Service line replacements: forecast method overview

UE BUS 4.05

Regulatory proposal 2021–2026

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Contents

1 Overview

The aim of this document is to provide an overview of how we have developed prudent and efficient forecasts for service line replacements over the 2021–2026 regulatory period.

In particular, we outline our asset management approach for service lines, and the intervention options considered in developing our forecast. These forecasts include our proactive replacement programs for the following service types:

- neutral screen services
- PVC twisted services.

We have also increased our service line replacement volumes to account for services replaced as part of our increased pole replacement program (as set out in our pole replacement forecast overview document).[1]

A summary of our forecast capital expenditure requirements is shown in table 1.1. These forecasts were modelled in calendar year terms, and converted to financial year estimates following changes to our reporting period (as required by the Victorian Government and the Australian Energy Regulator).

Table 1.1 Capital expenditure forecasts: service line replacements ($ million, 2021)

Description	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Inspection and faults	3.7	3.7	3.7	3.7	3.7	18.6
Proactive replacement program: PVC twisted	0.6	0.5	0.5	0.4	0.3	2.3
Proactive replacement program: neutral screen	0.8	0.7	0.6	0.5	0.4	3.0
Total	**5.1**	**4.9**	**4.8**	**4.6**	**4.5**	**23.9**

Source: United Energy

[1] UE BUS 4.02 - Pole replacement - Jan2020 - Public

2 Background

Service lines are network assets that connect the LV distribution network to a customer's point of supply or terminals at the customer's premises. This section provides a snapshot of the types, population, age profile and historic performance of service lines in our network.

2.1 Asset population

There are over 364,000 service lines in our network which supply electricity to many of our 685,000 residential, industrial and commercial customers.

Our service lines comprise of overhead conductor and underground cables. The material types of our overhead service lines are set out in table 2.1, and sample images are shown in figure 2.1.

Table 2.1 Overhead service lines: material type

Construction type	Characteristics	Installation dates
Bare conductor	This type has an active phase conductor that is insulated but the neutral conductor remains uncovered.	Pre-1961
Neutral screen	This type refers to a one wire construction that has the neutral phase acting as the conductor shield (i.e. it surrounds the active phase). The entire conductor is then insulated with chlorosulphonated polyethylene.	1961–1975
PVC grey twisted	This type has the active and neutral conductors insulated by grey polyvinyl chloride.	1976–1989
Aerial bundled cable	This type has the active and neutral conductors insulated by cross-linked polyethylene.	1990 onwards

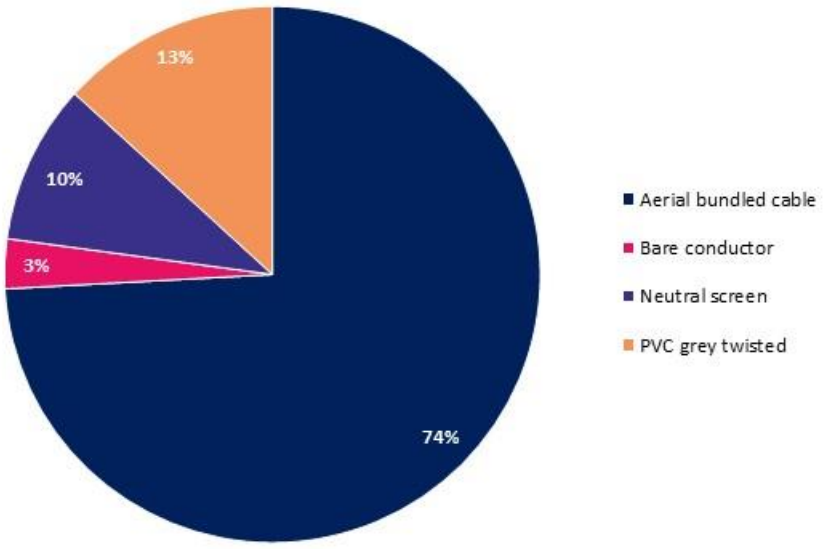
Source: United Energy

Figure 2.1 Sample images: neutral screen service, PVC grey twisted, and aerial bundled cables (respectively)

Source: United Energy

Aerial bundled cable (**ABC**) is the current preferred material type for new and replacement installations, and figure 2.2 shows it is the most common type on our network.

