Service Line Replacements

Business Case

22 January 2024

Part of Energy Queensland

CONTENTS

List of Tables

List of Figures

DOCUMENT VERSION

Version Number	Change Detail	Date	Updated by
Draft v0.1	AER Document Initial Release	07/09/2023	Snr Asset Engineer
Draft V0.2	Finalising of draft post feedback	31/10/2023	Snr Engineer Asset Strategy
V1.0	Approved	15/11/2023	Manager Asset Strategy

RELATED DOCUMENTS

Document Date	Document Name	Document Type
JAN 2024	Asset Management Plan - Services	PDF
NOV 2023	Risk Modelling - Weibull – Services v0.1	Docx & Excel
JUN 2023	RIN 2.2 Compare 2021-22 (Rosetta)	Excel
NOV 2023	Ergon 2022-23 - Category Analysis - RIN Response - Consolidated - 23 November 2023 – PUBLIC (16058117.2)	Excel
AUG 2023	Maintenance Activity Frequency (MAF) – Release 2	PDF
JUN 2023	Maintenance Acceptance Criteria (MAC) – Release 11	PDF
OCT 2023	Lines Defect Classification Manual	PDF
JUL 2023	Substation Defect Classification Manual	PDF
OCT 2023	Australian Government, Department of the Prime Minister and Cabinet (Office of Best Practice Regulation) – Best Practice Regulation Guidance Note - Value of a Statistical Life:	PDF
ND	Australian major natural Disasters.xlsx (a compendium of various sources)	Excel
JAN 2024	Asset Management Plan - Services	PDF
NOV 2023	Risk Modelling - Weibull – Services v0.1	Docx & Excel

1 SUMMARY

Title	Service Line Replacements
DNSP	Ergon Energy Network
Expenditure category	☒ Replacement ☐ Augmentation ☐ Connections ☐ Tools and Equipment ☐ ICT ☐ Property ☐ Fleet
Purpose	The purpose of this Business Case is: • to evaluate the benefits of the forecast volume of overhead services replacements for regulatory period AER 2025-2030 • to support the Ergon's forecast capital expenditure over the regulatory period via a cost benefit analysis
Identified need	☒ Legislation ☒ Regulatory compliance ☒ Reliability ☐ CECV ☒ Safety ☒ Environment ☒ Financial ☐ Other Ergon Energy is committed to adopting an economic, customer value-based approach when it comes to ensuring the safety and reliability of the network. To demonstrate the advantages of this approach for the community and businesses, we have employed Net Present Value (NPV) modelling. This commitment is in line with our efforts to maximise the benefits to our customers. We are proposing to continue with our current volume of 8,500 targeted replacements and rectifying 100% of our defective service lines to maintain our level of service within acceptable limits So Far as is Reasonably Practicable (SFAIRP) approach. Investment in the reactive and targeted replacement of services is required to manage reliability, financial, safety, and environmental risks and consequences that may arise due to the failure of a service asset. This document also provides a summary of replacement scenarios as well as the impact in terms of performance, risk, and cost to demonstrate that our approach is prudent. Ergon Energy observed that the unassisted failure rate averaging around 1000 services per year was presenting significant risks to public safety and reliability for customers and community. Increased failures could have resulted in a major safety or network incident leading to significant impact on community/company. Services that are replaced as part of the conductor and pole replacements are included in the Overhead Conductor and Pole business cases.
Alternate options	Three options were considered over the continuation of the counterfactual. • Option 1 – 50% of Current Targeted Program • Option 2 – Double Targeted Program • Option 3 – No Targeted Replacements.

Expenditure	In this business case the volume of targeted replacements is varied with the same defect rate applied across all options. Consequential replacement of service lines with conductor and pole replacements, and the respective benefits, are included in the overhead conductor and poles business cases.

Year $M, direct	2025/26	2026/27	2027/28	2028/29	2029/30	Total
Targeted Replacement*	11.4	11.4	11.4	11.4	11.4	57.0
Defect*	3.7	3.7	3.7	3.7	3.7	18.5
Consequential	9.1	9.3	9.4	9.5	9.5	46.8
Business Case Total Investment*	**15.1**	**15.1**	**15.1**	**15.1**	**15.1**	**75.5**

* Expenditure considered for this business case.

Benefits	After a thorough evaluation of all available options, we are proposing that the Counterfactual continue. This option has been chosen over other options, as it provides the best balance of benefits, deliverability and risks for the organization

2 PURPOSE AND SCOPE

The purpose of this document is to outline the proposed volumes of replacement and expenditure associated with services in accordance with the Reset RIN forecast and the lifecycle management strategies detailed in the Asset Management Plan. The document also includes the analysis of different options, to ascertain efficiency and prudency through financial NPV modelling, considered to maintain and improve the asset performance and deliver optimum outcome for our customers.

This document is to be read in conjunction with the Low Voltage (LV) Service Asset Management Plan.

3 BACKGROUND

Ergon Energy overhead services provide a connection for electricity between the Ergon Energy overhead low voltage (LV) mains line and designated points of connection owned by individual customers. These overhead services are considered low-cost assets and are typically managed based on population, using regular inspections and systematic performance reviews to identify and address any issues or concerns.

Overhead Service unassisted failures present the following risks:

- Failure of the neutral circuit leading to elevated risk of customer shock and fatality
- Failure of the active circuit leading to loss of customer supply
- Breakage of the overhead service line, falling to the ground and remaining energized, leading to elevated public risk of public shock

Overall Service asset population performance is currently measured in terms of the number of reported public shocks directly related to Overhead Service operations. Where possible, EQL aims to reduce the number of public shocks towards zero so far as is reasonably practicable (SFAIRP).

Factors influencing prudent management of this asset class include public safety, the large and geographically dispersed overhead service population, assessed Overhead Service condition, various historical design standards, and diverse environmental and operational conditions.

Ergon is actively working to align data collection and record systems relating to customer overhead services across all regions, employing the best and most suitable systems from both legacy organizations.

Ergon continues to improve safety and the cost-effective management of these assets through the use of and continuous improvement of inspection and analysis techniques (such a Light Detection and Ranging (LiDAR), imagery and predictive analytics), optimal delivery models/techniques, and industry best practice management through active participation in Energy Networks Australia (ENA) working groups.

3.1 Asset Population

As per 2022-23 RIN data EE had a total of approximately 448,700 overhead services as shown in Figure 1. This shows that 136,000 services will be over 40 years by 2029-30. Ergon Energy's data system is not designed to record the age of the service as historically services not being registered as an asset. Therefore, to age our service lines, we first use the service conductor period contract for the type of service that was purchased, followed by the nearest pole's pole age to infer the services age.

