ASSET CLASS OVERVIEW

PROTECTION AND CONTROL SYSTEMS

PAL BUS 4.10

2026–31 REGULATORY PROPOSAL

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1. Overview

Protection and control systems are designed to detect the presence of network faults or abnormal operating conditions and are critical to the safe and reliable operation of our network. Our protection and control systems comprise electromechanical, analogue electronic, and digital relays.

Historically, we have applied a reliability-centred maintenance (RCM) approach to assess asset conditions and determine intervention priorities. However, in 2018, we transitioned to a more advanced condition-based risk management (CBRM) model, which has allowed us to make more informed investment decisions by incorporating monetised risk assessments.

Based on our CBRM, our management of this asset class has targeted high-risk relays, particularly the high-voltage (HV) feeder protection relays, as failures of these relays typically result in larger customer outages. As a result, we have now replaced a significant portion of our high-risk electromechanical and analogue electronic relays with modern digital equivalents in the current regulatory period.

Notwithstanding these interventions, defects and failures have continued to increase steadily. This reflects the underlying characteristics of our relay population, and consistent with this, network risk is projected to increase significantly in the absence of further intervention.

For the 2026–31 regulatory period, therefore, our risk-based approach to relay interventions will continue to address individual high-risk relays. By replacing approximately 14% of the relay population in the next regulatory period, the risk by 2031 is reduced by approximately 42% (relative to the base case). Residual risk, however, will remain higher than risk levels prevailing today.

This approach prioritises the replacement of high priority assets over full zone substation replacements and minimises long-term costs to customers.

A summary of our protection and control relay replacement expenditure is set out in table 1.

TABLE 1 FORECAST PROTECTION AND CONTROL EXPENDITURE ($M, 2026)

EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Unplanned relay replacements	0.7	1.3	1.3	0.7	0.7	4.6
Risk-based relay replacements	5.2	4.4	9.4	2.7	2.8	24.5
Total	**5.9**	**5.7**	**10.6**	**3.4**	**3.5**	**29.1**

(1) Our protection and control expenditure included in our reset RIN includes relay replacement due to zone substation replacement. Given the driver of these works is the underlying primary plant replacement, the correspdong cost, economic anlaysis and risk modelling for these projects are presented in our zonesubstation switchgear asset class overview

(2) In addition to modelled relay replacements, our risk-based category also includes annual ongoing programs

2. Background

Zone substation protection and control systems are designed and configured to detect the presence of network faults, or abnormal operating conditions. These systems automatically initiate action to isolate the faulted network component by opening the appropriate circuit breaker(s) or by correcting the abnormal operating condition through initiating some pre-defined control sequence.

Protection and control systems are essential components of the network, playing a critical role in ensuring continuous supply of electricity and maintaining safety.

2.1 Compliance 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 2013 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

The protection and control systems asset class comprise of relays that are typically mounted in cubicles housed in zone substation buildings or substation control rooms. These relays include electromechanical relays, analogue electronic relays, and digital relays.

As shown in table 2, the majority of our asset class are digital relays. Over the past 50 years, relay technology has evolved significantly. We can no longer replace nor repair electromechanical and analogue electronic relays on a like-for-like basis due to lack of manufacturer support and/or spares. As such, our relay population is continuing to shift towards digital relays.

TABLE 2 RELAY POPULATION

RELAY TYPE	VOLUME
Electromechanical	155
Analogue electronic	604
Digital	1,922
Total	**2,681**

Note: This table excludes auxiliary relays and other ancillary equipment such as trip relays and repeat relays that are commonly associated with the main protection and control relays used to form a system or scheme.