Figure 2.2 Services population by material type



Source: United Energy

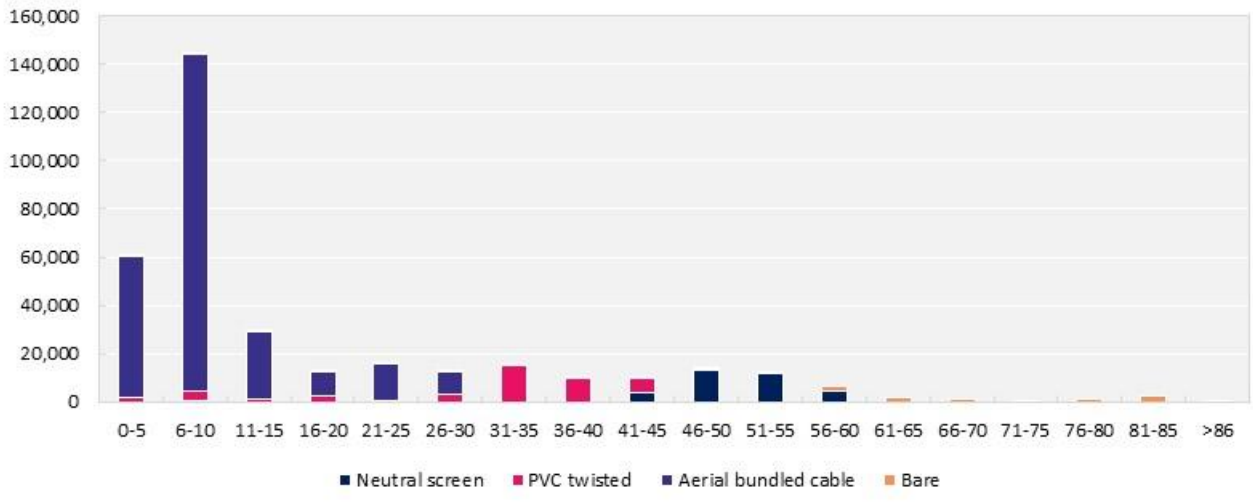
2.2 Asset age profile

The age profile of our service line population is set out in figure 2.3. The relatively young population reflects recent intervention programs to address safety risks and compliance, including:

- neutral screen service replacement program (ongoing, with most replacements completed in 2011–2016)
- non-compliant service height rectification program (ongoing from 2010).

Notwithstanding our neutral screen and non-compliant service height rectification programs, 22% of our services population are older than the 30-year design life of a service line.

Figure 2.3 Service age profile (volumes)



Source: United Energy

2.3 Historical asset performance

The historical performance of our service line population is driven by a range of factors. Notably, the following factors contribute to the deterioration and subsequent failure of service lines:

- corrosion of the neutral screen
- insulation failure—insulation failure of the active can result in contact between the active and conductive materials (i.e. metal pipes, taps)
- mechanical failure of cable and/or anchoring fixtures due to deterioration or physical impact
- environment—exposure to sunlight, rain, wind and airborne pollutants can degrade insulation of service lines.

2.3.1 Failure consequences

Although individual service lines pose minimal reliability risk to our electrical distribution network (as a failure would typically impact just a single customer), service lines pose the following public safety risks:

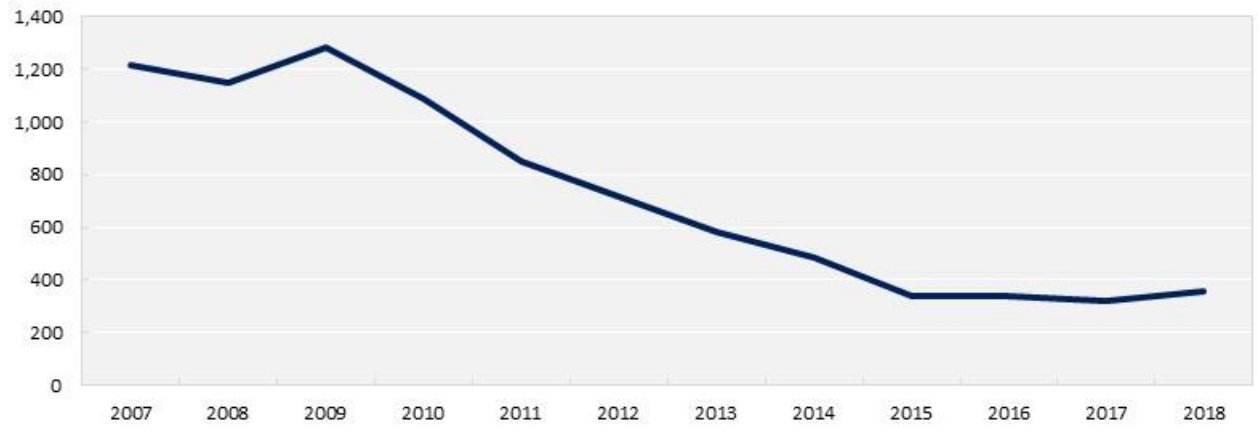
- safety risks—as services are installed on customers' premises, there is a risk of electric shocks to members of the public (e.g. this can be caused by a broken neutral or from a service line that has fallen to the ground)
- fire risks—a fire can be started by contact between vegetation and a live conductor, or a broken service line that has fallen to ground.

At an aggregate level, service lines contribute, on average, to around 2% of total fire starts in our network.

2.3.2 Performance trends

Figure 2.4 shows the annual failure rate of service lines from 2007–2018. The reduction in failures from 2009 can be attributed primarily to our neutral screen service replacement program, which significantly reduced incidents from broken neutrals or electrical failures related to neutral screen services.