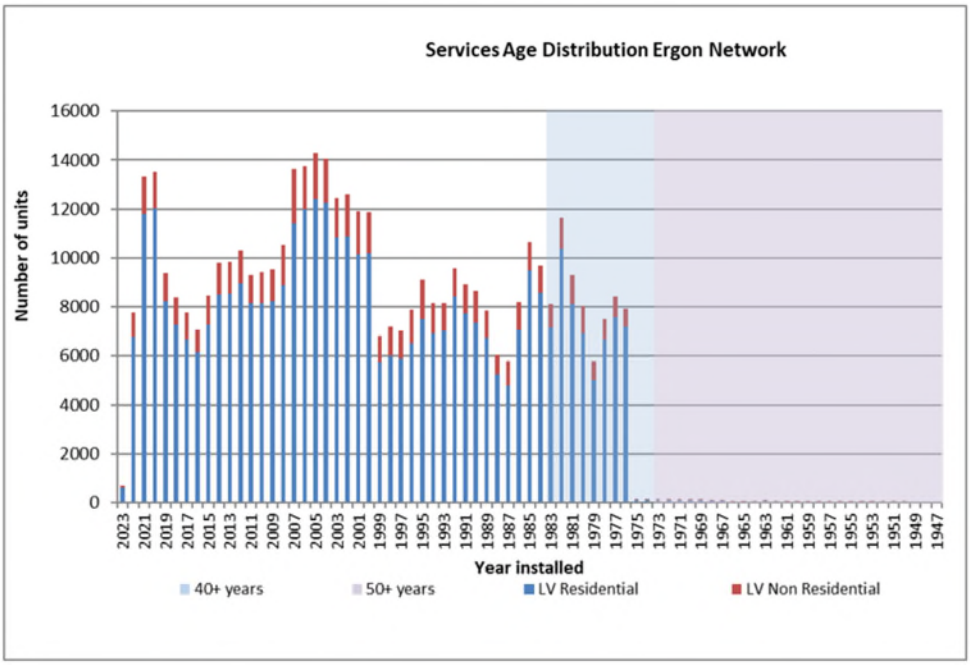

Figure 1: LV Services Age Profile

3.2 Asset Management Overview

This asset class is managed, consistent with our corporate asset management policy, to achieve all legislated obligations and any specifically defined corporate key performance indicators and to support all associated key result areas as reported in the Statement of Corporate Intent (SCI).

Safety risks associated with this asset class is eliminated as per so far as is reasonably practicable (SFAIRP), and if not able to be eliminated, is mitigated SFAIRP. All other risks associated with this asset class are managed to be as low as reasonably practicable (ALARP).

All inspection and maintenance activities are performed consistent with manufacturers' advice, good engineering operating practice, and historical performance, with the intent to achieve the longest practical asset life overall. End of asset life is determined by reference to the benchmark standards defined in the Defect Classification Manuals and or Maintenance Acceptability Criteria.

As listed in Table 1, problematic assets such as very high maintenance or high safety risk assets in the population are considered for retirement. Replacement work practices are optimised to achieve bulk replacement to minimise overall replacement cost and customer impact. Asset management strategies for this asset class focus upon improving shock related performance.

Overhead Service type	Installation Range
Bare Open Wire	< 1976
Neutral Screen PVC	1976 - 1987
Parallel Web PVC	1976 - 1997
Twisted Multiphase PVC	1976 - 1997
XLPE	1997 - Present

Table 1: Problematic Service Types

Our targeted services replacement program is the largest component of our forecast costs. This program is estimated based on a combination of identified problematic services type and design which present a high risk in the event of in-service failure. A large number of services will also be replaced when undertaking reconductoring or defective pole replacements programs as an efficient means of work delivery. This consequential investment and benefit have been considered in the respective business cases.

3.3 Asset Performance

The two functional failure modes of Services defined in this model are found in Table 2:

Functional Failure Type	Description
Catastrophic (Unassisted failure)	Loss of structural or conductivity integrity of any component associated with an overhead service, excluding any associated pole top hardware, such that the residual strength/conductivity of the component required immediate intervention. Functional failure of a services asset under normal operating conditions not caused by any external intervention such as abnormal weather or human
Degraded (Defect)	A service asset deemed defective based on observed serviceability strength criteria and if not rectified within a prescribed timescale (P0/P1/P2) could cause to an unassisted catastrophic failure.

Table 2: Description of Functional Failure

Identified defects are scheduled for repair according to a risk-based priority scheme (P0/P1/P2). The P0, P1 and P2 defect categories relate to priority of repair, which effectively dictates whether normal planning processes are employed (P2), or more urgent repair works are initiated (P1 and P0).

Many overhead service failures in Figure 2 are attributed to the age of the service. Failures were stable before 2022-23, following a step change in targeted volume replacements in 2020-25 compared to the 2015-20 regulatory control period. 2022-23 shows an increase in failures, which have been investigated to assess as part of continuous monitoring and improvement opportunity in our asset management strategies for this asset class.

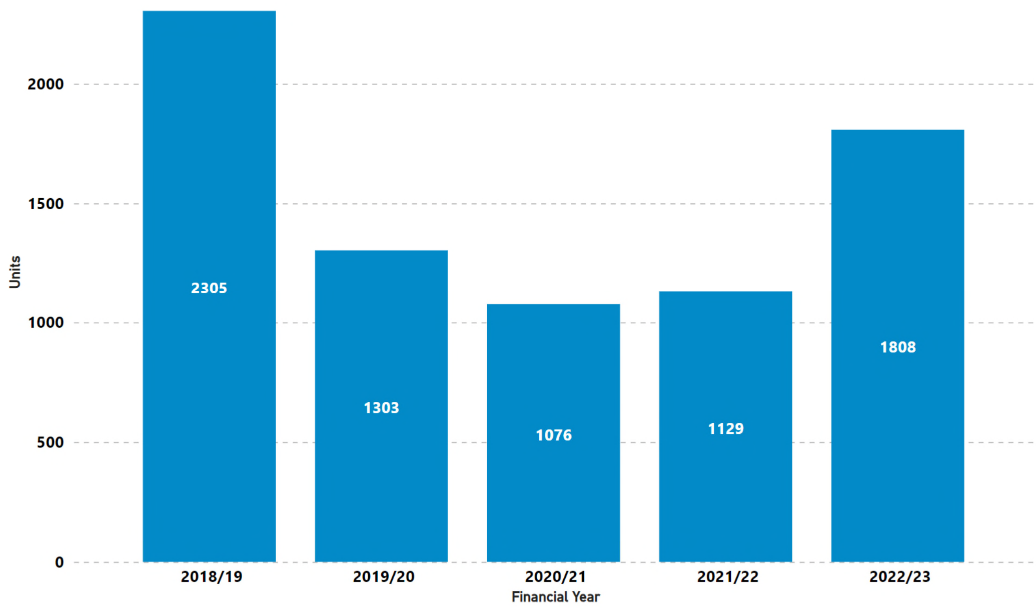

Figure 2: Unassisted Services Failures

Figure 3 shows the number of identified P1 and P2 defects in service lines. Any low voltage service that is in poor condition, has an exposed conductor, positioned below the statutory height, or is broken or damaged will be considered a defect that requires action immediately.

