Consequential Replacements | Overhead Conductor

Business Case

18 November 2024

Part of Energy Queensland

CONTENTS

REFERENCED DOCUMENTS

Document Number	Document Name	File Type
5.5.04B	Ergon - 5.5.04B - Distribution Lines Refurbishment Guideline - REPEX – 3034999 - November 2024 - public	PDF
5.5.01A	Ergon - 5.5.01A - Repex Ex-Post and Ex-Ante Narrative Document - November 2024 - public	PDF
5.5.01C	Ergon - 5.5.01C - RIN Repex Forecast Model Report – October 2024 - confidential	Excel
5.5.01D	Ergon - 5.5.01D - RIN Repex Forecast 2025-30 Revised Submission – October 2024 - public	PDF

1 SUMMARY

Title	ERG Consequential Replacement - Overhead Conductors AER 2025-30
DNSP	Ergon Energy Network
Expenditure category	☒ Replacement ☐ Augmentation ☐ Connections ☐ Tools and Equipment ☐ ICT ☐ Property ☐ Fleet
Purpose	The purpose of this Business Case is to: • Outline the drivers and need for the proposed investment in consequential **pole, pole top structure and service line** replacements resulting from Overhead (OH) Conductor replacement program. • Note that, we have accepted the reduced AER reduced alternate forecast outlined in the Draft Decision for the other consequential OH conductor replacements (distribution transformers and distribution switches) This document does NOT focus on the targeted replacement of OH conductors as the AER accepted Ergon Energy's draft proposal for OH conductor investments in the Draft Decision.
Identified need	☒ Legislation ☒ Regulatory compliance ☒ Reliability ☐ CECV ☒ Safety ☒ Environment ☐ Financial ☐ Other Due to the replacement of OH conductors, there is a need to consequentially replace poles, pole top structures and service lines which is driven by the following: • Minimum design requirements of the assets • The distribution line refurbishment guidelines; and • Our efficiency bundling guidelines. The objective of the planned refurbishment programs is to remove the highest risk assets from the network first whilst delivering efficient programs that address multiple risks in a logical bundle of work wherever possible. In the reconductoring program if the consequential assets are operating beyond their expected life (e.g.; pole >50 years, TR >45 years) they are recommended to be part of reconductoring project to avoid future defects and unplanned outage from failure of these assets, emission improvement from avoiding repeated visits.

Expenditure for Proposed Option	**Table 1: Proposed expenditure in the 2025-30 period on consequential OH conductors (excluding already accepted Transformer and switches)**

Year $m, direct 2024-2025	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Poles	17.8	18.6	19.1	19.7	20	95.2
Pole tops	16.1	16.8	17.3	17.8	18.1	86.2
Service lines	4.1	4.3	4.4	4.6	4.7	22.1
Total Consequential (This Business case)	***38***	***39.7***	***40.9***	***42.1***	***42.8***	***203.5***
+ “AER Approved” Conductor	44.9	46.9	48.3	49.7	50.5	240.3
+ “AER Approved” Consequential Distribution Transformer (alternate fcst)	4.7	4.9	5.1	5.2	5.3	25.3
+ “AER Approved” Consequential Distribution Switchgear (alternate fcst)	4.3	5.1	5.3	5.4	5.6	25.7
Grand Total (Conductor + Consequential)	**91.9**	**96.6**	**99.6**	**102.5**	**104.2**	**494.8**

2 PURPOSE AND SCOPE

The purpose of this business case is to justify the need for consequential replacements associated with the replacement of OH conductors. Consequential replacements of assets—such as poles, pole tops, and services—are unavoidable when replacing aged OH conductors. This business case focuses on evaluating the necessity and benefits of these replacements and provides a rationale for their inclusion in the OH conductor replacement program for the 2025–30 regulatory control period.

This business case covers the need for the consequential replacements of associated poles, pole-top structures, and services as a result of OH conductor replacements.

All financial references in this document are based on real $2024-25 and excludes overheads.

3 BACKGROUND

The management of Ergon Energy's OH conductors is uniquely complex, due to the diversity of our assets and network conditions. As Ergon Energy is an amalgamation of six legacy organisations, we maintain a very diverse population of OH conductor types and sizes.

