evoenergy

Appendix 2.1: Secondary Systems Business Case

Revised regulatory proposal for the Evoenergy electricity distribution determination 2024 to 2029

November 2023

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1. Business need

This business case has been prepared to support Evoenergy's proposed secondary systems replacement expenditure (repex) for the Evoenergy Electricity Distribution Network Determination 2024–29 (EN24) Revised Regulatory Proposal. It has been prepared to respond to concerns noted by the Australian Energy Regulator (AER) in its Draft Determination for the 2024–29 regulatory period and better articulate the process that Evoenergy employs to forecast its required repex.

The business case demonstrates that we have undertaken an appropriate analysis of the need for the expenditure and identified credible options that will ensure Evoenergy continues to meet the National Electricity Objectives and maintain the quality, reliability, and security of electricity supply and safety for customers in the Australian Capital Territory (ACT).

1.1 Overview of secondary systems

Communication, control and protection and associated DC auxiliary systems (collectively referred to as secondary systems) form critical systems for modern power systems, enabling control, monitoring and communication with other devices and control rooms, as well as ensuring safety and reliability to customers and protecting assets against damage. Secondary systems enable the automated protection schemes, ongoing monitoring of network status and remote switching/network configuration that deliver the flexibility to operate modern distribution networks at much lower levels of opex than would be required in the past for field attendance. They also act to protect the far more expensive primary equipment from faults that could otherwise result in damage that is many magnitudes of the cost of the secondary assets.

This secondary system asset class includes Protection Relays, Supervisory Control and Data Acquisition (SCADA), including Remote Terminal Units (RTUs), Modems, Local Area Network (LAN) switches and batteries/chargers. The types of secondary systems considered in this business case are presented in Table 1 below.

This business case is focused on addressing the risk presented by deteriorated conditions, obsolescence, and compliance management obligations across Evoenergy's suite of secondary system technologies.

1.2 Key risks

Communications, control, protection systems and equipment failures pose loss of supply risks as well as safety risks to workers and the public. In most instances, a multiple contingency failure would need to occur to realise an actual Loss of Supply risk for communications, control and protection assets. However, single failures can place the power system in an unsafe operating state or leave the far more costly primary asset vulnerable to a much higher consequence failure under certain network loading conditions.

The potential consequences can vary depending on the type of assets and how they are used. Communications and control assets are essential to enable an efficient level of operational staffing as they allow switching and monitoring to be conducted centrally rather than via manual attendance at each control point across the network. Without the operational staff available to Evoenergy to respond to network faults and perform switching, the counterfactual case for these assets increasingly becomes the incremental response cost that can be avoided if the switching and monitoring functions are conducted centrally with these asset types.

Both of these factors are taken into account in a new investment business case and are equally applicable for the management of failed or obsolete assets off the network.

The primary risks have been described in Table 1.

Table 1 Risk categories and descriptions

Asset sub class	Major consequences
Protection relays	Failure of protection devices such as a transmission line, power transformer, or distribution feeder protection relays can cause loss of electrical supply, damage to infrastructure and injury or death to the public. If a protection device is faulty, then the local or remote backup protection will be required to operate to clear the fault. The resulting longer operation time increases the risk to the public and workers, and backup (upstream) protection operation will impact reliability, with more customers affected to clear network faults.
SCADA	The unavailability of remote monitoring and control for one or more network elements leads to uncertainty of network status in the control room. This may delay responding to events, which increases the loss of electrical supply risk and may expose Evoenergy to increased public and safety risks and associated risk treatment costs.
Communications	The communications network is critical to ensure the safe and reliable operation of the electrical network. Loss of communications used for SCADA can result in delayed response times, extending outages and therefore result in poor service to Evoenergy's customers. Keeping pace with current cyber security features is important for communications assets in the Operational Technology (OT) space, as is avoiding technical obsolescence. Communications are also used for transmission line unit protection, and loss of these communications systems exposes Evoenergy to increased risk of loss of electrical supply, damage to infrastructure and increased risk of injury or death to the public.
Batteries/chargers	The batteries in a substation are crucial to the operation of control and protection, communications, and switchgear systems. The loss of battery supply may result in the loss of any or all before-mentioned systems. A compromised protection system may result in extended physical damage to the primary network by delays or inability to clear a fault.
Transformer AVR	Failure of transformer voltage regulation devices such as relays and associated control circuitry can cause loss of electrical supply, damage to infrastructure and injury or death to the public. If a voltage regulation device is faulty, it may cause either a lockout scenario where voltage is not managed with a change in load or may cause busbar level voltage to runaway above or below nominal voltage limits, causing damage to network assets or customer owned premises. This has the potential to impact worker and public safety.

1.3 Replacement strategy

Table 2 outlines the replacement strategies for each asset sub-class. This asset class has experienced a significant transition in technology. Replacement is driven by assets with known condition issues and replacements of obsolete technology.

Table 2 Asset sub class replacement strategy description

Asset sub class	Replacement strategy
Protection relays	**Condition / performance / safety** For most protection schemes/relays, replacement decisions are based on their condition (either aged and previously repaired (short term), at-risk without sufficient spares or obsolete technology being managed off the network). As a high-level indicator, currently, 43.84% (1507) of protection relays are operating beyond their typical expected life, and 161 have been identified as requiring replacement based on slow operations, unstable calibration drift and known type vulnerabilities. The high proportion of 'over-age' assets demonstrates that Evoenergy is managing its protection relay population based on condition and performance indicators and not simply replacing it based on asset age. The relatively small volume of 'over-age' relays that are targeted for replacement illustrates the targeted focus of Evoenergy's replacement program on relays that remain in service with demonstrated performance issues.
SCADA	**Condition / compliance / [redacted]** For the majority of SCADA equipment, replacement decisions are based on condition or are replaced in conjunction with an upgrade of the primary assets or protection relays at the substation to enable the associated equipment to be monitored/controlled. [redacted] [redacted]
Communications	[redacted] [redacted] [redacted]

Asset sub class	Replacement strategy
	[redacted] Replacement decisions are driven primarily by technical obsolescence as well as vendor end of support notices. Evoenergy aims to replace unsupported communications equipment in line with vendor end of support.
Batteries/chargers	**Condition / performance / safety (as per protection relays)** Batteries in a substation are crucial to the operation of protection/switchgear systems. The loss of battery supply results in an upstream protection device operating instead of a local device. In some situations, physical damage to the primary network may be exacerbated by delays or the inability to clear a fault. Batteries must be periodically tested and replaced on condition assessment to ensure that they are able to fulfill their function and allow secondary assets to continue to operate in the event of an outage at the substation. Battery replacement for DC auxiliary supply is typical of substation, telecommunications stations and UPS assets across different critical industries.
Transformer AVR	**Condition / service history / compliance** For transformer voltage regulation schemes, replacement decisions are based on their condition assessment.

