reduce WACC – this has the effect of bringing forward the optimum replacement time for individual assets. All other things held constant, reducing the WACC from 9.72 to 5.88 (as advised by the AER) suggests optimum replacement quantities for power transformers should increase from 42 to 77 transformers over the 2015-2020 regulatory period. Increasing WACC has the reverse effect.
- Reduce VCR – this has the effect of bringing forward the optimum replacement time for individual assets. All other things held constant, reducing VCR from $47,850 to $40,206 as has recently occurred, has increased the optimum replacement quantities from 42 to 43 transformers over the regulatory period. Increasing VCR has the reverse effect.
- Increase the value of an asset management life for safety comparisons. This has the effect of bringing forward the optimum replacement time for power transformers. Ergon Energy had omitted to adjust this parameter from early model development. All other things held constant, increasing the value of an asset management life from $2.4 million to $4.5 million as documented in the Engineering Reports, has increased the optimum replacement quantities from 42 to 46 transformers over the regulatory period. Decreasing the value has the reverse effect.

Combining all of these parameters as detailed above increases the optimum replacement volume from 42 to 75 power transformers over the 2015-2020 regulatory period. The repex modelling employed by the AER does not accommodate such impacts.

The WACC is the subject of some variability going forward, and ultimately driven by decisions yet to be made by the AER. Ergon Energy acknowledges a general expectation that the WACC will be lower than that used in in CBRM modelling as part of its proposal submission. However, Ergon Energy is not proposing to increase its proposed volume forecast replacements to accommodate this change.

The AER's decisions, based upon more simplistic repex modelling and a heterogeneous population heavily weighted towards distribution transformers is promoting dramatic volume reductions and effectively ignoring the long term economic efficiency benefits available from CBRM modelling.

Ergon Energy contends the AER's approach does not promote long term efficiency or the capex objectives of the NEO for this asset class.

Earthing defect thresholds

In its proposal, Ergon Energy identified some maintenance and refurbishment issues with distribution earthing systems. These are documented in proposal document *07.01.04 Modifications to Distribution Earth Defect Thresholds*.

The circumstances of the program relate to the fact that the Queensland Electrical Safety Office (ESO) released a Code of Practice and mandated compliance for earthing systems to operate with a maximum step and touch potential. This represented an extremely large impact for Ergon Energy, and the ESO approved a staged improvement plan over several regulatory reset periods to achieve compliance in a manageable fashion.

As part of its submission for 2015-2020 regulatory control period, Ergon Energy reconsidered the situation, and reviewed its next staged improvement for continued prudency. A proposed program was therefore established and documented to accommodate this.

EMCa advised that

> *We note the approach to earth defect management proposed as indicative of prudent decision making.* [101]

In its development of the Reset RIN data, Ergon Energy allocated such costs under distribution transformer costs.

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total of two (2) paragraphs[102] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million.

This approach resulted in, amongst other things, the complete rejection of program forecast expenditure related to modifications to earth system defect thresholds, a program that was considered indicative of prudent decision making by EMCa.

Ergon Energy therefore requests that the AER re-evaluate its decision and recognise the need for separate funding allocation for the Distribution Earth Defect Threshold Modification Program.

4.7.5. Modelled repex – switchgear

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total two (2) paragraphs[103] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million.

Ergon Energy employs CBRM modelling for circuit breakers and substation isolators. Ergon Energy employs run-to-failure strategies for lines switchgear assets and employs an asset inspection process to identify failures.

Ergon Energy provided a repex model based on this reset RIN category and provided the results of its modelling, documented in submission document *07.01.44 Repex Model Mark III Report 2013-2014*.

Ergon Energy's switchgear repex model established that Ergon Energy's proposed future expenditure was lower than the results of the repex forecasts.

Ergon Energy's switchgear repex model suffers from a similar problem to that of the transformer repex model. Essentially, age of the 5,248 items of switchgear within substations is reasonably well recorded. Age of the 152,365 lines asset switchgear items is almost entirely estimated. Ergon Energy considers that given the combined errors implied in combining two substantially different asset classes with a failure rate history of just 4 years, reliable age data for 5,248 condition monitored substation switchgear items and estimated age data for 152,365 run-to-fail distribution switches, the model result is very heterogeneous and subject to very large error tolerance bands. Given this situation, Ergon Energy asserts that the AER's repex models, being derived from this estimated data set, may significantly underestimate any appropriate and prudent forecast.

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[101] AER Preliminary Decision Attachment 6, page 72
[102] AER Preliminary Decision Attachment 6, page 77
[103] AER Preliminary Decision Attachment 6, page 77

Of note, Ergon Energy 's CBRM modelling of the 5,248 items, which was only established during the current regulatory period, has not recommended a significantly different replacement volume in the first year –suggesting that Ergon Energy's past substation switchgear replacement volumes were probably sufficient[104] for optimum service delivery.

The AER stated[105]:

> *As detailed in our repex handbook, the repex model is most suitable for asset categories and groups with a moderate to large asset population of relatively homogenous assets. It is less suitable for assets with small populations or those that are relatively heterogeneous.*

Ergon Energy considers that the combination of various switchgear types into one model results in a heterogeneous model that is unsuitable for reliable repex modelling use.

In the light of this, and the significant issues highlighted in this section and section 4.1, Ergon Energy directly questions the validity and accuracy of the AER's models.

In terms of technical assessment, the AER appears to have relied upon a statement by EMCa to reach its conclusions, stating[106]:

> *In its report EMCa considered Ergon Energy provided insufficient justification to support the proposed repex forecasts in the transformers and switchgear asset categories, …... For these remaining modelled categories [which includes switchgear] , given that the calibrated scenario predicted a lower amount of business as usual repex, and that EMCa found Ergon Energy lacked justification for these repex forecasts, we do not consider there is reason to adopt a forecast other than the business as usual calibrated scenario.*

In its report, EMCa noted[107] *:*

> *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.*

In terms of distribution switchgear, EMCa noted[108]*:*

> *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.*

While neither EMCa nor the AER sought clarification to obtain further information, Ergon Energy provided this level of information in the following proposal documents:

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, section 6.2.3*
- *07.01.01 Line Asset Defect Management Methodology, sections 11.5-11.7 and 16.3*
- *07.01.46 Lines Defect Classification Manual sections 5,6 and 7*
- *07.09.05 Management Plan Overhead and Underground Plant and Equipment, section 10-16*

[104] Proposal document 07.01.07 Engineering report Circuit Breakers and Switchboards replacement and refurbishment Figure 4
[105] AER Preliminary Decision Attachment 6, page 141
[106] AER Preliminary Decision Attachment 6, page 77
[107] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 77
[108] AER Preliminary Decision Attachment 6, page 78

In terms of distribution switchgear, Ergon Energy contends that a significant amount of information was provided but that EMCa do not appear to have used the information to establish Ergon Energy's approach and performance in this area.

In terms of "subtransmission" switchgear, EMCa noted[109]:

> *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.*
>
> *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". 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.*

And[110]

> *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.*

In terms of "subtransmission" switchgear, Ergon Energy presumes that EMCa were referring to substation switchgear and the application of CBRM models. This includes 11kV, 22kV and 33kV switchgear.

Ergon Energy's CBRM approach, described in various submission documents, is that while health indices represent asset condition, such condition is only part of the picture. Each asset exists in a unique part of the power network, and the position in the network and its related impact upon nearby assets and service delivery is also an important element to be considered. For example, a earth switch used for maintenance every 6 or 12 years will have a lower risk impact compared to a circuit breaker employed for switching a radial subtransmission feeder supplying thousands of customers. The former asset may be allowed to run-to-failure, while the latter may need to be replaced pre-emptively when close to imminent failure. Ergon Energy reflected this in its engineering reports, documenting changing risk over time. Ergon Energy evaluated risk rather than just the health index of each asset. Ergon Energy asserts that these principles espoused and effectively encoded into the CBRM model, combined with its implementation strategies, achieve prudent and efficient asset management strategies that are entirely consistent with NEO.

In the proposal document *07.01.07 Engineering Report Circuit Breakers and Switchboards Replacement and Refurbishment*, Appendix A detailed extensive details about problematic circuit breakers, including details about the asset model populations, testing and maintenance data, current performance, current issues, failure modes, maintenance, refurbishment history and renewal history. Given the extensive amount of information provided, and the sparse comments by EMCa, it appears that EMCa did not use or reference any of this information to establish Ergon Energy's approach and performance in this area. Based upon this information, Ergon Energy requests the AER review its technical and financial decisions documented in its Preliminary Determination outcomes.

Consistent with the information provided in section 4.7.1, and for the further avoidance of doubt, Figure 7 provides the CBRM forecast impact of changing health indices for power circuit breakers,

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[109] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 78

[110] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 77

and Figure 8 provides the CBRM forecast impact of changing health indices for substation isolators and earth switches. These charts are routinely generated as part of the CBRM model. They demonstrate that the current health of the circuit breaker and isolator populations (the Year 0 graph) will slowly degrade over the next 10 years. With no intervention, the degradation will markedly accelerate compared to the proposed replacement process.

