Pole Top Structure Replacements

Business Case

25 January 2024

Part of Energy Queensland

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DOCUMENT VERSION

Version Number	Change Detail	Date	Updated by
Draft v0.1	Draft	22/10/2023	Engineer Asset Strategy
Draft v0.2	Draft review post feedback	30/10/2023	Snr Engineer Asset Strategy
V1.0	Finalised	15/11/2023	Manager Asset Strategy

RELATED DOCUMENTS

Document Date	Document Name	Document Type
JAN 2024	Asset Management Plan – Pole Top Structure	PDF
NOV 2023	Risk Modelling - Weibull – Pole Top Structure 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

1 SUMMARY

Title	Pole Top Structure 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 replacement volume for pole top structures, mainly crossarms, for 2025-30 regulatory control period. • to support Ergon's forecast capital expenditure over the 2025-30 regulatory control 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 their efforts to maximise the value for our customers. Investment in the reactive and targeted replacement of pole top structures (predominantly crossarms) is required to manage reliability, financial, safety, and environmental risks and consequences that may arise due to the failure of a pole top structure. This document provides a summary of replacement scenarios as well as the impact in terms of performance, risk, and cost to demonstrate prudence from cost benefit analysis. Crossarms consequentially replaced under our reconductoring and pole replacement programs are included in the respective Overhead conductor and pole business cases. Most of the crossarm replacement is driven by well-established inspection programs to identify observed severe structural strength degradation. They are actively managed through a condition-based approach.
Summary of preferred option	The counterfactual is a continuation of the current replacement rate of 9,116 units per year. Three other options were considered as follows: 1. Option 1 – Counterfactual +50% Targeted 2. Option 2– Counterfactual -50% 3. Option 3– Counterfactual +7,000 Targeted (**Proposed Program**).

<table>
<tr>
<td>Expenditure of Proposed Program</td>
<td>
This business case relates only to defective pole top structure crossarm and targeted replacement. The consequential investment and their respective benefit is included in the overhead conductor and pole replacement business cases.
Preferred Option 3: Counterfactual + 7,000 Targeted.
<table>
<tr><th>Year
$m, direct 2022-23</th><th>2025-26</th><th>2026-27</th><th>2027-28</th><th>2028-29</th><th>2029-30</th><th>2025-30</th></tr>
<tr><td>Grand Total (BC)</td><td>45.3</td><td>45.3</td><td>45.3</td><td>45.3</td><td>45.3</td><td>226.5</td></tr>
<tr><td>Defect*</td><td>25.6</td><td>25.6</td><td>25.6</td><td>25.6</td><td>25.6</td><td>128</td></tr>
<tr><td>Targeted Replacement*</td><td>19.7</td><td>19.7</td><td>19.7</td><td>19.7</td><td>19.7</td><td>98.5</td></tr>
<tr><td>Consequential#</td><td>41.3</td><td>41.9</td><td>42.3</td><td>42.7</td><td>42.9</td><td>211.2</td></tr>
</table>
* Expenditure considered for this business case.
# Expenditure included in other investment programs (Pole Replacement, Overhead Conductor)
</td>
</tr>
<tr>
<td>Benefits</td>
<td>After a thorough evaluation of all available options, it has been determined that the <u>Option 3</u> (Counterfactual + 7,000 Targeted) is the most viable and prudent option. This option has been chosen over other options, as it has been demonstrated that incorporating a targeted replacement approach along with the existing defect replacement strategy, is beneficial to the customer and provide a positive net NPV of $192 million over the modelling period. Further we will continue to focus on optimizing existing processes and enhancing efficiencies where possible to deliver additional benefits through consequential replacements of crossarms in other programs.</td>
</tr>
</table>

2 PURPOSE AND SCOPE

The purpose of this business case is to outline the proposed volumes of replacement and expenditure associated with pole top structures for the regulatory period 2025-30. This document covers only the defect-based and targeted replacements of crossarms. Consequential replacement investment and benefits related with other programs such as pole replacement and reconductoring are included in their respective business cases. The document also includes the analysis of different options, to demonstrate prudency through NPV modelling.

This document is to be read in conjunction with the Asset Management Plan - Pole Top Structures.

3 BACKGROUND

Pole top structures refer to the structures, insulators, and hardware at the top of a pole that supports and position conductors and other pole top equipment. Crossarms are predominantly used as part of the pole top structure. Some pole top structure designs utilise insulators and steel brackets directly attached to the pole instead of crossarms. This document predominantly focusses on crossarms.

Crossarms are crucial components of our overhead distribution network. Their integrity is critical for safety as well as for continuity of supply to deliver minimum services standards.

We have recently improved the quality of the collected field, population and failure data for our crossarm population. The improved data captured has indicated a flat failure rate in recent 3 years for unassisted crossarm failures that justifies the requirement for more future investment in this asset category. Coupled with a new asset modelling methodology using the Weibull model to predict the probability of failure, a reliable and prudent replacement program can be proposed.

3.1 Asset Population

Ergon Energy Network have a total of 1.2m crossarms including 864,000 timber crossarms, as detailed in Figure 1. Our age profile of timber crossarms shows that 266,000 crossarms are over 35 years. Composite crossarms were introduced from late 2000s and can be seen to increase steadily.