2.3 Asset age profile

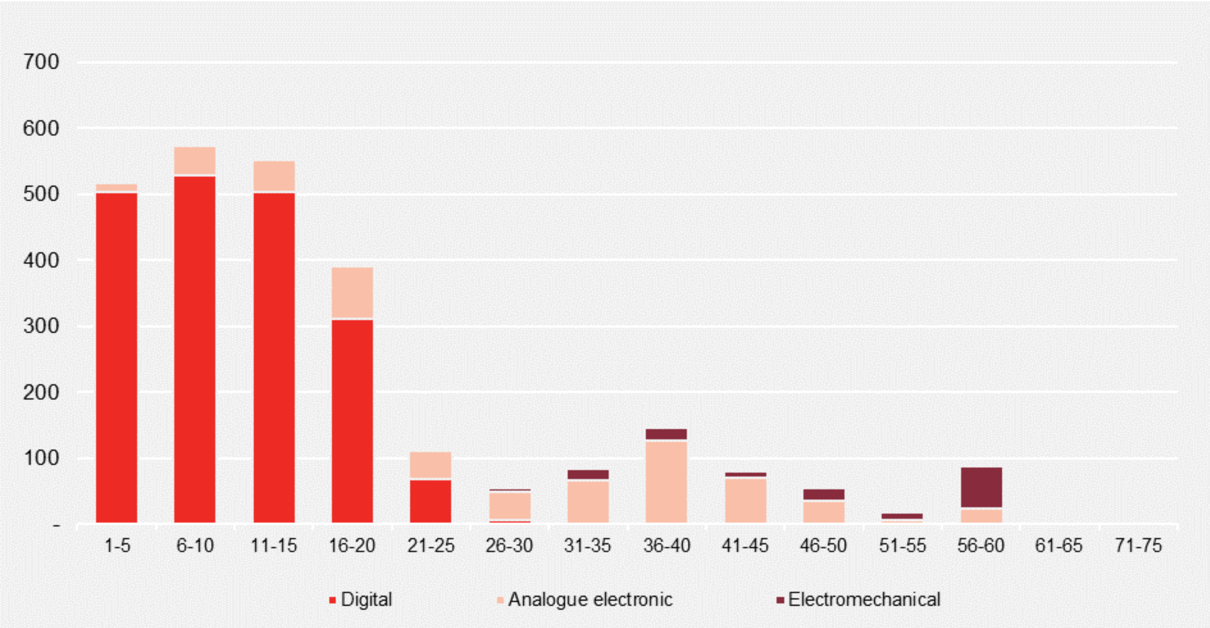
Table 3 sets out the expected service life of each relay type. Service life is the expected period of time after which the asset is unlikely to be fit for purpose, typically determined by safety, technology and/or obsolescence.

TABLE 3 RELAY SERVICE LIFE (YEARS)

RELAY TYPE	EXPECTED SERVICE LIFE
Electromechanical	51
Analogue electronic	20
Digital	28

The age profile of our relay population, by type, is also shown in figure 1**Error! Reference source not found.**. This chart shows the majority of electromechanical relays and analogue electronic relays respectively are operating beyond their expected service life.

FIGURE 1 RELAY AGE PROFILE (NUMBER OF RELAYS BY AGE)



3. Identified need

The performance of our protection and control systems are critical to the safe and reliable operation of the distribution network, particularly under network fault conditions. If protection and control system failures coincide with a network fault, it can:

- result in loss of electricity supply to more customers than needed
- pose a safety risk to our personnel and public
- increase the risk of a fire start, particularly in electric line construction areas (ELCAs) and hazardous bushfire risk areas (HBRA)
- increase the likelihood of damage to key network assets such as power transformers.

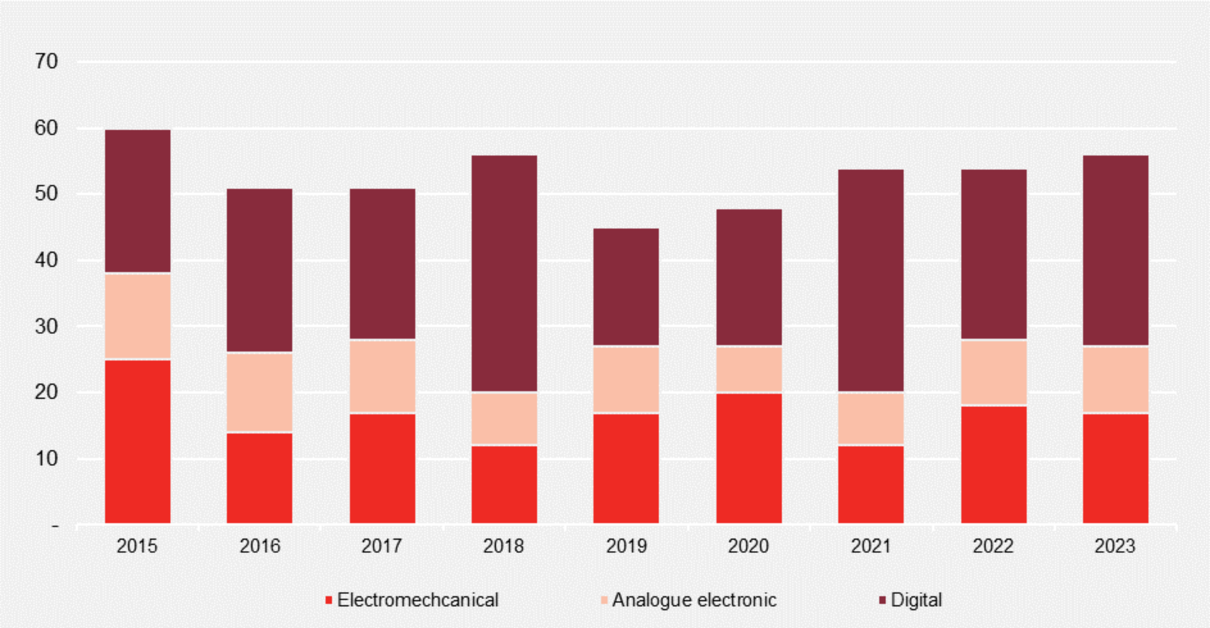
The identified need, therefore, is to manage our protection and control system asset class to maintain reliability in line with our customers preferences, minimise safety risks as far as practicable, and reduce the risk of harm to the environment, consistent with our regulatory and legislative obligations.