1.4 Options

Three primary drivers for secondary system asset replacement have been considered – **Condition Assessment, Obsolescence** and **Technical Compliance.** Assets that have been identified for replacement as a result of Obsolescence and Technical Compliance have been identified, and the associated risks and obligations discussed.

These assets are critical to managing the network, and Evoenergy evaluates and manages economically and technically obsolete assets off the network over time to maintain the reliability and security of its network. The current focus is on the relatively low cost and shorter life secondary systems assets that control and protect the much higher value primary assets.

Ultimately, the failure of the secondary system asset places the primary asset at risk of damage, as well as placing the system into an unsafe operating condition that may pose a risk to public and worker safety through a subsequent protection failure. Furthermore, our current operating principles and procedures are reliant on the correct operation of secondary equipment, such as switching practices and fault response, which also assist in managing worker safety risks.

Evoenergy's asset age profile shows that the business maintains a significant volume of aged assets in service and will continue to evaluate the performance, risk and condition of these assets over the upcoming regulatory control period and beyond as part of the ongoing risk and condition-based assessment of replacement needs.

Our proposed program represents an increase in secondary system asset replacement needs above the historical period that reflects genuine compliance, security, safety and performance issues within the network, over what was delivered in the current regulatory period.

These replacements are required to maintain Evoenergy's level of exposure to the risks posed by the older technology types, lower historical reliability, and slower acting secondary system assets over the next regulatory control period.

For condition-based replacements, the two options are to replace secondary assets in line with historical trends, or via a targeted risk-based approach. The options analysis focusses on the cost, risk and prudency of replacement strategies, summarised below in Table 3.

Table 3 Options descriptions and recommendations

Option	Option name	Description	Recommendation
1	Replacement volumes in accordance with historical rates	Replace secondary systems in line with historical rates.	**Not recommended.** Historical replacement rates represent a largely 'replace on fail' strategy that has not addressed emerging risks with the existing population. Without the planned management of obsolete, poor performing or poor condition assets off the network there will be an increasing risk to public and worker safety, reliability, and the environment. Furthermore, there is an increasing volume of assets identified in the latter part of their lifecycle due to the transition in technology to static relays over the 1980s and 1990s and then microprocessor-controlled relays over the past 20 years. These technology changes effectively reduced the expected life of relays to around 20-25 years from the 40+ years that were previously available from older (rebuildable) electro-mechanical units. Digital relays provide faster operating times, reduced maintenance, greater monitoring, control, and centralised protection settings coordination. These have proven operational expenditure benefits that far outweigh the longer service life of older technology. As a result, the skills and spares needed to keep older protection operating are no longer available in the market – meaning that the older static relays and any remaining electromechanical units are being managed off the network.
2	Target the highest risk secondary system assets for replacement	Target the highest risk secondary systems for replacement based on condition, technology, spares, and skills.	**Recommended.** There is a growing population of poor performing or unsupported secondary systems assets (such as electromechanical relays) that are in poor condition and are considered obsolete from a vendor supportability perspective. Further, Evoenergy can no longer maintain these older assets due to a lack of skills, spares, or suitable replacements. These populations pose an increasing risk to worker and public safety, as well as network reliability and are being managed off the network over time.

1.5 Investment forecast quantities

Based on the recommended management strategy, Table 4 shows the forecast replacement volumes for the different asset sub-classes of Communications, Control and Protection and Auxiliary DC Systems proposed for the 2024–29 regulatory period. The values are based on the outcomes of our cost benefit analysis (CBA) and supported by a top-down evaluation, industry practice and consideration of the limitations on spares and skill availability within the ACT.

The replacement forecast is based on the preferred Option 2 strategy that manages the risk of secondary systems with known condition, support, performance or technology type vulnerabilities.

Table 4 Forecast replacement volumes

Asset group	Replacement quantities	Replacement need
Auxiliary DC systems		
Replace distribution sub battery	52	Condition Assessment
Replace zone sub battery	15	Condition Assessment
Replace distribution sub battery charger	11	Condition Assessment
Replace zone sub battery charger	5	Condition Assessment
Protection		
Replace busbar protection	4	Condition Assessment
Replace feeder protection	71	Condition Assessment
Replace group breaker (11kV Incomer) protection	20	Condition Assessment
Replace line protection	4	Condition Assessment
Install group control panel (for IEC 61850 SAS)	7	Condition Assessment
Replace transformer AVR	16	Condition Assessment
Replace transformer protection	16	Condition Assessment
Replace distribution protection	23	Condition Assessment
SCADA		
Replace distribution (Chamber) RTU	68	Obsolescence

Replace distribution (Chamber) substation RTU and rack	23	Obsolescence
Replace zone substation HMI and RTU	5	Obsolescence
Replace zone substation HMI	1	Obsolescence
Replace GPS clock	3	Obsolescence
Replace zone substation RTU	5	Obsolescence
Communications		
Replace zone substation routers and switches	28	Obsolescence
Replace carrier modems, including security/support upgrades	203	Obsolescence
Replace microwave radio links	4	Obsolescence
Replace communications DC supplies	16	Obsolescence
Replace tele-protection devices	12	Obsolescence

1.6 Recommendation

As per Table 5, the recommended option is Option 2— a targeted, proactive replacement of the most critical condition secondary system assets for the 2024–29 regulatory period. In total, we expect to spend $23.17 million ($2023/24, excluding corporate overheads)[1] to complete the works described below. It is essential that this program commences, as proposed, to manage the associated risk and ensure the continued safety and reliability of Evoenergy's network.

The recommended option has a high benefit cost ratio (BCR) net present value (NPV) and is aligned with Evoenergy's current strategy and asset management objectives. As a result, it is the recommended option on the basis that it maximises benefits to customers. Compared to Option 1, it also more strongly aligns with our customer expectations and Evoenergy's broader duty of care to maintain the safety, reliability, and security of their network.

[1] Note, all $ in this appendix are reported on this basis, unless otherwise specified.

Note that values have been discounted to present values, using the real Weighted Average Cost of Capital (WACC) of 3.13 per cent[2] as the discount rate, as per Evoenergy's proposed Post Tax Revenue Model for the 2024–29 regulatory period. The present value of costs and benefits have also been calculated on a 10 year basis, while the EN24 capital expenditure (capex) value is for the 2024–29 regulatory period.

Table 5 Comparison of options

Comparison criteria ($2023/24)	Option 1	Option 2
PV cost ($ m, 2023/24)	$10.24	**$12.78**
PV benefits ($ m, 2023/24)	$29.24	**$35.96**
Benefit Cost Ratio	2.85	**2.81**
NPV ($ m, 2023/24)	$18.99	**$23.19**
Capex ($ m, 2023/24)	$16.18	**$23.17**

[2] AER, Evoenergy Revised PTRM 2024/25-28/29, 'WACC' Sheet, Cells G19:K19, Real Vanilla WACC.