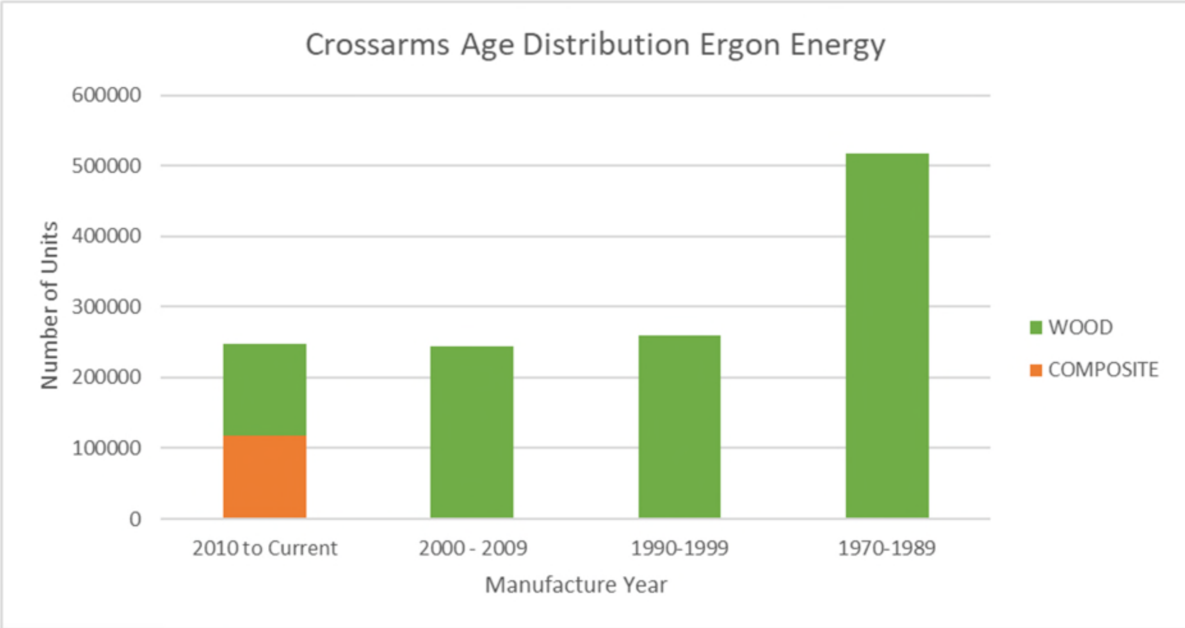

Figure 1: Crossarm Age Profile

3.2 Asset Management Overview

Crossarm replacements are mostly driven by well-established inspection programs which identify severe structural strength degradation. They are actively managed through a condition-based approach including:

- Visual inspection of physical condition from ground level.
- Aerial visual inspection carried out from helicopters/aircrafts/drones.
- Pole top structures inspection carried out from elevated work platform or climbing.

Physically defective crossarms identified through inspection are replaced. They may also be proactively replaced based on risk assessment. Proactive replacement is typically undertaken with other work such as feeder refurbishment programs or bundled into logical groups for efficiency of delivery and cost.

The current strategy is to transition away from wood crossarms in favour of alternatives such as composite crossarms.

3.3 Asset Performance

Two functional failure modes of crossarms defined in this model are found in Table 1.

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

Table 1: Description of Functional Failure

Figure 2 displays the number of unassisted crossarm failures. All these failures are from wood crossarms as there has been no reports of composite or steel crossarm unassisted failures. The main cause of failure are rot and decay which makes up 75% of failures.

The unassisted failure data in Figure 2 indicates a steady trend in last three years averaging around 300 failures per year.

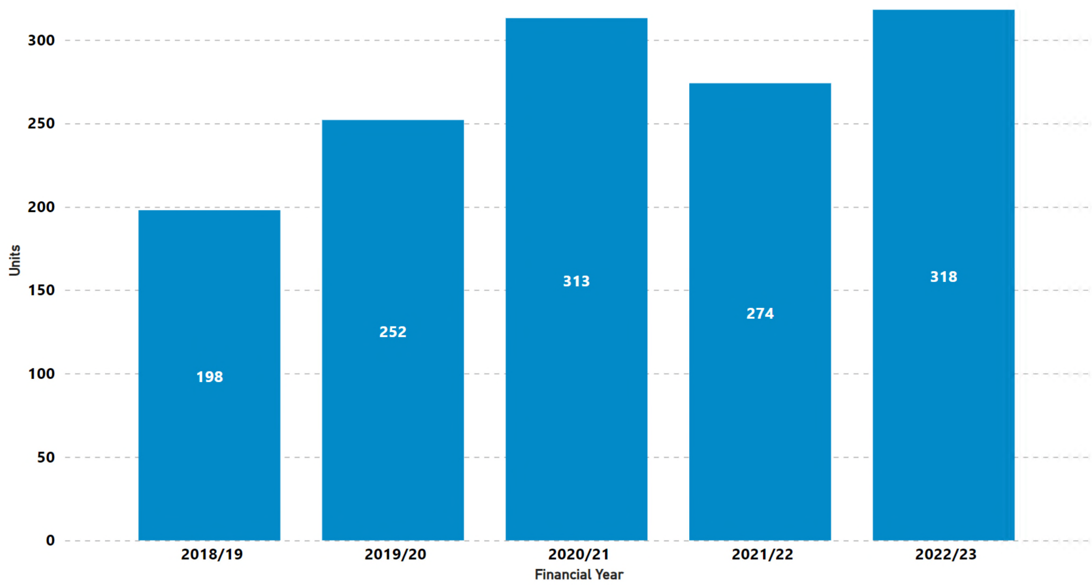

Figure 2: Pole Top Structure Unassisted Crossarm Failures

Identified defects are scheduled for repair according to a risk-based priority scheme (P0/P1/P2/C3/no defect). 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).

Figure 3 contains the volume of crossarm P1 and P2 defects. The defect data indicates over 13,000 defects in 2018-19 followed by consistently high volumes averaging approximately 9,600 defects per year over the four subsequent years. The variation in defect volumes can be attributed to various interventional programs including proactive replacements, reconductoring, pole replacement, clearance to ground (CTG), clearance to structure (CTS), and the aerial inspection program.