This section outlines the historical performance of our protection and control systems, as well as current and expected asset condition.

3.1 Historical asset performance

As shown in figure 2 below, defects and failures have been steadily increasing since 2019. These defects and failures include self-reported defects by relays, mal-operations, failures to operate, and issues discovered during routine maintenance. Relay failures can also remain undetected until they are discovered during routine maintenance. Alternatively, these failures may only be identified when a relay malfunctions unexpectedly or fails to operate correctly during a network incident.

FIGURE 2 DEFECTS AND FAILURES (NUMBER PER YEAR)



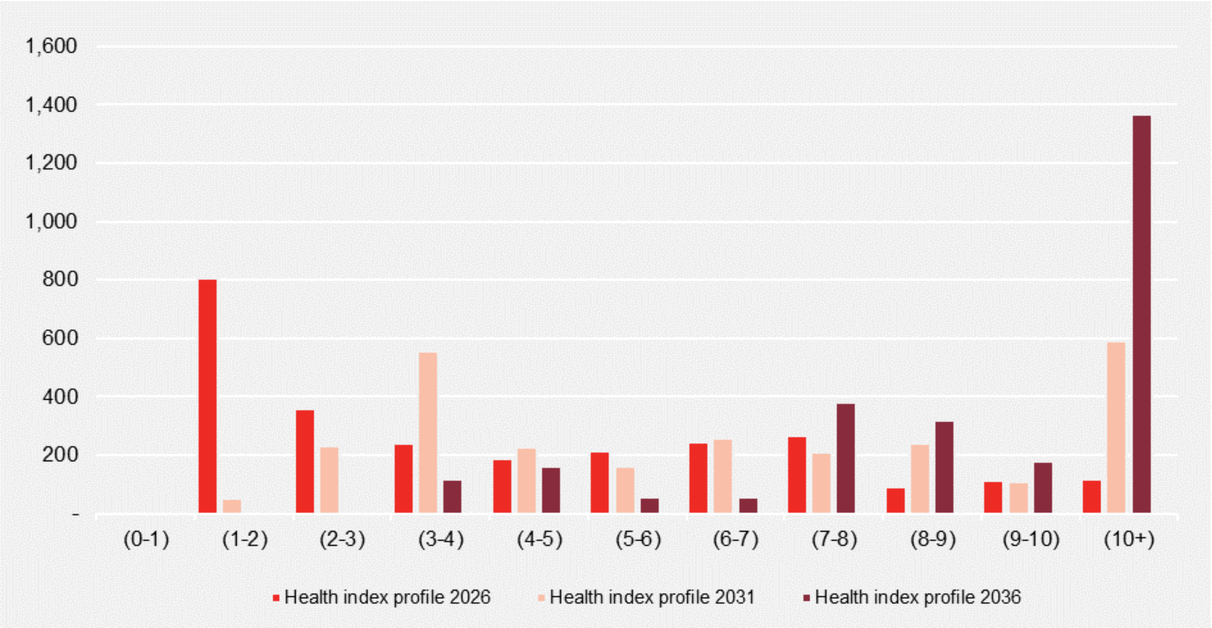
Given the underlying condition of our asset population (as discussed in section 3.2 below), these defect and failure numbers are expected to increase over time.

3.2 Asset condition

The condition of our protection and control assets is an important factor in considering the extent of the need to maintain the safety and reliability of our network for customers. As part of our risk-based approach, the condition of our relays is represented by the health index derived in the CBRM model using the asset age and condition data (including defects and failures).

The predicted health index profile for 2026, 2031 and 2036 is set out in figure 3. A health index of seven or higher is considered critical, indicating that the asset has reached a point where there is a high chance of failure.

FIGURE 3 HEALTH INDEX PROFILE



As shown table 4**Error! Reference source not found.**, the proportion of assets with a higher risk asset condition rating is increasing.