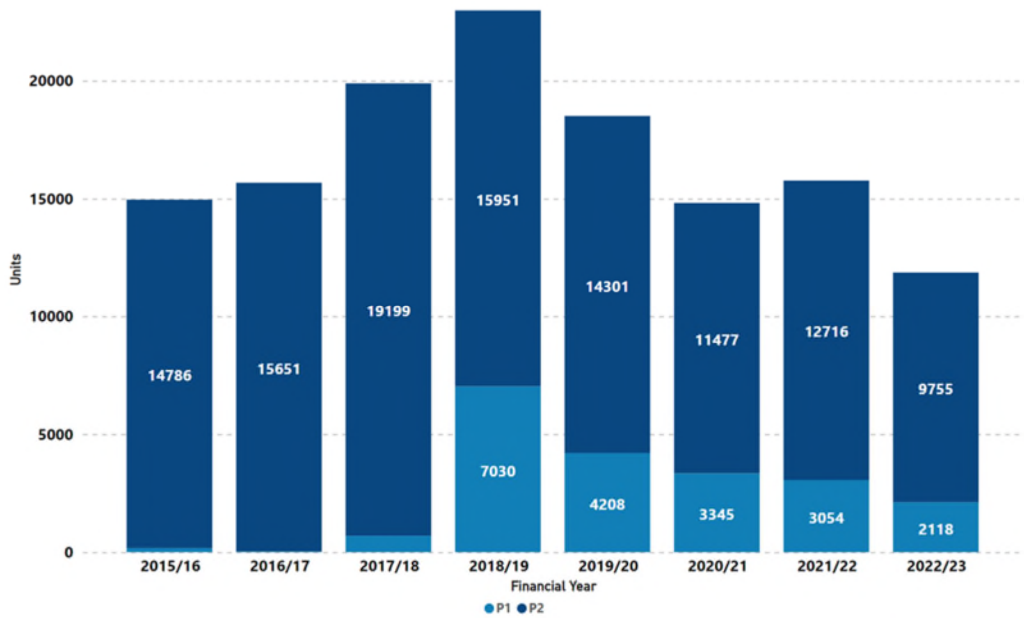

Figure 3: Services Defects P1 & P2

The number of defects were significant during the first two years, with a step increase in next two years peaking in 2018-19, triggering our increased replacement volume program. After rigorous replacements the defects volume with additional targeted conductor, it has gradually and continuously declined, however it is still at considerably high level.

The main cause of defects being insulation, ageing and degradations in associated components causing loss of conductivity and strength in the services, which if left unaddressed eventually cause an unassisted failure of the services. Also, there have been a few known issues with different types of services used during the last 50 to 60 years, requiring replacements proactively to improve the asset performance.

Additionally, Figure 4 shows the number of shocks and tingles reported that are directly attributable to overhead services. Ergon Energy is committed to keep the number of shocks per annum to as low as possible.

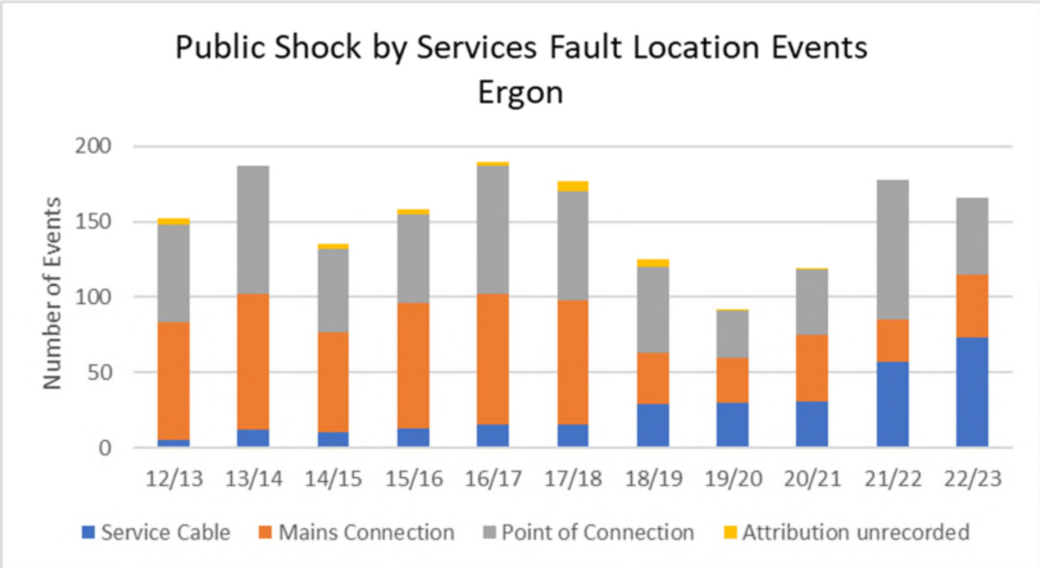

Figure 4: Shock and Tingle Incidents

4 RISK ANALYSIS

In evaluating the risks associated with our services assets, we model each service with age band.

As such, our cost benefit analysis is aimed at calibrating our risk calculation at the program level, so that on average we will be able to maximise the benefits to customers. As such, following the cost benefit analysis through NPV modelling, the most positive NPV of the volumes considered will form the basis for selecting the preferred option about replacement. In this business case, the most positive NPV validates the volume of replacement undertaken over the forecast period is a prudent approach.

The monetised risk is simply calculated as per the calculation in Figure 5:

Figure 5: Monetised risk calculations

Each consequence category follows the same calculations to obtain the total monetised risk as per Figure 6. Ergon Energy broadly considers five value streams for investment justifications regarding replacement of widespread assets. In Figure 6, only four of the value streams are considered; the 'Export' is not material to services.