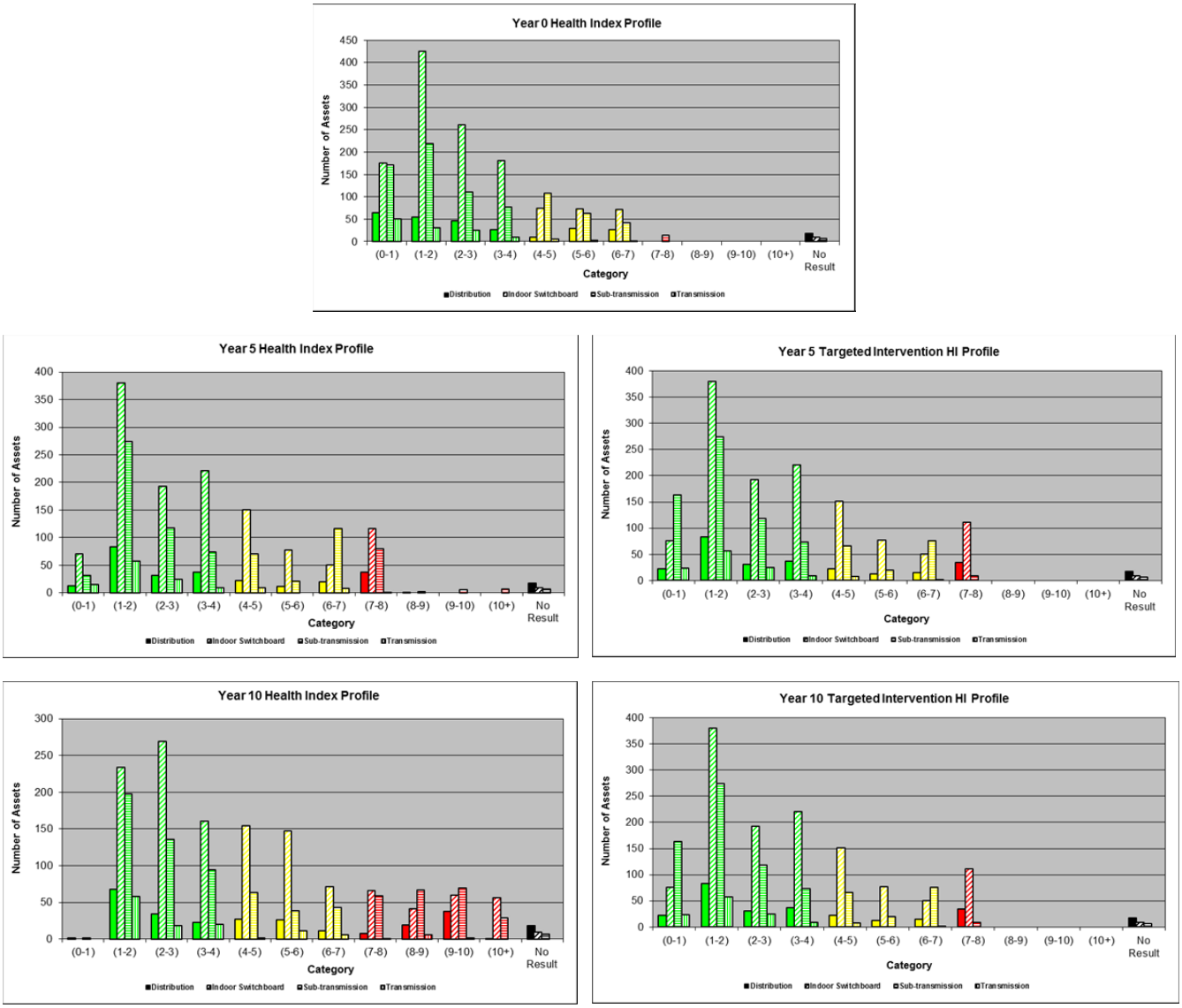
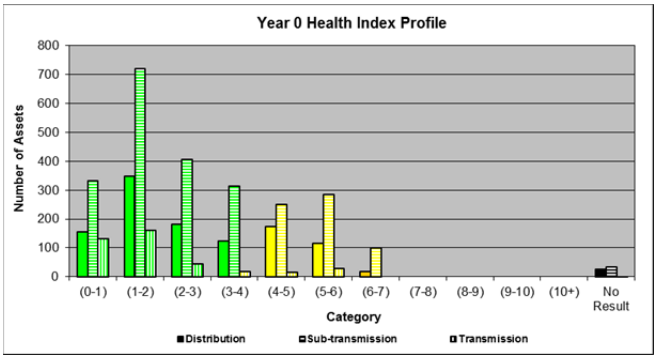
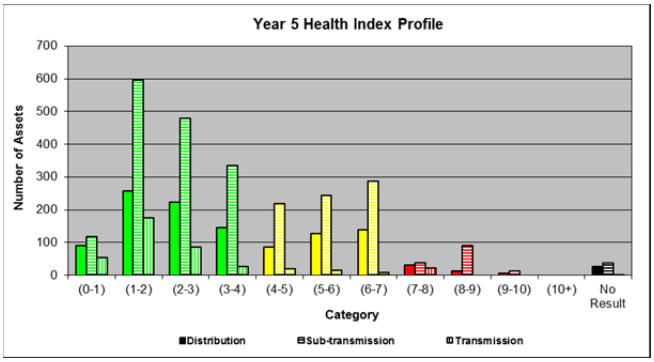
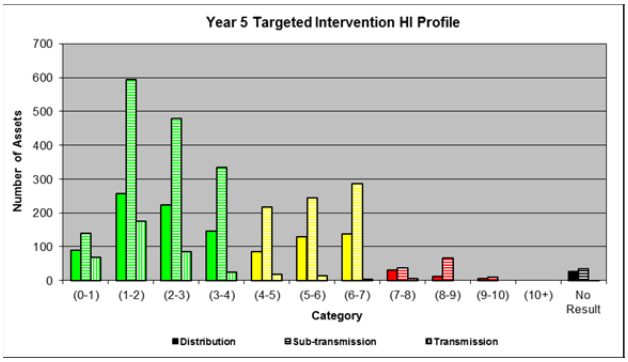


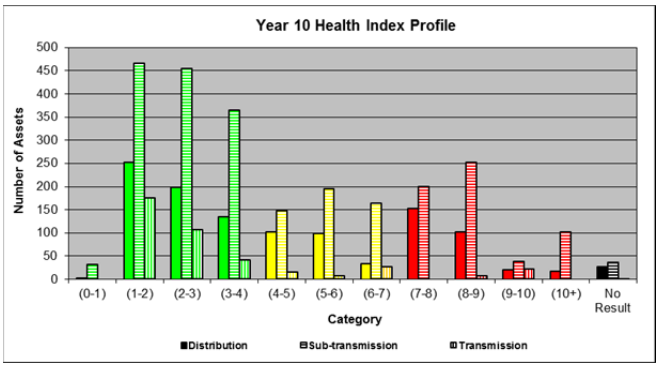
Figure 7 CBRM CBs - HI Comparison - No Intervention vs proposed Intervention

Comparison of the two year 10 charts reveals the intended impact of the proposed repex forecasts. Red represents those assets with poor health index (very poor condition), green with excellent/good health index (very good condition), and yellow represents fair condition. The targeted intervention year 10 chart (right hand side) details expected asset condition following Ergon energy's proposed repex expenditure. The other (left hand side) year 10 chart details expected asset condition with no intervention (i.e. only replace on failure). Ergon Energy's strategy to replace highest risk assets also accomplishes replacement of most of the assets with worst condition.









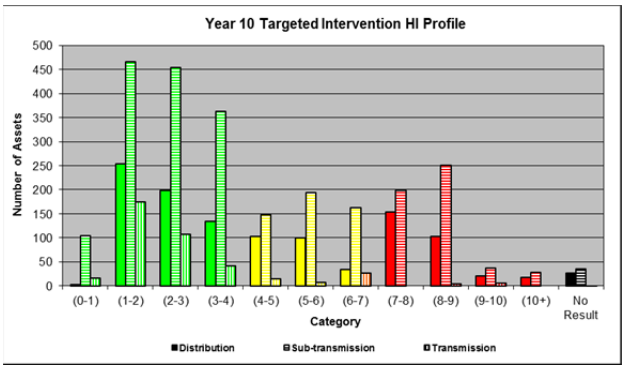


Figure 8 CBRM Isolators - HI Comparisons - No Intervention vs proposed intervention

Comparison of the two year 10 charts reveals the intended impact of the proposed repex forecasts. Red represents those assets with poor health index (very poor condition), green with excellent/good health index (very good condition), and yellow represents fair condition. The targeted intervention (right hand side) year 10 chart details expected asset condition following Ergon energy's proposed repex expenditure. The other (left hand side) year 10 chart details expected asset condition with no intervention (i.e. only replace on failure). Ergon Energy's strategy to replace highest risk assets also accomplishes replacement of most of the assets with worst condition.

Ergon Energy again notes that there is no intention to increase spares inventory for switchgear. Spares inventory will only be used as a method of efficient replacement asset purchasing, with the added benefit of cycling the spares inventory to support overall spares longevity and usability when needed.

Ergon Energy provided this information in the following proposal documents

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, section 6.2.3*
- *07.01.07 Engineering Report Circuit breaker and Switchboard Replacement and Refurbishment*
- *07.01.13 Engineering Report Outdoor Isolators and Earth Switches Replacement*
- *07.01.30 A. CBRM Data Collecting Tool – CB (excel spreadsheet)*
- *07.01.34 CBRM Data Collecting Tool – Isolator (excel spreadsheet)*

The AER sought further information about this topic, and was specifically directed to the abovementioned spreadsheets. The AER sought and were provided specific business cases that were directly supported by the above mentioned documents. These are documented in responses to AER Questions, including

- AER Ergon 053(10)
- AER Ergon 053(9)

The asset Health Index (HI) scores and overall trending has been documented (reference above). The volume of replacement assets, sourced from spares inventory, defined by the observed failure rates were discussed within the engineering reports. The discussion about problematic circuit breakers is documented in detail as appendices of the engineering reports

While Ergon Energy has not been able to provide the complete CBRM models to the AER/EMCA due to copyright issues, a significant amount of information was provided. With the added information about HI performance, Ergon Energy considers it has demonstrated the need for its proposed forecasts. The documented sparse detail of the review by EMCa does not lend itself to present an adequate technical review or conclusion, and hence Ergon Energy disputes EMCa's findings in this regard.

The AER's decisions, based upon more simplistic repex modelling, a heterogeneous population with ages heavily weighted towards a significant number of different distribution asset types, estimated age data and the use of forecast data as historical data is incorrectly promoting dramatic volume reductions. It is also effectively ignoring the long term economic efficiency benefits available from CBRM modelling.

Given the documentation presented in the proposal documents about the problematic assets and the CBRM modelling taking into account the long term economic efficiency benefits available, Ergon Energy contends the AER's approach as detailed in the Preliminary Determination, does not promote long term efficiency or the capex objectives of the NEO and will adversely impact the long term safety and reliability of Ergon Energy's power network.

EDO Fuse Replacement in High Fire Risk areas

While Ergon Energy does not have the same level of risk of catastrophic bushfires as southern counterparts, it does have assets in a significant number of national parks and forestry areas. Proposal document *07.01.19 EDO Fuse Replacement in High Fire Risk* areas discusses the issues associated with operation of this particular switch type. In operation, the fuse ejects burning material

which can initiate fires. Fuse operation in high risk bushfire areas therefore presents as significant public safety risks and significant legal risk for Ergon Energy.

Ergon Energy has a compliance obligation to mitigate safety risks and has applied the SFAIRP principle in proposing a program to replace the EDO fuse types in high risk fire areas.

Ergon Energy can find no reference to or review of this proposed program in EMCa's technical review.

Ergon Energy can find no reference to or review of this proposed program in the AER's Preliminary Determination.

Ergon Energy has included these assets in the reset RIN category of Switchgear.

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total two (2) paragraphs[111] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million. By this approach, the AER appears to have substantially removed funding for this important yet small safety mitigation program.

The proposal for this program is entirely driven by safety mitigation. The risk and need for replacement will therefore not be reflected in an age based repex model.

Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the proposed program to replace EDO fuses in high fire risk areas.

4.7.6. Modelled repex – underground cables

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total two (2) paragraphs[112] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million.

Ergon Energy provided estimated data for this asset category in the reset RIN response. Ergon Energy notes that apart from locational data, it holds very little asset history for this assets category. Age profiles have been estimated. The repex model is therefore highly suspect.

