ASSET CLASS OVERVIEW

OVERHEAD CONDUCTORS

UE BUS 4.03 – PUBLIC
2026–31 REGULATORY PROPOSAL

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1. Overview

Our overhead conductor population comprises almost 10,000km of lines. Our conductor replacement program, therefore, is critical to our ability to maintain network reliability and minimise safety risks as far as practicable in accordance with our legislated and regulatory obligations.

Since 2019, the number of HV conductor failures and high priority defects have been increasing.

Further, our condition forecasts show that in the absence of any intervention before 2031, 44 per cent of our overhead conductor population (or approximately 1,585km) will have a modelled condition rating associated with higher risks of failure. This compares to only 10 per cent of the population today.

Although we have been managing our overhead conductor performance to date, the scale of our conductor population and the ongoing deterioration in condition (as these assets continue to age) supports the need to move toward more sustainable intervention volumes.

Our proposed intervention approach, therefore, represents a step-up on replacement volumes relative to those completed in the 2021–26 regulatory period. This uplift is driven by a risk-based program which aims to address our HV bare conductor failure risk.

The scale of our forecast program also balances overall deliverability and affordability considerations. Specially, we are not seeking to intervene on all conductor sections that have been identified as economic to replace through our risk modelling—overall, our annual forecast replacement rate of 0.6 per cent remains very low and implies our conductors on average will need to last 170 years before replacement.

A summary of our forecast expenditure for overhead conductor for the 2026–31 regulatory period is set out in table 1.

TABLE 1 OVERHEAD CONDUCTOR: EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Defective conductor	2.1	2.2	2.3	2.4	2.4	11.4
Risk-based HV conductor	9.5	9.5	9.5	9.5	9.5	47.4
Total	**11.6**	**11.7**	**11.8**	**11.8**	**11.9**	**58.8**

2. Background

Overhead conductors and connectors are key network assets that provide the electrical conducting medium to connect various parts of the electrical network. They are attached to poles and interconnected throughout the electrical network to distribute electricity.

This section provides an overview of our conductor asset class, including a high-level summary of our compliance obligations, asset population and age profile.

2.1 Our reliability and safety obligations

We operate under a combination of national and state legislation which establish our obligations and the regulatory framework under which we operate.

The National Electricity Rules sets out reliability and safety obligations and the Electricity Distribution Code of Practice include performance requirements. We must also manage our network assets in accordance with the Electricity Safety Act 1998, the Electricity Safety (Management) Regulations 2019, the Electricity Safety (Bushfire Mitigation) Regulations 2023 and the Victorian Environment Protection Act 2017.

These obligations can be summarised as follows:

- Electricity Safety Act 1998 – requires us to minimise safety risk 'as far as practicable' including bushfire danger
- Electricity Distribution Code of Practice – requires us to manage our assets in accordance with principles of good asset management and to minimise the risks associated with the failure or reduced performance of assets
- National Electricity Rules – requires us to forecast expenditure to maintain the quality, reliability and security of supply of our networks and maintain the safety of the distribution system
- Victorian Environment Protection Act (2017) – requires us to reduce the risk of harm from our activities to human health and the environment and from pollution or waste.

In short, we must maintain reliability, minimise safety risk 'as far as practicable' including bushfire danger arising from our network, and reduce the risk of harm to the environment.