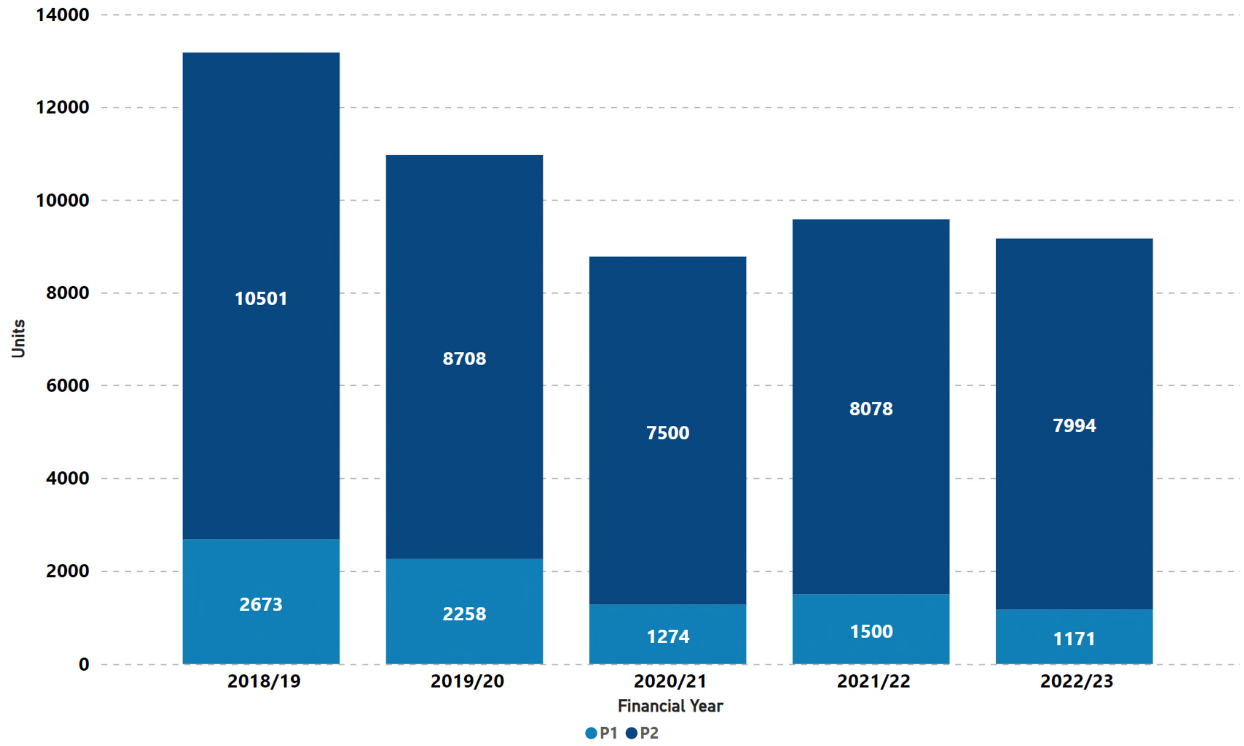

Figure 3: Pole Top Structure Crossarm Defects

4 RISK EVALUATION

Our cost-benefit analysis aims to optimise our risk calculation at the program level, so that we can maximise the benefits to our customers. After conducting a cost-benefit analysis using net present value (NPV) modelling, we will select the preferred replacement option based on the most positive NPV of the volumes considered. In the case of this AER submission proposal, the most positive NPV validates that the volume of replacement proposed over the AER period 2025-2030 is a prudent approach.

The monetised risk is simply calculated by as per the calculation in Figure 4.

Figure 4: Monetised Risk Calculation per Category

Each consequence category follows the same calculations in Figure 4 to obtain the total monetised risk is as per Figure 5.

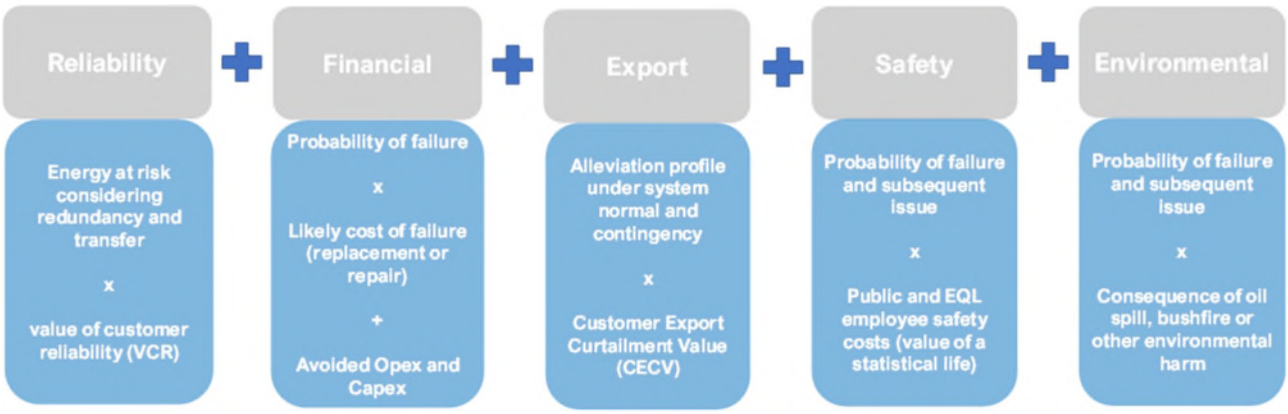

Figure 5: Total Risk Cost Calculation

4.1 Probability of Failure (Weibull Analysis)

Due to the limited condition data available for the implementation of an Asset Health Index (AHI), the Weibull distribution model was utilised. The Weibull distribution is widely used due to its flexibility and ability to model skewed data. It's ability to work with extremely small number of sample (less than 20 samples) makes it the best choice, if not the best practice. By modelling the crossarm failures against the Weibull curve, the probability of failure (PoF) for each asset age group is derived.

The Weibull parameters are outlined in Table 2.