2. Identified need

This section provides the background and context to this business case, identifying the issues that pose the highest risk to the secondary systems of Evoenergy's customers and describing the current mitigation program.

2.1 Condition based replacement

Evoenergy has historically implemented a program of works to replace end-of-life assets with modern equivalents, with replacements frequently occurring on the failure or performance degradation of individual assets. The change in age profile and quantity over time for protection assets is shown in Figure 1. The protection assets form the largest component of secondary system assets. However, other secondary system asset classes (including SCADA, Comms and DC systems) that support protection and control functions show a similar aging profile, with significant volumes of assets with observed performance or condition issues as they reach end of life over the 2024–29 regulatory period, as evidenced in the failure and defects graphs below (see Figure 7 and Figure 8).

Approximately 60 per cent of protection relays are over 20 years old, which will increase to 64 per cent by the end of the 2024–29 regulatory period without significant replacement. Over 40 per cent of those are over the age of 30 and are operating well beyond their expected 'new asset' design lives of 20 years. The older style electromechanical and static relays (with discrete electrical components) that remain on the network are no longer able to be repaired due to the decline of skills, spares, technology and supplier support to maintain them in service.

Evoenergy is also experiencing the earlier generations of microprocessor based electronic relays reaching the point where end of life renewal planning will commence in parallel to the older technology types. **This alone results in a significant increase in relay replacement needs when compared to the historical period that was used as the basis for the AER's substitute repex forecast.** The planning for the increasing volume of relay replacement must be addressed to allow the longer-term management of protection system renewal within Evoenergy's operational capacity over the 2024–29 and subsequent regulatory periods.

Figure 1 Protection relay age profile

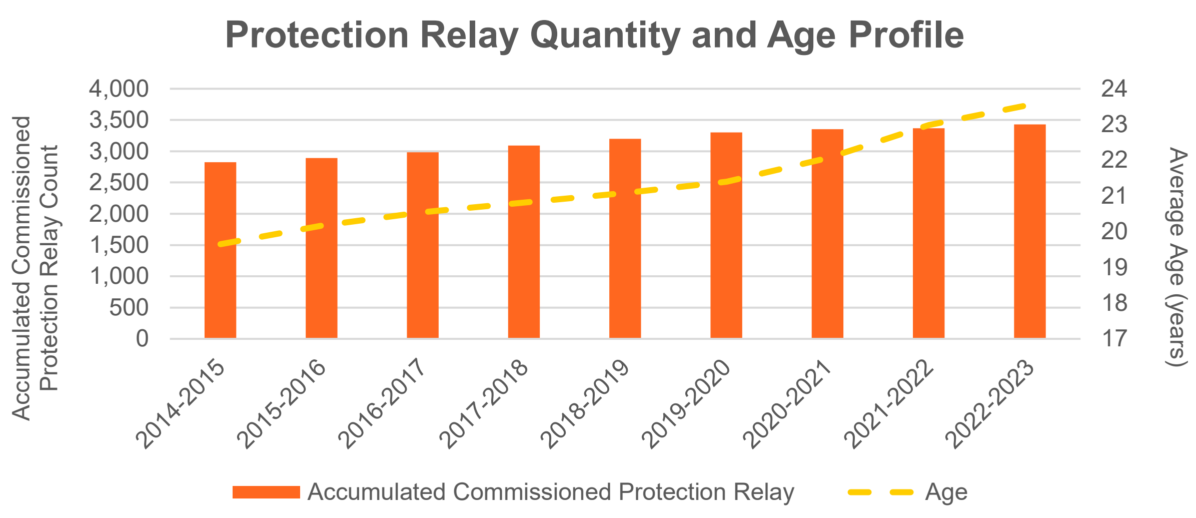
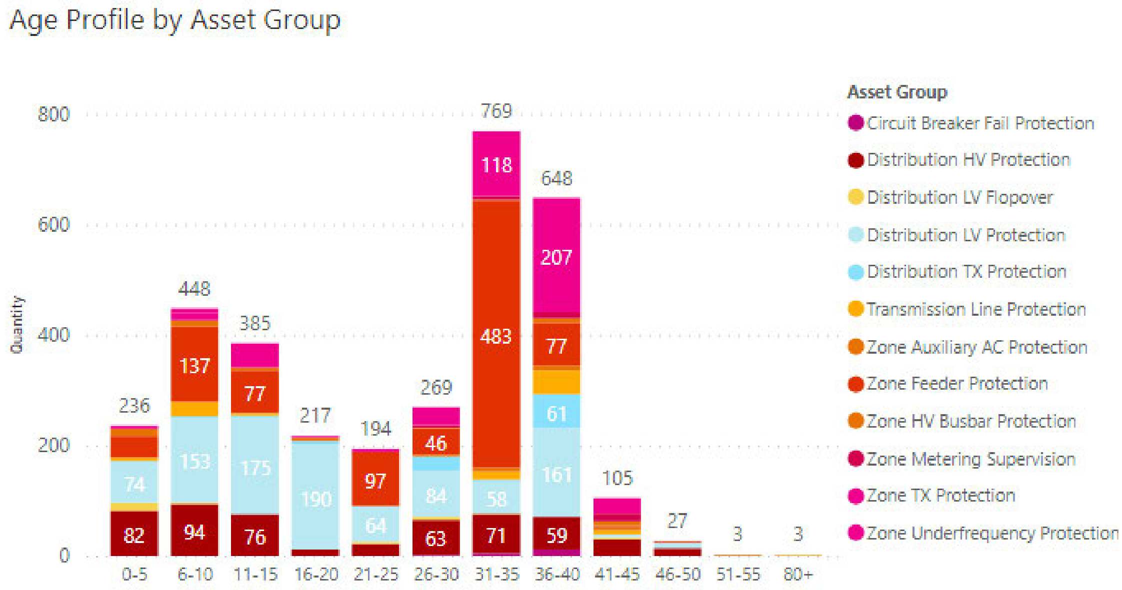


Figure 2 Protection relay age profile by asset type



The asset replacement strategy for the five year period 2024–29 regulatory period for protection targets the renewal of the zone feeder and transformer protection relays, as well as SCADA and communications assets that exhibit significant condition, performance, or risk vulnerabilities. Risk factors affecting these assets include known failures, technology type, condition assessment, and lack of support.