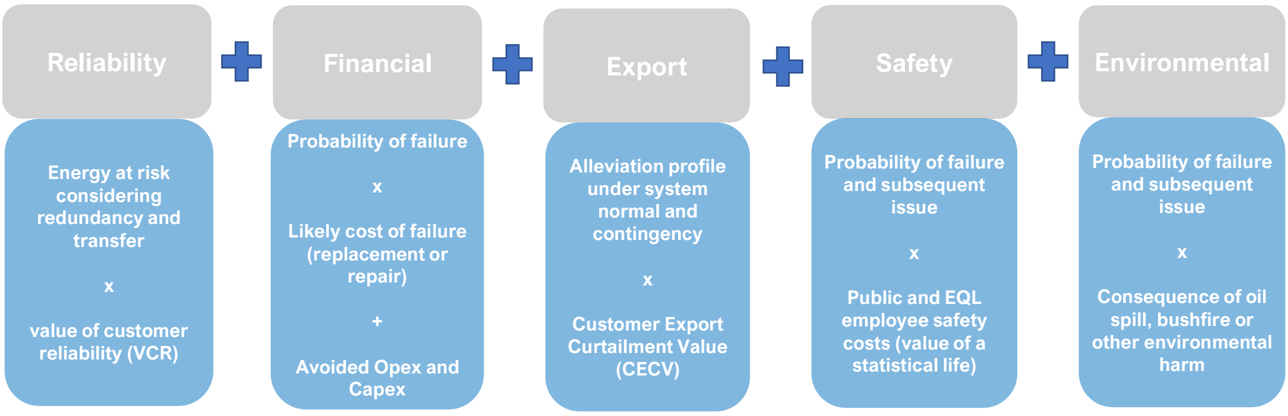

Figure 6: Risk steams for assets

4.1 Probability of Failure

Due to the limited condition data available for the implementation of an Asset Health Index (AHI), the Weibull distribution model was utilised instead due to its flexibility and ability to model skewed data. The Statistical model Weibull Distribution has been developed for assets having only observed inspection and not having measured data to predict the PoF such as Low Voltage service cables, Pole Top Structures (Crossarm), distribution transformers and distribution switches to assist with the replacement management of ageing assets.

The Weibull distribution is one of the most widely used lifetime distributions in reliability engineering. It is a versatile distribution that can take on the characteristics of other types of distributions, based on the value of the shape parameter, beta (β) and the scale parameter, eta (η). The function used to determine the probability of failure from a particular asset's time of failure is the Cumulative Distribution Function (CDF).

Shape parameter eta defines the average period when 63.2% of asset population is expected to fail. The other parameter represents the failure rate behaviour, if beta is less than 1, then the failure rate decreases with time; if beta is greater than 1, then the failure rate increases with time. When beta is equal to 1, the failure rate is constant. The resultant Weibull curve shown in Figure 7 for the services has produced beta β as 3.7 and the η as 37.

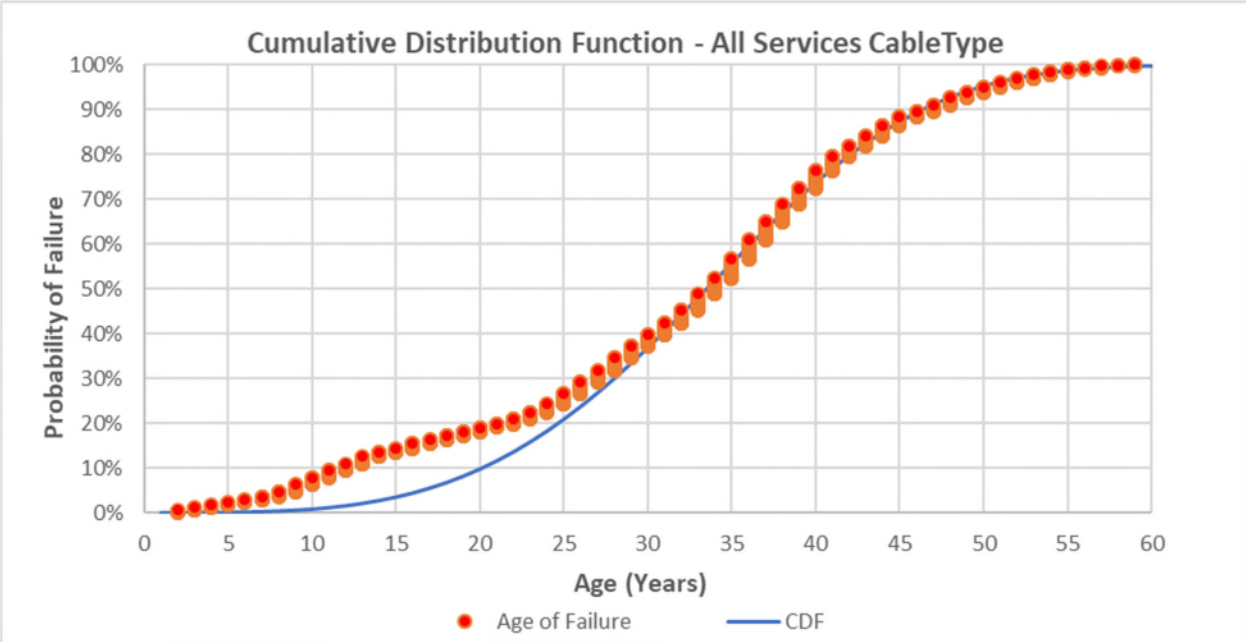

Figure 7: Cumulative Distribution Function – All Service Cable Type

4.2 Consequence of Failure (CoF) and Likelihood of Consequence (LoC)

The key consequence of services that have been modelled are reliability, financial, safety and environmental. The CoF refers to the financial or economic outcomes if an event were to occur.

The LoC refers to the probability of a particular outcome or result occurring because of a given event or action. To estimate the LoC, Ergon Energy has utilised a combination of historical performances and researched results. Ergon Energy has analysed past events, incidents, and data to identify patterns and trends that can provide insights into the likelihood of similar outcomes occurring in the future. Additionally, Ergon Energy also has conducted extensive research to gather relevant information and data related to the respective risk criteria such as bushfire.

To the extent possible the CoF and LoC are services specific. This is particularly the case for the reliability and benefits stream, where the bushfire risk informs the benefits calculations for preventing unassisted service failures.

4.2.1 Reliability

Reliability represents the unserved energy cost to customers of network outages and is based on an assessment of the amount of Load at Risk during three stages of failure: fault, initial switching, and repair time. The following assumptions are used in developing the risk cost outcome for a services failure:

- **Lost load:** As per the AER Frontier Economics 2021, the average consumption for a household based on 3-person family is 1 kW. This load on each service in our network is utilised to determine the kW that would on average be lost following a service failure
- **Restoration timeframe:** The average loss of supply has been estimated for a period of average 5 hours for service failures and 2 hours for service defect replacement

- **Value of Customer Reliability Rate:** We have used the Queensland average VCR rate for not only different residential loads
- **Probability of Consequence**: all in-service service failures result in an outage to customers

4.2.2 Financial

Financial cost of failure is derived from an assessment of the likely replacement costs incurred by the failure of the asset, which is replaced under emergency. The following assumptions have been used in developing the safety risk costs for a service:

- **Service replacement:**
  - Average failure replacement cost is $2,860
  - Average defect replacement cost is $1,938
  - Average targeted replacement cost is $1,938
- **Probability of Consequence:** all in-service service failures result in a need to replace the service under emergency

4.2.3 Safety

The safety risk for a service failure is primarily that a member of the public is in a premises with a failed service line. This could result in a fatality or injury. For our modelling we have used August 2022 published document from Australian Government, Department of the Prime Minister and Cabinet (Office of Best Practice Regulation) – Best Practice Regulation Guidance Note - Value of a Statistical Life:

- **Value of a Statistical Life**: $5.4m
- **Value of an Injury**: $1.35m
- **Value of a shock or tingle**: $500
- **Disproportionality Factor:** 6 for members of the public
- **Probability of Consequence**: Following an unassisted service failure, there is a 1 in 20 years chance of causing a fatality and 1 in 10 years chance of a serious injury based on historical data evidence. In the last 10 years there has been one fatality incident associated with service line failure.

