Replacement Expenditure (Repex) Forecasting Approach

2025-30 Regulatory Proposal

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Document: 5.3.2

SA Power Networks

Empowering South Australia

Contents

Glossary

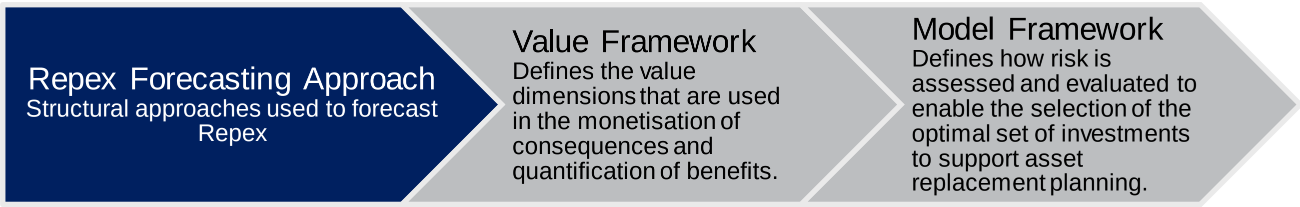
Acronym / term	Definition
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
GIS	Gas Insulated Switchgear
RCP	Regulatory control period
Repex	Replacement expenditure

1. Introduction

1.1 Purpose

The purpose of this document is to outline SA Power Networks' methods for forecasting capital expenditure on network asset replacement and refurbishment (**repex**) for the regulatory control period from 1 July 2025 to 30 June 2030 (2025-30 **RCP**). This document forms part of a suite of documents for our modelling and forecasting of replacement expenditure, as set out in Figure 1.

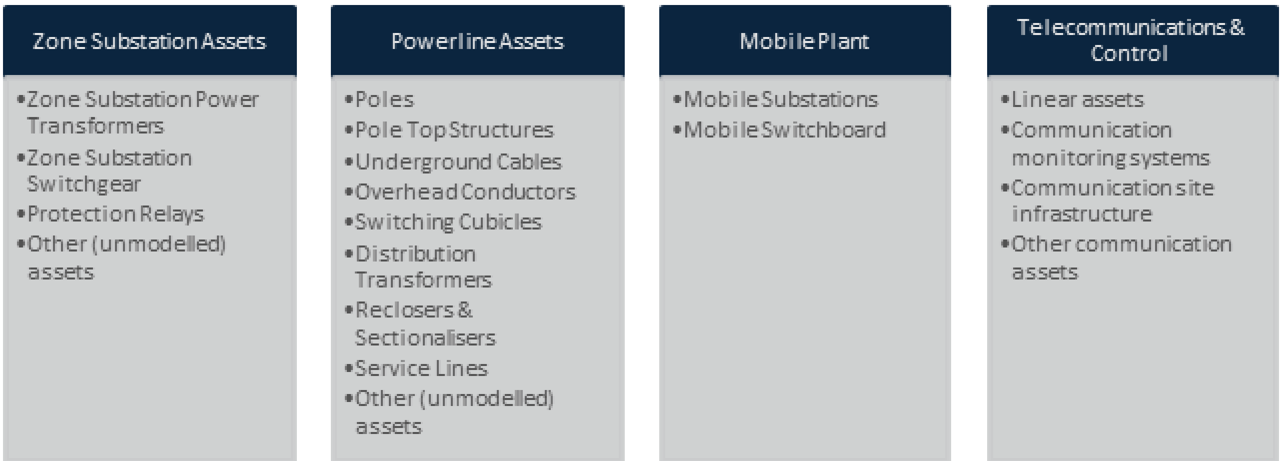
Figure 1 Repex document suite



1.2 Scope

This document covers the repex forecast for our electricity distribution network assets used to provide Standard Control Services (**SCS**). Asset classes covered by this document are outlined in Figure 2.

Figure 2 Repex asset classes



This document does not cover:

- assets used in the provision of Alternative Control Services (for example metering equipment and public lighting infrastructure); nor
- Standard Control Services (SCS) expenditure relating to:
  - augmentation of electricity distribution network assets;
  - new/altered connections to the electricity distribution network; and
  - non-network related assets such as business and commercial telecommunications systems, motor vehicles, properties, office buildings and building equipment (eg. furniture, computers).