Condition based zone substation asset failure

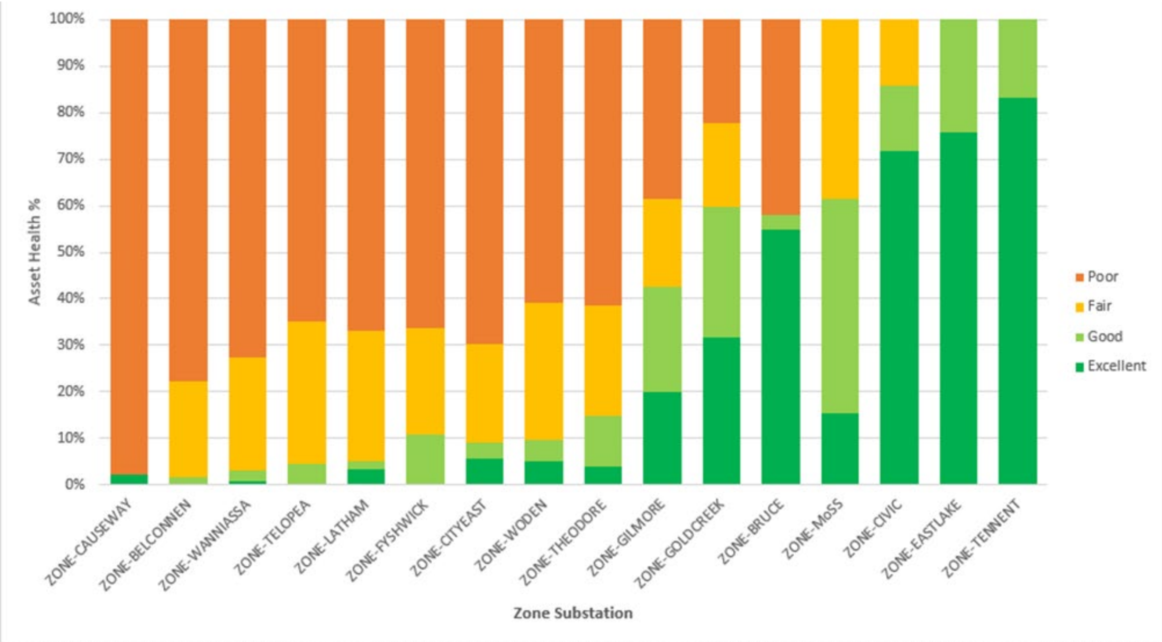
Accordingly, for feeder protection, City East zone substation (ZSS), Woden ZSS and Theodore ZSS have been identified for complete feeder bay protection replacement to replace failing ABB relays type SPAJ140C, with known type vulnerabilities, performance issues and condition concerns.

For transformer protection, City East ZSS, Gilmore ZSS, Gold Creek ZSS, Telopea ZSS, Wanniassa ZSS and Latham ZSS have been identified to replace failing and defective ABB transformer differential relay type RADSB. The asset health analysis for each substation has been presented in Figure 3.

The transmission line protection relays are RAZFE type, a first-generation electronic static relay that has been in service for 37 years and operating well beyond their typical 30 year service life. This asset type has a poor maintenance history and suffers from calibration issues with out-of-tolerance analogue circuit drift noted over time. The asset is subject to false tripping on non-faults and not tripping for actual faults with risks to reliability and damage to network assets. Furthermore, these relays are installed as a singular protection scheme and do not meet National Electricity Rules (the Rules) requirements of duplicated protection.[3] These assets have already had their service life extended through recalibration. However, given the significance of the primary assets that these relays protect on the ACT power system and their history of calibration drift, the relays have already effectively failed on performance and renewal over the next regulatory control period is critical.

[3] Rules, S5.1.9(d).

Figure 3 Zone substation protection assets health analysis



SCADA and communication assets

The mean age of SCADA equipment is 11.55 years which is at an average of 77 per cent of typical life, which has been established as 15 years for SCADA assets. Figures 4 and 5 show the health and age profile of SCADA assets. The focus of the EN24 submission is replacing obsolete SCADA assets and managing unsupported assets out of the network to maintain control capability [redacted]

Figure 4 SCADA asset health profile

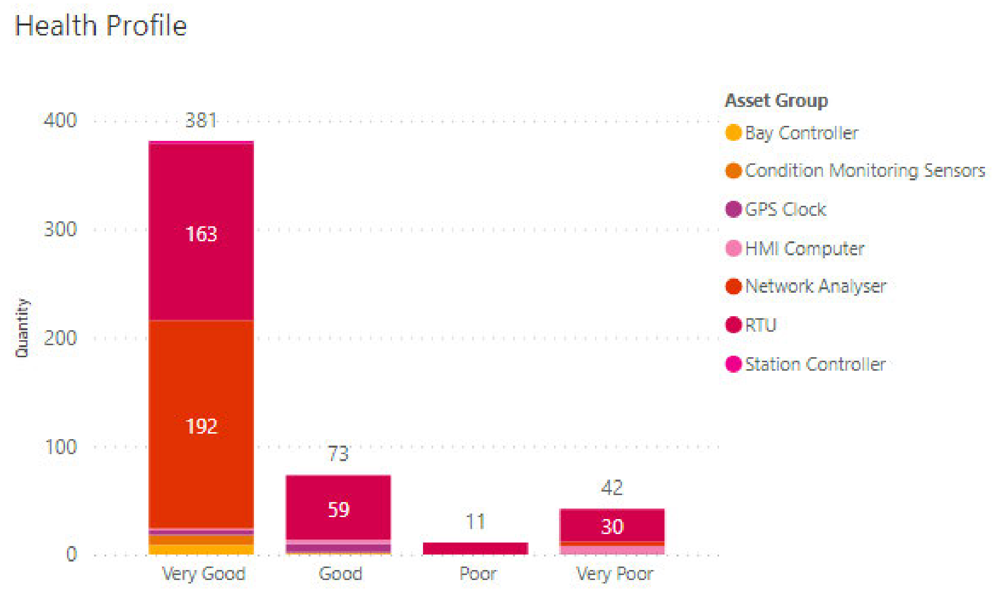
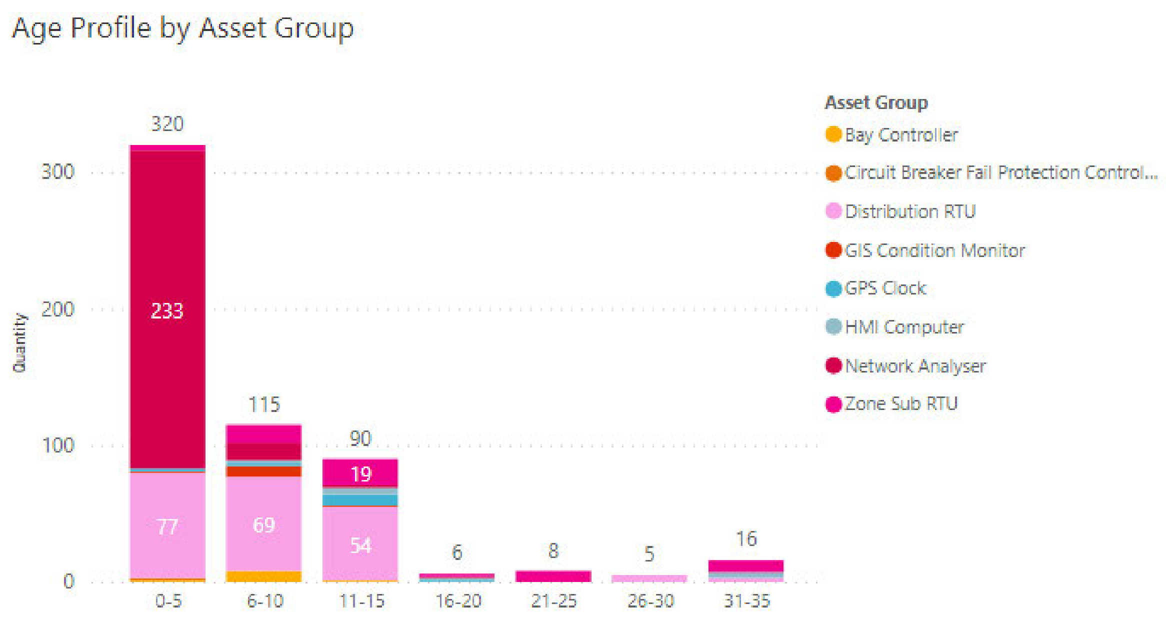


