ASSET CLASS OVERVIEW

OVERHEAD CONDUCTORS

PAL BUS 4.03 – PUBLIC
2026–31 REGULATORY PROPOSAL

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1. Overview

Our overhead conductor population comprises almost 70,000km 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 high priority defects have been increasing.

Further, our condition forecasts show that in the absence of any intervention before 2031, approximately 45 per cent of our overhead conductor population (or around 25,700km) will have a modelled condition rating associated with higher risks of failure. This compares to long-term average annual replacement volumes of around 135km.

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 three separate risk-based programs, as well as compliance-driven program to rectify conductor clearance issues:

- risk-based replacement of 66kV radial line sections to address single point-of-failures for customers on rural sub-transmission lines
- risk-based replacement of polyphase HV conductors targeted at aged and deteriorated lines
- risk-based replacement of bare HV conductor as part of our ongoing bushfire mitigation program[1]
- compliance-driven rectification of conductor clearances following the improved use of inspection technology.

The scale of our forecast program, however, also balances overall deliverability and affordability considerations. Specifically, 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 0.2 per cent remains very low, and implies our conductors on average will last 500 years before replacement.

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

[1] The driver and underlying analysis supporting this risk-based program is set out in our separate bushfire mitigation overview, however, for completeness, the volumes and expenditure associated with this program are included in this asset class overview (noting that as this risk-based program results in the replacement of overhead conductor, the corresponding volumes and costs are included in our overhead conductor category replacement forecasts in the reset RIN).

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

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Defective conductor	10.3	10.3	10.3	10.3	10.3	51.5
Rectification of clearances based on LiDAR	3.4	3.4	3.4	3.4	3.4	16.8
Replacement of 66kV radial lines	3.2	3.2	3.2	3.2	3.2	16.0
Replacement of aged and deteriorated HV conductors	0.4	0.4	0.4	0.4	0.4	2.0
Replacement of bare HV conductor bushfire mitigation	5.2	5.2	-	-	-	10.5
Total	**22.5**	**22.5**	**17.3**	**17.3**	**17.3**	**96.8**

Note: Our overhead conductor expenditure forecast included in our reset RIN includes a minor additional amount reflective of the allocation to overhead conductor from works undertaken as part of other asset replacements (e.g. replacement of pole mounted distribution transformers and switchgear typically result in minor associated overhead conductor works). This allocation is not shown above, but represents less than three per cent of our overhead conductor forecast.

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

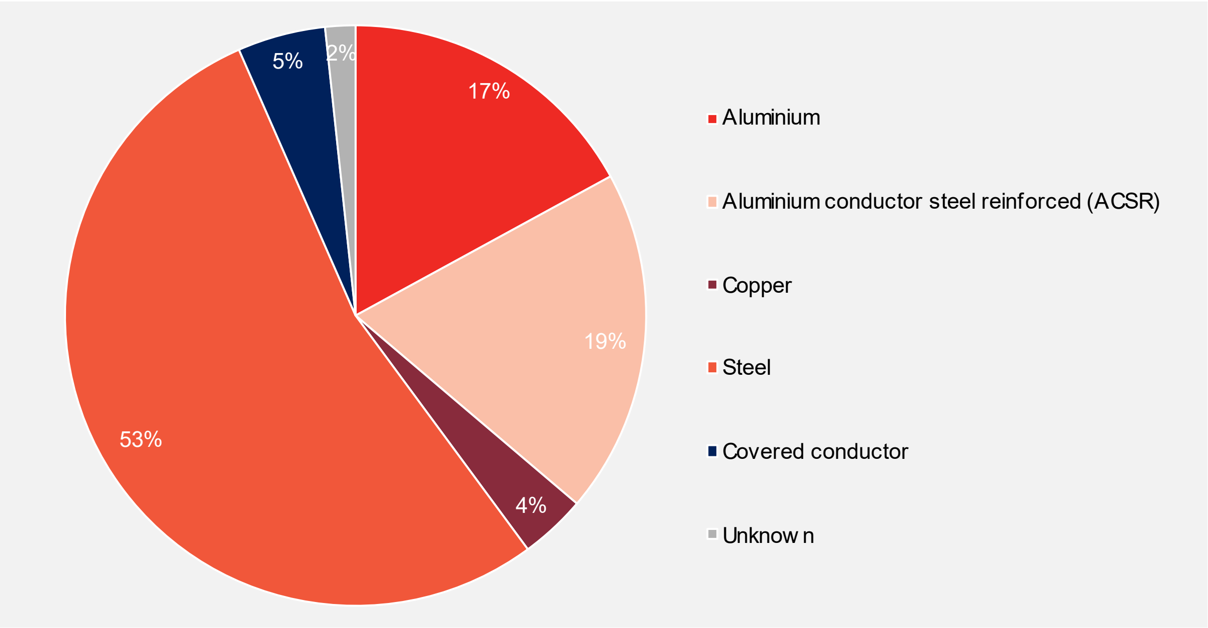
Our overhead conductor population comprises low voltage (LV), high voltage (HV) and sub-transmission conductor, as shown in table 2. The majority of our overhead conductors are HV.