4.2.4 Environmental - Bushfire

The value of a Bushfire Event consists of the safety cost of a fatalities and the material cost of property damage following a failed service causing a downed line and fire. For our modelling we have used:

- **Value of Bushfire:** $22.3m – which includes average damage to housing and fatalities following a bushfire being started. In Queensland as per Australian major natural Disasters.xlsx (a compendium of various sources), there were 122 homes lost and 309 buildings lost during bushfires between 1990 and present (2021) across 12 significant fire records. Homes were estimated an average cost of $400,000 while the buildings were estimated at an average cost of $80k

- **Probability of Consequence:** In consideration with the chances of the fire caused by services failure, EQL uses the four years average fire data to infer the frequency of different level of fire incident, fire caused by services with no material damage, spread wider, with small damage and with serious damage. EQL did not record any bushfire caused by services with serious damage in the past. Due to the location of the services is close to occupied premises, the chances of having serious damage bush fire is very low. Once in 20 years assumption is used in this mode

5 CONSEQUENTIAL REPLACEMENT

Within the scope of the pole and overhead conductor replacement investments, we assess the condition of the equipment attached to the assets and determine the feasibility and cost-effectiveness of replacing them. This equipment includes pole top structures, transformers, service lines, and switches. Consequently, when evaluating the benefits of this approach for our customers, we consider the investments and advantages associated with these consequential replacements in our analysis of the respective 2025-30 Poles and Overhead Conductor business cases to ensure that the overall asset expenses are accounted for. Table 3 outlines the volume of Low Voltage services to be replaced as a result of the pole replacement and reconductoring program during the regulatory period 2025-30.

Consequential Services Forecast Volume	2025/26	2026/27	2027/28	2028/29	2029/30	Total
With Pole Replacements	4,046	4.046	4,046	4,046	4,046	20,230
With Reconductoring	2,749	2,867	2,945	3,024	3,063	14,647

Table 3: Consequential Asset Volume – Proposed Program

6 IDENTIFIED NEED

6.1 Problem Statement

Ergon Energy reviewed its asset management practices with respect to services in response to increasing level of unassisted services failure. Over recent years there has been an effort to improve the quality of the failure data. The improved failure data captured has indicated an escalating failure rate for unassisted services failures.

Effective management of overhead service assets requires a range of factors to be considered, including public safety, physical condition, historical design standards, and environmental and operational conditions. Ergon has a regulatory duty of care to manage these assets and has introduced performance targets to help monitor and manage asset-related public shocks. The asset inspection and defect management process, supplemented by targeted replacement programs, will be critical to ensuring the ongoing safety and reliability of overhead service assets in Ergon Energy.

6.2 Compliance

Corporate Policies relating to establishing the desired level of service are detailed in the reference documents of Appendix A - Reset RIN Data Reconciliation.

Public shocks are monitored monthly, with shocks related to neutral integrity being the most significant factor (60-70%). Public shocks are considered notifiable events, required to be reported to the Electrical Safety Office.

In line with EQL's regulatory duty of care, there is an imperative to maintain the incidence of services related shocks SFAIRP. Regulatory performance outcomes for this asset include compliance with all legislative and regulatory standards, including the Electrical Safety Act 2002 (Qld), the Electrical Safety Regulation 2013 (Qld) (ESR), and the Electrical Safety Codes of Practice.

The Electrical Safety Act 2002 (Qld) s29 imposes a specific duty of care for EQL, which is a prescribed Electrical Entity under that Act:

- An electricity entity has a duty to ensure that its works:
  - are electrically safe
  - are operated in a way that is electrically safe
- Without limiting subsection (1), the duty includes the requirement that the electricity entity inspect, test and maintain the works

The ESR details some requirements for overhead service lines. These include various general obligations related to the safety of works of an electrical entity and a number of specific obligations, notably:

- ESR Schedule 2 - Exclusion zones for overhead electric lines
- ESR Schedule 5 - Clearance of low voltage overhead service lines
- ESR s76(4) - "The electricity entity must at periodic reasonable intervals inspect and maintain the insulation of the clamp or apparatus"

- ESR s215 - “An electricity entity must ensure the integrity of the insulation of the relevant part of the electrical entity’s works is inspected and maintained inspection and maintenance must be performed as periodic reasonable intervals”
- ESR s215 - “An electricity entity must ensure the integrity of insulation for the clamp or other apparatus at the point where consumer mains are connected to the electricity entity’s overhead service line is inspected and maintained inspection and maintenance must be performed at periodic reasonable intervals”

It is clear from the legislated requirements above that there is an intention to ensure inspection is undertaken “at periodic reasonable intervals”. Its nature and interval are defined by engineering judgement, taking into account overall safety and performance obligations.

6.3 Counterfactual (Base Case Scenario) – Proposed Program

To provide a comparison of the potential alternatives to our preferred program for our cost benefit analysis, we have set the counterfactual volumes as our proposed program.

6.3.1 Costs/Volumes

Ergon Energy Networks programmed 8,500 targeted services replacement per year on top of rectifying 100% of our defective and failed service lines. The resultant replacement cost and volume for the forecast period is shown in Table 4.

Counterfactual Volume/Costs	2025/26	2026/27	2027/28	2028/29	2029/30	Total
Services Cost $m	15.1	15.1	15.1	15.1	15.1	**75.5**
Defect %	100%	100%	100%	100%	100%	
Targeted Replacement Quantity	8,500	8,500	8,500	8,500	8,500	**42,500**

Table 4: Counterfactual Delivery Volumes

6.3.2 Risks Quantification

Ergon Energy has determined the risk values for a twenty-year time horizon as a period representative of the expected period of realisable benefits from any program interventions.

Risk costs is estimated to be maintained with counterfactual option in next five years, but have a gradual increase in future regulatory period, safety risk is the main driver and followed by financial risk associated with services failures, that leads to a possibility of increasing the replacement volume in future.