Ergon Energy developed a repex model for this category based upon the reset RIN information and detailed in submission document *07.01.44 Repex Model Mark III Report 2013-14*.

Ergon Energy provided information about this asset category generally in the following documents

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, sections 6.2.2 and 6.2.6*
- *07.01.01 Engineering Report Line Asset Defect Management Method, sections 7.1, 11.14 and 16.8.15*
- *07.01.16 Engineering Report cast iron Pot head Replacement*

EMCa's entire discussion about underground cables stated[113]

> *Forecast expenditure reflects a step increase from 2014-15 levels corresponding with an increase in 11kV underground cable expenditure over the RCP.*

[111] AER Preliminary Decision Attachment 6, page 77
[112] AER Preliminary Decision Attachment 6, page 77
[113] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 85

We have not identified any systemic issues in our review of this asset category.

The AER stated that

> *EMCa did not identify any systemic issues in its review of the underground cables asset category. However we note this category represents less than two per cent of Ergon Energy's forecast repex. For these remaining modelled categories, given that the calibrated scenario predicted a lower amount of business as usual repex, and that EMCa found Ergon Energy lacked justification for these repex forecasts, we do not consider there is reason to adopt a forecast other than the business as usual calibrated scenario.*

Ergon Energy questions the AER conclusion that "*EMCA found Ergon Energy lacked justification for these repex forecasts*". As detailed above, EMCa did not make such a finding in respect of underground cables.

Ergon Energy proposed a program relating to replacement of cast iron pothead replacements. Based upon recent history failure rates, not to execute the program would result in ongoing impacts for the community for an estimated 25 years. Ergon Energy demonstrated that the community VCR benefit of such a program would achieve community payback of the required funding within two (2) years. Ergon Energy also described the safety mitigation benefits of such a program.

This program was included in the reset RIN forecast in the underground cables category.

The issues were also discussed in proposal document *07.01.01 Line Asset Defect Methodology*, Section 11.14 and *07.09.03 Management Plan Underground Feeder Circuits*, Section 9

Ergon Energy is concerned that EMCa's brief mention of Ergon Energy's underground cable expenditure without reference to the proposed cable pot head replacement program proposal provides little credence to EMCa having performed a genuine technical evaluation of the proposed program.

Ergon Energy contends that on the basis that any repex modelling is severely limited and certainly not accurate due to the estimated nature of the age profile and the lack of documented technical review, the AER has not considered the NEO in its unilateral dismissal of step changes in funding for this asset category.

4.7.7. Modelled repex – service lines

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total two (2) paragraphs[114] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million.

As documented in its submission proposal[115], service lines are normally managed using a run-to-failure strategy. Ergon Energy's proposal document *07.01.01 Line Asset Defect Methodology*, Section 11.9 and 16.8.16 discusses the historical impacts and expected general trends of service defect driven replacement during the 2015 – 2020 regulatory period.

Ergon Energy has identified an error in the reset RIN template 2.2 provided in October 2014, and has detailed the issue and correction in section 4.2.1

[114] AER Preliminary Decision Attachment 6, page 77
[115] Ergon Energy submission document 07.01.44 Repex Model Mark III Report 2013-2014, section 7.5.3 page 28

Ergon Energy identified insulation issues as a result of several significant safety incidents and advice relating to specific service line types, and identified the need for separate replacement programs.[116] These are discussed in the sections of this document immediately below.

Following identification of the insulation degradation problem, the obligation to mitigate the public safety impacts So Far As Is Reasonably Practical (SFAIRP is a Queensland regulatory obligation) has led Ergon Energy to develop proposed replacement programs. These programs were supported by engineering reports detailing the most prudent management approach. In terms of the historical and forecast reset RIN information, these programs present as proposed forecast step changes.

In terms of a repex model, where the model forecast is essentially based upon a run-to-failure strategy these targeted programs, perhaps unsurprisingly, show a forecast higher than a historically based repex model would predict. Ergon Energy demonstrated this in its provided repex model and expressed these caveats in its proposal document *07.01.44 Repex Model Mark III Report 2013-2014*, section 7.5.3.

Ergon Energy has proposed a budget for service replacement $56.1 million which consists of two components:

> *(a) ongoing service replacement identified from Ergon Energy's Asset Inspection / Defect Remediation program and*
>
> *(b) an additional three (3) targeted programs to replace problematic service cable types.*

The following sections discuss the AERs preliminary Determinations in relation to these proposed targeted programs.

Overall, Ergon Energy requests that the AER review its decision in regards to Ergon Energy's proposals relating to Services, to correct identified errors, and account for essential safety mitigation work.

Neutral Screened Services

Proposal Document *07.01.14 Engineering Report Neutral Screened Low Voltage Overhead Services* identified safety risks associated with these assets (insulation degradation), however the problem is developing and appears not yet endemic to every asset. The report recommended a replacement of a subset of these services, based upon specific criteria, to both resolve high risk locations and gather further evidence.

In considering all services programs, EMCa stated[117]

> *We consider that the assumptions applied by Ergon have resulting(sic) in an inflated forecast expenditure for its figure 8 service cable replacement, whereas the other programs appear reasonable.*

Despite this finding that the neutral screened services replacement program appears reasonable, the AER has stated

> *In its report EMCa considered Ergon Energy provided insufficient justification to support the proposed repex forecasts in the transformers and switchgear asset categories, and that the proposed repex for service lines was likely to be higher than necessary.*

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[116] Ergon Energy submission documents 07.01.11; 07.01.14; and 07.01.18

[117] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 80.

EMCa stated[118]

> *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.*

EMCa acknowledged that Ergon Energy had rated the safety risk as medium.

Ergon Energy has discussed in Section 3.1 how EMCa and the AER determined that Ergon Energy applied ALARP considerations their evaluation, and argued that NPV style cost benefit approaches should be applied. As discussed within this document, this program is intended to manage a safety issue. Ergon Energy employed SFAIRP principles when establishing mitigation measures for this program.

Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the proposed Neutral Screen Low Voltage Overhead Services replacement program.

XLPE (brand specific) Services

Submission Document *07.01.18 Engineering Report XLPE Service Cable Insulation Degradation* identified an industry alert highlighting safety risks associated with these assets (insulation degradation). Chemical analysis of the insulation in Ergon Energy services of this type has revealed low volumes of carbon black which is used to prevent UV degradation, and concluded that acceleration of the degradation of cable insulation was inevitable. The report recommended a replacement of a subset of these services, in high UV areas to allow further study and mitigation of this issue.

In considering all services programs, EMCa stated[119]

> *We consider that the assumptions applied by Ergon have resulting(sic) in an inflated forecast expenditure for its figure 8 service cable replacement, whereas the other programs appear reasonable.*

Despite EMCa's finding that this program appears reasonable, the AER has stated

> *In its report EMCa considered Ergon Energy provided insufficient justification to support the proposed repex forecasts in the transformers and switchgear asset categories, and that the proposed repex for service lines was likely to be higher than necessary.*

EMCa stated[120]

> *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.*

Ergon Energy had rated the current safety risk as medium.

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[118] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 80.
[119] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 80.
[120] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 80.

Ergon Energy has discussed in Section 3.1 how EMCa and the AER determined that Ergon Energy applied ALARP considerations in their evaluation, and argued that NPV style cost benefit approaches should be applied. As discussed within this document, this program is intended to manage a safety issue. Ergon Energy employed SFAIRP principles when establishing mitigation measures for this program.

Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the proposed XLPE Service Cable Insulation Degradation replacement program.

Colour Coded Services

Submission Document *07.01.11 Engineering Report Colour Coded Low Voltage Overhead Services* identified that an Ergon Energy customer had recently experienced a severe public shock as a result of insulation degradation. Audits initiated as a result of this have revealed that 'figure 8' colour coded services are starting to reveal systemic premature insulation failure. The report also identified some routine inspection improvements that could be made to identify deteriorated services and these have already been implemented. The report identified that some 30% of 'figure 8' colour coded services had defective insulation and recommended replacement of all 'figure 8' services due to the safety, legal, and compliance risks they represented.

EMCa stated[121]

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

EMCa appears to have erroneously read the associated table. The table describes how 130 'twisted' colour coded services and 30 'figure 8' services were inspected (not 160 'figure 8' services). None of the 'twisted' services were found deteriorated except at the cable tails. The proposed program does not therefore intend to replace twisted colour coded services – they will be repaired via the normal defect management process if and when required. Of the 'figure 8' colour coded services, 10 out of 30 had degraded insulation – approximately 30%.

EMCa stated[122]

> *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.*

Ergon Energy has rated the current safety risk for these assets as high[123]. The residual risk after the proposed program has been completed will be rated at low[124]. As discussed above, an Ergon Energy customer has already experienced a severe shock and burns as a result of this situation.

The AER has stated

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[121] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 79-80.
[122] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 80.
[123] *07.01.11 Engineering Report Colour Coded Low Voltage Overhead Services, section 9.7.2*
[124] *07.01.11 Engineering Report Colour Coded Low Voltage Overhead Services, section 11.2*

In its report EMCa considered Ergon Energy provided insufficient justification to support the proposed repex forecasts in the transformers and switchgear asset categories, and that the proposed repex for service lines was likely to be higher than necessary.

EMCa stated[125]

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.

Ergon Energy has discussed in Section 3.1 how EMCa and the AER applied ALARP considerations in their evaluation, and argued that NPV style cost benefit approaches should be applied. As discussed within this document, this program is intended to manage a safety issue. Ergon Energy employed SFAIRP principles when establishing mitigation measures for this program.

Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the proposed 'figure 8' Colour Coded Service Cable Insulation Degradation replacement program.

Replacement of Non-ceramic Fuses

A specific brand of low voltage fuses are subject to overheating. Installed on customer facia boards, the fuses present a significant fire and safety risk for the residents. Proposal document *07.01.20 Engineering Report Replacement of Non-Ceramic Fuses* discusses the issues involved. Ergon Energy has a compliance obligation to mitigate safety risks and has applied the SFAIRP principle in proposing a program to replace the fuse types.

Ergon Energy can find no reference to or review of this proposed program in EMCa's technical review.

Ergon Energy can find no reference to or review of this proposed program in the AER's Preliminary Determination.

Ergon Energy has included these assets in the reset RIN category of Services.

In its Preliminary Determination, the AER combined the modelled repex categories of underground cables, service lines, transformers and switchgear. The AER devoted a total of two (2) paragraphs[126] in dismissing Ergon Energy's forecast repex, reducing proposed funding from $319 million as proposed to $178 million, a reduction of around $141 million. By this approach, the AER appears to have substantially removed funding for this important yet small safety mitigation program.

Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the proposed non-ceramic fuse replacement program.