TABLE 2 OVERHEAD CONDUCTOR: POPULATION BY VOLTAGE (KM)

CONDUCTOR VOLTAGE	TOTAL LENGTH
LV	10,670
HV: 11kV	55
HV: SWER	21,309
HV: 22kV	34,607
Sub-transmission	3,247
Total	**69,888**

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

FIGURE 1 OVERHEAD CONDUCTOR: POPULATION BY MATERIAL



2.3 Asset age profile

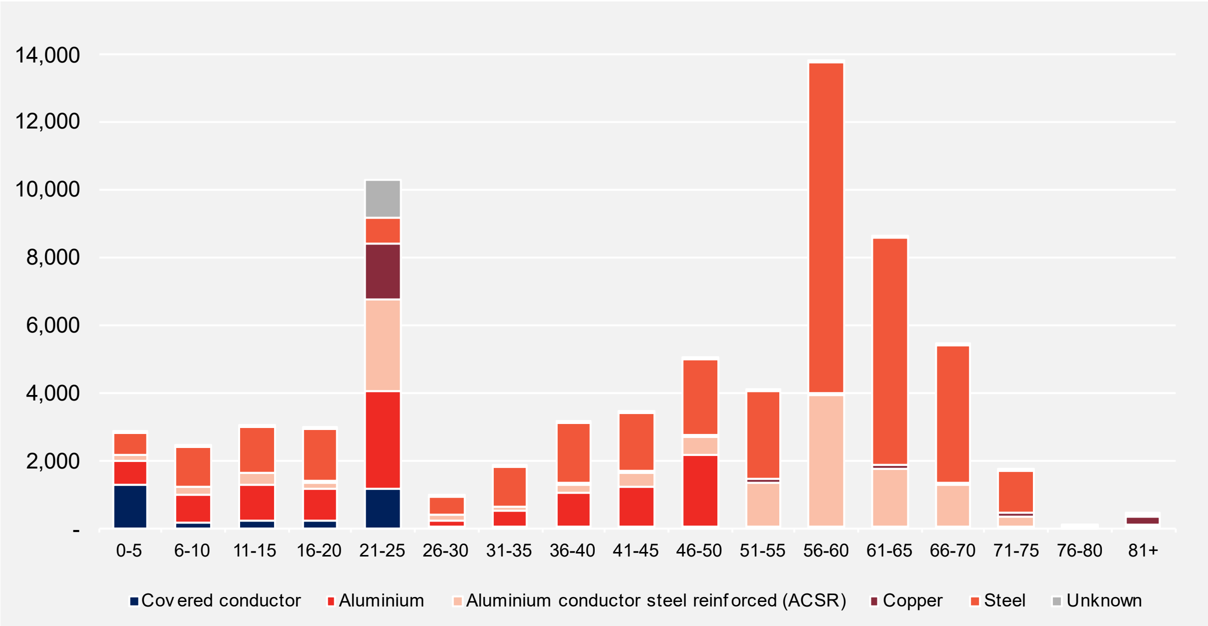
Table 3 sets out the expected service life for our different conductor materials. This service life is the expected period of time after which the asset is unlikely to be fit for purpose, typically determined by safety, technology and/or obsolescence.