Figure 5 SCADA asset age profile by asset group



2.2 Managing obsolescent assets off the network

Technical and economic obsolescence are factors that all distribution network service provider (DNSPs) must manage. It is rarely efficient to simply replace all assets at once, but rather, the typical approach that is taken is to identify the affected assets, consider the risks and costs that are associated with retaining obsolete assets in service and assess the highest risk assets as initial renewal targets. The remainder of the population can then be managed off the network over time to obtain extended service lives from the lower risk assets—considering the availability of spares, skills and any type, performance, opex or condition vulnerabilities.

Over the past 20–30 years, many electromechanical assets have become technologically obsolete, with electronic relays becoming commonplace from the 1980s and more advanced microprocessor units emerging with increasingly sophisticated programming, control, and monitoring capabilities from the 1990s to the present day. Evoenergy still retains some electromechanical and static electronic relays. These assets are increasingly difficult to maintain due to the lack of necessary components, inability to obtain spares, limited staff and vendor capabilities, and the rapidly reducing industry skill base for these technologies as they have been retired from service. This results in an increasing risk to maintain the safe and reliable operation of the network by those assets.

Reliability consequences associated with communication/SCADA system failures can result in a number of different outcomes, including catastrophic failure or damage to associated primary assets, cascading outages affecting other parts of the network, extended outages to customers, and offloading generation.

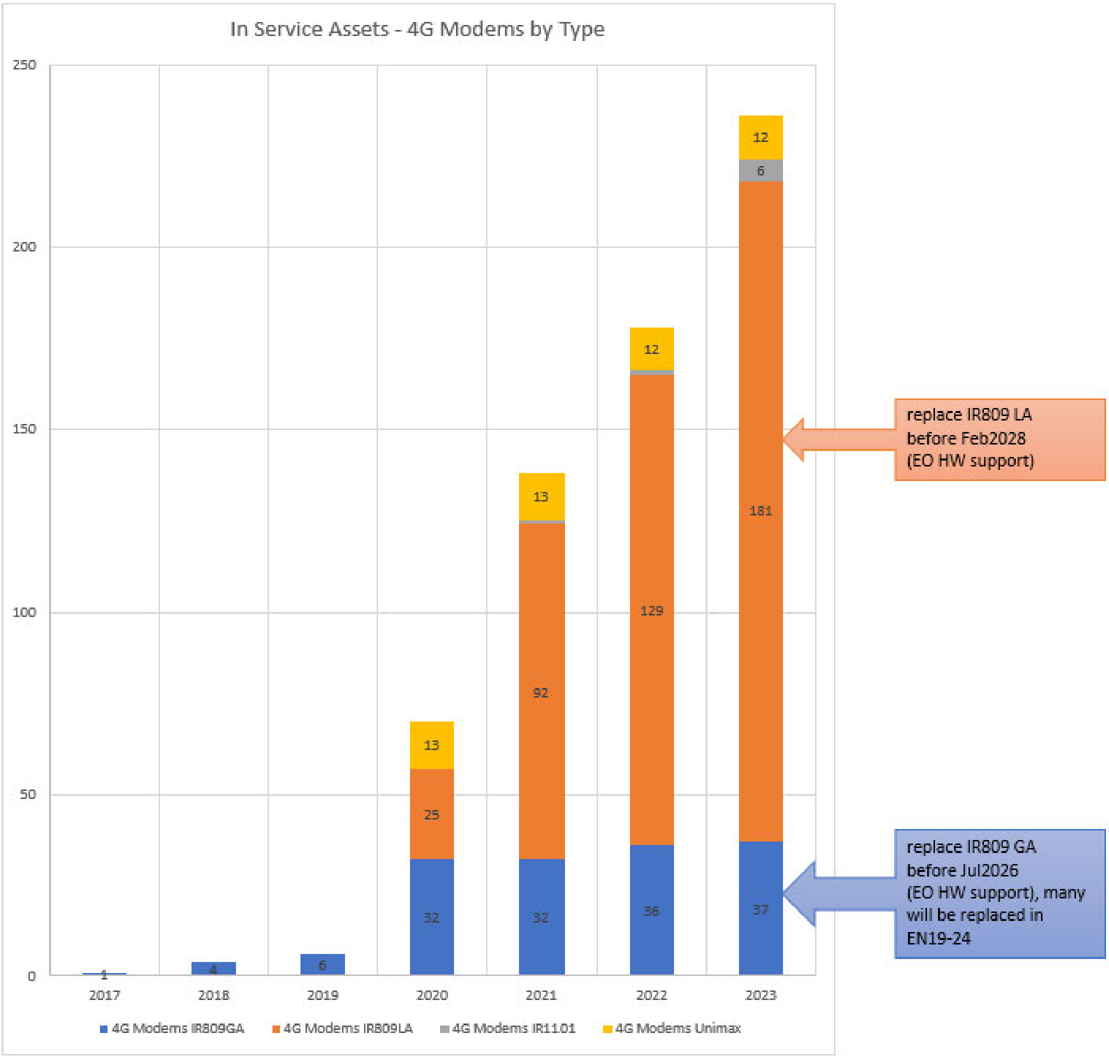
The importance of vendor support withdrawal windows

[redacted]

Furthermore, the improved functionality offered by modern replacement devices can augment the existing remote access for monitoring, configuration management, post event data access and analysis. Across the network, these functions enable Evoenergy to manage reliability outcomes and operational resourcing at a relatively consistent level over time.