OH conductors are an asset of strategic importance as they provide the physical connection for the safe and reliable distribution of electricity. Failure of these assets negatively impacts Ergon Energy's ability to comply with business objectives related to safety, customers, and compliance. To effectively manage these assets, Ergon Energy considers factors such as the large geographically dispersed asset population, the age, range, and variability of conductor materials, and the diverse environmental and operational conditions.

Additionally, with the implementation of new OH conductors, other assets that contribute to the structural integrity of the distribution network may need to be replaced (aged (pole and pole top) and problematic associated assets (service).

3.1 Asset Population

Ergon Energy maintains a population of approximately 144,815km of OH conductor route length throughout Queensland at distribution, sub-transmission, and transmission voltages. The majority of our OH conductors are installed at distribution voltages of less than or equal to 11kV (47%) or as part of the single wire earth return (SWER) distribution network (34%).

3.2 Asset Management Overview

OH conductors are an asset of strategic importance to the network as they provide the physical connection for the safe and reliable distribution of electricity. Failure of these assets is significant as it adversely impacts our ability to meet business objectives related to safety, customers, and compliance. This includes System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) targets.

OH conductors are high-volume, low individual-cost assets, and typically need to be replaced alongside other asset replacement if the minimum design requirements of the new asset necessitate a new OH conductor.

4 PROBLEM STATEMENT

The design requirements of overhead (OH) conductors necessitate the replacement of poles, pole top structures, and service lines to ensure the reliability and safety of Ergon Energy's distribution network and service to customers. This maintains the levels of reliability and safety of Ergon Energy's distribution network and service to customers.

5 COMPLIANCE

As an electricity entity, Ergon Energy has a duty to comply with all current legislation, regulations, rules, and codes. For example, an electricity entity must comply with the following:

- **Electrical Safety Act 2002 (Qld) s29**
    - An electricity entity must ensure that its works are electrically safe and operated in an electrically safe manner. This includes the requirement that the electricity entity inspects, tests, and maintains the works.
- **Electricity Regulation 2006 (Qld)**
    - An electricity entity must, in accordance with recognised practice in the electricity industry, periodically inspect and maintain its works to ensure the works remain in good working order and condition.
- **Electricity Safety Regulations 2013 (Qld)**
    - General obligations related to the safety of works of an electrical entity for this asset class outline specific obligations regarding clearances to the ground and nearby structures, including vegetation clearing and management. Schedules 2 and 4 of the Regulations specify the distances required for exclusion zones and clearances. EQL is also required to notify the Electrical Safety Office in the event of any Serious Electrical Incident (SEI) or Dangerous Electrical Event (DEE).
    - Energy Network Association (ENA), the peak national body representing gas and electricity distribution and transmission throughout Australia, has acknowledged that the conductor population is ageing globally and despite technological changes, there had been little change in cost-effective monitoring of conditions of conductors.
    - Good industry practice including degradation mechanisms, and holistic lifecycle management of overhead lines, is described in AS/NZS7000 Overhead Line Design Standard and previous versions of C (b) 1 – Guidelines for the Design and Maintenance of Distribution and Transmission Lines.
    - Ergon Energy has a strategic objective to ensure a safe, cost-effective, and reliable network for the community. Performance targets associated with these asset classes, aim to reduce in-service failures to levels that deliver a safety risk outcome that is considered SFAIRP and as a minimum maintains current reliability performance standards including the SAIDI and SAIFI targets agreed with AER.

6 OVERVIEW OF REPLACEMENT VOLUME AND EXPENDITURE

During OH conductor replacement, the condition of the supporting structure and other equipment affixed to the supporting structure is evaluated to determine whether it is feasible and cost-effective to replace them. This includes poles, pole top structures, transformers, service lines, and switches (this business case only focuses on poles, pole top structures and service lines). Ergon Energy has accepted the AER's Draft Decision and the reduced alternate forecast for distribution transformers and distribution switches.

We consider consequential equipment replacement as an integral part of conductor replacement. In their Draft Decision, the AER did not accept a proportion of the proposed consequential replacements of poles, pole tops and service lines as part of the OH conductor business case, citing further justification is required. For the 2025-30 period, the consequential replacement volumes forecast from the last 3-year actual averages are shown in Table 2.