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.[2]

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:

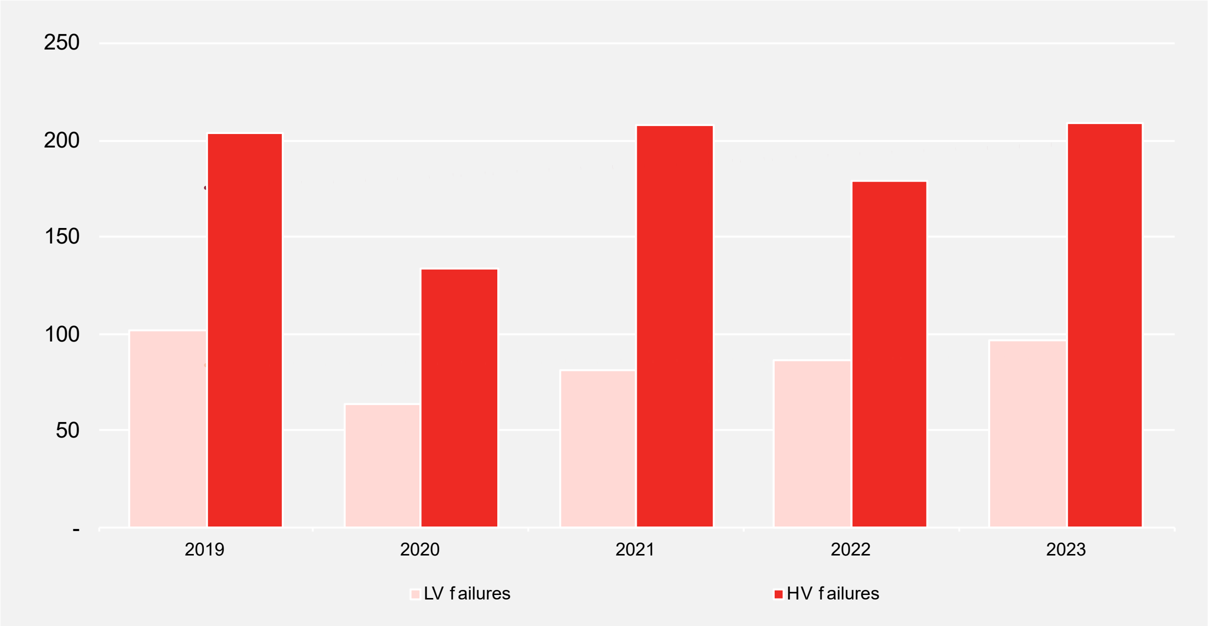
- increasing unassisted asset failures indicates a likely need to act immediately and review asset management practices (noting that robust inspection practices and governance over the application of these methods may drive low failure rates, but if the underlying condition of the relevant asset population 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, both LV and HV failures have been increasing since 2019, with a steeper gradient in HV failures.

2 As set out in appendix A, these obligations include current industry standards for electrical clearances.

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 and figure 5, the number of high priority LV and HV defects in our overhead conductor asset class have been increasing since 2019. Similar to failures, the gradient of the trend has been higher in our HV assets.