2.2 Asset population

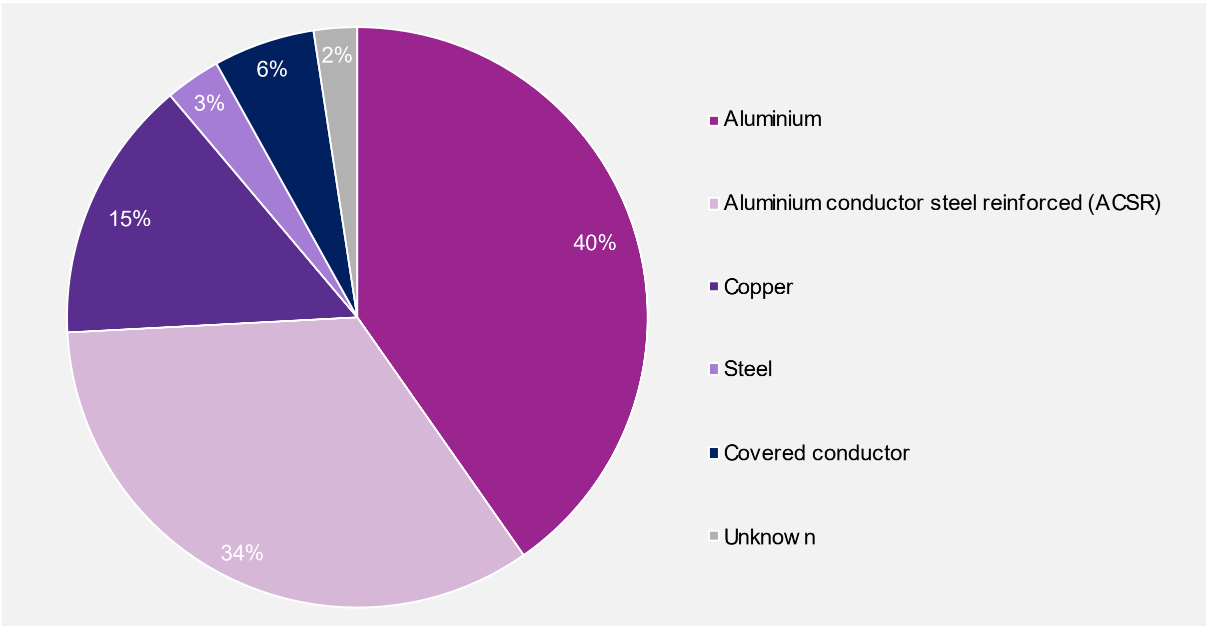
Our overhead conductor population comprises low voltage (LV), high voltage (HV) and sub-transmission conductor, as shown in table 2. The majority of our overhead conductors are LV.

TABLE 2 OVERHEAD CONDUCTOR: POPULATION BY VOLTAGE (KM)

CONDUCTOR VOLTAGE	TOTAL LENGTH
LV	5,705
HV	3,609
Sub-transmission	612
Total	**9,927**

The material types of our conductor are also shown below, with aluminium and aluminium conductor steel reinforced (ACSR) comprising the majority of the population.

FIGURE 1 OVERHEAD CONDUCTOR: POPULATION BY MATERIAL



2.3 Asset age profile

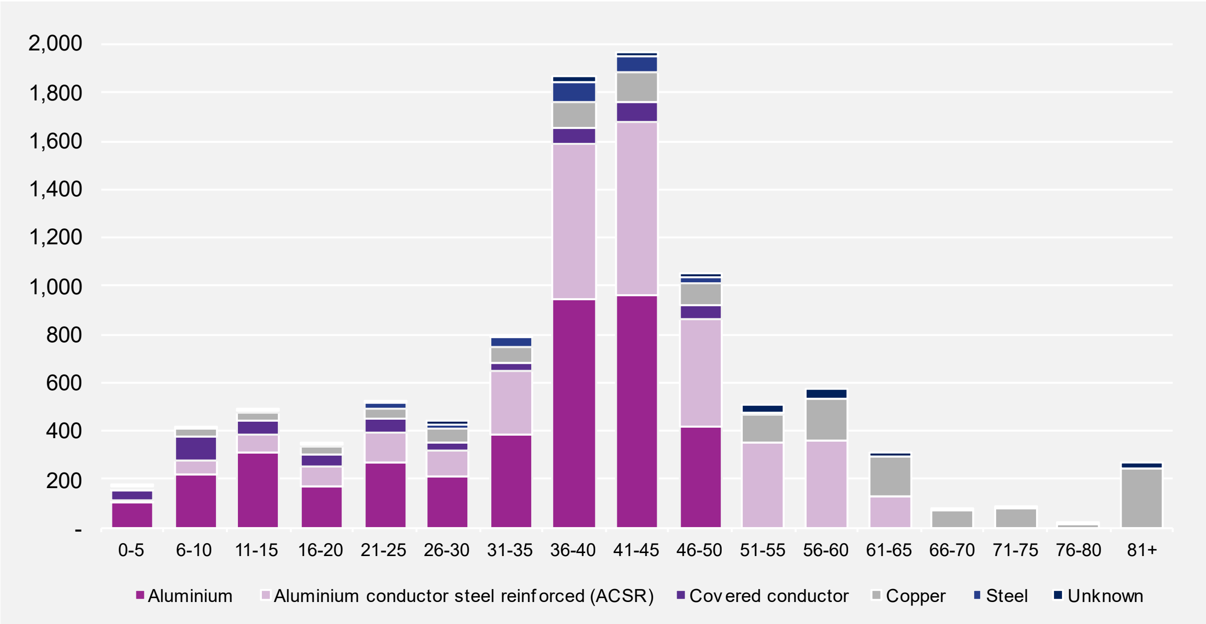
Table 3 sets out the expected service life for our different conductor materials. This service life is the expected period of time after which the asset is unlikely to be fit for purpose, typically determined by safety, technology and/or obsolescence.