Table 2 : Consequential Asset Volume in Reconductor Program – Proposed Program

Proposed Program (2025-30) Consequential Replacement Volume, $m	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Pole	2,529	2,638	2,710	2,783	2,819	13,478
Pole Top	5,086	5,305	5,451	5,596	5,669	27,107
Service Lines	2,739	2,857	2,935	3,014	3,053	14,599

The indicative revised proposal investment amount over the 2025-30 period for consequential OH conductor replacements is $204.4 million, which can be seen in Table 3.

Table 3 : Consequential Replacement Ex-Ante Investment Amount

Relevant Asset, $m	Draft Proposal	AER Draft Decision	Revised Regulatory Proposal
Pole	95.6	53.0	95.6
Pole Top	86.7	48.1	86.7
Service Lines	22.1	12.3	22.1
Total	**204.4**	**113.4**	**204.4**

7 CONSEQUENTIAL REPLACEMENT DRIVERS

7.1 Standard Design Requirements

When reconductoring old lines, we must assess the line according to modern standards, specifically AS/NZS 7000. This can be better understood through an example:

An old copper conductor is typically replaced with an aluminium-based conductor, as aluminium is the modern standard. Aluminium conductors have different strength, sag, and tension characteristics and need to be of a larger diameter to match the conductivity of copper for the same current rating. Additionally, the conductor strand size must ensure reliability and prevent future broken strands, which is a known issue with the 0.064” (1.6mm) strand of copper.

For instance, replacing 7/.064 Cu (4.9mm diameter) with Libra 7/3.00 AAC (9mm diameter) results in a larger diameter that increases wind loading on the attachments, crossarms, and poles. During this assessment, we must adhere to the modern standards applicable at the time of reconductoring. Over time, standards have become more stringent, so everything from the required pole foundation depth to the strength of poles and crossarms needs to be reviewed for suitability.

In many cases, poles designed and installed decades ago will not meet modern requirements when a new conductor is installed. Therefore, the consequential replacements must be made regardless of age or level of defect. Below is an additional example: Designers use the CATAN program for their designs. The pole in question is an inline pole with a raiser and is nailed.

This approach ensures that all aspects of the line are evaluated and updated to meet current safety and reliability standards. In Table 4 below, the after-replacement factor of safety has increased to improve structural integrity (i.e., allow for greater levels of pole degradation and increasing wind loading).

Table 4 : Limit state before and after replacement

	Before Replacement	After Replacement
Calc Tipload Limit State (kN)	5.25	5.35
Foundation Limit State (kN)	5.26	7.25

Figures 1 and 2 below are snap shots using the engineering tool, CATAN. From this engineering assessment, for the conductor replacement project, it was found that the existing pole has a maximum Tipload (Figure 1 - 5.26kN) which would not meet the safety requirements for the new conductor (Figure 2 - 5.35kN). Therefore, the existing pole would not be able to safely support the new conductor and needed to be replaced.