Weibull Variables	Value
Beta β	4
Eta η	41.5

Table 2: CDF Weibull Variables

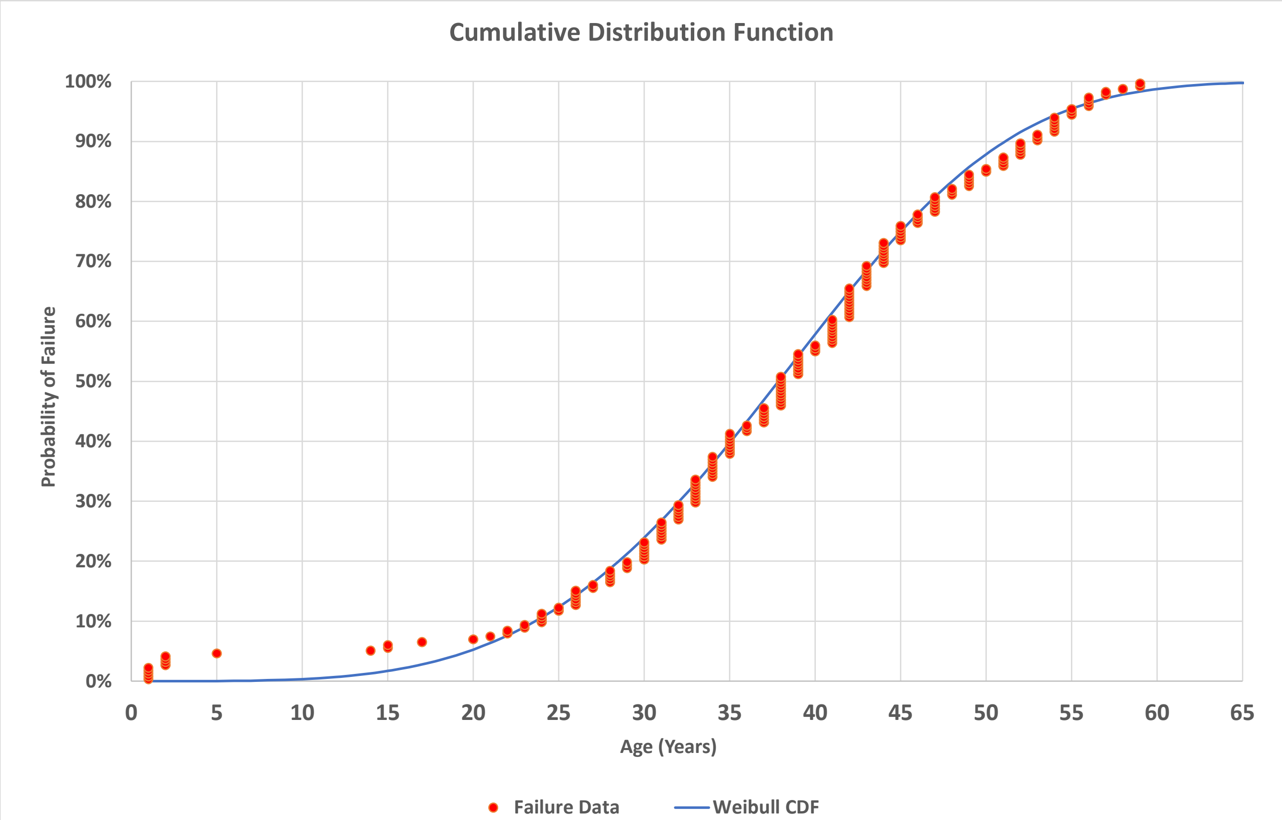

Figure 6: Crossarm Failure Plot against Weibull CDF Curve

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

The key consequence of crossarm failures 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 crossarm age band specific. This is particularly the case for the reliability and benefits stream, where the site-specific location and bushfire risk informs the benefits calculations for preventing unassisted crossarm 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 crossarm failure:

- **Lost load:** Each crossarm in our network is modelled individually, with the relationship developed between a crossarm and the pole and feeder/conductor that it is supporting. The historical average load on each feeder in our network is utilised to determine the kW that would on average be lost following a crossarm failure. We have utilised half of the historic average load on the feeder, which represents the most likely outcome, as the data regarding the exact electrical location of the crossarm in a feeder is not feasible to obtain as Crossarm is not a uniquely identified asset.
- **Load transfers and Restoration timeframe:** The average loss of supply has been estimated for a period of average 4 to 9 hours based on locality, staged restoration approach, and historical data for outages/durations. This is based on the average load on our fleet of feeders, divided under 'Rural Short, rural long, urban, and sub-transmission.
- **Value of Customer Reliability Rate:** We have used the Queensland average VCR rate.
- **Probability of Consequence:** For modelling purpose, crossarm failures results in the conductor drop has been assumed to cause an outage to customers.

4.2.2 Financial

The Financial cost of failure is derived from an assessment of the likely replacement costs incurred by the failure of the asset and replaced under emergency. The same unit cost has been taken for replacement in both planned and unplanned circumstances. Historical average cost has been used for this purpose and is approximately $2,800.

4.2.3 Safety

The safety risk for a crossarm failure is primarily that a member of the public is in the presence of a fallen conductor which was caused by crossarm failure. This could result in a fatality or injury. For our modelling we have used October 2023 published document from, The 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
- **Disproportionality Factor:** 6 for members of the public
- **Probability of Consequence:** Following an unassisted asset failure in Ergon Energy, there is a 1 in 20 years chance of causing a fatality and 25 in 20 years chance of a serious injury based on historical data evidence. The average number of safety incidents has been derived by analysing 20 years of Significant Electrical Incident data comprising 26 incidents where unassisted asset failure has driven a safety incident of the appropriate severity. Historically, the data shows, pole top structure has not been the cause of fatality, therefore the fatality incident due to a conductor asset unassisted failure has been considered for the modelling purpose.

4.2.4 Environment (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 crossarm and conductor. 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. The weighted average cost of bushfire consequence per pole top has been estimated as $6,763.
- **Safety Consequence of Bushfire:** Safety consequences are evaluated on same assumptions as safety incident consequence in 4.2.3 with a frequency of 0.5 per incident as there has been 6 fatalities recorded across those 12 bushfire incidents in Queensland.
- **Probability of Consequence:** Following the failure of a crossarm, we have estimated that there is a 0.0260 chance of causing a fire. This is based on a historical full year when there were 22 fires recorded due to electrical asset failures in Ergon Energy. In that year there were 114 pole failures, 265 cross-arm failures and 467 conductor failures that had potential to cause fire ignition, giving a probability of 0.0260 (22/846).
    - Also, bushfire consequence weighting and probability of containing/non-containing the fire has been incorporated into calculations along with % number of days considerations during no-forecast to extreme/catastrophic danger rating forecasts. A fire is also only considered to be possible if the conductor has dropped and made contact with the ground due to the failure of a pole top. In 2021, a total of 56 conductors dropped in the 274 failures recorded. Therefore a 20.4% factor has been considered as part of the probability of consequence.