Additionally, Queensland Energy and Job Plan (QEJP) include installation of smart meters by 2030 and we are investigating the transition towards ‘replacement on defect’ approach for this asset class as we assess the capability of this data to detect neutral break to eliminate the shock risks from the broken neutrals, the biggest risk associated with this asset class.

Figure 8 provides the results of a quantitative forecast of emerging risk associated with Ergon’s services asset population failure due to condition related failure modes.

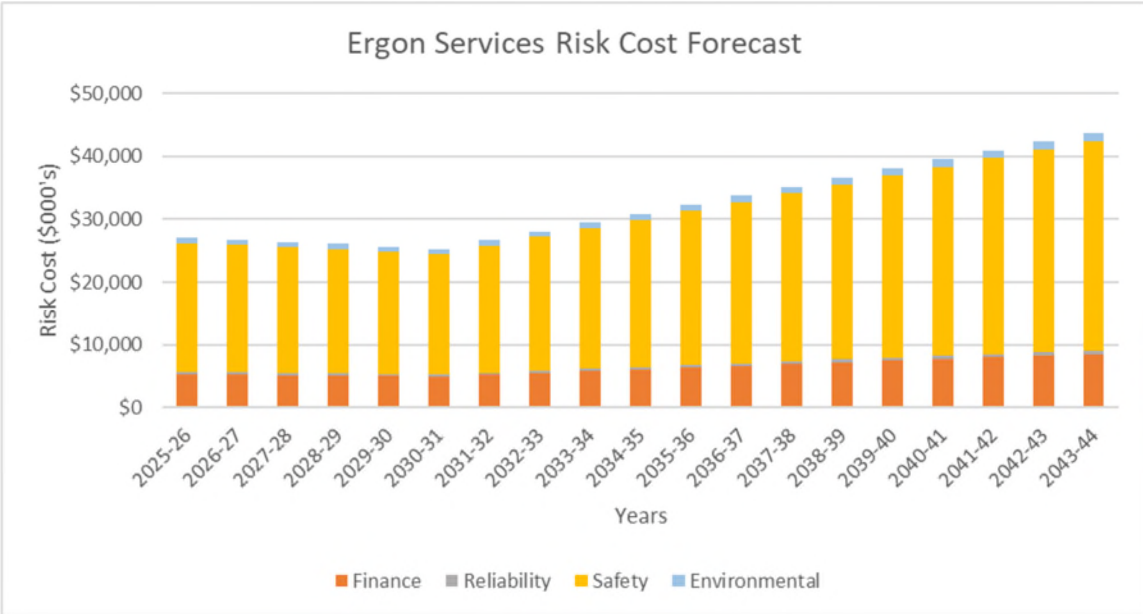

Figure 8: Counterfactual Quantitative Risk Assessment

Figure 9 shows the failure forecast for services over the next 20 years shows similar feature as the risk evaluation above.

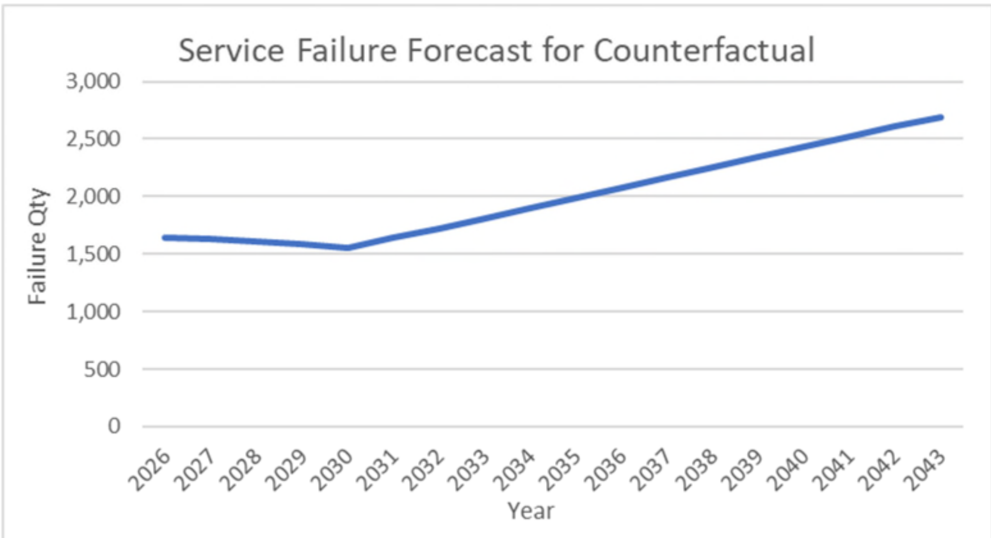

Figure 9: Counterfactual Failure Forecast

7 OPTIONS ANALYSIS

In the process of maximizing the value to customers to address the identified need, Ergon Energy has sought to identify a practicable range of technically feasible, alternative options that will satisfy the network requirements in a timely and efficient manner.

7.1 Option 1 – 50% of Current Targeted Program

This option is to halve the targeted replacement volume to 4,250 targeted services replacement per year on top of the 100% defect and failed service replacements. The resultant replacement cost and volume for the 2025-30 period is shown in Table 6.

7.1.1 Costs and Volumes

The volumes and costs that have been modelled as part of Option 1 are outlined in Table 5.

Historical Replacement Volume/Costs	2025/26	2026/27	2027/28	2028/29	2029/30	Total
Services Cost $m	11	11.2	11.3	11.4	11.5	**56.3**
Additional Targeted Volumes	4,250	4,250	4,250	4,250	4,250	**21,250**
Defective Replacement Cost $m	2.3	2.3	2.4	2.4	2.4	**11.7**
Defective Replacement Quantity	2,460	2,513	2,564	2,613	2,661	**12,812**

Table 5: Replacement Cost/Volume

7.1.2 Risks/Benefits

In this option, our modelling shows that the unassisted service failures are projected to increase considerably in comparison to those in the counterfactual option Furthermore, opting for this approach will result in a growing need for substantial investment in the near term due to the escalating rate of asset failures. This is primarily because leaving a large number of defective and old/obsolete services in active services resulting in increased investment requirements and poor asset performance.

7.2 Option 2 – Double the Targeted Program

This option includes 100% of defect and failure replacement with 17,000 targeted services replacement – double the volume of the counterfactual targeted delivery. This option provides the best NPV performance, but the feasibility will be limited by current resources and there is also a significant cost impact on customers.

7.2.1 Costs/Volumes

The volumes and costs that have been modelled as part of Option 2 are outlined in Table 6.