There is a critical need emerging in the 2024–29 regulatory period for Evoenergy to manage the SCADA and communications network through migration to modern equivalent assets as modems reach the end of production and progress the staged withdrawal of vendor support to 2027.

Figure 6 Modem type and vendor security and support summary



Evoenergy has already received several End of Life (EoL) and EoS notices, with a large quantity of critical communications components expected to be retired by vendors over the next three to five years. [redacted]

Affected assets

[redacted]

Furthermore, critical components of the SCADA networks (specifically type SCD5200) have been identified to be at EoL and progressing through their supplier EoS window within the next regulatory period, with spare parts or replacement units no longer available from the supplier for any of Evoenergy's fleet of SCD5200 RTUs. Other failures of critical Zone Substation SCD5200s have required the replacement of an entire RTU Node, including the backplane, field wiring cards, and RTU control module.

This failure and others like it of the SCD5200 have developed without identifiable component failure, making them impossible to predict and impacting our operational capabilities accurately.

Failures

There are several secondary systems assets exhibiting increasing failure rates in the network. These failures are not only attributed to age, but also are a result of legacy installations and operational history.

In 2023, seven protection assets have already failed at Latham, Wanniassa and City East zone substations. The common mode of failure for this asset has been its power supply—which cannot be economically repaired. The average age of the asset type is now more than 30 years old, and 'on average' has exceeded its typical life, meaning that there is a disproportionate volume of older protection relays that pose a significant risk to the system.

A total of 62 protection relays have failed across Evoenergy's zone substations in the last decade. The majority of failed relays were of types SPAJ140C, RADSB, RAZFE and old electromechanical relays that do not self-monitor and report relay failure. This means that a failed relay is only detected during the next maintenance cycle and can be in an inoperable state for years. The failed relays leave feeders, lines and transformers vulnerable and reliant on No.2 systems and backup protection to clear faults. Whilst a number of poor condition relays have been pre-emptively replaced at Gold Creek, Gilmore and Civic zone substations, a vast majority of the other zone substations still carry failure prone assets.

The SCADA asset sub class has experienced 15 asset failures since 2017 (Figure 7), with failures of control cards on SCD5200 RTUs at zone substations being the majority. These SCD5200 faults have occurred during auto-reclose events as well as during normal control operations, extending feeder outages and adversely affecting reliability. As a priority, these sites have been identified for replacement in the SCADA repex for the 2024–29 regulatory period.

The communications asset sub class has also been expanding since an MPLS WAN was introduced in 2014, and we started using carrier 4G modems in 2017—these assets will be reaching EoL [redacted]

The SCADA and Communications assets have also experienced an increasing defect rate over the last decade that has exceeded 250 in recent years (Figure 8), where site visits are required to investigate and repair or apply workarounds to temporarily return the asset to service (device resets, recalibrations, use of alternative ports etc.). The replacement of SCADA and communications assets with modern equivalents will assist in reducing the defect rate and permitting remote management of assets, lowering the required maintenance opex.

The proposed replacement program only seeks to replace the highest risk secondary systems, representing 11 per cent of communications, control and protection assets. Given the relatively short typical lives of these assets, the replacement rate is less than the 15–20 per cent that would typically be expected across a mature population of 5–20 year old assets.

Table 6 Forecast failure rates (2024–29)

Asset sub class	Forecast average annual failures	Annual % of population
Protection relays	8	0.24%
SCADA	3	0.53%
Communications	3	0.30%

Figure 7 Secondary systems asset failure rates

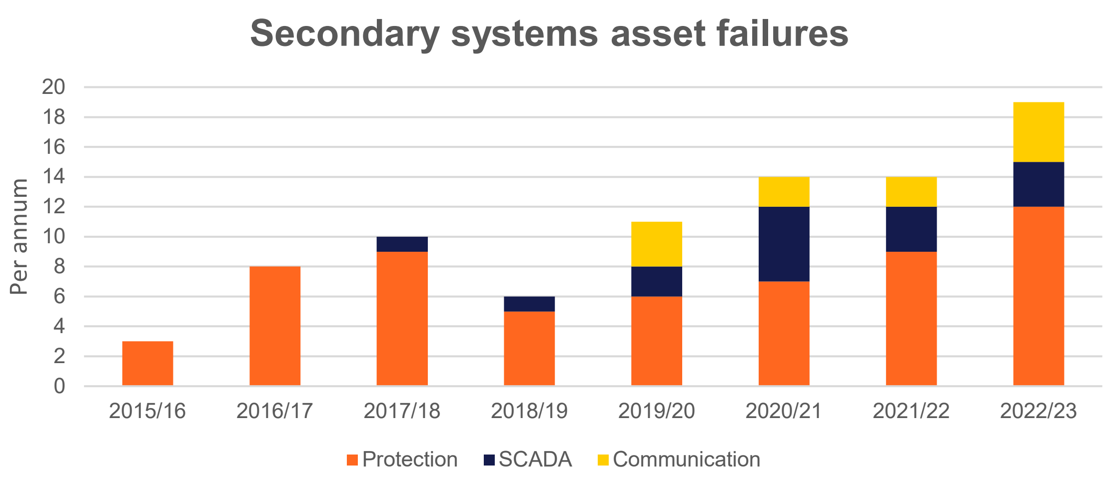
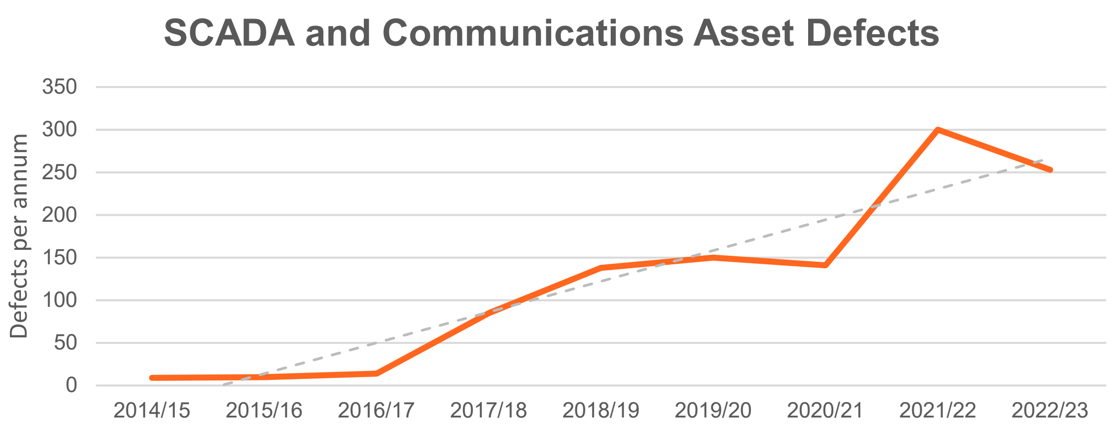


Figure 8 SCADA and communications asset defects (per annum)



2.3 Cyber security threats

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

4 Australian Signals Directorate, *Cyber Threat Report 2022-2023*
5 IBM *Cost of Data Breach Report 2023,* p.5
6 Assuming IBM quoted 2023 USD/AUD conversion of 1.4916.