TABLE 4 PROPORTION OF RELAYS CONSIDERED CRITICAL

YEAR	PERCENTAGE
2026	22%
2031	44%
2036	85%

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 distribution switchgear 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

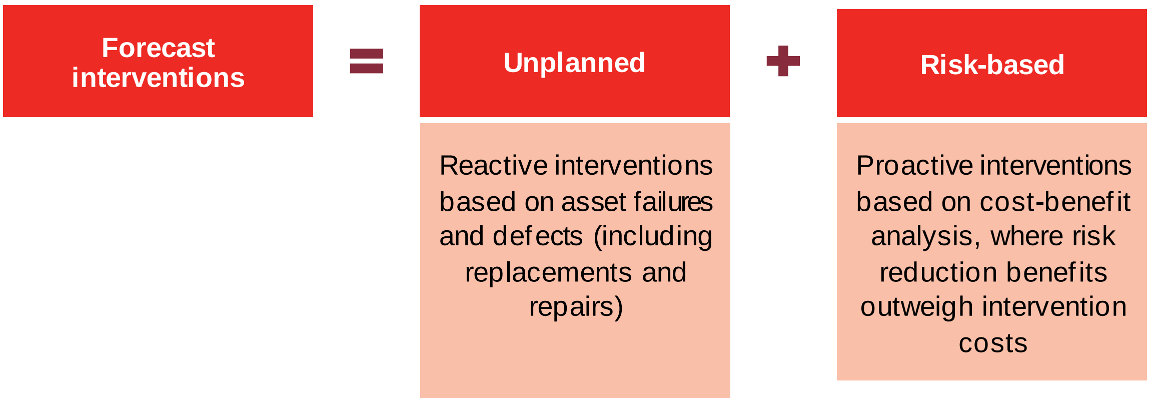
Our asset management strategy aims to maintain network reliability and minimise safety risks while meeting regulatory obligations. As part of this strategy, we routinely inspect our protection and control systems, and undertake planned, preventative maintenance.

Our response to both relay defects and failures is also to inspect the asset. Upon inspection, relays will typically be repaired or replaced.

Reactive interventions, however, result in elevated maintenance expenses and generally carry greater risk of protection system malfunctions and poorer customer service outcomes. As such, our asset management strategy also considers risk-based interventions, with proactive options considering both individual relay replacements as well as full station upgrades.

Our intervention forecast for the 2026–31 regulatory period is therefore based on two categories, as shown in **Error! Reference source not found.**. The basis of these forecasts is discussed in more detail below.

FIGURE 4 FORECAST CATEGORIES



4.1 Unplanned interventions

Unplanned interventions in response to defects and failures are expected to occur on a consistent basis with recent history. As such, we forecast unplanned intervention expenditure based on an historical average of the previous five years.

4.2 Risk-based interventions

Risk-based interventions comprise relay replacements across the following two categories:

- relay replacements driven by individual asset and zone substation assessments
- relay replacements driven by the replacement of major zone substations assets, such as at the same time as a full switchboard replacement.

The following sections outline our forecast methodology for relay replacements driven by individual assessments only. Relay replacements driven by other primary plant interventions are discussed in the corresponding primary plant asset class overviews (given these are the driver of the underlying relay works).

4.2.1 Forecast methodology

Our risk-based assessment for relay replacements is derived using CBRM, developed by EA Technology and adapting principles from the common network asset indices methodology (CNAIM) commonly used in the United Kingdom. This methodology has been widely adopted by utilities within Australia and internationally.

The CBRM integrates asset data, engineering expertise, and practical experience to predict network asset conditions, performance, and risks. This structured approach assists us in managing asset-related risks effectively.

The application of our CBRM is summarised in figure 5, and ensures we invest only when the cost of replacing existing infrastructure exceeds the total value of the underlying risks. This approach is consistent with the AER's asset replacement planning application note.

FIGURE 5 RISK MONETISATION APPROACH

Probability of failure

The probability of failure is a key input in any risk monetisation approach. The CBRM determines the probability of failure by linking the health index for each asset to historical failure rates to estimate the likelihood of future failures.

The health index itself is based on measured asset condition, considering factors like age, operational environment, and historical performance. It predicts future degradation and is calibrated against historical failure data.

Consequence of failure

The consequence of failure is based on the identified failure modes for an asset, and their corresponding likelihoods and consequences. Our risk monetisation considers four separate consequences to determine annual risk costs, as outlined in figure 6.