Additional Targeted Replacement Volume/Costs	2025/26	2026/27	2027/28	2028/29	2029/30	Total
Services Cost $m	26.4	26	25.6	25.2	24.8	**128**
Additional Targeted Volumes	17,000	17,000	17,000	17,000	17,000	**85,000**
Defective Replacement Cost $m	1.9	1.7	1.5	1.4	1.2	7.7
Defective Replacement Quantity	2,030	1,856	1,678	1,501	1,331	**8,395**

Table 6: Replacement Cost/Volume

7.2.2 Risks/Benefits

Under this approach, our modelling predicts that the occurrence of unassisted services failures will be notably reduced in comparison to the counterfactual option. Accordingly, this transition aims to bring the failure rate down SFAIRP ensuring a satisfactory level of public safety risks. While this option provides significant advantages to customers it is not without substantial cost impacts.

7.3 Option 3 – No Targeted Program

This option includes only defect and failure replacements and no targeted services replacement however provides the worst NPV performance.

7.3.1 Cost/Volumes

The volumes and costs that have been modelled as part of Option 3 are outlined in Table 7.

Repex Model Live Scenario Volume Repex Model Live Scenario Expenditure	2025/26	2026/27	2027/28	2028/29	2029/30	Total
Services Cost $m	5.9	6.2	6.5	6.8	7.1	**32.6**
Volumes based on % defect Replacement	100%	100%	100%	100%	100%	**100%**

Table 7: Replacement Cost/Volume

7.3.2 Risks/Benefits

Under this option, our modelling indicates that unassisted service failures are expected to be more compared to the counterfactual option. Choosing this approach will necessitate a significant increase in near-term and long -term investments due to the rising rate of asset failures and will be detrimental to Ergon Energy commitments of reduce the number of shocks.

8 OUTCOMES OF OPTIONS ANALYSIS

8.1 Service Failure Forecast

The service failure rate forecast for all the main options have been provided in Figure 10. The projected failure forecast shows a significant improvement in asset performance for the options involve increased targeted replacement strategy.

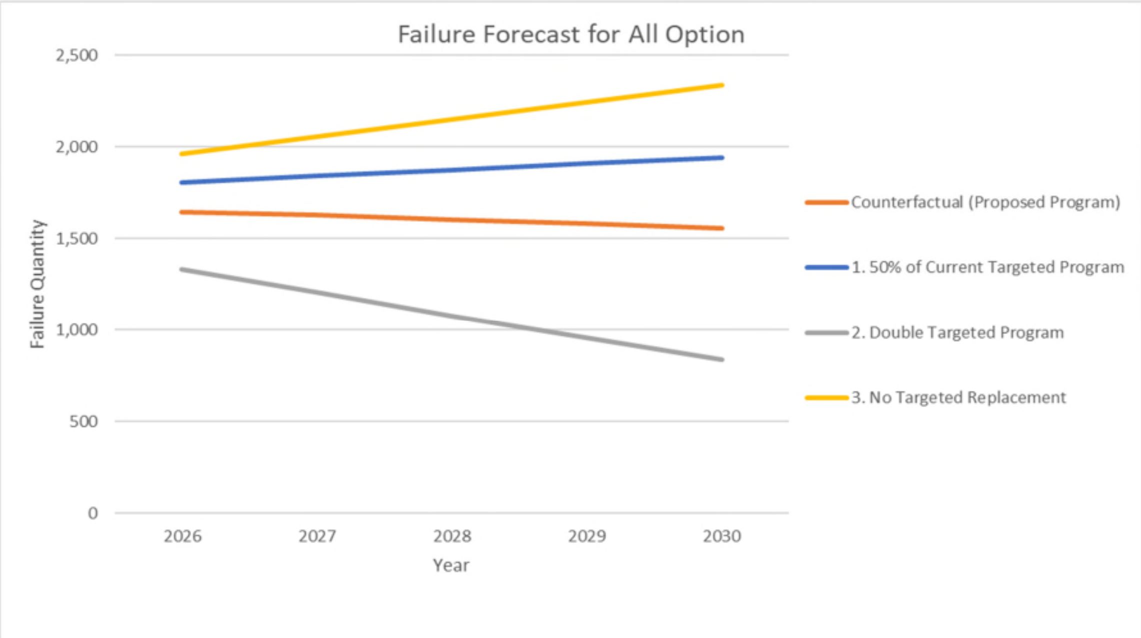

Figure 10: Failure Forecast - Intervention options

8.2 Economic Analysis

The NPV of cost benefit analysis of the options is summarized in Table 8 and the associated volume in Table 9.

- The proposed program is taken as the base line of the analysis. This includes 8,500 targeted replacements and 100% defects
- Option 1 includes 4,250 targeted replacements and 100% defects. This option will save $17.5m in investment compared to the counterfactual option. However, due to increasing failures there will be negative benefits to our customers, making the NPV negative.
- Option 2 includes 17,000 targeted replacements and 100% defects. This option requires additional $35.2m investment. As a result of the reduction of asset failure, this option will provide $113m benefit to the customer
- Option 3 includes no targeted replacements and 100% defects. This option will save $34.8m of investment. However, due to increasing failures there will be negative $119m benefits to our customers, resulting in a negative NPV.

Options	Rank	Net NPV	Intervention CAPEX NPV	Intervention Benefits NPV
Counterfactual (Proposed Program)	**2**	**$0**	$0	$0
1. 50% of Current Targeted Program	**3**	**-$39,775,335**	$17,456,443	-$57,231,778
2. Double Targeted Program	**1**	**$74,055,097**	-$35,278,056	$109,333,153
3. No Targeted Replacement	**4**	**-$80,418,973**	$34,849,748	-$115,268,721

Table 8: NPV Modelling and Consequential Benefits

Options	Targeted	Defect
Counterfactual (Proposed Program)	8,500	100%
1. 50% of Current Targeted Program	4,250	100%
2. Double Targeted Program	17,000	100%
3. No Targeted Replacement	0	100%

Table 9: Option volumes

Figure 11 compares the net NPV progression and gains over the modelling period compared to counterfactual option. This indicates significant NPV gains for option 2 with NPV increasing thrice at the rate of additional investment. However, this option required additional resource and investment compare to counterfactual. Our preferred option counterfactual is the most optimum solution in terms of investment, net NPV gains and practicality of delivery. Considering that Counterfactual is the option which is highly likely to achieve network standard compliances with improvement in the public safety risk this is prudent to choose this option.