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3. Business cases and economic justification

We have provided supplementary economic analysis and justification to demonstrate a positive present value for the proposed repex allocation of $23.17 million ($2023/24, excluding corporate overheads). This section describes the options that were considered to mitigate and manage the emerging risk arising from secondary systems with performance, condition, or type vulnerabilities. These options are assessed based on their ability to address the identified needs, prudency and efficiency and technical feasibility.

The selected option represents the program with the highest NPV and a BCR substantially higher than one for customers.

3.1 Cost benefit analysis

A CBA is conducted to quantify and compare the economic benefits of different investment options. In this case, the benefits are the reduced exposure to potential risks that arise from secondary system replacement that otherwise may accrue to either Evoenergy (e.g. reliability penalties under the Service Target Performance Incentive Scheme (STPIS)), customers or the community (e.g. bushfire risk) more broadly as a result of the failure of an Evoenergy asset.

When performing a CBA, customer benefits are reflected as costs and risks avoided from undertaking asset replacement. The customer benefits associated with Evoenergy assets are calculated based on factors including the following:

Table 8 Risk categories and descriptions

Risk category	Description
Public safety	Harm to the public due to contact with live electrical equipment and faulty protection.
Worker safety	Harm to maintenance workers due to live electrical equipment and faulty protection.
Outage	Costs associated with interruptions to electricity supply which can affect single customers, businesses, and whole communities.
Financial	Expected costs to repair or replace the failed asset.
Environment (fire)	Failure effects costs to the environment due to bushfires.
Environment (oil)	Failure effects costs to the environment due to oil spills.

Additional justification is included in cases where there is a material driver of cost or benefit that falls outside the categories outlined in Table 8. These are addressed on a case-by-case basis.

3.2 Risk assessment

Where CBA has been undertaken, risk before investment (inherent risks) and after investment (residual risk) are considered as part of Evoenergy's network planning process and investment decisions to assess network performance and capacity against future network needs based on the projected demand forecast and remaining useful life for the main network components. Additionally, a series of network and non-network options are considered as part of its investment decision making to meet the required performance targets.

As noted in Evoenergy's Annual Planning Reports, prioritisation of infrastructure spending is considered based on the condition and performance requirement for the asset, as well as minimum capacity thresholds to serve the expected demand requirements.

When calculating a risk magnitude, the customer benefits are reflected as costs and avoided risk exposure from undertaking asset replacement. We have considered and quantified the key consequences that can result from functional failure, including harm to the public and workers, loss of supply, and damage to the environment (as described in Table 8 above).

Condition based options analysis

This section describes the various options that were analysed to address the increasing risk associated with retaining existing secondary systems in service to identify the recommended option. The options are assessed based on an ability to address the identified need, prudency and efficiency, commercial and technical feasibility and balancing between long term asset risk and short-term asset performance.

- Option 1: Replace in line with historical trends
- Option 2: Targeted risk-based approach

A comparison of the two identified credible options and the issues they address in section 2 is shown in Table 9. Note that figures are direct costs only (excluding corporate overheads).

Table 9 Comparison of options

Assessment Metrics	Option 1	Option 2
NPV ($ m, 2023/24)	$18.99	$23.19
BCR	2.85	2.81
CAPEX ($ m, 2023/24)	$16.18	$23.17
Meets customer expectations	◐	●
Aligns with asset objectives	◐	●
Technical feasibility	●	●
Deliverability	◕	●
Preferred	**No**	**Yes**

● Fully addresses the issue. ◕ Adequately addresses the issue. ◐ Partially addresses the issue. ○ Does not address the issue.

This shows that Option 2 represents the preferred option in terms of the quantitative evaluation of costs and avoided risk, as well as the present value of the cost and benefit profiles associated with the program. The higher NPV of Option 2 and a strong BCR demonstrates that the additional capex associated with the option delivers more favourable outcomes for customers than Option 1.

In addition, Option 2 better allows for more co-ordinated delivery and a safer, more responsive network for customers.

Option 1 – Replace in line with historical trends.

This option is to replace secondary system assets in line with historical rates and manage the increasing risk through maintenance and repair. Under this replacement scenario, Evoenergy forecasts an asset replacement program for an estimated cost of $16.18 million (excluding corporate overheads).

It is worth noting that SCADA and communications assets have design lives of 7–15 years, and the bulk of the modems and SCADA system assets will approach or reach the end of life over the 2024–29 regulatory period. This replacement approach ensures that most assets that reach the end of support are replaced. However, 3.9 per cent protection relays will remain on the network in critical condition, with Evoenergy continuing to manage the risk posed through the remaining end of life phase population of this asset class. This is too risky and does not align with the asset objectives to maintain asset risk at an acceptable level.

This presents an escalating risk to reliability, security of supply, and public and worker safety risk. This option is not recommended and only partially meets customer expectations and asset objectives.

Option 2 – Targeted risk based approach

This option proposes a targeted replacement program focusing on the highest risk secondary system assets in order to maintain system safety and reliability in a prudent and cost-effective manner. A risk-based prioritisation has been performed, considering asset age and condition, to develop the targeted replacement program. Replacement of all 'high risk' assets will lead to an increase in expenditure cost impacts on customers and is not considered efficient and prudent. Instead, Evoenergy intends to replace the highest risk assets for an estimated cost of $23.17 million.

Option 2 represents an expanded program of $23.17 million (excluding corporate overheads) to address the identified high risk secondary systems over the 2024–29 regulatory period. This allows Evoenergy to address the known population of secondary system assets that have demonstrated condition or performance issues over the 2024–29 regulatory period to maintain the risk posed by the population in line with historical approaches.

We note that this requires a higher level of investment due to the lower historical need for replacement. Evoenergy was monitoring and extending the service life of its secondary system asset population and continues to do so for the vast majority of its secondary systems assets. For the assets that are targeted in EN24, the available life extension options have been exhausted.