1.3 Principles used in developing a forecast

SA Power Networks has sought to align its approach to forecasting repex with:

- the principles in the Australian Energy Regulator (**AER**) Asset Replacement Application Note;
- industry best practice; and
- the expenditure objectives, factors and criteria in sections 6.5.7 and 6.5.6 of the National Electricity Rules (NER).

2. Forecasting Approaches

SAPN has identified three main drivers of repex and the asset replacement programs which address these drivers. Our approach to forecasting repex expenditure is derived for each asset class, dependant on asset volume and asset data availability.

2.1 Asset replacement drivers

Forecast repex is intended to address risks arising from the operation of assets over time. There are three drivers for repex as in Table 1.

Table 1: Asset replacement driver breakdown

Driver	Asset replacement driver details
Conditional failure	• Where an asset's condition declines beyond an acceptable limit or threshold. If left untreated, it is expected that continued operation would result in a functional failure in the short term. • Forecasting repex associated with conditional failure requires a prediction on how likely the asset is to functionally fail.
Functional failure	• Where an asset has failed whilst in service, due to either its deteriorated condition or an external factor where the asset's condition was not relevant. [1]
Asset obsolescence	• Where replacement is driven by issues such as high costs to maintain or high risks of continued operation that cannot be otherwise mitigated.

2.2 Asset replacement programs

The forecast repex programs are based on the asset replacement driver as set out in Table 2.

Table 2: Determinants of program categorization

Program	Asset details for program suitability
Conditional	• Proactive replacement (pre-functional failure) is expected to provide benefits. • Condition of the asset can be assessed or predicted and used to forecast failure.
Reactive	• Asset failure has low criticality and consequence . • Detectability/predictability of asset condition is difficult. • Proactive replacement (pre-functional failure) is unlikely to provide benefits.
Planned	• Proactive replacement is expected to provide benefits. • Monitoring condition does not contribute to a change in risk eg. assets with inherent / unacceptable safety risks unrelated to condition.

[1] For example, an extreme weather event may cause an asset to functionally fail, irrespective of its condition.

2.3 Forecasting approach

Our repex forecasting approach is categorised according to the replacement program, and the asset value / volume, as set out in Table 3 below.

Table 3: Forecasting approaches by asset type and program

Asset type \ Replacement program	Conditional	Reactive	Planned
High volume assets - sufficient data for modelling	Volumetric risk-based model	Historic	Individual business case
High volume assets - insufficient data for modelling	Historic	Historic	Historic
High value asset	Individual business case	Historic	Individual business case

Where sufficient data is available, forecasts are underpinned by detailed modelling and value assumptions as set out in SA Power Networks' **Model Framework**, and consistent with the expectations set out in the AER's Asset Replacement Planning (ARP) note[2]. This detailed modelling may be in the form of high-volume asset class forecasts (ie. for asset classes with large populations consisting of similar assets) or individual asset renewal business cases – both of which are guided by the SA Power Networks Model Framework.

High volume asset class forecasts rely on a large population of similar assets, for instance Poles. These forecasts are derived using bottom-up modelling of each individual asset, relying on statistical modelling to determine expected lives using large populations of data (eg. population age profile, failure rates). For this statistical analysis to be valid, the population must have similar physical traits. For this reason, an asset class may be separated into sub-populations - for instance within the Distribution Transformer population, statistical lives of pole-top transformers would be considered separately from ground level.

Where an individual asset within an asset class is unique or of significant value - for example a single instance of outdoor Gas Insulated Switchgear (**GIS**) in a population of predominantly indoor Oil Insulated Switchgear, this individual asset may be considered separately from the population through an individual business case. The same economic principles outlined in the **Model Framework** are applied in an individual business case.

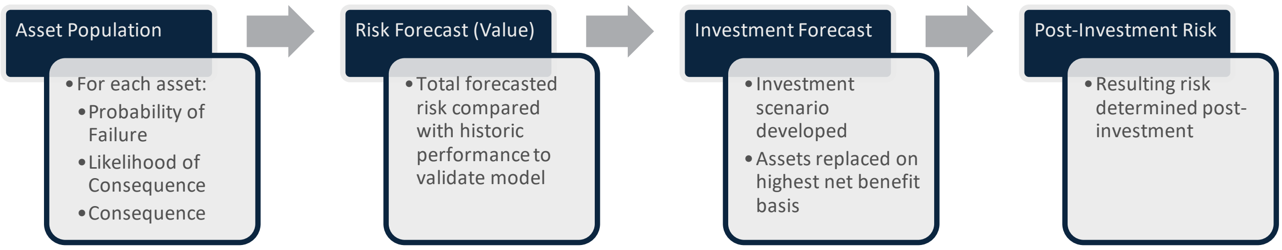
Where insufficient data is available to support an asset risk (benefit) modelling approach, historical expenditure is generally relied upon. This forecasting approach is likely to be conservative as it assumes a homogeneous age/condition profile across the asset population which is often not the case. Using the historical expenditure approach, only a single case is considered – continue the current rate of expenditure.