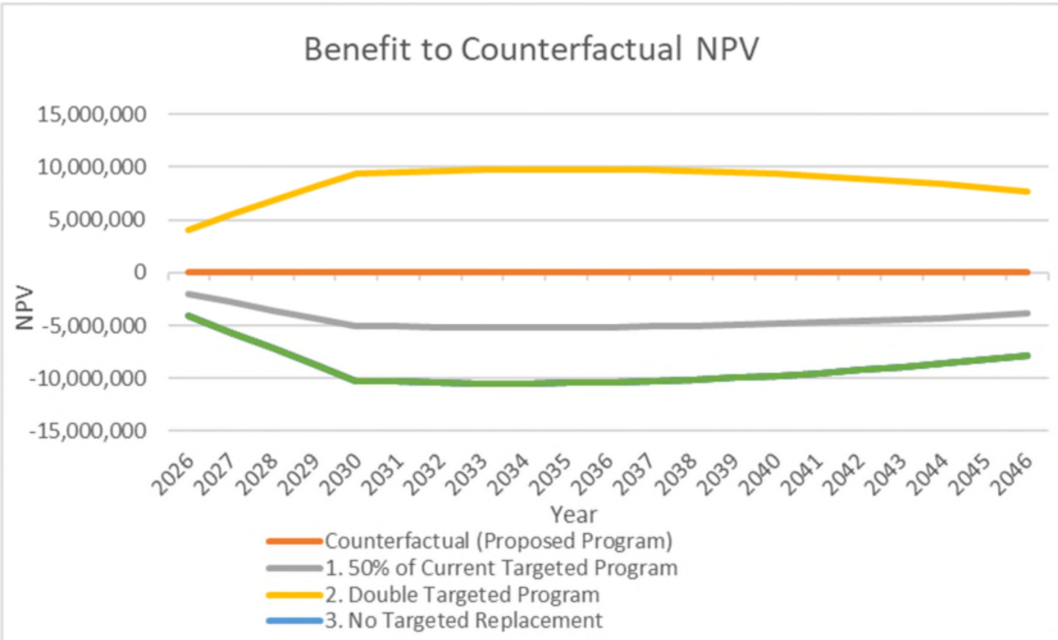

Figure 11: Benefit to Counterfactual NPV

The analysis presented here in Table 10 compares the options to their respective Counterfactual (**Preferred**) alternatives.

Criteria	Option 1 – 50% of Current Targeted Program	Option 2 – Double Targeted Program	Option 3 – No Targeted Program
Net NPV	-$ 40	$ 74m	-$ 80m
Investment Risk	Low	High	Low
Benefits	Very Low	High	Very Low
Delivery Constraint	Low	High	Low
Detailed analysis – Advantage	• -50% of the targeted replacement will result in $17m investment benefit. • Remove all defective assets. • Low impact on delivery requirement	• Additional $109m Customer Benefit compares to counterfactual. • Positive NPV • Remove all failed assets. • Best option for improving asset performance.	• Do minimal option will result in $35m investment benefit.
Detailed analysis – Disadvantage	• Doesn’t reduce failure rate as desirable or in SFAIRP approach • Negative NPV	• High investment risk option with cost impact on customers • High delivery impact • Double the resource requirement.	• Public shock and failure rate rise is likely. • Impacting public/customer safety. • Negative NPV

Table 10: Options Analysis Scorecard

9 SUMMARY

It is clear, even if Ergon Energy double the targeted replacement as per Option 2, the outcome is NPV positive. However, due to top-down constraints such as delivery and financial resources, Ergon Energy's proposed plan is to move forward with the **Counterfactual (Preferred)** volume from the regulatory period of 2025-2030. This proposed plan has been deemed prudent based on the risk monetisation outcome.

While the counterfactual program does not provide desired asset performance improvement, it was the minimum program necessary for the future period. Further increases in the program are likely to be required in the future based on the asset performance trend.

9.1 Sensitivity

To further test the effectiveness and prudency of the preferred option, a number of sensitivity analysis criteria have been applied, with ± 25% values, to compare the outcomes of the modelling in different scenario. The main sensitivity criteria are:

- Annual Risk cost
- WACC
- Probability of Failure (PoF)

In most of the sensitivity analysis outcomes the 'Preferred Option' has claimed its prudency and effectiveness over other options and therefore is recommended to be approved.

10 RECOMMENDATION

After a thorough evaluation of all available options, it has been determined that the **Counterfactual option** is the most viable. This option has been chosen over other options, as it provides the best balance of benefits and risks for our customers. As such, we are proposing to continue with our current approach, with a focus on optimizing existing processes and enhancing efficiencies where possible.

Our counterfactual option also reflects a tolerable risk position which balances the achievement of asset management objectives and customer service levels and ensures a level of investment which avoids future consequences based on the uncertainty associated with the capability new technologies may bring.

11 APPENDIX A - RESET RIN DATA RECONCILIATION

	2025/26	2026/27	2027/28	2028/29	2029/30
	Expenditure	Expenditure	Expenditure	Expenditure	Expenditure
RIN (Services)	24,205,162	24,362,929	24,468,107	24,573,286	24,625,875
NAMP Recorded Proactive	11,383,766	11,383,766	11,383,766	11,383,766	11,383,766
Services Defect	3,721,421	3,721,421	3,721,421	3,721,421	3,721,421
Pole Defect Program	5,418,588	5,418,588	5,418,588	5,418,588	5,418,588
Reconductor Program	3,189,572	3,347,339	3,452,517	3,557,695	3,610,284
Conductor Defect Program	491,815	491,815	491,815	491,815	491,815
Consequential Replacement	**9,099,975**	**9,257,742**	**9,362,920**	**9,468,098**	**9,520,687**

Table 11: Reset RIN reconciliation table – Expenditure

$, direct 2024-25	2025/26	2026/27	2027/28	2028/29	2029/30
RIN (Services)	27,542,246	27,861,112	28,120,899	28,275,454	28,544,239
NAMP Recorded Proactive	12,953,208	13,018,319	13,083,225	13,098,825	13,195,103
Services Defect	4,234,481	4,255,766	4,276,984	4,282,084	4,313,557
Pole Defect Program	6,165,631	6,196,623	6,227,518	6,234,943	6,280,771
Reconductor Program	3,629,307	3,827,971	3,967,936	4,093,691	4,184,737
Conductor Defect Program	559,620	562,433	565,237	565,911	570,070
Consequential Replacement	**10,354,558**	**10,587,027**	**10,760,690**	**10,894,545**	**11,035,579**

Table 12: Reset RIN reconciliation table – Expenditure $ in 2024-25

	2025/26	2026/27	2027/28	2028/29	2029/30
	Replacement Qty	Replacement Qty	Replacement Qty	Replacement Qty	Replacement Qty
RIN (Services)	18,073	18,191	18,270	18,348	18,388
NAMP Recorded Proactive	8,500	8,500	8,500	8,500	8,500
Services Defect	2,779	2,779	2,779	2,779	2,779
Pole Defect Program	4,046	4,046	4,046	4,046	4,046
Reconductor Program	2,382	2,499	2,578	2,656	2,696
Conductor Defect Program	367	367	367	367	367
Consequential Replacement	**6,795**	**6,913**	**6,991**	**7,070**	**7,109**

Table 133: Reset RIN reconciliation table – Volume