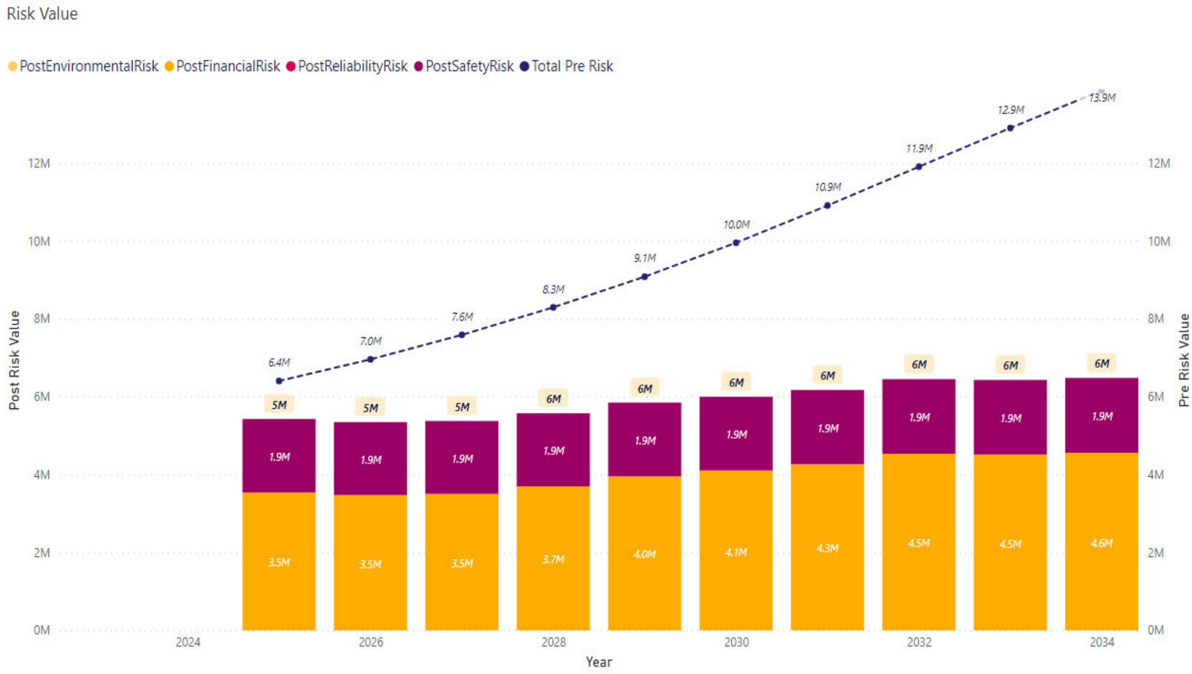
Option 2 delivers greater total value to customers, as evidenced in the higher NPV and associated management of the residual risk profile within Evoenergy's capability to manage. This proposed program will address the identified need by progressively replacing the highest risk assets.

Figure 10 demonstrates the high-level comparison between Evoenergy's baseline risk ('Total Pre-Risk') and the forecasted risk levels over the upcoming 10 year period under the asset strategies as described within this document. Figure 10 shows that the asset replacement targeted for the 2024–29 regulatory period is focussed on managing the risk associated with a significant aging of an already mature asset base.

Regardless of the modelling methodology selected, it is clear that Evoenergy will experience an increasing need to replace secondary systems over the upcoming decade. The principal concerns are defining the scale and the timing of this work. Whether this is determined by the Evoenergy forecast or the AER's repex model, it is clear that a repex allowance that is above the historical levels provided in the AER's draft decision will be required and that it is in the interests of customers to do so on the basis of the CBA conducted for this business case.

Evoenergy's revised proposal maintains risk over the 2024–29 regulatory period at a level that is slightly above the current level, allowing for a modest but constrained growth in the risk that it is managing to 2029. Beyond that, further replacement is required as the currently younger assets reach maturity, and the mature assets are managed off the network in accordance with an appropriate end-of-life strategy.

Figure 10 Risk valuation for secondary systems



4. Recommendation

Given the more favourable NPV for Option 2 (manage asset risk through targeted replacement) and strong BCR (2.81), it represents the preferred option for Evoenergy's secondary systems replacement capex.

This results in a higher total repex allowance than has been allowed for in the AER's draft determination due to the demonstrated need and economically supported analysis of the proposed program benefits and costs. The curtailed program implied in the AER's substitute forecast would typically deliver a greater short-term benefit (from avoided investment cost), but this would be offset over time by an unacceptable increase in risk from Evoenergy's perspective.

We note that the assessment approach will tend to favour retaining assets on the network due to the fact that it only considers the 10 years from 2024 to 2034. This means that it does not account for the following:

- the continuation of benefits from replacement assets beyond 2034 (substantially attenuating the benefits realised by the replacement assets to 5–10 years);
- the continuation of risk exposure costs beyond 2034 (substantially attenuating the value of risk for assets that are not replaced before 2034); and
- the very high modelled risk of failure for the remaining assets at the extreme end of the lifecycle under either the Evoenergy, AER or most other modelling approaches.

As such, it should be kept in mind that the relative benefit of Option 2 would be considerably larger if these factors were included in the analysis. Their exclusion reduces the reliance on the long lives of network assets to justify high capex solutions in business cases without considering the real option value provided by lower cost, shorter life assets, and technology cost curve benefits over the service life of the investment.

Assessment Metrics	Option 1	Option 2
NPV ($ m, 2023/24)	$18.99	$23.19
BCR	2.85	2.81
CAPEX ($ m, 2023/24)	$16.18	$23.17
Meets customer expectations	◑	●
Aligns with asset objectives	◑	●
Technical feasibility	●	●
Deliverability	◕	●
Preferred	**No**	**Yes**

● Fully addresses the issue. ◕ Adequately addresses the issue. ◑ Partially addresses the issue. ○ Does not address the issue.

[redacted]

Abbreviations

Abbreviation	Meaning
AER	Australian Energy Regulator
AESCSF	Australian Energy Sector Cyber Security Framework
BCR	Benefit Cost Ratio
CBA	Cost Benefit Analysis
DC	Direct Current
DNSP	Distribution Network Service Provider
EoL	End of Life
EoS	End of Support
EV	Electric Vehicles
LAN	Local Area Network
MPLS	Multi-Protocol Label Switching
NEM	National Electricity Market
NER	National Electricity Rules
NPV	Net Present Value
OT	Operating Technology
RIN	Regulatory Information Notice
RTU	Remote Terminal Units

SCADA	Supervisory Control and Data Acquisition
SOCI	Security of Critical Infrastructure
UPS	Uninterruptable Power Supply
WACC	Weighted Average Cost of Capital
ZSS	Zone Substation