2.3.1 Volumetric risk-based model

High volume asset class forecasts are developed using value-based decision making. The decision to replace (or refurbish) an asset is made weighing up the investment cost against the value delivered through that investment using the **Value Framework**.

[2] AER, *'Industry practice application note – Asset replacement planning, 25 January 2019'*, available via: [https://www.aer.gov.au/documents/aer-industry-practice-application-note-asset-replacement-planning-25-january-2019], accessed 26/01/2024

Figure 3: sequence of analysis



The Value Framework defines the economic impacts (benefits / costs) to the community that are expected to arise from the occurrence of events (eg. asset failure / asset replacement) across different value dimensions.

In order to estimate the Value delivered through replacing (or refurbishing) an asset, we have developed asset population models in line with the **Model Framework**[3]. These models forecast the probability of failure, likelihood of consequences and consequences (as described in the **Value Framework**[4]) for each individual asset within an asset class population.

Asset class population models are then used to forecast the total expected number of failures and corresponding network risk across the Value dimensions for the asset class, including:

- Reliability Performance
- Bushfire Risk
- Environmental Risk
- Worker and Public Safety Risk
- Financial Costs

Using observed historical asset class performance, the reasonableness of the risk forecast is tested by comparing forecast risk against historic performance. If the forecast risk appears to be over-stated, the probability of failure, likelihood of consequence and consequences are reviewed. Adjustments are also made to forecasted risk for any Augmentation expenditure which may reduce Replacement expenditure.

2.3.1.1 Scenario modelling

A number of investment scenarios are then developed, weighing investment costs against Value delivered, to produce differing counterfactuals of service performance outcomes (post investment risk) for customers. These counterfactuals aim to transparently identify the trade-offs for customers between different levels of investment that we can use to inform our engagement with customers in developing our regulatory proposal.

We also intend to overlay a consideration of what these counterfactuals would mean in terms of our compliance with our jurisdictional reliability service standards.

The scenarios we have been developing to inform our consumer engagement include:

(1) **a base case**: maintaining the current period spend level:

- This scenario provides a forecast of risk based on retaining the current investment profile. It provides a base-line counterfactual against which alternative scenarios can be considered

[3] See supporting document: 5.3.4 - Repex model framework - Methodology

[4] See supporting document: 5.1.5 - Value framework

- There are two sub-scenarios considered, the first considers the best return on investment (i.e. where investment can be best targeted to reduce risk, irrespective of the asset class[5] and the second considers the risk profile with investment being maintained at the asset class level.

(2) **economic investment**: investing wherever the annualised cost of that investment is outweighed by the value delivered:

- This scenario produces a forecast where all investment at the individual asset level is Net Present Value positive, that is, the costs of all investment is less than the benefits of that investment for customers.

(3) **maintain existing levels of risk / performance in aggregate:** maintaining the overall level of risk and performance on the network (ie. asset class agnostic)

- This scenario seeks to maintain risk / service performance across all service parameters, irrespective of the economic evaluation and return on investment.

(4) **maintain existing levels of risk / performance by asset class:** maintaining the level of risk and performance on an individual asset class basis

- This scenario seeks to maintain risk / service performance across all service parameters, irrespective of the economic evaluation and return on investment.

(5) **composite:** maintaining existing levels of reliability risk / performance by geographic region, maintaining safety risk / performance in aggregate; achieving compliance with CBD reliability jurisdictional service standard

- This scenario seeks to provide a provide a forecast that achieves the service outcomes that our customers have expressed a preference for in our consumer engagement to date and also ensuring compliance with our jurisdictional regulatory service standard.

Sensitivity analysis is undertaken by altering input parameters such as:

- Probability of Failure
- Capital input costs
- Discount rate
- Bushfire Consequences
- VCR Values

Non-repex options such as Stand-Alone Power Systems (SAPS), microgrids or other augex will be considered as an alternative to asset replacement as a post-model adjustment.