[125] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 80.
[126] AER Preliminary Decision Attachment 6, page 77

4.8. Unmodelled repex

4.8.1. Unmodelled repex – poletop structures

The AER stated in its Preliminary Determination that poletop structures were not included in the repex model:

> *because of lack of commonality or because we did not possess sufficient data to include them in the model.*[127]

Ergon Energy has provided estimated age information to the AER for such a model. Ergon Energy produced a pole-top repex model, documented in submission document *07.01.44 Repex Model Mark III Report 2013-2014*.

The AER advised[128]

> *Expenditure on pole top structures was also excluded, as it is related to expenditure on overall pole replacement and modelling may result in double counting of replacement volumes.*

Ergon Energy included pole-tops and poles together in its repex model. Ergon Energy considers that its intended expenditure is significantly lower than that suggested by the calibrated repex model, noting the AER's observation detailed in section 4.1.5 of this document.

In addition, the following sections raise considerable concern about the AERs approach to this asset category.

Laminated crossarm replacement

EMCa observed that

> *We note … 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.*[129]

Ergon Energy acknowledges the general thrust of EMCa's comments. However, as documented in proposal document *07.01.17 Engineering Report ACQ Treated Laminated Veneer Crossarms*, the inspection and defect program is designed to identify and manage visually (from the ground) deteriorated crossarms. The document also discusses why this approach alone is inadequate (due to preservative leaching and promotion of internal fungal growth) for mitigating future public safety issues similar to those that have already occurred.

Ergon Energy extracted a sample of thirty crossarms from stores across Queensland and tested them for residual strength. The independent laboratory testing revealed all thirty items (100%) failed to meet the minimum design strength standard required of these crossarms.

Crossarm failures invariably result in conductors falling to the ground, resulting in dangerous electrical events. Ergon Energy recognised the issue was particularly prevalent in high rainfall areas, and has adopted a prudent approach of replacement in those locations, with trend monitoring for further degradation for those assets located in other areas.

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[127] AER Preliminary Decision Attachment 6, page 83
[128] AER Preliminary Decision Attachment 6, page 141
[129] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 84

Ergon Energy asserts that the proposed funding for this program is directly targeted at reducing public safety risk, and is a compliance obligation.

Ergon Energy is concerned that, by reviewing the program under ALARP evaluation standards and opting for a no-step change approach, the AER has removed funding allocation for an essential safety mitigation program. Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the proposed laminated crossarm replacement program.

Subtransmission Line Refurbishment

EMCa observed that

> *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 sub-transmission pole-top replacement.*

In terms of subtransmission pole-top replacement, in its proposal document *07.01.03, Engineering Report Subtransmission Line Refurbishment*, Ergon Energy described how existing asset inspection processes have only been partially successful, as they are, for the most part, ground based inspections. The document described how 77% of dangerous electrical events on subtransmission lines occur as a result of pole-top issues. The situation therefore requires a measured response by Ergon Energy, So Far As Is Reasonably Practical (SFAIRP), to mitigate the public safety risk, which is a compliance obligation. The proposal document describes that this is a recurrent problem, and details Ergon Energy's intentions to resolve it – via a continuous, long term (across multiple regulatory periods) renewal process, somewhat akin to routine targeted maintenance. Ergon Energy defined a program that would match overall degradation rates.

In establishing such a program, Ergon Energy detailed a mechanism for identifying the worst performing subtransmission feeders for pole top condition to provide optimum volume and cost for the 2015-2020 regulatory period.

Ergon Energy notes the AER's general and documented approach of:

> *We recognise the limitations of expenditure trends, especially in circumstances where replacement needs may change over time (e.g. a service provider may have a lumpy asset age profile or legislative obligations may change over time). In recognising these limitations we have used this analysis as follows:*
>
> - *we have drawn general observations from the historic trend analysis and benchmarking in relation to repex, but we have not used trend analysis to reject Ergon Energy's forecast of repex or develop our alternative estimate*[130]

Despite this statement and despite EMCa's finding that development of such a program was reasonable, the AER has completely rejected any and all step changes in funding allocations for this asset class.

Ergon Energy is concerned that in opting for a no-step change approach the AER has removed funding allocation for an essential safety mitigation program. Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and provide separate funding provision for the

[130] AER Preliminary Decision Attachment 6, page 67

proposed subtransmission pole top refurbishment program. In doing so, it will better support its obligations under NEO.

4.8.2. Unmodelled repex – SCADA, Network Control and Protection

SCADA

SCADA (Supervisory Control and data Acquisition) is employed to monitor and control operation of the power network, to ensure safe and reliable operation on a continuous basis.

Ergon Energy documented its forecast requirements in proposal document *07.01.26 Engineering Report RTU Replacement program*.

In addition, it provided information in the following documents:

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, sections 6.2.5*
- *07.09.12 Management Plan Protection and Control*

Ergon Energy has significant obsolescence issues relating to RTU (Remote Terminal Unit) assets. A significant number are more than twice the recommended service life age, are no longer supported by the manufacturer and the in-house engineering expertise is rapidly disappearing. Ergon Energy has already established obsolescence approaches, including securing all available external spare components, reusing components and adopting judicious maintenance practices that extend life as much as possible.

Ergon Energy notes that EMCa did not mention Ergon Energy's SCADA proposal forecast except including them in the review document Figure 27[131]. In addition, EMCa did not provide a summary technical review comment relating to SCADA. The lack of information in EMCa's report begs the question about whether EMCa performed a technical review at all.

The AER defined SCADA, network control and protection as a single asset category referred to as "SCADA' and subsequently excluded this asset category 'SCADA' from its repex modelling process.[132]

Despite the fact that EMCa only commented upon Ergon Energy's protection program (refer to section 'Protection' for a separate discussion about EMCa's treatment of Ergon Energy's protection forecasts for more detail), the AER interpreted EMCa's comments to cover all of SCADA, Network Control and Protection, and concluded Ergon Energy had not justified a step change in its forecasts.

This effectively eliminated Ergon Energy's proposals for RTU replacements, which are at critical levels of obsolescence management.

SCADA (Supervisory Control and Data Acquisition) is employed to monitor and control operation of the power network, to ensure safe and reliable operation on a continuous basis. RTUs represent a critical component of SCADA. Ergon Energy asserts that the AER's funding approach will severely limit RTU renewal during the 2015-2020 regulatory period and result in extending the average length of customer outages.

Because it is relying only upon a historical bundled asset trend, and is without any apparent basis of technical review, Ergon Energy does not believe the AER's approach to this forecasting approach has met the capex objectives of the NEO.

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[131] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 82

[132] AER Preliminary Decision Attachment 6, page 84

Ergon Energy formally requests the AER review its approach to treatment of Ergon Energy's proposal forecasts, and in the absence of any rationale to reject Ergon Energy's forecast, accept and approve Ergon Energy's forecast expenditure for its essential RTU renewal program.

Network Control

Ergon Energy documented its forecast requirements in proposal *document 07.01.23 Audio Frequency Load Control Strategy*.

In addition, it provided information in the following documents:

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, sections 6.2.7*
- *07.09.12 Management Plan Protection and Control*

Ergon Energy notes that EMCa did not mention Ergon Energy's AFLC proposal forecast except including them in the review document Figure 27[133]. In addition, EMCa did not provide a summary technical review comment relating to AFLC or Network Control at all. The complete dearth of information in EMCa's report begs the question of whether EMCa performed a technical review at all.

The AER defined SCADA, network control and protection as a single asset category referred to as "SCADA' and subsequently excluded this asset category 'SCADA' from its repex modelling process.[134]

Despite the fact that EMCa only commented upon Ergon Energy's protection program (refer to section 'Protection' for a separate discussion about EMCa's treatment of Ergon Energy's protection forecasts for more detail), the AER interpreted EMCa's comments to cover all of SCADA, Network Control and Protection, and concluded Ergon Energy had not justified a step change in its forecasts.

Audio frequency Load Control (AFLC) is a form of demand management employed to switch fixed installation loads such as hot water systems. This facility is offers customers reduced tariffs for related energy usage. This facility allows Ergon Energy to manage and limit system peak loads by switching the AFLC controlled assets during system load peaks, and has the direct asset management impact of allowing deferral of capacity augmentation. Failure and degradation of AFLC Load Control facilities results in a magnifying financial impact by resulting in increasing observed system peak loads and hence bringing forward augmentation expenditure.

By relying only upon a historical bundled asset trend, and without any apparent basis of technical review, Ergon Energy does not believe the AER's approach has met the capex objectives of the NEO.

Ergon Energy formally requests the AER review its approach to treatment of Ergon Energy's proposal forecasts, and in the absence of any rationale to reject Ergon Energy's forecast, accept and approve Ergon Energy's forecast expenditure for its essential AFLC asset renewal program.

Protection

Under National Electricity Rules, and Queensland legislation, Ergon energy is required to ensure that it acts to protect all power system assets and in relation to its assets, ensure so far as is reasonably practical, the electrical safety of the Queensland public and its staff.

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[133] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 82

[134] AER Preliminary Decision Attachment 6, page 84

Functional and reliable protection assets are essential assets employed by Ergon Energy in its strategy to achieve this obligation.

Ergon Energy has identified an error in the reset RIN template 2.2 provided in October 2014, and has detailed the issue and correction in section 4.2.1

Ergon Energy documented its requirements in proposal document *07.01.06 Protection Relay Replacement Engineering Report.*

EMCa stated[135]:

> *Ergon has considered a number of options, and presented a risk assessment against those options. We note the risk assessment is rated as 'High' 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 raise concerns regarding the application of the risk framework and potential overestimation of risk.*

And[136]

> *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.*

Ergon Energy has discussed its risk assessment process elsewhere its proposal documents and subsequent responses to questions. In evaluating any risk, two (2) distinct factors are considered – consequence and likelihood. The risk assessments detailed in Ergon Energy's document reflect this.

Replacing an aged or faulty protection relay cannot completely eliminate the potential for future relay failure, and hence the possibility of an electrocution (fatality) (a consequence) following a power system event such as a vehicle hitting a power pole exists. However, replacing a problematic relay or replacing a relay of substantial age, where failure is considered more likely (relative to the general population of relays), with a new modern equivalent will clearly reduce the likelihood of relay failure occurring and hence the likelihood of such a significant (electrocution) event. Effectively, replacing more of the identified/targeted relays reduces but does not eliminate the overall exposure to the electrocution hazard and vice versa.

Ergon Energy's Engineering Report documents the risk assessments of the proposed options for renewal and is summarised in Table 7.