FIGURE 4 OVERHEAD CONDUCTOR ASSET CLASS: LV HIGH-PRIORITY DEFECTS

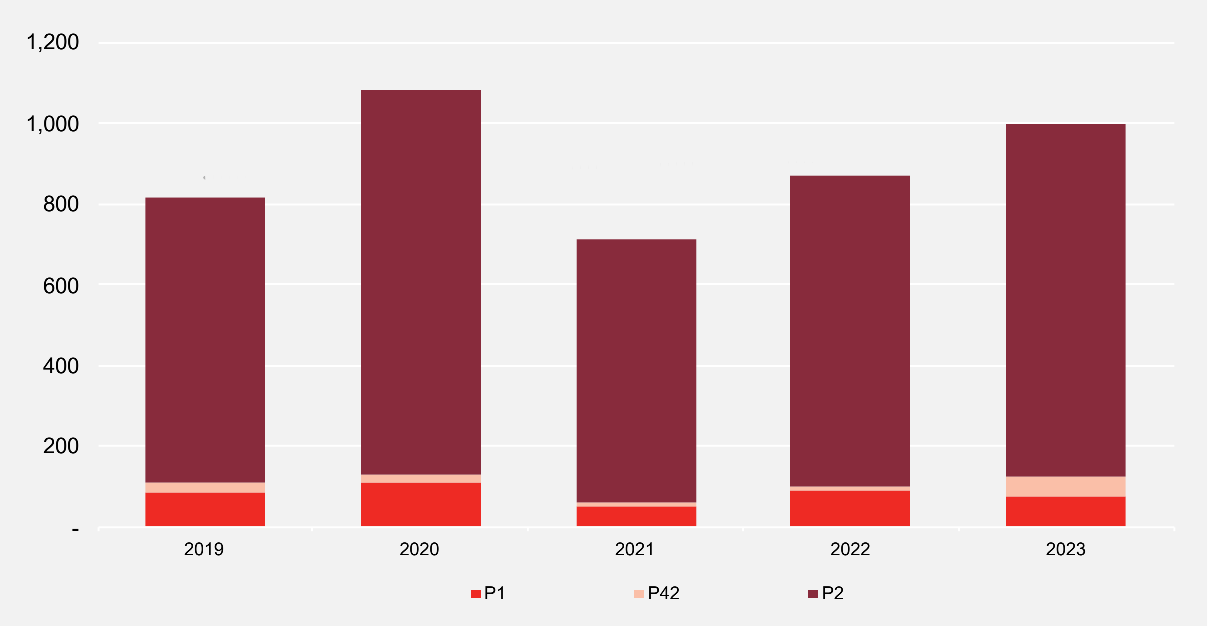
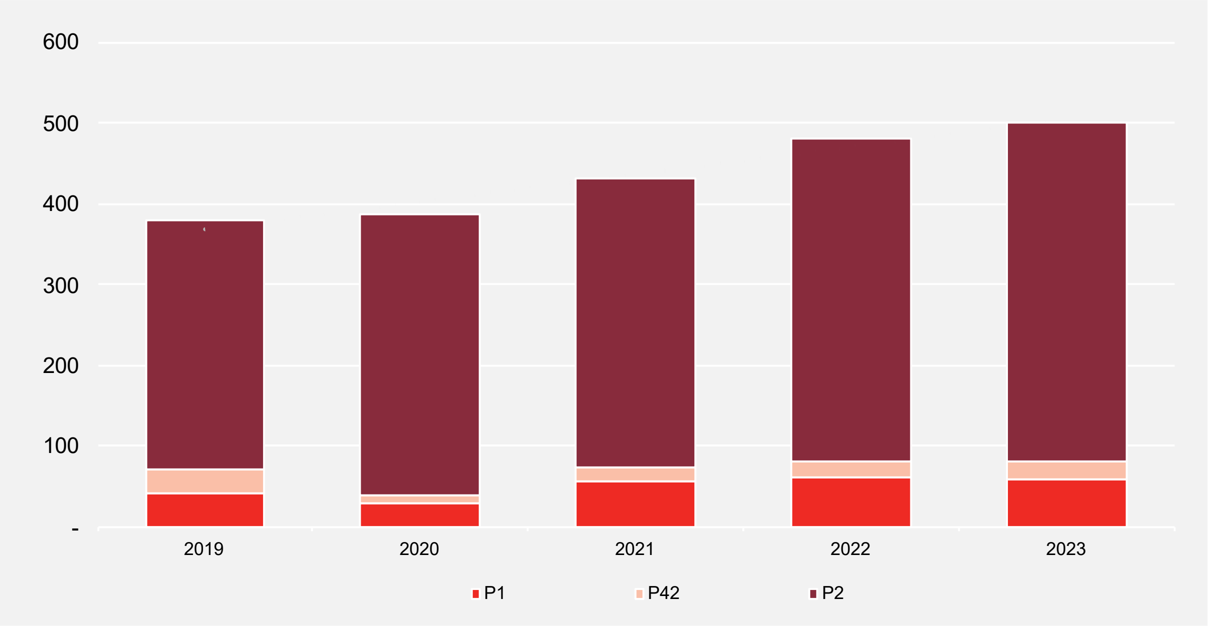