2.3.2 Individual business cases

Business cases outlining cost-benefit analysis are developed for large projects (typically those meeting the RIT-D threshold) or programs not suited to volumetric risk-based modelling.

Table 4 outlines the individual business cases that we envisage assessing and the structure that we intend to adopt in our analysis. This list is only provisional at this stage, noting that we are still undertaking customer engagement for the 2025-30 Regulatory Proposal.

Table 4: structure for individual business cases

Project / Programme	Identified need	Base-case	Investment options[6]	Sensitivities
Magill-Whitmore	Repeated failure in service over recent	Business As Usual (BAU):	1. Replace cable	• Discount rate • Load growth

Project / Programme	Identified need	Base-case	Investment options[6]	Sensitivities
Square 66kV cable replacement	years leading to soil contamination and opex costs	Continue to repair on failure	2. Construct alternate 66kV circuit	• Input costs • Failure rate
Northfield 66kV (GIS) replacement	Condition deterioration in recent years risking major supply outages	Business As Usual (BAU): continue to repair / remediate	1. Replace GIS switchgear 2. Construct new Air Insulated Switchgear	• Discount rate • Load growth • Input costs • Probability of failure
Adelaide CBD cable replacement / reliability program	Repeated cable failures in recent years leading to poor Adelaide CBD reliability and non-compliance with jurisdictional reliability performance requirements	Proactive cable replacement program	1. Proactive program to replace cables with highest benefit 2. Combined program of cable replacement and automation (augex)	• Discount rate • Load growth • Input costs • Probability of failure
Coonalpyn-Meningie 33kV line replacement	Increasing number of repeated conductor and attachment failures over recent years causing customer outages.	Business As Usual (BAU): continue to repair on failure	1. Replace line and poles in situ; 2. Install new line adjacent and remove existing line.	• Discount rate • Load growth • Input costs • Probability of failure
Mobile Substation replacement	Condition deterioration in recent years of assets used for emergency backup and / or support during planned maintenance, risking extended outages.	Business As Usual (BAU): continue to repair / remediate	1. Proactive replacement of mobile substations 2. Refurbishment and re-construction	• Discount rate • Input costs • Probability of failure
High risk service line replacement / detection program	Safety risk to customers posed by degraded service lines	Business As Usual (BAU): continue to repair / remediate	1. Proactive program to replace service lines with highest risk. 2. Combined program of service line replacement and neutral failure detection (augex / opex)	• Discount rate • Load growth • Input costs • Probability of failure

[5] Under this scenario, it is possible that all expenditure could be allocated to one high risk asset class.

[6] The benefits and costs of these investment options are to be assessed relative to the base-case counterfactual.

2.3.3 Historical expenditure

Where insufficient data is available to support an asset risk (benefit) modelling approach, historical expenditure in the current regulated control period is generally relied upon. This forecasting approach is conservative as it assumes a homogeneous age/condition profile across the asset population which is often not the case. Using the historical expenditure approach, only a single case is considered – continue the current rate of expenditure.

2.4 AER repex model (Alternate forecast)

The AER Repex model is used as a comparison for High volume forecasts of modelled assets. Where our economic modelling produces forecasts that are higher than the AER Repex Model, in-depth analysis is undertaken to explain the difference in modelled outcomes.

Appendix A: Asset Class Forecasting approach

Table 5 below outlines the forecasting approach SA Power Networks undertakes for each asset class.

Table 5: Forecasting approach by asset class

Asset Class	Population Risk/Cost Modelling	Historical Expenditure	AER Repex Model	Targeted/ Individual Business Case
Poles	●		○	
Pole Top Structures		●		
Underground Cables (Excl CBD and Magill-Whitmore Square 66kV)	●		○	
Underground Cables (Adelaide CBD)				●
Underground Cable (Magill-Whitmore Square 66kV)				●
Overhead Conductors	●		○	
Switching Cubicles	●		○	
Distribution Transformers	●		○	
Reclosers/Sectionalisers	●			
Service Lines/Detection Program	●			●
Zone Substation Power Transformers	●		○	
Zone Substation Switchgear (Excl Northfield GIS)	●		○	
Zone Substation Switchgear: Northfield GIS				●
Protection Relays	●			
Other unmodelled powerline assets		●		
Other unmodelled zone substation assets		●		
Telecommunication assets		●		
Mobile Plant				●

○ alternate forecast considered
● proposed forecast approach