5 CONSEQUENTIAL REPLACEMENT

In addition to defective crossarm replacements, many crossarms are replaced as a result of pole replacement as it is considered delivery efficient to replace both pole and crossarm together instead of just replacing the pole and then dismantling and reinstalling the old crossarm. This is called the consequential replacement of crossarm and is undertaken wherever a pole is replaced. The cost and investment associated with such consequential replacements associated with other programs (e.g pole replacements) are excluded from this business case document and has been included in respective business cases.

The estimated volume of consequential cross arm replacement with other replacement programs has been provided in Table 3.

Forecast Volume Consequential Replacement	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Pole Program	9,594	9,594	9,594	9,594	9,594	**47,970**
Reconductoring Program	5,097	5,316	5,462	5,607	5,680	**27,162**

Table 3: Consequential Replacement with Pole and Reconductoring Programs

The volume has been estimated based on a factor of 0.78 per pole replacement for all the intervention options. This ratio is based on last three years average delivery of consequential replacement along with pole replacement.

6 IDENTIFIED NEED

6.1 Problem Statement

Pole top structures condition and failure consequence risks (reliability, financial, safety, and environmental) are regularly assessed through asset inspection and defect identification processes. The asset performance trend analysis reveals that the performance has not had any improvement since 2019-20 result in review of asset management strategies. Additionally on average around 20% of crossarm failure lead to a conductor falling to the ground, exposing a high safety risk to the community.

The current program approach is replacing the inspection driven defective pole top structures of around 9,000 per annum. We note that consequential replacement volume is almost similar to the defect numbers. Our concerns with the risk of ageing population and to ensure improvement of asset performance, we have decided to introduce targeted replacement approach for this asset group. The candidate for the targeted volume is obtained from inspection and defect condition criteria.

6.2 Compliance

Ergon Energy's crossarm assets are subject to a number of legislative and regulatory standards.

- The Electrical Safety Act 2002 (Qld) s29 imposes a specific duty of care on a prescribed Electrical Entity to ensure that its works
  - are electrically safe
  - are operated in a way that is electrically safe.
- The duty includes the requirement that the electricity entity inspects, tests and maintains the assets and works.

The Electrical Safety Regulation 2013 details requirements for electric lines, specifically about safety clearances, of which crossarms are classed as associated equipment. These include various general obligations related to the safety of works of an electrical entity. The desired level of service for crossarms in the Ergon Energy network is to achieve in-service crossarm failure numbers which deliver a safety risk outcome which is considered SFAIRP.

6.3 Counterfactual Analysis (Base case)

The counterfactual for 2025-2030 regulatory proposal is continuing with the existing strategy of replacing crossarms volumes based on historical defect volume delivered in 2022-23.

6.3.1 Intervention Volumes

The number of crossarm replacement volume modelled in this option is outlined in Table 4.

Year	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Volume	9,116	9,116	9,116	9,116	9,116	**45,580**

Table 4: Counterfactual Delivery for Reset RIN period (2025 – 2030)

6.3.2 Risk Quantification

Figure 7 provides the results of a quantitative forecast of emerging risk associated with pole top structure failure. The risk increases substantially due to a large number of poor condition (end of service life) crossarms over 35 years still being in service requiring intervention and posing safety and reliability risk to community.

Figure 8 represents the failure forecast where the rate continues to rise if the replacement volume needs to remain at counterfactual level.