Figure 1 : Before replacement, increased tipped limit state calculations

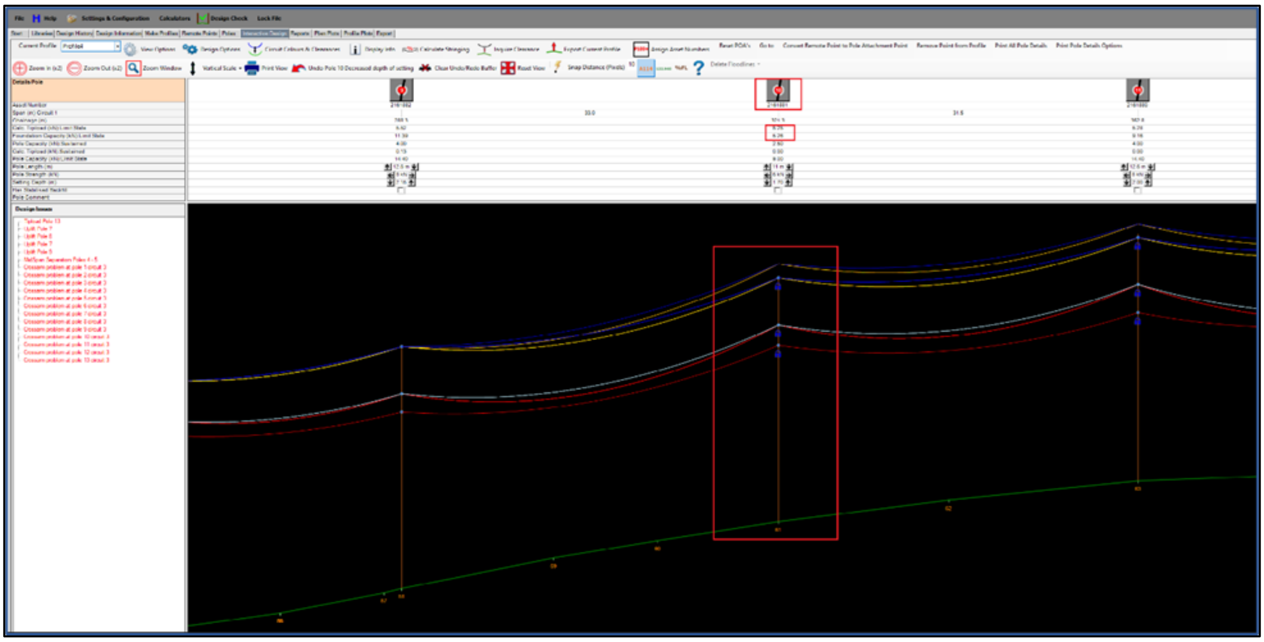
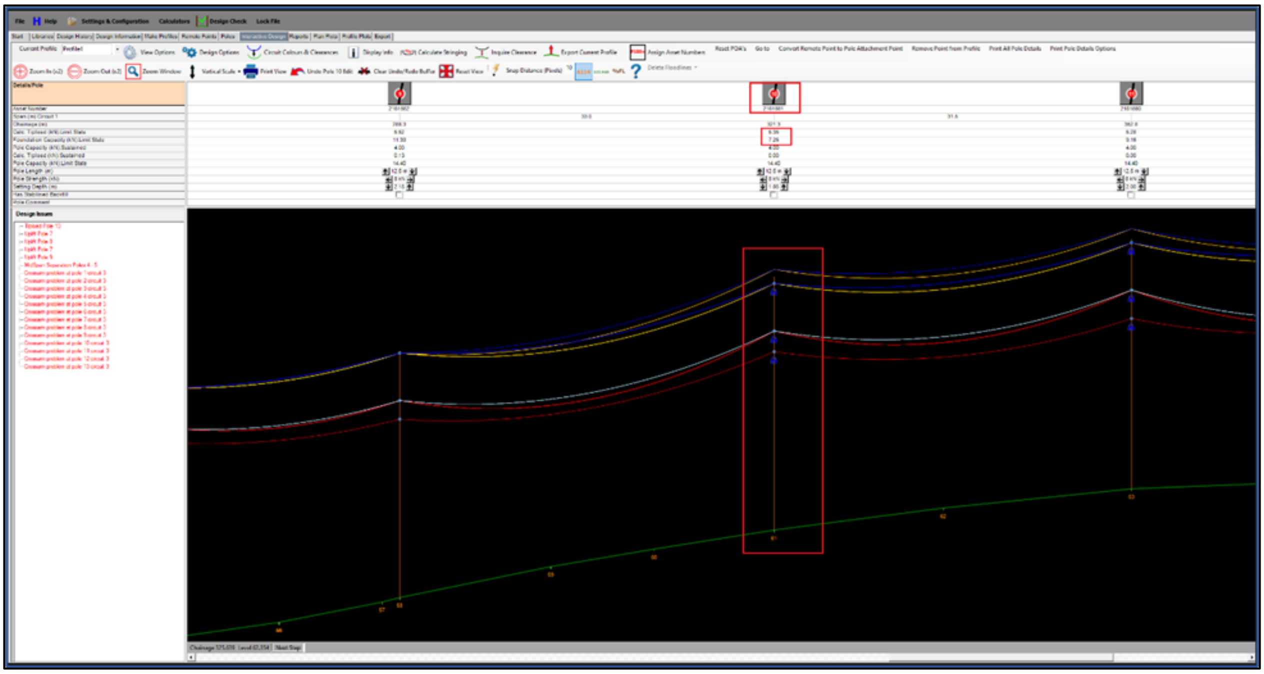