FIGURE 5 OVERHEAD CONDUCTOR ASSET CLASS: HV HIGH-PRIORITY DEFECTS

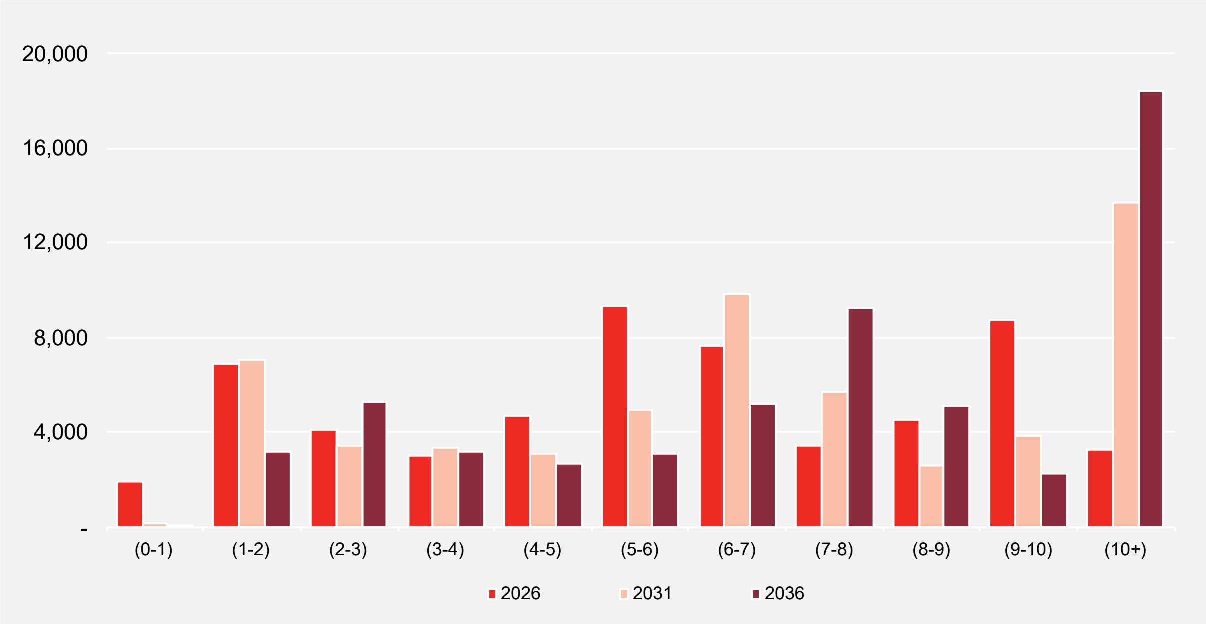


3.2 Asset condition

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 (e.g. long-term average annual replacement volumes of around 120km since 2015), 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	19,935	35
Higher-risk conductor: 2031	25,784	45
Higher-risk conductor: 2036	35,040	61

3.3 Demand growth

By 2031, the electrification of everything from homes to transport, along with ongoing population growth, will require our energy system to evolve.

As recently as December 2024, our network almost surpassed its previous highest peak demand (set in 2014). This near-peak event occurred far earlier in the summer season than previously experienced, and in the same month we also saw new record minimum demands (with our network acting as a net exporter of over 300MW in the middle of the day). These patterns of extremes are expected to grow with the increasing electrification of our customers' homes and businesses

Growth in demand increases the energy that would not be supplied to customers if our 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.[3]

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 programs and is consistent with the need to begin prudently managing this asset class toward more sustainable long-term intervention volumes.

[3] 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[4]	148	148	148	148	148	740
Replacement of 66kV radial lines	30	30	30	30	30	148
Replacement of aged and deteriorated HV conductors	4	4	4	4	4	18
Replacement of bare HV conductor bushfire mitigation	31	31	-	-	-	62
Total	**212**	**212**	**181**	**181**	**181**	**967**

Note: Volumes associated with our compliance-driven conductor clearnance program are not shown above, as these are not forecast on a per-km basis. Instead, these are reported in our reset RIN under the 'other' conductor category.

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 and compliance driven volumes.

Defect forecasts

As shown in section 3.1.2, historical defects for overhead conductor have been increasing since 2019. 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.

Compliance forecasts

In 2018, following a major review of our vegetation clearance management and contract arrangements, we introduced new technologies to provide faster and more accurate visibility of our network. This included using light detection and ranging (LiDAR) technology to replace our ground-based vegetation inspection practices.

The application of LiDAR has improved across several years, with a steady-state level of maturity and confidence in the accuracy of the outputs being achieved from around 2022.

In 2023, we expanded the use of our LiDAR to identify non-compliant conductor clearances. This program has shown that while our overhead lines were compliant with the electrical clearance standard at the time of construction, approximately 4,400 sites have become non-compliant with AS 7000:2016 over time due to environmental factors.

[4] Volumes and expenditure associated with faults are consolidated with defective conductor for presentation purposes

To rectify these clearances, our forecast interventions include the continuation of a 10-year program that will target 340 of the highest-risk sites per annum. This program was discussed with ESV during the development of our regulatory proposal, and is set out in more detail in appendix A.

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 three separate risk-based programs. Two of these programs are set out in appendices B and C of this document:

- risk-based replacement of 66kV radial lines to address the risk of 66kV conductor failure causing station black and supply interruption to customers
- risk-based replacement of aged and deteriorated polyphase HV conductors to address HV conductor failure risk.

A third risk-based program—the targeted replacement of bare, non-REFCL protected 22kV conductors in hazardous bushfire risk areas (HBRA)—is part of our broader bushfire mitigation approach. The driver and underlying analysis supporting this risk-based program is therefore set out in our separate bushfire mitigation overview. However, for completeness, the volumes and expenditure associated with this program are included in this asset class overview (noting that as this risk-based program results in the replacement of overhead conductor, the corresponding volumes and costs are included in our overhead conductor category replacement forecasts in the reset RIN).