[135] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 83

[136] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 83

Table 7 Proposed protection relay replacement option risk assessment summary

Risk	Business as Usual	After Option 1 (proposed)	After Option 2 (reduced replacement volume)	After Option 3 (increased replacement volume)
Network fault event resulting in death of employee	High	Medium	Medium	Medium
Network fault event resulting in significant injury of employee	High	Low	Medium	Low
Large and extended Customer Interruptions	High	Low	Medium	Low

EMCa has raised a concern about Ergon Energy's application of the risk framework in relation to a fatality (catastrophic event). A fatality is reflected in Ergon Energy's risk assessment tables such that unless the risk can be completely eliminated, it will be classified at least at Medium level. In the case of protection relay replacement, such a risk cannot be eliminated. Exposure to such a risk, due to relay mal-operation or complete failure, can be reduced, but not eliminated, by replacement of relays that have reached the manufacturer recommended end of service life or that are operating erratically (as an asset class). Ergon Energy questions the AER as to why this approach is inappropriate or imprudent.

Ergon Energy is obliged to employ the principles of SFAIRP (as discussed extensively in Section 3.1) when developing mitigation measures against events such as fatalities and injuries. This means that if there is a mitigation action that can occur, and the cost is not grossly disproportionate to the benefit gained, it should be done. Ergon Energy's forecast expenditure as discussed in proposal document *07.01.06 Protection Relay Replacement Engineering Report* is not considered grossly disproportionate.

Ergon Energy has not developed a CBRM type model for protection relays. There is as yet no such model commercially available to be used. Ergon Energy has developed substantially aged based models (not repex models) to establish expected end of life dates for each relay and hence proposed volumes. This has required substantial data collection in the current regulatory period.

Ergon Energy provided substantial documentation to demonstrate its need for protection relay replacement. These include:

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, sections 6.2.5*
- *07.01.06 Protection Relay Replacement Engineering Report*
- *07.09.12 Management Plan Protection and Control*

These documents provide

- A life cycle management plan for protection relays,
- Details of known and emerging risks, including obsolescence and failures
- Detailed asset condition information
- Approach to maintenance and periodic testing
- Approach to strategic spares
- An engineering report discussing the need for replacement and selection of relays known to be at manufacturer advised end of service life or identified as problematic

Except for the last item, EMCa has not documented that it considered any of these aspects in its technical review.

The AER advised[137]

> *We did not consider these asset groups were suitable for inclusion in the model, either because of lack of commonality, or because we did not possess sufficient data to include them in the model*

Based solely on EMCa's apparent cursory technical review, the AER has concluded[138]:

> *we see no justification for the step change proposed by Ergon Energy. As Ergon Energy has not established the need for a step increase in expenditure for these assets*

Based upon Ergon Energy's obligations in regards to assuring public and staff safety, a risk assessment review based upon ALARP principles performed by EMCa, and lack of documented evidence of EMCa's technical review, and a material error in forecast volumes, Ergon Energy requests that the AER review its preliminary Determination decision to reject and replace Ergon Energy's forecast with an alternate forecast, using Ergon Energy's revised information.

Communication Systems

Ergon Energy documented its proposal forecast for this asset category in submission document *07.01.22 Telecommunications Network Strategy 2014-2020*

The AER defined SCADA, network control and protection as a single asset group referred to as "SCADA' and subsequently excluded this asset group 'SCADA' from its repex modelling process.[139]

Ergon Energy included these assets in the reset RIN category 'SCADA'.

Ergon Energy can find no reference to network related communications repex needs except as a component of a forecast trend for (presumably) 'SCADA' components[140] and a general comment that expenditure is expected to fall as the regulatory period progresses. Ergon Energy has found no technical review of these proposed repex programs in EMCa's technical review document.

Ergon Energy can find no reference to network related communications repex or any review of these proposed programs in the AER's Preliminary Determination.

Despite the fact that EMCa only commented upon Ergon Energy's protection program (refer to section 'Protection' for a separate discussion about EMCa's treatment of Ergon Energy's protection forecasts for more detail), the AER interpreted EMCa's comments to cover all of SCADA, Network Control, communication and Protection, and concluded Ergon Energy had not justified a step change in its forecasts.

Ergon Energy therefore requests that the AER re-evaluate its Preliminary Determination and approve separate funding provision for the proposed programs to renew network related communication system components that have reached end of life.

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[137] AER Preliminary Decision Attachment 6, page 83
[138] AER Preliminary Decision Attachment 6, page 84
[139] AER Preliminary Decision Attachment 6, page 84
[140] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 82

4.8.3. Unmodelled repex – 'Other Assets' reset RIN category

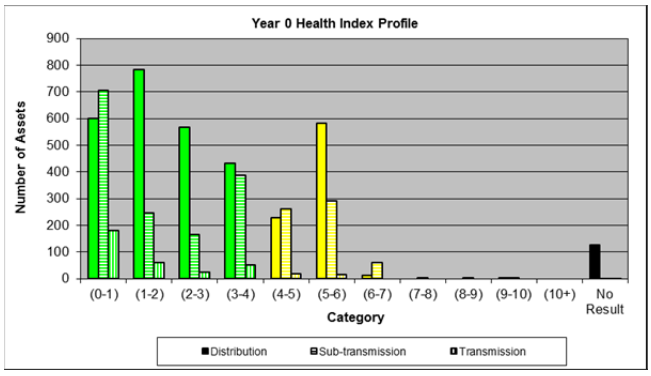
Instrument Transformers – CTs

Ergon Energy documented its requirements in proposal document *07.01.08 Engineering report Instrument Transformer Replacement and Refurbishment Program*.

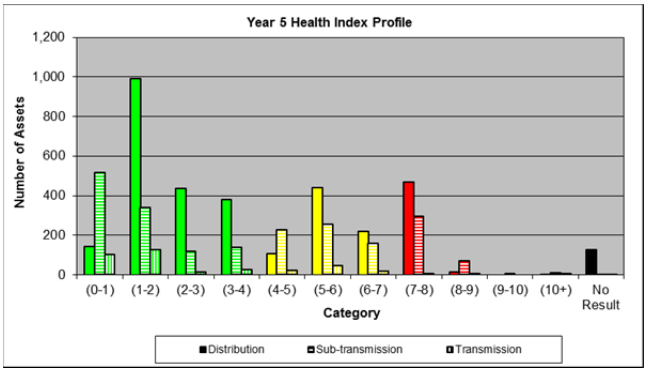
Ergon Energy's CBRM modelling for current transformers, which was only established during the current regulatory period, does not recommend a significant replacement volume in the first year – effectively suggesting that Ergon Energy's past replacement volumes were sufficient[141] for optimum service delivery.

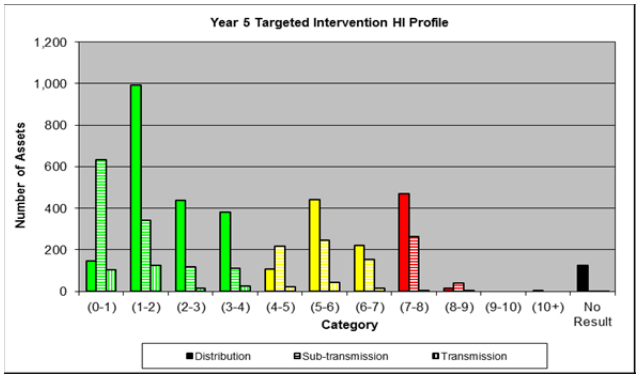
Ergon Energy's approach, described in various submission documents, is that while health indices represent asset condition, such condition is only part of the picture. Each asset exists in a unique part of the power network, and the position in the network and its related impact upon nearby assets is also an important element to be considered. For example, a current transformer employed for SCADA only monitoring of a particular load will have a lower risk impact compared to a current transformer employed for protection scheme monitoring for switching a radial subtransmission feeder supplying thousands of customers. The former asset may be allowed to run-to-failure, while the latter may need to be replaced pre-emptively when close to imminent failure. Ergon Energy reflected this in its engineering reports, documenting changing risk over time. Ergon Energy evaluated risk rather than just the health index of each asset. Ergon Energy asserts that these principles espoused and effectively encoded into the CBRM model, combined with its implementation strategies, achieve prudent and efficient asset management strategies that are entirely consistent with NEO.

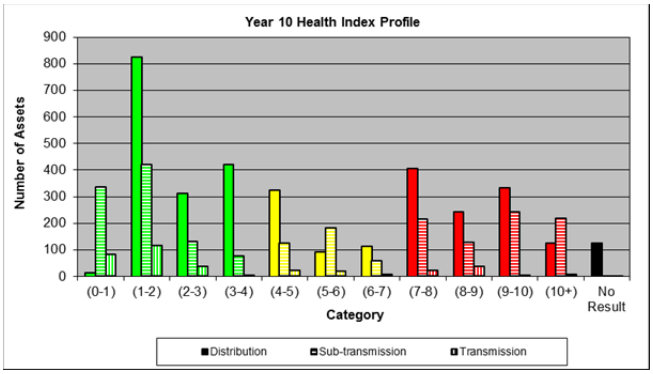
Consistent with the information provided in section 4.7.1, and for the further avoidance of doubt, Figure 9 provides the CBRM forecast impact of changing health indices for current transformers. These charts are routinely generated as part of the CBRM model. They demonstrate that the current health of the current transformer populations (the Year 0 graph) will slowly degrade over the next 10 years. With no intervention, the degradation will markedly accelerate compared to the proposed replacement process.



[141] Ergon Energy proposal document 07.01.08 Engineering report Instrument Transformer Replacement and Refurbishment Program, Figure 3







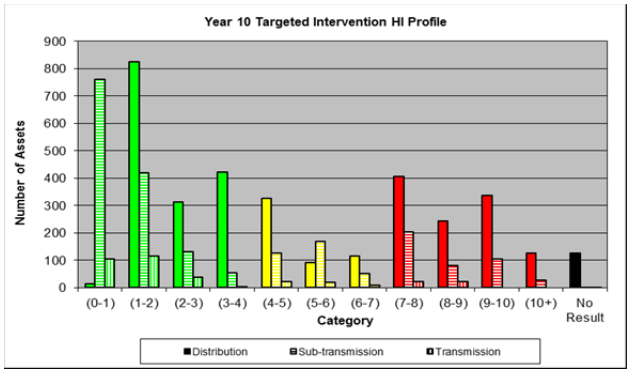


Figure 9 CBRM CTs - HI Comparison - No Intervention vs proposed Intervention

Comparison of the two year 10 charts reveals the intended impact of the proposed repex forecasts. Red represents those assets with poor health index (very poor condition), green with excellent/good health index (very good condition), and yellow represents fair condition. The targeted intervention year 10 chart (right hand side) details expected asset condition following Ergon energy's proposed repex expenditure. The other year 10 chart (left hand side) details expected asset condition with no intervention (i.e. only replace on failure). Ergon Energy's strategy to replace highest risk assets also accomplishes replacement of most of the assets with worst condition.

Ergon Energy notes that there is no intention to increase spares inventory for current transformers. Spares inventory will only be used as a method of efficient replacement asset purchasing, with the added benefit of cycling the spares inventory to support overall spares longevity and usability when needed.