FIGURE 6 CONSEQUENCE OF FAILURE APPROACH

The determination of these consequences is summarised below:

- network performance risk (energy at risk) is determined based on forecast demand for the relevant zone substation. The value of energy at risk is based on the AER’s determined value of customer reliability
- safety risks to our staff or member of the public are determined based on the likelihood of the failure, likelihood of a person present when the failure occurs, and the likelihood of an injury or death and consequence (the cost to prevent an injury or death)
- financial risks comprise unplanned replacement and unplanned repair impacts respectively, and recognise challenges associated with technical obsolescence of our electromechanical and analogue electronic relays (e.g. these relay types no longer have manufacturer support or

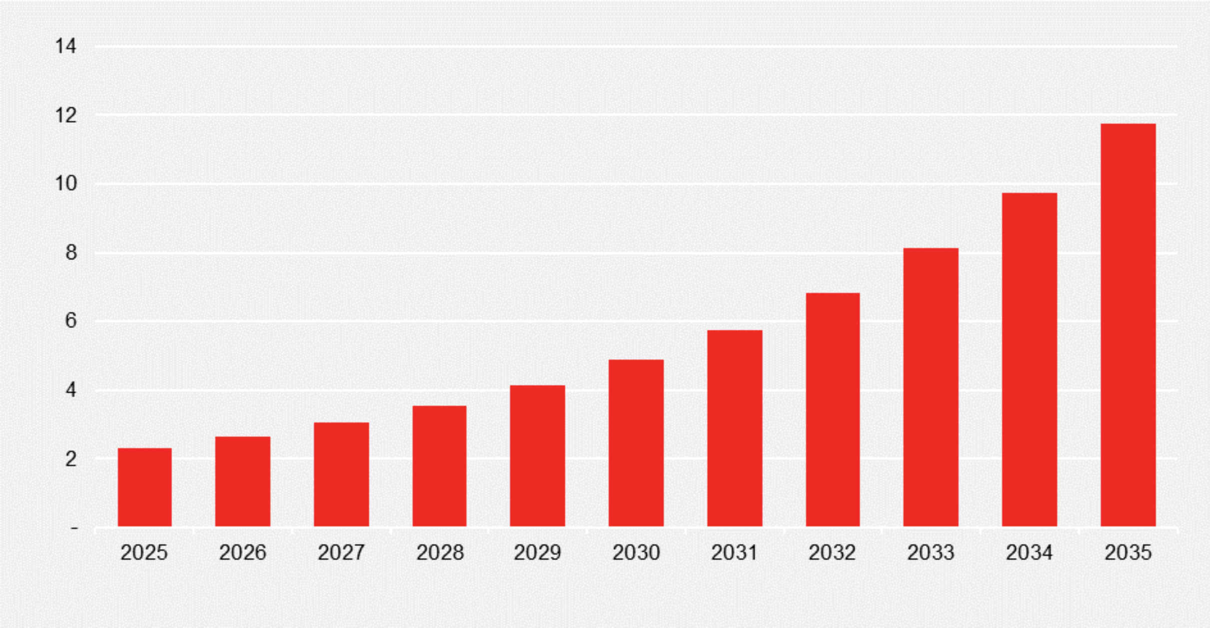
available spares, meaning we may be limited in our ability to repair relays or replace a like-for-like basis, both of which increase costs). We categorise relay failures as either significant or major, where significant failures are those that are repairable and major failures requiring the replacement of the asset

- environmental risks are determined by the likelihood of failure and the individual consequence. For protection relays, the only consequence is the cost of waste disposal. It's important to note that the environmental risk for this asset class is minimal.

4.2.2 Forecast network risk

The forecast network risk profile for our network protection and control assets, based on our CBRM and under a base-case (i.e. no investment scenario), is shown in figure 7. In the absence of any interventions, the annual network risk is projected to increase materially over the next 10 years.

FIGURE 7 PROTECTION AND CONTROL ASSET RISK PROFILE ($M, 2026)



4.2.3 Options considered

The options considered for our risk-based relay interventions are set out in table 5**Error! Reference source not found.**. This table lists all the potential zone substation protection and control assets intervention options. However, the suitability of these options depends on the underlying characteristics of the protection and control assets and the zone substation.

TABLE 5 RISK-BASED INTERVENTION OPTIONS

OPTION	DESCRIPTION
Do-nothing different	No change to existing practices and no planned replacement
Replacement of high priority relays	Replace all high-priority relays identified by CBRM in 2026-2031
Defer replacement of high priority relays	Defer replacement of all high priority relays identified by CBRM to the next regulatory period

We also considered the following intervention options, but these were assessed as not credible:

- refurbishments or repairs – this is not a long-term solution due to the technical obsolescence of our electromechanical and analogue electronic relays. The majority of these relay types no longer have manufacturer support or available spares, making repairs inefficient and costly. Additionally, there are limited skills in the workforce to perform these tasks
- increase frequency of routine maintenance inspections – this is not a viable solution due to the substantial workforce required to perform these tasks more frequently, coupled with the minimal risk reduction achieved. Additionally, the inherent risks associated with these relays will persist, necessitating their eventual replacement. This approach is therefore considered ineffective
- whole of zone substation replacement – as per industry practice, we considered the replacement of all relays at the zone substation control room, however, we can manage our relay risk more efficiently by instead targeting only the high priority relays
- non-network solutions – we are not aware of any non-network solutions that would replace the functionality of relays.