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.[5]

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.

FIGURE 8 RISK MONETISATION APPROACH

Annual risk cost = **Annual probability of failure** × **Likelihood of consequence** × **Cost of consequence**

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.

As set out in appendices B and C of this document, the preferred option for each of our risk-based programs remains preferred even if the probability of conductor failure is reduced by 10 per cent.

[5] AER, Asset replacement planning industry practice application note, July 2024, p. 38

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. Specifically, we assessed our risk-based conductor replacements against the following programs:

- our proposed single-wire earth return (SWER) intervention program, which includes the installation of early fault detection and replacement of some bare SWER with covered conductor
- our broader regional and rural SWER upgrade program
- the targeted replacement of bare, non-REFCL protected 22kV conductors in hazardous bushfire risk areas (HBRA).

As we are not proposing any risk based SWER replacements as part of our overhead conductor replacement program, there are no overlaps with the above SWER replacement programs. Similarly, we found no overlap with our program to replace bare, non-REFCL protected 22kV.

As a further top-down consideration, our annual forecast replacement rate equates to 0.2 per cent of our total overhead conductor population. This implies that on average, our overhead conductor will need to last over 500 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.

Table 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	10.3	10.3	10.3	10.3	10.3	51.5
Rectification of clearances based on LiDAR	3.4	3.4	3.4	3.4	3.4	16.8
Replacement of 66kV radial lines	3.2	3.2	3.2	3.2	3.2	16.0
Replacement of aged and deteriorated HV conductors	0.4	0.4	0.4	0.4	0.4	2.0
Replacement of bare HV conductor bushfire mitigation	5.2	5.2	-	-	-	10.5
Total	**22.5**	**22.5**	**17.3**	**17.3**	**17.3**	**96.8**

Note: Our overhead conductor expenditure forecast included in our reset RIN includes a minor additional amount reflective of the allocation to overhead conductor from works undertaken as part of other asset replacements (e.g. replacement of pole mounted distribution transformers and switchgear typically result in minor associated overhead conductor works). This allocation is not shown above, but represents less than three per cent of our overhead conductor forecast.

A

RECTIFICATION OF CLEARANCES BASED ON LIDAR

A Rectification of clearances based on LiDAR

Overhead lines are designed and constructed to achieve minimum standard electrical clearances to conductors for reliability, network safety and public safety purposes. The current industry standard for electrical clearances is set out in Australian standards (AS 7000:2016 - Design of Overhead Lines).

A.1 Identified need

While our overhead lines were compliant with the electrical clearance standard at the time of construction, they can become non-compliant with AS 7000:2016 over time due to environmental factors such as:

- changes in ground level because of road works
- leaning poles
- reduced conductor tension.

These factors can lead to reduced electrical clearances between:

- conductor and ground (i.e. ground clearances)
- conductor of different phases (i.e. mid span phase-to-phase clearances)
- conductor and pole top (i.e. pole top clearances).

In 2018, following a major review of our vegetation clearance management and contract arrangements, we introduced new technologies to provide faster and more accurate visibility of our network. This included using light detection and ranging (LiDAR) technology to replace our ground-based vegetation inspection practices.

The application of LiDAR has improved across several years, with a steady-state level of maturity and confidence in the accuracy of the outputs being achieved from around 2022.

In 2023, we expanded the use of our LiDAR to identify non-compliant conductor clearances. Identifying conductor clearances without the use of technology can otherwise be challenging given the high volume of our conductor population and the difficult terrain.

Our LiDAR inspections have now shown that while our overhead lines were compliant with the electrical clearance standard at the time of construction, approximately 4,400 sites have become non-compliant with AS 7000:2016 over time.

The identified need, therefore, is to rectify non-compliant conductor clearances.

A.2 Options considered

The solutions considered to rectify non-compliant conductor clearances vary dependent on the clearance issue identified. As shown in table 8, only ground clearance issues have potential multiple rectification solutions.

TABLE 8 HIGHEST RISK CONDUCTOR RECTIFICATION OPTIONS

CLEARANCE ISSUE	RECTIFICATION SOLUTIONS
Ground	• Pole replacement • Pole top upgrade • Re-stringing • Other solutions, such as LV retirement
Mid span phase-to-phase	• Spreader
Pole top	• Pole top upgrade

In addition, we install interim risk mitigation measures prior to the implementation of clearance solutions. For example, Rotamarka power line warning flag markers are installed as a risk mitigation measure until the clearance rectification solution can be implemented.