TABLE 3 OVERHEAD CONDUCTOR: EXPECTED SERVICE LIFE (YEARS)

TYPE	MATERIAL	EXPECTED SERVICE LIFE
Bare	AAC	60
	ACSR	65
	Steel	70
	Copper	80
Covered	Aerial bundled cable and covered conductor	30

The corresponding age profile of our conductor asset population is shown in figure 2.

FIGURE 2 OVERHEAD CONDUCTOR: AGE PROFILE BY MATERIAL TYPE (KM)



3. Identified need

The performance of our overhead conductor may impact our network service level as failures may lead to a loss of supply for customers, pose safety risks to our personnel and the public, and start fires, particularly in electric line construction areas (ELCAs) and hazardous bushfire risk areas (HBRA).

The identified need, therefore, is to manage our overhead conductor population to maintain reliability and minimise safety risks as far as practicable, consistent with our regulatory and legislative obligations.

The large volume of our overhead conductor population, and its underlying condition and age profile, is also driving the need to move toward more sustainable intervention volumes to prudently manage deliverability and safety factors.

This section outlines the historical performance and condition of our overhead conductor, which has informed how we assess (and respond, as required to) this identified need.

3.1 Historical asset performance

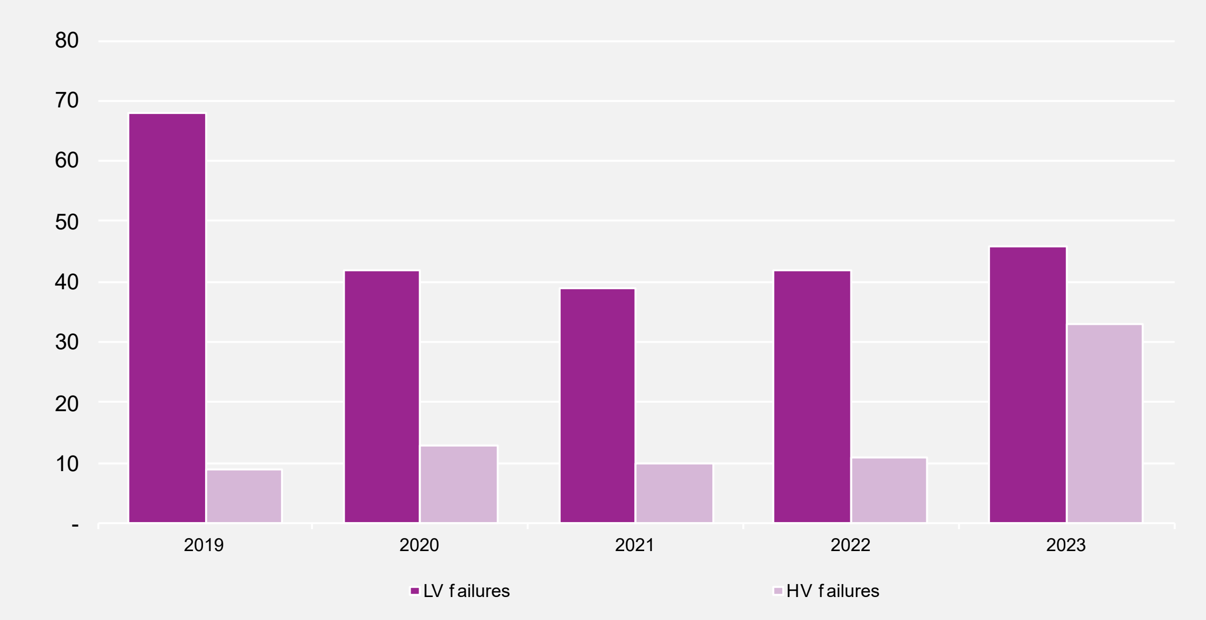
In assessing the need to intervene on our overhead conductor assets, we monitor several asset performance indicators, including asset failures, high priority defects, and asset condition. These indicators inform our underlying asset management response—for example:

- increasing unassisted asset failures indicates a likely need to act immediately and review asset management practices (noting that robust inspection practices and governance over the application of these methods may drive low failure rates, but if the underlying condition of the relevant asset population is poor and/or deteriorating, high and/or increasing intervention volumes may still be prudent and efficient)
- increasing high-priority defects or deteriorating condition (relative to asset management thresholds) indicates a likely need to act soon to increase interventions over time, and/or undertake risk-based assessments.