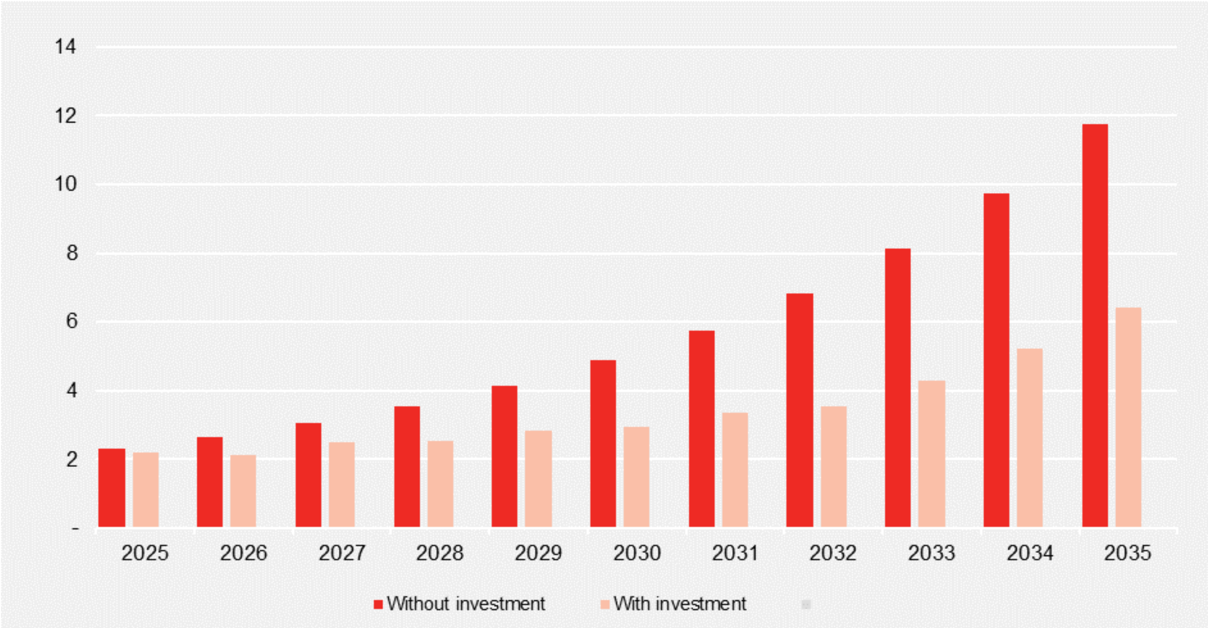
4.2.4 Forecast risk-based interventions

Our forecast risk-based interventions, as justified in our attached net present value (NPV) model, will allow us to efficiently manage the increasing risk profile relative to a do-nothing option (shown below in figure 8).[1]

In summary, by replacing approximately 14% of the relay population in the 2026–31 regulatory period, the risk by 2031 is reduced by approximately 42% (relative to the base case). Residual risk, however, will remain higher than risk levels prevailing today.

[1] PAL MOD 4.07 – Relay replacement – Jan2025 – Public

FIGURE 8 PROTECTION AND CONTROL ASSET RISK PROFILE ($M, 2026)



A full list of our forecast risk-based relay replacements is also shown in table 6 with the costs for these works based on the underlying site and recently completed projects.

Further detail on individual project assessments is outlined in the following appendix, and our attached model.[2]

[2] PAL MOD 4.07 – Relay replacement – Jan2025 – Public

TABLE 6 RISK-BASED PROTECTION AND CONTROL EXPENDITURE ($M, 2026)

ZONE SUBSTATION	FY27	FY28	FY29	FY30	FY31	TOTAL
AC	2.6	-	-	-	-	**2.6**
BAN	-	1.5	-	-	-	**1.5**
DDL	2.6	-	-	-	-	**2.6**
ECA	-	-	-	0.6	-	**0.6**
FDN	-	-	0.8	-	-	**0.8**
GCY	-	-	3.2	-	-	**3.2**
MLN	-	-	-	2.1	-	**2.1**
SA	-	-	4.4	-	-	**4.4**
SHN	-	-	-	-	2.5	**2.5**
SHL	-	-	-	-	0.3	**0.3**
TYA	-	-	1.0	-	-	**1.0**
WBE	-	2.9	-	-	-	**2.9**
Total	**5.2**	**4.4**	**9.4**	**2.7**	**2.8**	**24.5**

Note: In addition to modelled relay replacements, our risk-based category also includes annual ongoing programs

A
APPENDIX
RELAY REPLACEMENT ASSESSMENTS

A Site-based summaries for proposed relay replacements

This appendix provides a summary of site-based assessment for our proposed risk-based relay replacements.