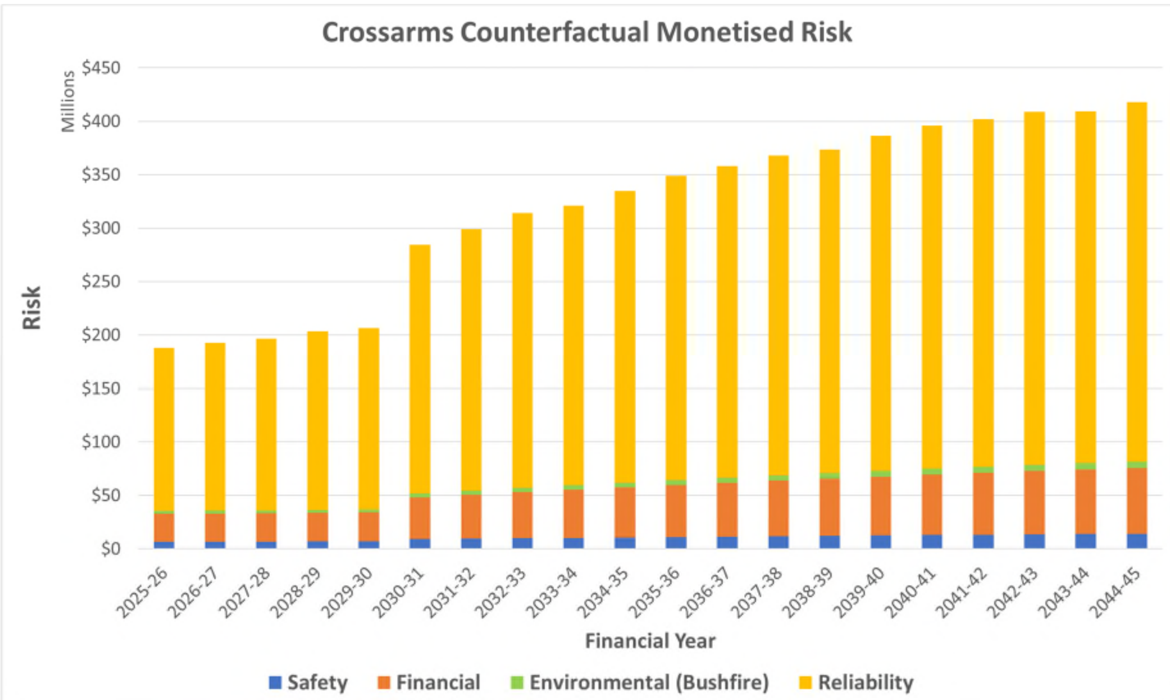

Figure 7: Counterfactual Quantitative Risk Assessment

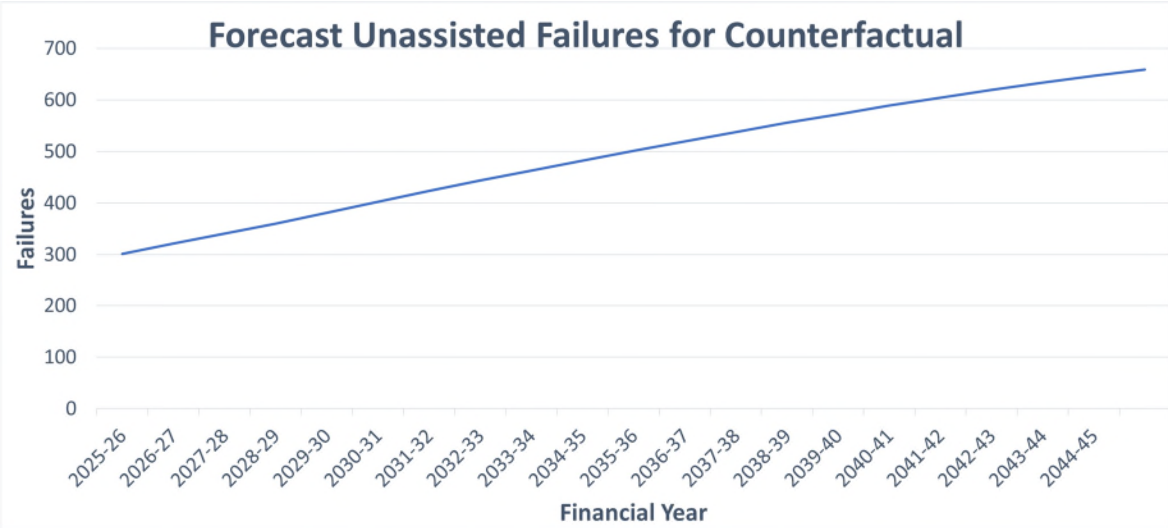

Figure 8: Counterfactual Unassisted Failures

7 OPTIONS ANALYSIS

In assessing the prudency of our proposed program, we have compared a range of interventions against the counterfactual (Historical volumes) to assess the options that maximise value for our customers. We have sought to identify a practicable range of technically feasible, alternative options to satisfy our network requirements in a timely and efficient manner.

7.1 Option 1 – Counterfactual + 50% Targeted

Option 1 includes the counterfactual replacement program plus 50% targeted replacement. An increase in replacement volume has estimated some improvement in safety, financial and reliability risk.

7.1.1 Intervention Volumes

The volumes under this option have been provided in Table 5.

Year	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Volume	13,674	13,674	13,674	13,674	13,674	68,370

Table 5: Counterfactual +50% Targeted

7.1.2 Risks/Benefits

Under this approach our modelling has indicated that this option provides better customer benefits (safety and reliability), compare to counterfactual option, and reduces the failures make a substantial impact in asset performance. Additionally, this option provides the transition toward performance improvement with moderate impact on budget and resources.

7.2 Option 2 – Counterfactual -50%

This option is equivalent to the half of historical defect replacement program.

7.2.1 Intervention Volumes

The volumes under this option have been provided in Table 6.

Year	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Volume	4,558	4,558	4,558	4,558	4,558	22,790

Table 6: Option Counterfactual -50% - Volumes

7.2.2 Risks/Benefits

Under this option our cost/benefit analysis has indicated that this is worse than counterfactual as it leaves 50% of defect unattended. The asset failures will start to increase similar to counterfactual approach justifying this is not an option Ergon Energy would consider.

7.3 Option 3 – Counterfactual + 7,000 Targeted (Preferred Program)

This option is the proposed program introducing targeted replacement of 7,000 cross arms per annum in addition to counterfactual volume.

7.3.1 Intervention Costs/Volumes

The cost and volumes under this option has been provided in Table 7 and Table 8.

Year	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Volume	16,116	16,116	16,116	16,116	16,116	80,580

Table 7: Counterfactual + 7,000 proactive replacement Reset RIN period (2025 – 2030)

Year	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Expenditure ($m)	45.3	45.3	45.3	45.3	45.3	226.5

Table 8: Expenditure Reset RIN 2025-30

7.3.2 Risks/Benefits

In this option, our modelling shows that unassisted service failures are projected to be reduced compared to all options including counterfactual option. This option is the most effective choice for gradually moving towards achieving the criteria for lowering the failure rate and maximizing customer benefits.

While this option does require more resources and investment than the other options, the benefits for customers outweigh any potential drawbacks this extra cost. Although this option transitions Ergon Energy towards the reduction of failures at a gradual pace, it's essential to maintain the same level of investment as a minimum in the future to continue improving customer benefits and avoid the need for a significant increase in near-term investments.

8 OUTCOME OF OPTION ANALYSIS

8.1 Crossarm Failure Forecast

The pole top structure failure forecast for all main options is shown in Figure 9. In Option 2, where a portion of defects are left unattended, unassisted failures will escalate up significantly to an unsustainable level. Counterfactual, Option 1 and Option 3 (Preferred Option) are expected to produce similar outcomes with option 3 providing least failure rate among all options.