Given the above, table 9 sets out potential options to address these conductor clearances. For options two and three, these programs would target 340 sites per annum over a 10–15 year period, with delivery during the period based on prioritising the highest risk sites.

Note, a further option of seeking to rectify all conductor clearances in the 2026–31 regulatory was not considered credible given our current resourcing arrangements. This option, and our preferred approach outlined below, were discussed with Energy Safe Victoria during the development of our regulatory proposal.

The derivation and assessment of these options is set out in our attached cost model.[6]

TABLE 9 POTENTIAL OPTIONS ($M, 2026)

POTENTIAL OPTIONS		COST
1	Do-nothing different: maintain existing maintenance program with no proactive capital works	**-**
2	Rectify clearance issues using spreaders and pole top upgrades for phase and pole top clearances, and pole replacements for ground-clearance issues	19.6
3	Rectify clearance issues using spreaders and pole top upgrades for phase and pole top clearances, and a combination of solutions for ground-clearance issues, i.e. based on 2023 LiDAR results, we would remediate ground clearance issues with pole replacements (52 per cent), re-stringing (38 per cent), pole top upgrades (6 per cent) and other solutions (4 per cent)	16.8

Note: Costs shown are totals for the 2026–31 regulatory period

6 PAL MOD 4.09 – Conductor rectification based on LiDAR – Jan2025 – Public

A.3 Preferred option

The do-nothing base case outlined above will not meet the identified need to rectify non-compliant conductor clearances. As such, it is not considered a credible option to continue forward.

Options two and three above would both work equally toward rectifying our compliance obligations with AS 7000:2016, and therefore, the preferred option is option three as it represents the least-cost to comply.

A summary of the proposed capital expenditure in the 2026–31 regulatory period for the preferred option is set out in table 10.

TABLE 10 PREFERRED OPTION: EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Rectification of clearances based on LiDAR	3.4	3.4	3.4	3.4	3.4	16.8

B

REPLACEMENT OF 66KV RADIAL LINES

B Replacement of 66kV radial lines

We currently have 10 zone substations that are each supplied by single 66kV radial lines. If any of these 66kV radial lines experience a fault, it will result in station black and the loss of electricity supply to all customers supplied by the zone substation.

Table 11 lists these zone substations and corresponding customers numbers.

TABLE 11 RADIAL FED ZONE SUBSTATIONS

ZONE SUSBTATION	CUSTOMERS
Boundary Bend (BBD)	465
Cohuna (CHA)	4,391
Charam (CHM)	1,301
Cobram East (CME)	10,429
Charlton (CTN)	7,876
Merbein (MBN)	10,909
Numurkah (NKA)	7,808
Ouyen (OYN)	3,186
Robinvale (RVL)	2,192
Wemen (WMN)	339
Total	**48,896**

B.1 Identified need

Given the high consequences of a failure on the radial sub-transmission lines outlined above, the identified need is to manage the risk of loss of electricity supply to customers supplied by these 10 radial zone substations.

B.2 Options considered

Table 12 lists all the potential options considered to address the supply risk to customers serviced by these radial zone substations. The assessment of these options is set out in our attached assessment model.[7]

[7] PAL MOD 4.10 – 66kV radial lines – Jan2025 – Public

TABLE 12 POTENTIAL OPTIONS ($M, 2026)

POTENTIAL OPTIONS		CREDIBLE OPTION	COST
1	**Do nothing different** Maintain our existing maintenance program with no planned capital works	Yes	-
2	**Risk-based replacement** Risk-based replacement of aged and deteriorated sections of radial 66kV line to reduce the likelihood of line failure	Yes	16.0
3	**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	N/A
4	**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	N/A
5	**Build a second 66kV line** Build a second 66kV line for each zone substation to provide supply redundancy	No; commercially not feasible as prohibitively expensive	N/A

The credible options in table 12 were evaluated based on the methodology set out in section 4.1.3. We used the demand forecast of the zone substation to calculate the energy at risk because failure of a radial conductor supplying the zone substation will result in station black.

These options were assessed individually for each of the 414 radial line sections across the 10 zone substations. Each radial line comprises of multiple sections.