Ergon Energy provided this information in the following proposal documents

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, section 6.2.3*
- *07.01.08 Engineering Report Instrument Transformer Replacement and Refurbishment*
- *07.01.32 C1.CBRM Data Collecting Tool – CT (excel spreadsheet)*

While Ergon Energy has not been able to provide the complete CBRM models to the AER/EMCa due to copyright issues, a significant amount of information was provided. With the added information about HI performance, Ergon Energy considers it has demonstrated the need for its proposed forecasts.

Ergon Energy notes that EMCa did not find any systemic issues in their technical review of the AER's "other assets" category, which includes current transformers.

Ergon Energy notes that the AER has accepted Ergon Energy's proposal forecast expenditure for this asset class.

Instrument Transformers – VTs

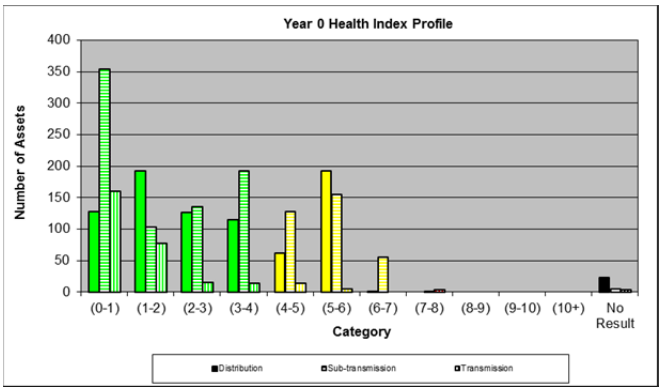
Ergon Energy documented its requirements in proposal document *07.01.08 Engineering report Instrument Transformer Replacement and Refurbishment Program*.

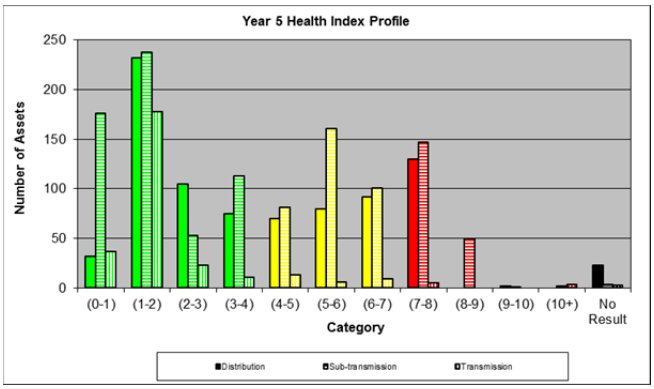
Ergon Energy 's CBRM modelling for voltage transformers, which was only established during the current regulatory period, does not recommend a significant replacement volume in the first year – effectively suggesting that Ergon Energy's past replacement volumes were sufficient[142] for optimum service delivery.

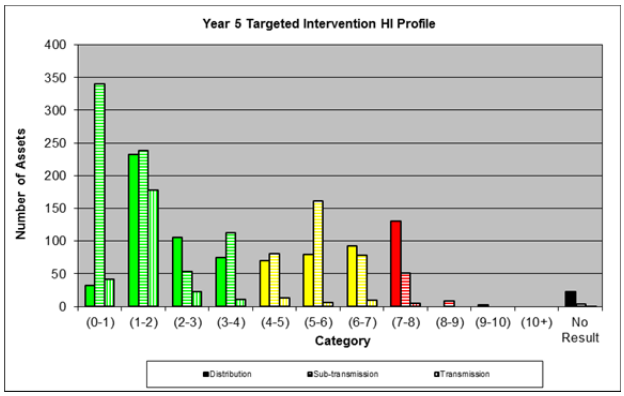
Ergon Energy's approach, described in various submission documents, is that while health indices represent asset condition, such condition is only part of the picture. Each asset exists in a unique part of the power network, and the position in the network and its related impact upon nearby assets is also an important element to be considered. For example, a voltage transformer employed for SCADA only monitoring of a particular bus voltage will have a lower risk impact compared to a voltage transformer employed for a protection scheme for a radial subtransmission feeder supplying thousands of customers. The former asset may be allowed to run-to-failure, while the latter may need to be replaced pre-emptively when close to imminent failure. Ergon Energy reflected this in its engineering reports, documenting changing risk over time. Ergon Energy evaluated risk rather than just the health index of each asset. Ergon Energy asserts that these principles espoused and effectively encoded into the CBRM model, combined with its implementation strategies, achieve prudent and efficient asset management strategies that are entirely consistent with NEO.

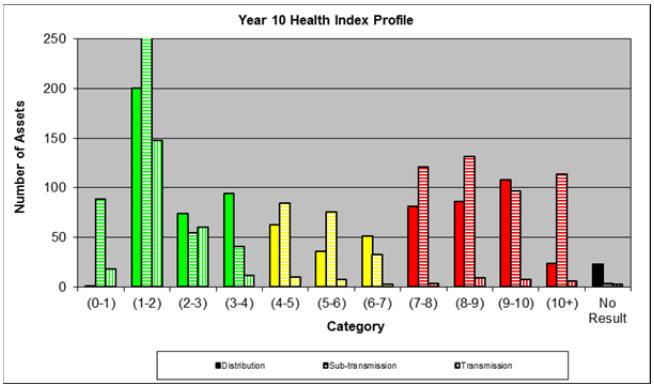
Consistent with the information provided in section 4.7.1, and for the further avoidance of doubt, Figure 10 provides the CBRM forecast impact of changing health indices for current transformers. These charts are routinely generated as part of the CBRM model. They demonstrate that the current health of the current transformer populations (the Year 0 graph) will slowly degrade over the next 10 years. With no intervention, the degradation will markedly accelerate compared to the proposed replacement process.

[142] Ergon Energy proposal document 07.01.08 Engineering report Instrument Transformer Replacement and Refurbishment Program, Figure 4









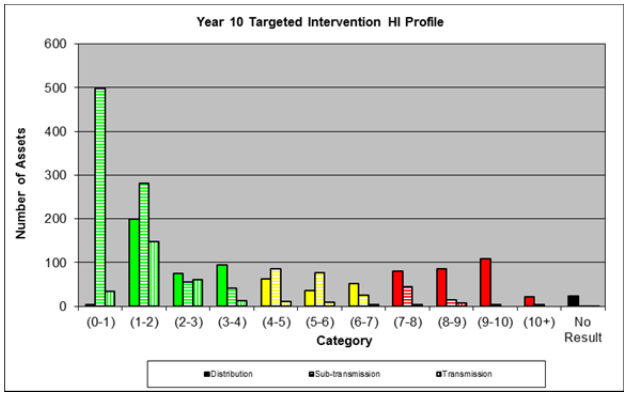


Figure 10 CBRM VTs - HI Comparison - No Intervention vs proposed Intervention

Comparison of the two year 10 charts reveals the intended impact of the proposed repex forecasts. Red represents those assets with poor health index (very poor condition), green with excellent/good health index (very good condition), and yellow represents fair condition. The targeted intervention chart details expected asset condition following Ergon energy's proposed repex expenditure. The other chart details expected asset condition with no intervention (i.e. only replace on failure). Ergon Energy's strategy to replace highest risk assets also accomplishes replacement of most of the assets with worst condition.

Ergon Energy notes that there is no intention to increase spares inventory volume for voltage transformers. Spares inventory will only be used as a method of efficient replacement asset purchasing, with the added benefit of cycling the spares inventory to support overall spares longevity and usability when needed.

Ergon Energy provided this information in the following proposal documents

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, section 6.2.3*
- *07.01.08 Engineering Report Instrument Transformer Replacement and Refurbishment*
- *07.01.33 C2.CBRM Data Collecting Tool – VT (excel spreadsheet)*

While Ergon Energy has not been able to provide the complete CBRM models to the AER/EMCA due to copyright issues, a significant amount of information was provided. With the added information about HI performance, Ergon Energy considers it has demonstrated the need for its proposed forecasts.

Ergon Energy notes that EMCa did not find any systemic issues in their technical review of the AER's 'other' category, which includes voltage transformers.

Ergon Energy notes that the AER has accepted Ergon Energy's proposal forecast expenditure for this asset class.

Capacitor Banks

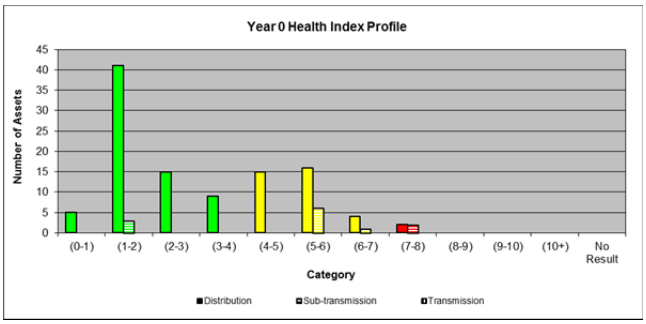
Ergon Energy documented its requirements in proposal document *07.01.12 Engineering report Capacitor Bank Replacement and Refurbishment Program*.

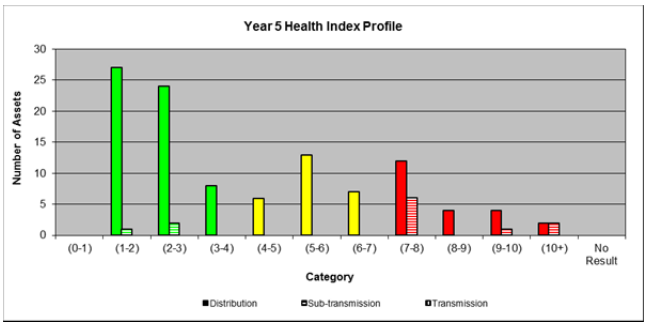
Ergon Energy 's CBRM modelling for capacitor banks, which was only established during the current regulatory period, does not recommend a significant replacement volume in the first year – effectively suggesting that Ergon Energy's past replacement volumes were sufficient[143] for optimum service delivery.

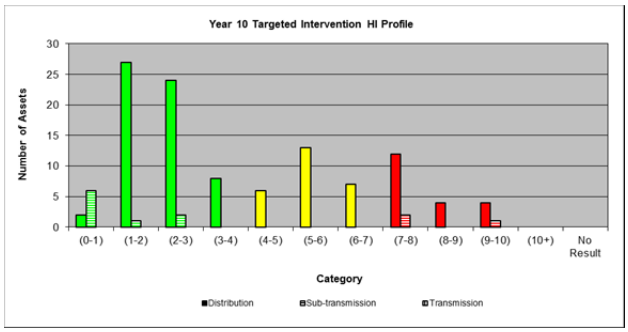
Ergon Energy's approach, described in various submission documents, is that while health indices represent asset condition, such condition is only part of the picture. Each asset exists in a unique part of the power network, and the position in the network and its related impact upon nearby assets is also an important element to be considered. For example, a Capacitor Bank employed to reduce VAR flow through a substation transformer that has significant spare capacity will have a lower risk impact compared to a capacitor bank employed to ensure power system voltage stability under normal loading conditions in a situation supplying thousands of customers. The former asset may be allowed to run-to-failure, while the latter may need to be replaced pre-emptively when close to imminent failure. Ergon Energy reflected this in its engineering reports, documenting changing risk over time. Ergon Energy evaluated risk rather than just the health index of each asset. Ergon Energy asserts that these principles espoused and effectively encoded into the CBRM model, combined with its implementation strategies, achieve prudent and efficient asset management strategies that are entirely consistent with NEO.