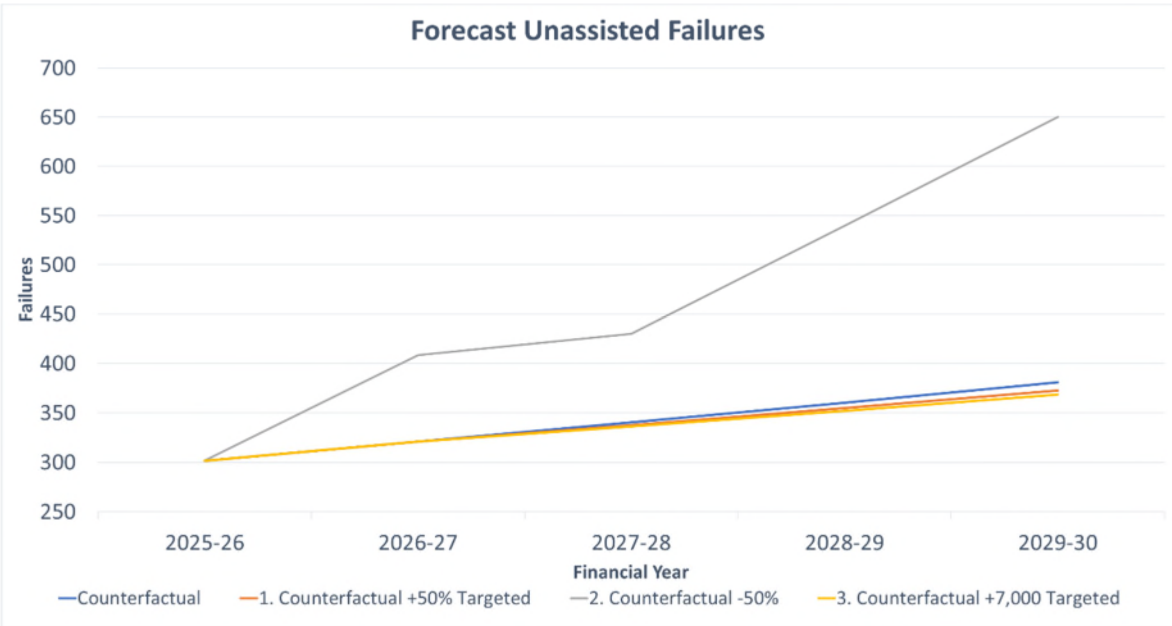

Figure 9: Unassisted Failures Forecast

8.2 Economic Analysis

The NPV of cost benefit analysis and related volumes of the options is summarised in Table 9 and Table 10 which demonstrates the following:

- Option 1 and 3 represented here shown a positive NPV against counterfactual, as both the options replacing more volume than counterfactual and providing additional benefit.
- Option 2 shown a negative NPV due to the increasing unassisted failures due to leaving majority of defects attended.
- Option 3 being the best option to transition towards asset performance improvement, maintain a sustainable replacement volume and avoid long term investment, an overall optimum outcome for our customers.

NPV Analysis to Counterfactual				
Intervention	Rank	Net NPV	Additional Cost	Benefit
Counterfactual	3	$0	$0	$0
1. Counterfactual +50% Targeted	2	$127,940,476	-$30,972,316	$158,912,791
2. Counterfactual -50%	4	-$571,694,273	$27,229,463	-$598,923,736
3. Counterfactual +7,000 Targeted	1	$198,142,825	-$47,978,920	$246,121,745

Table 9: NPV Analysis

Table 10 summarises the volume replacements for all options. It is notable that modelling forecast volumes based on historical failures and predicted by the modelling differs marginally from proposed volumes during 2025-30 as proposed volumes are based on average of three-year average historical replacements, specifically for counterfactual option.

Total Replacement					
	2025-26	2026-27	2027-28	2028-29	2029-30
Counterfactual	9,057	9,077	9,097	9,117	9,138
1. Counterfactual +50% Targeted	13,576	12,689	12,706	12,724	12,742
2. Counterfactual -50%	4,777	4,798	4,908	5,018	5,130
3. Counterfactual +7,000 Targeted	16,057	14,672	14,688	14,705	14,721

Table 10: Option Replacement Volume

Figure 10 illustrates the advantages of all options over their counterfactual and confirms option 3 and option 2 being optimal option for the community.