3.1.1 Historical failures

As shown in figure 3 our HV conductor failures have been increasing since 2019, with a significant jump in 2023. Following a reduction in 2020, our LV conductor failures have also been trending upwards since 2021.

FIGURE 3 OVERHEAD CONDUCTOR ASSET CLASS: LV AND HV FAILURES



3.1.2 Historical defects

Consistent with our regulatory obligations, we inspect our overhead conductor located in HBRA every two to three years and every five years for overhead conductor in low bushfire risk area (LBRA). These cyclic inspections provide snapshots in time of the overhead conductor condition and identify any defects.

Our response to identified defects depends on the nature and severity of the defect, and may include more frequent re-inspections. High priority defects that result in intervention are shown in table 4.

TABLE 4 RESPONSE TIMEFRAMES FOR HIGH PRIORITY DEFECTS

PRIORITY	TIMEFRAME FOR INTERVENTION
P1	Make safe within 24 hours of identification (replacements or repairs can occur beyond the initial 24 hours)
P42	Addressed within 42 days of identification
P2	Addressed within 32 weeks of identification

As shown in figure 4, the number of high-priority HV defects have been increasing steadily since 2019, particularly P2 defects. Figure 5 shows that P2 defects have also been increasing for LV conductor, however, at a total level our LV high-priority defects have reduced.