For each site, a full net present value (NPV) analysis has been undertaken and is provided in the attached model.[3] The options considered are consistent with those outlined in the body of this asset class overview and are presented relative to the base case (i.e. a do-nothing different option).

For each of the proposed sites, the preferred option that maximises net economic benefits for customers is a targeted replacement of high-risk relays only. This option is aligned with our customer expectations whereby maintaining customer reliability is a key priority and ensures trust is maintained throughout the energy transition.

A.1 AC zone substation

Altona Chemicals (AC) zone substation comprises of two 66/11kV 20/27MVA transformers in a fully switched configuration, supplying twelve 11kV distribution feeders and one 12MVar capacitor bank. The station supplies several large industrial and commercial customers in the Altona area, as well as two 11kV feeders to Altona (AL) zone substation (allowing supply in the event of an outage of the single transformer at AL).

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV circuit breaker fail, transformer, bus, feeder, and capacitor bank protection relays. In total, 28 relays will be replaced, with the majority of these protection schemes being analogue electronic relays that have been in service for over 42 years (more than double their expected service life).

These works follow the replacement of 66kV line protection relays in the 2021–26 regulatory period.

TABLE 7 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY27	-2.2	10.8	8.6
Defer relay replacement to FY33	-1.4	9.7	8.3

A.2 BAN zone substation

Ballarat North (BAN) zone substation comprises of three 66/22kV 20/40MVA transformers in a fully switched configuration, supplying three 22kV buses with a 22kV transfer bus, twelve 22kV distribution feeders, and three 6MVar capacitor banks. The station supplies several industrial, commercial,

[3] PAL MOD 4.07 – Relay replacement – Jan2025 – Public

residential and agriculture customers in the Ballarat CBD and an area from Clunes to Daylesford in the north and northeast area.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV circuit breaker fail, 66kV bus, transformer, master earth fault (MEF) and backup earth fault (BUEF) protection relays. In total, 17 discreet relays (including three electromechanical devices and 14 analogue electronic relays aged over 40-years), will be replaced with 17 multifunctional digital relays.

TABLE 8 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY28	-1.2	9.9	8.7
Defer relay replacement to FY33	-0.8	9.4	8.6

A.3 DDL zone substation

Drysdale (DDL) zone substation comprises of two 66/22 kV 20/33MVA transformers in a fully switched configuration, supplying two 22kV buses, eight 22kV distribution feeders, and one 12MVar capacitor banks. The station supplies several industrial, commercial and residential customers in the Bellarine Peninsula area, including Ocean Grove, Clifton Springs and Drysdale.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of transformer, 22kV circuit breaker fail, MEF, BUEF, 22kV bus, feeder, and capacitor bank protection relays. In total, 26 discreet relays (including 18 analogue electronic relays aged over 40-years and 10 digital relays aged between 19-30 years), will be replaced with 26 multifunctional digital relays.

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

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY27	(2.2)	13.0	10.9
Defer relay replacement to FY33	(1.4)	11.4	10.0

A.4 ECA zone substation

Echuca (ECA) zone substation comprises of two 66/22 kV 10/13MVA transformers and one 10/13.5MVA transformer in a partially switched configuration, supplying three 22kV buses with a 22kV transfer bus, six 22kV distribution feeders, one 12MVar capacitor bank and one 9.3MVar capacitor bank.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV bus, transformer, 22kV circuit breaker fail, MEF, BUEF and capacitor bank protection relays. In total, seven discreet relays (including 4 electromechanical relays aged 67 years, one analogue electronic relay aged 37 years and 3 digital relays aged 24 years old), will be replaced with seven multifunctional digital relays.

TABLE 10 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY30	-0.5	5.7	5.2
Defer relay replacement to FY33	-0.4	5.5	5.1

A.5 FDN zone substation

Ford Norlane (FDN) zone substation supplies the customer at 66kV and comprises of two 66kV lines and one 66kV circuit breaker.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV Y line, 66kV circuit breaker fail and transformer overcurrent protection relays. In total, 12 discreet relays (including 10 analogue electronic relays aged 38 years and 2 digital relays aged 19 years old), will be replaced with 10 multifunctional digital relays.

TABLE 11 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY29	(0.6)	3.1	2.5
Defer relay replacement to FY33	(0.5)	2.9	2.4

A.6 GCY zone substation

Geelong City (GCY) zone substation comprises of two 66/22 kV 20/27/33MVA transformers in a fully switched configuration, supplying two 22kV buses with eight 22 kV distribution feeders, and one 12Mvar capacitor bank. The station services the Geelong CBD, including several industrial, commercial and residential customers.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV line, circuit breaker fail, transformer, bus, feeder, MEF, BUEF, and capacitor bank protection relays. In total, 40 discreet relays (including 26 analogue electronic devices aged 44-years, and 14 digital relays aged 19-years) will be replaced with 31 multifunctional digital relays.