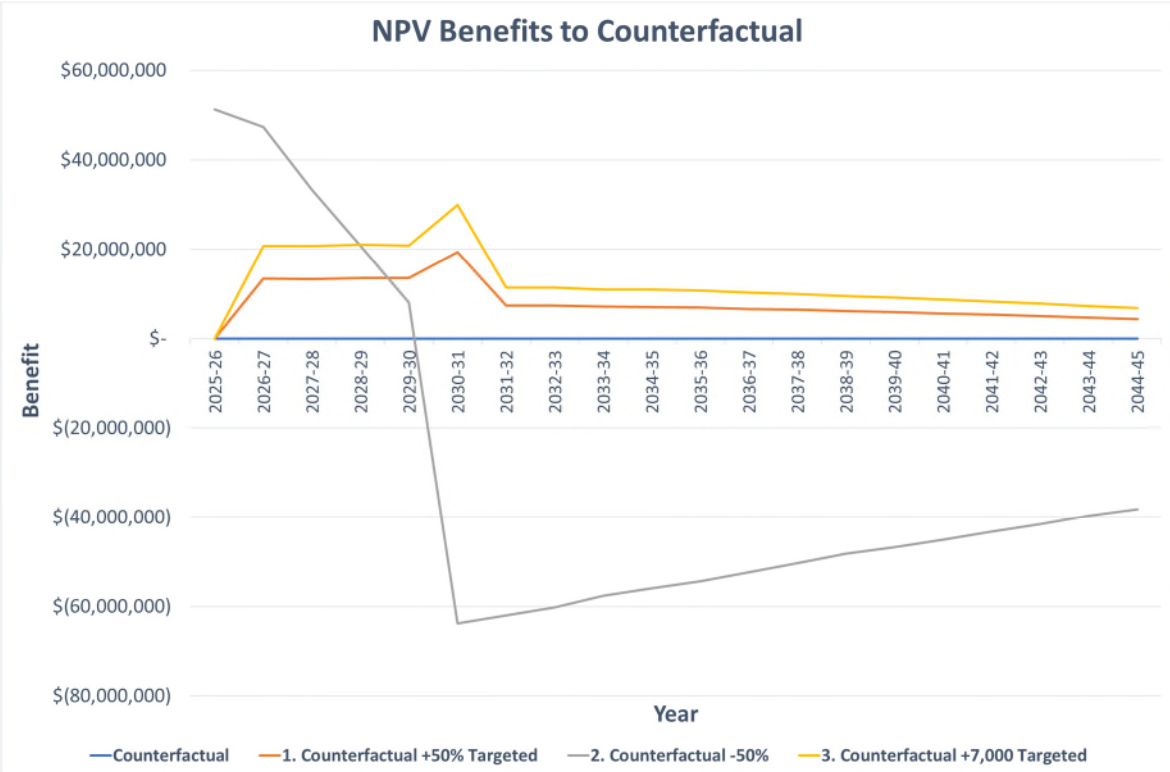

Figure 10: NPV Benefits for all Options compared to Counterfactual

The analysis presented in Table 11 compares the options to their respective counterfactual alternatives.

Criteria	Option 1 - Counterfactual +50% Targeted	Option 2 - Counterfactual -50%	**Option 3 - Counterfactual +7,000 Targeted (Preferred Option)**
Net NPV	$127.9	-$571.7	$198.1
Investment Risk	High	Low	High
Benefits	High	Very Low	Very High
Delivery Constraint	Med	Low	High
Detailed analysis – Advantage	- Customer benefit of $158.9m - Targeted replacement reduces defects - Transition towards improving the asset performance	- Investment saving of $27.2m - Do minimum option	- Customer benefit of $246.1m - Targeted replacement reduces defects - Transition towards improving the asset performance - Customer benefit outweigh resource and investment requirement
Detailed analysis – Disadvantage	- Additional investment of $31m - Additional resource requirement	- 50% of defects unattended - Failure rate increase - Additional risk of $599m to the customers	- Additional investment of $48m - Additional resource requirement

Table 11: Options Analysis Scorecard

9 SUMMARY

We have assessed and modelled three feasible options that we can undertake over the 2025-30 regulatory control period against counterfactual.

The modelling confirms that for our preferred Option 3, the total additional investment of $48m, provided a positive NPV benefit of $192m compared to the counterfactual option. It is noted that the modelled result for Option 3 shows that pole top structure performance is likely to improve marginally, but transition is gradual due to substantial ageing population.

9.1 Sensitivity Analysis

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

- Annual Risk cost
- Weighted Average Capital Cost (WACC)
- Probability of Failure (PoF).

In most of the sensitivity analysis outcomes, the Counterfactual (Preferred Option) has been demonstrated as the most prudent option.

10 RECOMMENDATION

The recommended program delivery in Option 3 (Counterfactual + 7,000 Targeted) is reflective of the commitment to provide maximum customer benefit and restrain customer price impacts. It 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 APPENDICES

11.1 Reset Rin Reconciliation

	2025/26	2026/27	2027/28	2028/29	2029/30
PoleTop Contributor	Replacement Expenditure	Replacement Expenditure	Replacement Expenditure	Replacement Expenditure	Replacement Expenditure
Grand Total	$86,586,459	$87,200,437	$87,609,756	$88,019,075	$88,223,735
Crossarm Defect	$25,622,217	$25,622,217	$25,622,217	$25,622,217	$25,622,217
Targeted Replacement	$19,673,879	$19,673,879	$19,673,879	$19,673,879	$19,673,879
CTG/CTS Program					
Reconductor Program Conseq	12,412,773	13,026,752	13,436,071	13,845,390	14,050,049
Conductor Defect Program Co	1,913,983	1,913,983	1,913,983	1,913,983	1,913,983
Pole Defect Program Conseq	26,963,607	26,963,607	26,963,607	26,963,607	26,963,607
Consequential Replacement	**41,290,363**	**41,904,341**	**42,313,660**	**42,722,979**	**42,927,639**

** Expenditure considered for this business case.*

 # Expenditure included in other investment programs (Pole Replacement, Overhead Conductor)

Table 12: Reset RIN – Expenditure $ 2022-23

$, direct 2024-25	2025/26	2026/27	2027/28	2028/29	2029/30
PoleTop Contributor	Replacement Expenditure	Replacement Expenditure	Replacement Expenditure	Replacement Expenditure	Replacement Expenditure
Grand Total	$98,523,841	$99,721,224	$100,688,829	$101,279,876	$102,261,520
Crossarm Defect	$29,154,666	$29,301,216	$29,447,303	$29,482,416	$29,699,115
Targeted Replacement	$22,386,250	$22,498,778	$22,610,950	$22,637,911	$22,804,303
CTG/CTS Program					
Reconductor Program Conseq	14,124,080	14,897,214	15,441,913	15,931,312	16,285,633
Conductor Defect Program Co	2,177,857	2,188,805	2,199,717	2,202,340	2,218,528
Pole Defect Program Conseq	30,680,988	30,835,211	30,988,946	31,025,897	31,253,941
Consequential Replacement	**46,982,925**	**47,921,230**	**48,630,576**	**49,159,549**	**49,758,102**

Table 13: Reset RIN – Expenditure $ 2024-25

	2025/26	2026/27	2027/28	2028/29	2029/30
PoleTop Contributor	Replacement Qty	Replacement Qty	Replacement Qty	Replacement Qty	Replacement Qty
Grand Total	30,808	31,026	31,172	31,317	31,390
Crossarm Defect	9,116	9,116	9,116	9,116	9,116
Targeted Replacement	7,000	7,000	7,000	7,000	7,000
CTG/CTS Program					
Reconductor Program Conseq	4,416	4,635	4,781	4,926	4,999
Conductor Defect Program Cons	681	681	681	681	681
Pole Defect Program Conseq	9,594	9,594	9,594	9,594	9,594
Consequential Replacement	**14,691**	**14,910**	**15,055**	**15,201**	**15,274**

** Expenditure considered for this business case.*

 # Expenditure included in other investment programs (Pole Replacement, Overhead Conductor)

Table 14: Reset RIN – Replacement Volume