FIGURE 4 OVERHEAD CONDUCTOR: HV HIGH-PRIORITY DEFECTS

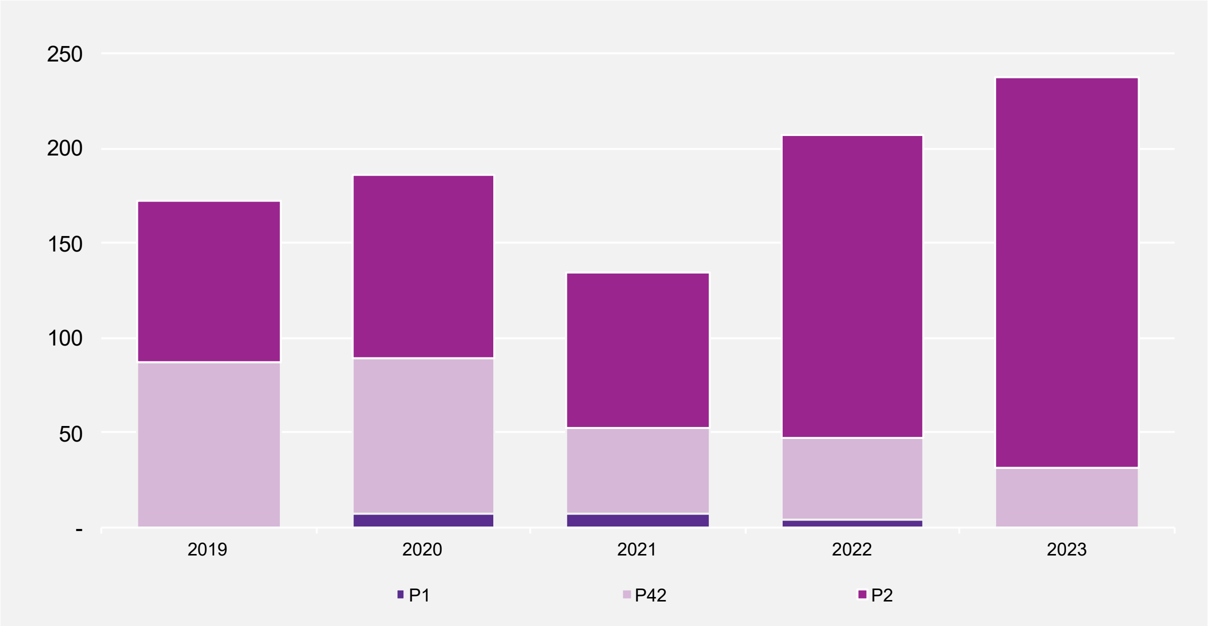
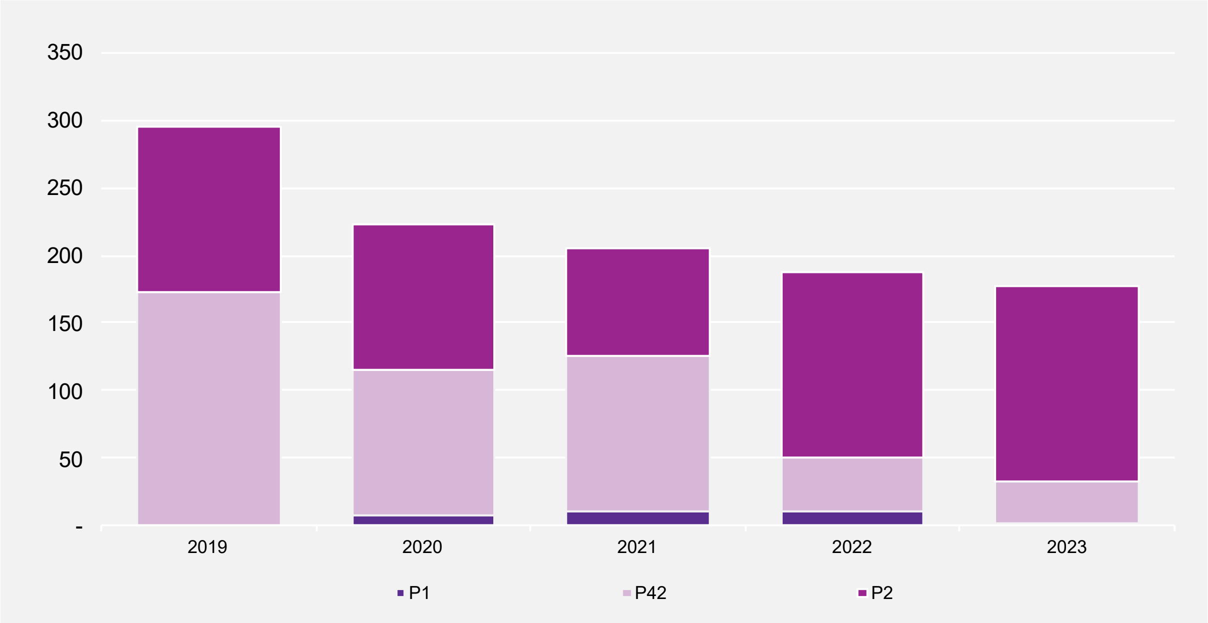