For option two, only 46 of the 414 radial line sections (i.e. 11 per cent) yielded a positive NPV, and accordingly, only these were included in the potential replacement program. Specifically, these 46 sections are part of the 66kV radial lines supplying three of the 10 zone substations, including:

- Cohuna (CHA) zone substation – 13 of the 20 sections are economic to replace
- Charam (CHM) zone substation – nine of the 55 sections are economic to replace
- Charlton (CTN) zone substation – 24 of the 139 sections are economic to replace.

Table 13 shows the results of the option evaluation against our base case.

TABLE 13 OPTION EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION TWO	NPV
Risk-based replacement of aged and deteriorated 66kV conductor sections	55.3

B.3 Preferred option

As shown above, the risk-based replacement of aged and deteriorated sections of 66kV radial lines at specific locations economically reduces risk relative to the base-case. These locations include 46 separate sections supplying our CHA, CHM and CTN zone substations, and in total, will reduce the risk of loss of electricity supply to over 13,500 regional and rural customers.

A summary of the proposed capital expenditure in the 2026–31 regulatory period for the preferred option is set out in table 10.

TABLE 14 PREFERRED OPTION: EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Replacement of 66kV radial lines	3.2	3.2	3.2	3.2	3.2	16.0

Sensitivity analysis was also used to test the robustness of our preferred option to potential downside scenarios (e.g. higher costs and/or lower benefits). We have (conservatively) not assessed upside scenarios, such as increased energy at risk driven by faster than expected uptake of electrification, as it would only increase the NPV and program.

Our preferred option remained economic under these sensitivities.

C

REPLACEMENT OF AGED AND DETERIORATED HV CONDUCTORS

C Replacement of aged and deteriorated HV conductors

Our network comprises almost 70,000km of overhead conductor, with approximately 50 per cent of these being polyphase 22kV HV conductors (excluding SWER).

C.1 Identified need

As outlined in section 3, the number of HV conductor high priority defects 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, 45 per cent of our overhead conductor population (i.e. approximately 25,780 km) is forecast to have a health index rating exceeding seven.

In comparison, our long-term average replacement volumes have been around 120km per annum since 2015.

The identified need, therefore, is to move toward more sustainable intervention volumes to prudently manage deliverability and safety factors associated with an increasingly high volume of aged and deteriorated polyphase HV conductor.

C.2 Options considered

Table 15 lists all the potential options considered to address the supply risk to customers due to the failure of aged and deteriorated HV conductors.

TABLE 15 POTENTIAL OPTIONS

POTENTIAL OPTIONS		CREDIBLE OPTION
1	**Do nothing different** Maintain our existing maintenance program with no planned capital works	Yes
2	**Risk-based replacement** Risk based replacement of aged and deteriorated sections of HV conductor to reduce the likelihood of failure	Yes
3	**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 14,025 individual HV line sections, totalling over 12,243km of conductor. Of these line sections, 8,376km were demonstrated to have a positive economic case to intervene (relative to the do-nothing option).

As shown in table 16, and provided in further detail in our attached assessment model, this results in significant economic benefits.[8]

TABLE 16 OPTION EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION TWO	NPV
Risk-based replacement of aged and deteriorated HV conductor sections	1,012

C.3 Preferred option

Although option two results in significant economic benefits, the corresponding costs of achieving these benefits in full is very high, and resourcing the delivery of this option in its entirety would be unachievable.

Our preferred option, therefore, is to deliver only a portion of the HV sections that are most economic in the 2026–31 regulatory period. This balances the need to move toward more sustainable intervention volumes, as well as overall deliverability and affordability considerations.

Specifically, our preferred replacement volumes are set out in table 17. We recognise that this volume is low in isolation, but we have taken a cautious approach for the 2026–31 regulatory period to increase overhead conductor volumes incrementally (and with recognition to the other proposed risk-based interventions). We consider this also provides an opportunity for the impacts of electrification to be observed more fulsomely, and to inform future capacity needs as well as like-for-like replacements. In any event, these 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 17 OPTION EVALUATION: RELATIVE TO BASE CASE (KM)

OPTION TWO	VOLUME
HV conductor assessed: total	12,243
HV conductor assessed: economic	8,376
HV conductor proposed for intervention: 2026–31	18

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

[8] PAL MOD 4.08 – Conductor replacement – Jan2025 – Public

A summary of the proposed capital expenditure in the 2026–31 regulatory period for the preferred option is set out in table 18.

TABLE 18 PREFERRED OPTION: EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Replacement of aged and deteriorated HV conductors	0.4	0.4	0.4	0.4	0.4	2.0

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