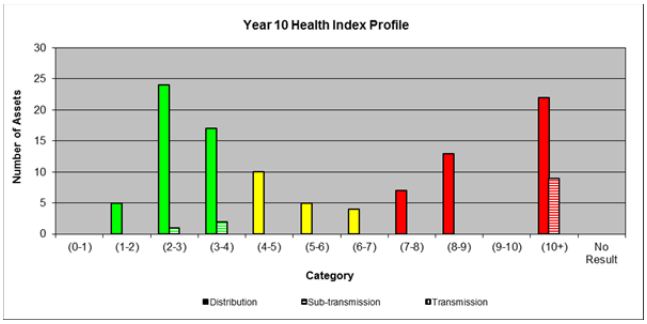
Consistent with the information provided in section 4.7.1, and for the further avoidance of doubt, Figure 11 provides the CBRM forecast impact of changing health indices for current transformers. These charts are routinely generated as part of the CBRM model. They demonstrate that the current health of the current transformer populations (the Year 0 graph) will slowly degrade over the next 10 years. With no intervention, the degradation will markedly accelerate compared to the proposed replacement process.

[143] Ergon Energy proposal document 07.01.12 Engineering report Capacitor Bank Replacement and Refurbishment Program, Figure 4









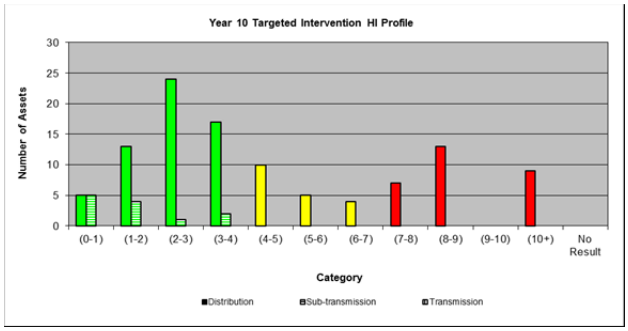


Figure 11 CBRM Cap Banks - HI Comparison - No Intervention vs proposed Intervention

Comparison of the two year 10 charts reveals the intended impact of the proposed repex forecasts. Red represents those assets with poor health index (very poor condition), green with excellent/good health index (very good condition), and yellow represents fair condition. The targeted intervention year 10 chart (right hand side) details expected asset condition following Ergon energy's proposed repex expenditure. The other year 10 chart (left hand side) details expected asset condition with no intervention (i.e. only replace on failure). Ergon Energy's strategy to replace highest risk assets also accomplishes replacement of most of the assets with worst condition.

Ergon Energy notes that there is no intention to increase spares inventory volume for Capacitor Banks. Spares inventory will only be used as a method of efficient replacement asset purchasing, with the added benefit of cycling the spares inventory to support overall spares longevity and usability when needed.

Ergon Energy provided this information in the following proposal documents

- *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020, section 6.2.3*
- *07.01.12 Engineering Report Capacitor Bank Replacement and Refurbishment*
- *07.01.35 E CBRM Data Collecting Tool – CapBank (excel spreadsheet)*

While Ergon Energy has not been able to provide the complete CBRM models to the AER/EMCA due to copyright issues, a significant amount of information was provided. With the added information about HI performance, Ergon Energy considers it has demonstrated the need for its proposed forecasts.

Ergon Energy notes that EMCa did not find any systemic issues in their technical review of the AER's 'other' category, which includes capacitor banks.

Ergon Energy notes that the AER has accepted Ergon Energy's proposal forecast expenditure for this asset class.

Static VAR Compensators

Ergon Energy documented its requirements in proposal document *07.01.10 Engineering report Static VAR Compensator (SVC) Replacement and Refurbishment*.

The Charleville SVC is at end of life. The function of dynamic voltage management is essential for normal system operation, as the network design is such that the system operates very close to the voltage collapse knee point. The proposal document details the extensive efforts made to extend the SVCs life. Replacement is now essential.

EMCa noted[144]

> *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.*
>
> *We have not identified any systemic issues in our review of this asset category.*

The AER detailed

> *EMCa observed the forecast repex was broadly consistent with the historic averages with the exception of 2017–18 which is dominated by expenditure for a single project for replacement of a static VAR compensator. EMCa did not identify any systemic issue in its review of this asset category. We consider Ergon Energy's forecast repex of $38 million is likely to reflect the capex criteria and have included this amount in our alternative estimate of total forecast capex. Ergon Energy categorised this asset in the 'Other' category within the reset RIN.*

Ergon Energy notes that the AER has accepted Ergon Energy's proposal forecast expenditure for this asset class.

4.9. Other consequences of the AER's preliminary Determination

The elements of this section detail follow-on needs and consequences of the AER's preliminary Determination.

Ergon Energy disagrees with the AER's preliminary Determination in regards to repex and has highlighted its concerns within this document. Ergon Energy requests re-evaluation of its original proposal and recommends acceptance in entirety. Should this occur, this section will become unnecessary.

Should the AER decide to adopt its preliminary Determination as final, additional issues arise that are over and above those detailed throughout this document.

[144] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 85.

Specifically, the AER approach of disallowing step changes completely has impacts both in repex and opex. These expenditure categories cannot be completely separated and treated as completely independent elements. AER proposed reductions in either of these categories will need to be offset by compensatory adjustments in the other. Major elements of these adjustments are detailed below.

4.9.1. Adjustment for cyclone response

The AER has not included a proposed step change for Ergon Energy's proposed Parametric Insurance[145] costs in their alternate opex forecast. The AER states:

> *We are also not satisfied that Ergon Energy has sufficiently demonstrated that it would be more efficient to buy parametric insurance than to self-insure (retain) the risk. Given the cost of the insurance, the expected payout and the size of Ergon Energy's asset base, we consider Ergon Energy has not provided us with sufficient evidence to convince us that it is more efficient for it to purchase parametric insurance than to continue to self-insure.*

A single event such as category 5 Cyclone Yasi cost Ergon Energy almost $100 million ($2013-14 combined capex and opex). The Queensland coast was hit by three (3) category 5 cyclones in 2014-2015. It was only fortuitous that these cyclones made landfall and weakened considerably before impacting major quantities of Ergon Energy infrastructure. Category 5 Cyclone Marcia recently hit the central coast with considerable damage to Yeppoon and Rockhampton and surrounding districts. This cyclone caused in excess of $30 million ($2014-15, combined capex and opex). There is conjecture within the scientific communities that such extreme storms are the result of continuing and ongoing climate change, and that the frequency of such events is likely to increase.

While the justification for re-instating the proposed operating expenditure for parametric insurance is discussed in other sections of Ergon Energy's revised proposal, not including the proposed expenditure for parametric insurance will require a funding allowance to allow for the capital costs associated with restoring the power network to its intended function. This amount was deducted from Ergon Energy's proposed base line capex spend to compensate for events covered under the proposed insurance.

EMCa stated[146]

> *We also note that a lower allowance for post-natural disaster repairs has been included as a result of the inclusion of parametric insurance. The insurance is intended to cover the 'most severe cyclonic wind events' such as cyclone Yasi and not small-medium 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.*
>
> *Ergon state 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.*

In order to self-insure, Ergon Energy will need to:

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[145] AER Preliminary Decision Attachment 7, C.4.4, page 7-307

[146] EMCa report to AER: Review of Proposed Network Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015-2020 Final version 8.3, 20/04/2015, page 70.

- Seek pass-through for all costs associated with damage where the costs to repair exceed the pass-through minimum amount
- Require an additional element in its replacement defect budget (and attributed across the reset RIN forecast models of poles, conductor and poletops of $40 million (direct $2014-15)
- Require additional opex defined for the purpose of the BST model as 2 events of separate value of $30 million (direct $2014-15).

Ergon Energy requests that the AER review its decision about requiring Ergon Energy to self–insure for large scale catastrophic wind events. If, following this review, the AER maintains steadfast in its approach to this matter, Ergon Energy requests that additional budgetary allowances are made to compensate for this.

4.9.2. Impact upon Opex of reduced Capex

Should the AER continue with reduction in the order of magnitude as advised in its preliminary Determination, Ergon Energy will be unable to replace the volume of assets as detailed in its proposal. Ergon Energy's general approach will be to prioritise funding to achieve those programs with safety as prime driver.

A reduction in overall repex funding will result in less assets being replaced under planned circumstances. In effect, a higher risk level will prevail.

To manage this risk, additional opex will be required to facilitate higher levels of asset inspection and maintenance, with additional operational and safety precautions introduced to ensure safe working and management of the power network.

Ergon Energy estimates this consequence will be of the order of $10 million (direct, $2014-15) for the 2015-20 regulatory period with cash flow impacting the latter years of the period as the assets that would have been replaced continue degrade over time

Safety Impacts

Should the AER continue with reduction in the order of magnitude as advised in its preliminary Determination, Ergon Energy will be unable to replace the intended volume of assets as detailed in its proposal. Ergon Energy's general approach will be to prioritise funding to achieve those programs with safety as prime driver.

4.9.3. Reliability Impacts

Ergon Energy employed consulting firm Jacobs Group (Australia) Pty. Ltd (Jacobs) to quantify impacts on reliability performance likely to occur as a result of implementation of the AER's Preliminary Determination. The report, *EXP09.02 Jacobs – Reliability Impact Assessment* is included in Ergon Energy's response documents.

The Jacob's assessment modelled the impact of the reduced expenditure allowed for in the AER Preliminary Decision on Ergon Energy's ability to discharge its Minimum Service Standards (MSS) obligations under the Ergon Energy Distribution Authority and its revenue outcomes under the AER Service Target Performance Incentive Scheme (STPIS). The modelling demonstrated that the reduction in expenditure resulted in increased frequency and average duration of supply interruption events over the Regulatory Control Period 2015-16 to 2019-20. The review highlighted that the improvements in reliability of supply established through investment in the current Regulatory Control Period will be eroded over the next Regulatory Control Period to the point where Ergon Energy will be at considerable risk of non-compliance across a number of MSS performance indices over the next two Regulatory Control Periods.

Based on the Jacob's report, it is expected that:

- MSS regulatory limits for SAIDI will be exceeded by:
  - Urban feeders – by 2019/20 and annually thereafter
  - Long Rural feeders – by 2018/19 and annually thereafter

- MSS regulatory limits for SAIFI are unlikely to be exceeded during the 2015-2020 regulatory period.