FIGURE 5 OVERHEAD CONDUCTOR: LV HIGH-PRIORITY DEFECTS

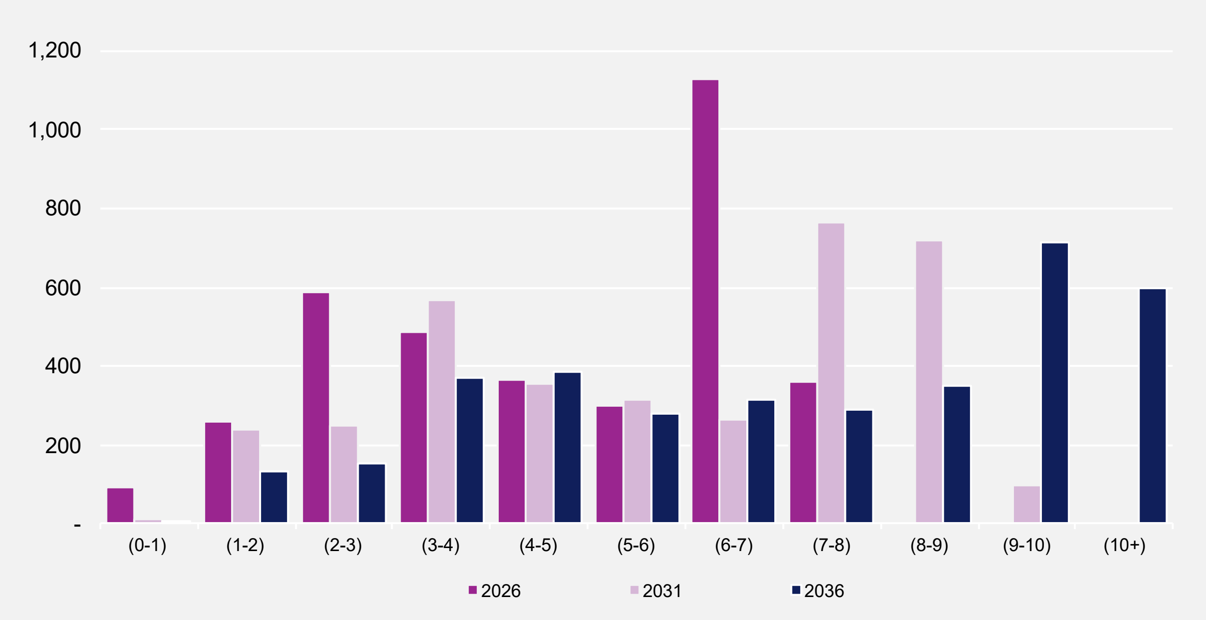


3.2 Asset condition

The condition of our overhead conductor is an important factor in considering the extent of the need to maintain the safety and reliability of our network for customers. Condition is represented by the health index derived in our condition-based risk management (CBRM) model.

The predicted health index profile for 2026, 2031 and 2036 is set out in figure 6. A health index of seven or higher is considered higher-risk, indicating that the asset has reached a point where there is a high chance of failure.

FIGURE 6 HEALTH INDEX PROFILE



As shown in table 5, the proportion of assets with a higher-risk asset condition rating is increasing. This deterioration in condition, coupled with the large underlying population and current level of replacements, supports the prudency of moving toward more sustainable intervention volumes.

TABLE 5 PROPORTION OF HIGHER-RISK OVERHEAD CONDUCTOR

YEAR	POPULATION (KM)	PROPORTION (%)
Higher-risk conductor: 2026	366	10
Higher-risk conductor: 2031	1,585	44
Higher-risk conductor: 2036	1,951	54

3.3 Demand growth

The electrification of everything from homes to transport, along with ongoing population growth, will require our energy system to evolve. By 2031, for example, we are forecasting a 25 per cent increase in annual consumption and 5 per cent growth in peak demand.

Growth in demand increases the energy that would not be supplied to customers if our overhead conductors failed.

We forecast demand at an asset level. Our risk modelling uses these asset level demand forecasts to accurately evaluate the energy at risk of not being supplied to customers downstream of specific assets.

4. Forecast interventions

Our current asset management approach for conductor includes cyclic inspections and interventions, where required, to meet service levels consistent with our compliance obligations and stakeholder expectations. Typically, replacement of end-of-life conductor is the only credible intervention response as refurbishment or repairs are not viable, and additional inspection and maintenance will not address the underlying asset condition.[1]

The derivation of our forecast interventions for the 2026–31 regulatory period, for our high-volume assets such as overhead conductor, are based on three broad categories—faults, corrective and risk-based forecasts. This approach is summarised in figure 7.

FIGURE 7 FORECAST CATEGORIES

Forecast interventions	=	Fault	+	Corrective	+	Risk-based
		Responses to asset failures that caused outages, including those due to external factors (such as third-party damage)		Interventions to address conditional failures associated with observable defects, deteriorated asset condition, and non-compliances		Proactive interventions based on cost-benefit analysis, where risk reduction benefits outweigh intervention costs

4.1 Forecast volumes

For the 2026–31 regulatory period, a summary of our forecast volumes for overhead conductor is shown in table 6.

In total, our forecast intervention volumes represent a step-up on those completed in the 2021–26 regulatory period. As discussed in more detail below, this uplift is driven by our risk-based program and is consistent with the need to begin prudently managing this asset class toward more sustainable long-term intervention volumes.

1 Complete conductor replacement is also typical due to the limitations of partial repairs. For example, replacing part of the conductor with sleeves will introduce additional points of potential failure and hence, increase the conductor failure rate.

TABLE 6 OVERHEAD CONDUCTOR: VOLUMES (KM)

VOLUMES	FY27	FY28	FY29	FY30	FY31	TOTAL
Defective and fault-based conductor replacements[2]	7	7	7	7	7	37
Risk-based HV conductor replacement	51	51	51	51	51	255
Total	**58**	**58**	**58**	**58**	**58**	**292**

Note: Volumes exclude interventions reported as overhead conductor (other) in our RIN as these are reported on a per unit basis

4.1.1 Fault forecasts

Faults on our overhead network occur somewhat randomly across our distribution area. Accordingly, our fault-based conductor intervention forecast is based on a simple average over the previous five-year period.