Figure 2 : After replacement increased in Tipped Limit State calculations



7.2 Repex Guidelines

The primary objective of the targeted conductor replacement program is to remove high-risk assets from the network while delivering efficient programs that address multiple risks in a logical bundle of work. The guideline provides specific criteria for replacing OH conductors, and corresponding consequential replacements. Targeted conductor replacement is the main driver, especially in urban areas with high PV penetration. The document emphasises balancing the expected life of conductors, poles, and attached hardware to minimise maintenance visits. Consequential replacements of poles, crossarms, and other components are necessary due to different design requirements and modern standards, ensuring overall network reliability and safety. An example of the poles replacement criteria included in the guidelines can be seen in Figure 3.

Figure 3 : Excerpt from Repex Guidelines showing pole replacement guidelines

Poles:

- Treated pole >= 55 years old
- Untreated pole > 65 years old
- Age of the nail >= 15 years old
- Pole is being replaced and is within 5km of the coast, replace the stay cable and stay rod
- Pole is being replaced and is on an agricultural property with irrigation used for seasonal cropping, replace the stay cable and stay rod
- Pole is being replaced and the stay rod is a legacy eye-bolt or turnbuckle, replace the stay rod
- Pole is being replaced and the pole is >25 years old, replace the stay cable and stay rod
- Visual inspection indicates severe deterioration in accordance with the LDCM, replace the stay wire and stay rod accordingly.

7.3 Efficiency Bundling

In accordance with our 2019 Bundling Guidelines, we bundle work to achieve more efficient outcomes, guided by a specific matrix and criteria. For example, we combine P1 and P2 defects with planned replacement works, such as addressing problematic overhead service wires within maintenance zones. This approach allows us to:

- Maximise efficiency by replacing poles, pole top structures, and service lines alongside reconductoring, especially in regional areas, avoiding multiple truck visits.
- Reduce costs by minimising repeated deployments to the same locations.
- Enhance safety and supply reliability by reducing road closure times.

This approach aligns with updated service standards requirements. The conductor replacement program focuses on high-risk assets, such as targeted conductors. To ensure efficient delivery, we bundle other assets with these replacements, including poles, cross arms, and service lines, based on design, safety criteria, asset age, and condition.

8 CONCLUSION

Ultimately, this Business Case supports the need for the consequential replacement of poles, pole top structures, and service lines during the 2025-30 regulatory period under the overhead conductor replacement program. This comprehensive asset management approach ensures that the network is aligned with updated design, regulatory, and safety standards. By bundling these replacements, Ergon Energy maximises efficiency, reduces costs, and enhances both safety and reliability across the network, particularly in regional areas. This approach aligns with our legislative and regulatory obligations, ensuring that Ergon Energy's distribution network continues to provide safe and reliable service to customers. The proposed investment of $204.4 million will support these objectives, enabling Ergon Energy to meet performance targets and maintain compliance with updated service standards and industry guidelines.

9 GLOSSARY

Term	Meaning
ACSR	Steel Reinforced Aluminium Conductors
AER	Australian Energy Regulator
CBRM	Condition Based Risk Management
CNAIM	Common Network Asset Indices Methodology
CoF	Consequence of Failure
DEE	Dangerous electrical event
DNSP	Distribution Network Service Provider
ENA	Energy Network Association
EOL	End of life
FY	Financial Year
HDBC	Hard Drawn Bare Copper
HI	Health Index
km	Kilometer
kV	Kilovolt
kWh	Kilowatt hour
LoC	Likelihood of Consequence
MSSS	Maintenance Strategy Support System
NER (or Rules)	National Electricity Rules
NPV	Net Present Value
OH	Overhead [Conductor]
PIR	Post Implementation Review
PoF	Probability of Failure
REPEX	Replacement capital expenditure
RIN	Regulatory information notice
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SC/GZ	Galvanised Steel
SEI	Serious Electrical Incident