TABLE 12 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY29	-2.6	14.2	11.7
Defer relay replacement to FY33	-1.9	13.2	11.3

A.7 MLN zone substation

Melton (MLN) zone substation consists of two 66/22 kV 20/27/33MVA transformers and one 25/33MVA transformer in a fully switched configuration, supplying three 22kV buses, ten 22kV distribution feeders and one 6MVar capacitor bank.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of transformer, 22kV bus, 22kV circuit breaker fail, MEF, and capacitor bank protection relays. In total, 19 discreet relays (including 10 analogue electronic relays aged 45 years and 9 digital relays aged between 18-23 years), will be replaced with 19 multifunctional digital relays.

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

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY30	-1.6	6.9	5.3
Defer relay replacement to FY33	-1.3	6.5	5.2

A.8 SA zone substation

St Albans (SA) zone substation comprises of two 66/22 kV 20/30MVA transformers and one 20/33MVA transformer in a fully switched configuration, supplying three 22kV buses with a 22kV transfer bus, twelve 22kV distribution feeders, and one 10MVar capacitor bank. The station supplies several large industrial, commercial and residential customers in the St Albans area.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV circuit breaker fail, transformer, bus, feeder, MEF, BUEF, and capacitor bank protection relays. In total, 61 discreet relays (including 26 electromechanical devices ranging up to 61-years old, nine analogue electronic relays aged over 50-years, and 26 digital relays aged between 17–23 years) will be replaced with 28 multifunctional digital relays.

TABLE 14 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY29	-3.4	26.0	22.5
Defer relay replacement to FY33	-2.6	24.6	22.0

A.9 SHL zone substation

Swan Hill (SHL) zone substation consists of two 66/22 kV 10/12.5MVA transformers and one 10/13.5MVA transformer in a partially switched configuration, supplying two 22kV buses with a 22kV transfer bus, six 22kV distribution feeders and one 12MVar capacitor bank. The station supplies several industrial, commercial, and residential customers in the Swan Hill and surrounding areas.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV bus and transformer protection relays. In total, 4 discreet relays (including 3 electromechanical relays aged 46 years and 1 digital relays aged 23 years old), will be replaced with 2 multifunctional digital relays.

TABLE 15 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY31	-0.2	0.7	0.5
Defer relay replacement to FY37	-0.2	0.7	0.4

A.10 SHN zone substation

Shepparton North (SHN) zone substation consists of two 66/22 kV 20/27/33MVA transformers in a fully switched configuration, supplying two 22kV buses, six 22kV distribution feeders and one 6MVar capacitor bank.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV circuit breaker failure, transformer, 22kV bus, 22kV circuit breaker, MEF, feeders and capacitor bank protection relays. In total, 31 discreet relays (including 24 analogue electronic relays aged 44 years and 7 digital relays aged 22 years old), will be replaced with 26 multifunctional digital relays.

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

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY31	-1.8	10.0	8.3
Defer relay replacement to FY33	-1.5	9.7	8.1

A.11 TYA zone substation

Toyota (TYA) zone substation supplies the customer at 66kV and comprises of two 66kV lines and one 66kV circuit breaker.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV line, 66kV circuit breaker fail and transformer overcurrent protection relays. In total, 16 discreet relays (analogue electronic relays aged 37 years), will be replaced with 11 multifunctional digital relays.

TABLE 17 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY29	-0.8	8.7	8.0
Defer relay replacement to FY33	-0.6	8.1	7.5

A.12 WBE zone substation

Werribee (WBE) zone substation comprises of three 66/22 kV 20/33MVA transformers in a fully switched configuration, supplying three 22kV buses with twelve 22kV distribution feeders, and one 12MVar capacitor bank. The station supplies several large industrial, commercial and residential customers in the Werribee area.

Scope of works for preferred option

The proposed scope of works for the preferred option includes the replacement of 66kV line, circuit breaker fail, transformer, bus, feeder, MEF, BUEF, and capacitor bank protection relays. In total, 45 discreet relays (including 29 analogue electronic relays aged between 24–31 years, and 16 digital relays aged between 19–24 years) will be replaced with 28 multifunctional digital relays.

TABLE 18 OPTIONS EVALUATION: RELATIVE TO BASE CASE ($M, 2026)

OPTION	PV COSTS	PV BENEFITS	NET BENEFITS
Replace high priority relays in FY28	-2.4	20.1	17.7
Defer relay replacement to FY33	-1.6	19.2	17.6

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