4.1.2 Corrective forecasts

Our corrective replacement forecast includes our defect driven volumes, which as shown in section 3.1.2, are increasing for HV conductor. The replacement length associated with a defect, however, will vary randomly.

Accordingly, we forecast our conductor defect volumes based on our historical five-year average replacement length.

4.1.3 Risk-based forecast

Risk-based replacements are based on a quantitative cost benefit assessment of replacement costs compared with the risks of conductor failure.

Our overhead conductor intervention forecast includes one risk-based program which is set out in appendix A. This program aims to address the risk of HV bare conductor failure.

Broadly, our risk assessments are underpinned by the monetisation approach shown in figure 8, which is consistent with the AER's asset replacement planning industry practice application note.[3]

The application of our risk-based approach is undertaken at the conductor section level because the entire length of a deteriorated conductor between two strain/tension poles needs to be replaced, which may include multiple spans. Only deteriorated conductor sections with positive net present value (NPV), where risk reduction outweighs the costs, are included in the risk-based replacement program. This ensures we only invest in replacements that are prudent and efficient that provide benefits to customers.

2 Volumes and expenditure associated with faults are consolidated with defective conductor for presentation purposes

3 AER, Asset replacement planning industry practice application note, July 2024, p. 38

FIGURE 8 RISK MONETISATION APPROACH

Probability of failure

The annual conductor section probability of failure was derived from our conductor CBRM model. Our CBRM model enables informed asset management decisions by using current asset information and experience to predict future asset condition, performance and risk.

Specifically, the probability of failure is derived from the conductor section health index in the CBRM.

Consequence of failure

Our approach to monetising risk compares the total cost (including risk) of technically feasible options. The preferred option(s) is that which provides the maximum benefit compared to costs. Figure 9 shows an overview of how we determine the total cost of each option. It identifies the most beneficial solution to manage the conductor section, based on the identified failure modes for an asset, and the corresponding likelihoods and consequences of failures.

FIGURE 9 OPTION RISK COST CALCULATION

The determination of these consequences is summarised below:

- network performance risk (energy at risk) is determined based on forecast demand and historical average outage duration for conductor failure. The value of energy at risk is based on the AER's determined value of customer reliability, and the likelihood of energy at risk is 100 per cent upon conductor failure (except for looped lines, where energy at risk will be avoided as there is an alternate supply path)
- safety risks to our staff or member of the public are determined based on the likelihood of a person present when the failure occurs, and the likelihood of an injury or death as a result. As the contribution of safety consequences are likely to be low for overhead conductor assets (given the high proportion of conductors in remote, rural locations), we have not quantified these risks in our cost-benefit analysis
- financial risks comprise unplanned replacement and unplanned repair impacts respectively, however, as conductor replacement is typically the only credible response to conductor failure, the likelihood of unplanned conductor replacement is typically 100 per cent. Unplanned conductor replacement costs are based on historical replacement costs
- bushfire starts can occur from sparks produced by a broken conductor. However, we have conservatively excluded bushfire risks from the risk-based programs set out in our appendices to ensure no double counting of bushfire reduction benefits with our broader bushfire mitigation programs.

4.1.4 Top-down portfolio review

As part of challenging our overhead conductor intervention forecast, we reviewed our forecast against the remainder of our replacement and augmentation portfolios to identify and remove any overlaps. No overlaps were identified.

As a further top-down consideration, our annual forecast replacement rate equates to 0.6 per cent of our total overhead conductor population. This implies that on average, our overhead conductor will need to last 170 years before we replace them. While we do not replace conductors based on age, this suggests our forecast replacement volumes are no regrets investment and consistent with the identified need to move toward more sustainable intervention volumes.

4.2 Expenditure forecast

To develop expenditure forecasts for our overhead conductor asset class, we have multiplied the forecast intervention volumes by observed unit rates for different conductor types.

Figure 7 summarises this expenditure forecast for the 2026–31 regulatory period.