Exceedance of the same MSS limit (i.e. SAIDI limit) three financial years in a row is considered a "systemic failure" and constitutes a breach of Ergon Energy's distribution authority.[147] In effect, it is projected that implementation of the AER's preliminary determination will result in Ergon Energy being in breach of its distribution authority at or near the end of the 2015-2020 regulatory period or in the first year of the 2020-2025 regulatory period.

The Jacob's report, also found that Ergon Energy's reliability of supply performance will degrade to a consistently STPIS penalty environment by the end of the 2015-16 to 2019-20 Regulatory Control Period.

4.10. Additional adjustments requested

4.10.1. Adjustment for low Conductor clearance defect program

In the past, Ergon Energy employed ground based inspection staff to identify conductor clearances to ground and buildings. While the standards were well defined and recorded in the Lines Defect classifications[148], there was a level of individual subjectivity built into the inspection process.

During the current regulatory period, Ergon Energy developed ROAMES, an award-winning 3D spatially intelligent system designed to efficiently identify vegetation clearances from Ergon Energy assets across Queensland. ROAMES was subsequently sold to Fugro Roames Pty. Ltd. and the system is now available under contract to Ergon Energy to continue to provide a vegetation issue identification service. The system employs Light Detection And Ranging technology (LiDAR) coupled with extensive computer intelligence to identify vegetation and Ergon Energy assets, and the distances between them. The first cycle of data capture was completed in early 2014.

Ergon Energy has subsequently worked closely with Fugro Roames, to extend LiDAR and associated processing to asset management functions other than vegetation clearance assessment. An additional product developed was to identify conductor to ground clearance.

Prior to Ergon Energy's proposal submission in November 2014, ROAMES had produced an initial pass of low conductor clearance defects with an extremely large volume of around 24,000. However the product was still in testing and development at the time of the submission and the number of defects was considered unrealistic. Ergon Energy identified that ROAMES processing had to account for historical legislation changes and amendments, and had to confirm by field validation that the information was accurate. Following data validation and integration of compliance level history benchmark definitions around February-March 2015, Fugro-Roames were able to provide a complete list of conductor spans that were below minimum regulatory heights above ground or were within minimum regulatory clearance distance to structures.

[147] Distribution Authority – No. D01/99 Ergon Energy Corporation Limited Section 9
[148] Ergon Energy proposal document 07.01.46 Lines Defect Classification Manual.

A total of 15,000 spans have been identified as non-compliant with regulatory standards, and there is a projected cost of rectification of $36.4 million ($2014-15 direct). This allowance is over and above the routine defect allowance as discussed on *07.01.01 Line Asset Defect Management Methodology* which substantially deals with service clearance issues, which the ROAMES system cannot yet identify accurately.

Ergon Energy has assessed this non-compliance situation as high risk, as there are a number of public shock incidents experienced annually due to contact with low conductor. Correcting this situation is a regulatory compliance obligation[149] and public safety issue.

As such, Ergon Energy has commenced planning of the remediation program and is establishing resources to substantially correct the issue as soon as practical over the 2015-16 and 2016-17 financial years. Some early and preparatory work has been initiated in the 2014-15 financial year, with first batches of defects issued for remediation. This presents a substantial resource management issue. Ergon Energy has established a program to achieve this work, and is providing to the AER a separate, detailed business case document detailing the need, strategies, solutions and costs forecasts. Ergon Energy is seeking AER endorsement of the funding increase forecast for this work.

More detail about this need for funding is included in new proposal document *Conductor Clearance to Ground Defect Remediation 2015-20 Business Case*.

Because this work has been established as a result of a change in use of technology, it is a unique and non-recurrent investment. Once resolved, there should be no further and ongoing additional material expense. Therefore, Ergon Energy has included this work and funding as a separate category under 'Other' group in the reset RIN template 2.2.

5. Proposed replacement expenditure summary

Ergon Energy's revised proposal for replacement expenditure has increased.

For the avoidance of doubt, Table 8 provides a summary of Ergon Energy's forecast renewal expenditure proposal.

This is also documented in proposal document *07.00.01 Forecast Expenditure Summary Asset Renewal 2015-2020*.

This document details the entire replacement expenditure proposal in $14-15, direct costs.

Table 8 Revised proposal – replacement expenditure

Proposed Program	2015 - 20 Revised Proposal $14-15M
Lines Defect Management Program	$345.1
Distribution Feeder Reconductoring Program	$167.2
Substation Power Transformer Replacement and Refurbishment Program	$81.7
Subtransmission Line Refurbishment Program	$50.1
Distribution Earthing Remediation	$46.1

[149] Queensland Electrical Safety Regulation 2013, Schedule 4

Substation HV Circuit Breaker and Switchboard Replacement Program	$27.2
Protection Relay Replacement Program	$23.8
Instrument Transformer Replacement Program	$20.8
Active Communication Equipment Replacement	$18.7
End of life Radio refurbishment Mackay to Maryborough	$16.6
Substation DC System Refurbishment Program	$10.7
Substation Isolators Replacement Program	$11.8
Substation SVC Replacement Program	$9.2
AFLC Equipment Asset Replacement Plan	$9.5
Replacement of Figure 8 Colour Coded Service Cables	$10.2
End of life Radio refurbishment Western Queensland	$13.2
Substation Capacitor Bank Replacement Program	$8.2
Corenet Site Infrastructure Replacement	$8.5
RTU Replacement Program	$8.1
Replacement of Neutral Screened Service Cables	$4.7
Defective Connector and Splice Replacement Program	$4.1
Cast Iron Cable Pot Head Replacement Program	$2.5
Replacement of Brand X XLPE Service Cable	$2.4
Replacement of Laminated Crossarms	$2.3
EDO Fuse Replacement in High Risk Fire Areas	$1.1
Non-Ceramic Customer End Service Fuse Replacement	$0.8
Conductor Clearance to Ground Defect Remediation (New program)	$36.4
	$941.1

6. List of changes

Table 9 sets out the changes we have made to our supporting documents in response to the AER's Preliminary Determination.

Table 9: Revisions to our supporting documents in relation to the AER's preliminary decision on renewal expenditure

Document	Section/Table	Revision
07.00.01 Forecast Expenditure Summary Asset Renewal	Section 2.1 Table 1 and 2	• Updated forecast Direct Expenditure information to $14-15 (SCS and ACS) and inclusion of Conductor Clearance to Ground Defect Remediation Program (2015-20)
	Section 2.2 Table 3 and 4	• Updated forecast Total Expenditure information to $14-15 (SCS and ACS)
	Section 4.2 Table 7	• Updated current period Direct Expenditure information • Updated 2014-15 year expenditure estimate and variance
	Section 5.3	• Updated sub-section 5.3.2 Discrete analysis, clarification of Ergon risk assessment methodology and inclusion of Conductor Clearance to Ground Defect Remediation Program (2015-20).
	Section 5.5.1	• Updated capital expenditure to $14-15 for the Colour Coded Service replacement program.
	Section 6.1 Table 11	• Updated forecast capital expenditure to $14-15 • Inclusion of safety driven Conductor Clearance to Ground Defect Remediation Program (2015-20).
	Section 6.2.1	• Updated capital expenditure information to $14-15. Included Conductor Clearance to Ground Defect Remediation Program (2015-20) in sub-section 6.2.1.
	Table 13 Tables 14 - 21	• Updated expenditure to $14-15, revised program names and inclusion of Conductor Clearance to Ground Defect Remediation Program (2015-20). Updated forecast capital expenditure to $14-15 by program
	Section 6.3	• Updated forecast Total Expenditure information to $14-15
	Table 22	• Updated Repex model and Ergon forecast SCS expenditure information to $14-15
	Appendix A	• Acronyms and definitions table updated
	Appendix B, Table 5	• Included business case information for the Conductor Clearance to Ground Defect Remediation 2015-2020.
07.00.09 Capital Expenditure Forecast Unit Cost Methodologies Summary	Table 2 Table 18 Section 7.3	• Inclusion of the Conductor Clearance to Ground Backlog Remediation Program

Document	Section/Table	Revision
07.09.01 Network Capital Expenditure Forecast Model Summary	Section 7.3.4 Annex A Table 15 Annex C	• Inclusion of the Conductor Clearance to Ground Backlog Remediation Program
07.09.02 Network Optimisation Management Plan Overhead Feeder Circuits	Section 11.4	• Update of known and emerging issues or risks - Inclusion of backlog of insufficient clearance to ground defects
	Section 11.5	• Update to Asset Management Approach to include the remediation of insufficient conductor clearance to ground defects
	Section 11.6.1	• Update to preventive maintenance to include conductor clearance to ground defects
	Section 7	• Update to preventive maintenance to include conductor clearance to ground defects

Supporting documents

The following documents support our response to the AER on renewal expenditure:

Name
Conductor Clearance to Ground Defect Remediation Business Case 2015-2020
Submission to the AER on its Preliminary Determination - Ergon Energy Reset RIN Response to Material Issues
Attachment A - EECL Reset RIN Revision to Template 2.2 Repex (this is an attachment to the *Ergon Energy Reset RIN Response to Material Issues* document)
EXP09.02 Jacobs – Reliability Impact Assessment
System Capex Financial Performance 2014-15

Definitions, acronyms, and abbreviations

AER	Australian Energy Regulator
AFLC	Audio frequency Load Control
ALARP	As Low As Reasonably Practical
Capex	Capital expenditure
CBRM	Condition Based Risk Management
CCIQ	Chamber of Commerce and Industry Queensland
CCP	Consumer Challenge Panel
DNSP	Distribution Network Service Provider
EDSD	Electricity Distribution Service Delivery
EMCa	Energy Market Consulting Associates
ENA	Energy Networks Association
ENCAP	Electricity Network Capital Program
Ergon Energy	Ergon Energy Corporation Limited
ESO	Electrical Safety Office
HI	Health Index
ICT	Information and Communication Technologies
IRP	Independent Review Panel on Network Costs
LiDAR	Light Detection and Ranging
MSS	Minimum Service Standards
NEO	National Electricity Objectives
NEM	National Electricity Market
NER	National Electricity Rules
NSP	Network Service Provider
Opex	Operating expenditure
QCOSS	Queensland Council of Social Services
QRC	Queensland Resources Council
Repex	Replacement Expenditure
ROAMES	Remote Observation Automated Modelling Economic Simulation
RIN	Regulatory Information Notice
RTU	Remote Terminal Units
SCADA	Supervisory Control and Data Acquisition
SFAIRP	So Far As Is Reasonably Practical
STPIS	Service Target Performance Inventive Scheme

SWER	Single Wire Earth Return
SVC	Static VAR Compensator
VCR	Value of Customer Reliability
WACC	Weighted Average Cost of Capital