TABLE 7 OVERHEAD CONDUCTOR: EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Defective conductor	2.1	2.2	2.3	2.4	2.4	11.4
Risk-based HV conductor	9.5	9.5	9.5	9.5	9.5	47.4
Total	**11.6**	**11.7**	**11.8**	**11.8**	**11.9**	**58.8**

A

RISK-BASED HV CONDUCTOR REPLACEMENT

A Risk-based HV conductor replacement

A.1 Identified need

As outlined in section 3, the number of HV conductor high priority defects and failures have been increasing since 2019. Further, the proportion of assets with a higher-risk asset condition rating is increasing—in the absence of any intervention by 2031, 44 per cent (i.e. approximately 1,585km) is forecast to have a health index rating exceeding seven. This compares to only 10 per cent of the population today (i.e. approximately 366km).

In comparison, since FY17 (i.e. the start of our previous 2016–20 regulatory period), we have replaced, on average, around 14km per annum.

The identified need, therefore, is to prudently manage deliverability, reliability and safety factors associated with an increasingly high volume of aged and deteriorated HV bare conductors.

A.2 Options considered

Table 8 lists all the potential options considered to address the supply risk to customers due to the failure of aged and deteriorated HV conductors.

TABLE 8 POTENTIAL OPTIONS

POTENTIAL OPTIONS		CREDIBLE OPTION
1	**Do nothing different** Maintain our existing maintenance program with no planned capital works	Yes
2	**Like for like replacement** Risk based replacement of aged and deteriorated sections of HV conductor to reduce the likelihood of failure	Yes
3	**Replace with covered conductor** Risk based replacement of conductor sections with new covered conductors to reduce the likelihood of conductor failure.	No; not credible as the cost of covered conductor is higher than bare conductors and it does not provide lower likelihood of failure.
4	**Increase inspection frequency** This option entails increasing line inspection frequency	No; increasing line inspection frequency will not reduce the conductor's probability of failure as the conductor can fail between inspections
5	**Install early fault detection (EFD)** This option entails installing EFD on the line, which detects potential conductor breakage	No; installing EFDs on aged and deteriorated conductors will increase costs and is impractical as these conductors will eventually need to be replaced

To assess the options above, we applied the methodology outlined in section 4.1.3 and compared the net benefits of option two relative to the do-nothing base case (i.e. option one).

Our risk-based methodology used a pro-rata feeder demand forecast to calculate the energy at risk. This was based on the conservative assumption that all HV feeder line sections can be back-fed, such that in the event of a conductor failure, only the line section with the failed conductor will lose supply.

In total, we assessed 30,515 individual HV bare conductor sections, totally over 3,479km of conductor. Of these line sections, 788km were demonstrated to have a positive economic case to intervene (relative to the do-nothing option).

As shown in table 9, and provided in further detail in our attached assessment model, this results in material economic benefits.[4]

TABLE 9 OPTION EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION TWO	NPV
Risk-based replacement of HV bare conductor sections	60.8

A.3 Preferred option

Option two—a risk-based replacement of aged and deteriorated sections of HV bare conductor—provides the greatest benefit to our customers. Notwithstanding this, a slower replacement program is likely to be more prudent with respect to deliverability.

Our preferred option, therefore, is to take a more cautious approach and increase conductor volumes incrementally over multiple regulatory periods—for the 2026–31 regulatory period, we are proposing to replace 25 per cent of the modelled volumes. We consider that this prudently provides opportunity for the impacts of electrification to be more fulsomely observed, and to inform future capacity needs as well as like-for-like replacements (while noting that volumes will need to escalate significantly in future regulatory periods).

We also note that ESV is expected to commence a broader review of overhead conductor management practices in 2025, and this may drive revised intervention volumes.

TABLE 10 OPTION EVALUATION: RELATIVE TO BASE CASE (KM)

OPTION TWO	VOLUME
HV conductor assessed: total	3,479
HV conductor assessed: economic	788
HV conductor proposed for intervention: 2026–31	255

Sensitivity analysis was used to test the robustness of individual conductor section to potential downside scenarios (e.g. higher costs and/or lower benefits). However, given the nature of our proposed approach—we are proposing to intervene on a small percentage of the conductor identified

4 UE MOD 4.07 – HV conductor risk based – Jan2025 – Public

as being economic to replace—this analysis has not changed the assessment of our preferred approach.

A summary of the proposed costs for the preferred option are set out in table 11.

TABLE 11 PREFERRED OPTION: EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Risk-based replacement of HV conductor	9.5	9.5	9.5	9.5	9.5	47.4

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