Figure 2.4 Annual failures of service lines (volumes)



Source: United Energy

Figure 2.5 shows the number of annual fire starts and safety incidents (resulting in a member of the public receiving an electric shock) associated with our service lines. The reduction in these incidents from 2011 is similarly driven by the success of our neutral screen replacement program. The exception in 2013 was due to deteriorated insulation in PVC grey twisted type services. Failures of this service type were monitored in 2014

and appeared to return to historic levels (but could be an indication that this asset class is approaching the end of its life).

Figure 2.5 Annual safety and fire start incidents of service lines (volumes)

Source: United Energy

Note: Fire starts caused by service lines are not show prior to 2012 because causes of fire starts were not recorded prior to 2012; electric shocks from connectors have been separately reported since 2017.

The condition of ABC service cables in our network is good, with no apparent issues and no shocks attributed to this service type.

3 Asset management overview

The identified need for managing service lines on our network, including replacement, is to ensure we maintain network service levels in accordance with our regulatory and compliance obligations (listed in appendix A).

Our approach to meeting this need incorporates managing the acquisition, creation, maintenance, operation, refurbishment, repair and disposal of service lines. A summary of our asset management approach is provided below.

3.1 Asset management approach

Our current asset management approach for services is a mix of inspection-based and proactive replacement programs. Specifically, assets are scheduled for replacement based on the following:

- inspection and testing program to identify replacements based on condition
- replacement of any remaining neutral screen services by monitoring of neutral service impedance for those which are connected to smart meters, or as they are identified by the normal cyclic inspection program
- opportunistic replacement of superseded services during any planned shutdown (e.g. when an outage is required to replace a pole top structure, a pole or distribution transformer, any non-preferred services—such as PVC twisted or neutral screens—will be replaced at the same time)
- overhead services are undergrounded where there is an identified safety driver, such as in high bushfire risk areas, or crossing an adjacent property with vegetation management issues
- ensure compliance with height regulations through replacement of low services or re-tensioning low services.

3.2 Asset management intervention options

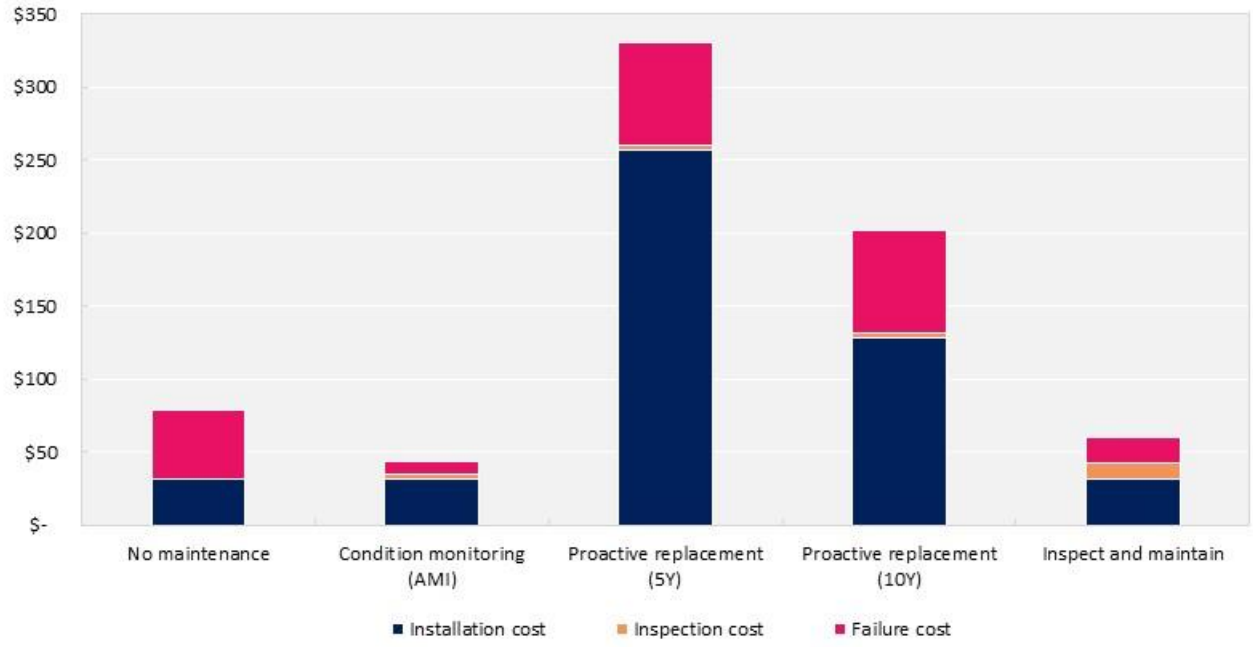
The development of our asset management approach for service lines included the assessment of multiple options for maintaining service levels (consistent with our compliance obligations, as set out in appendix A). These options included the following:

1. Do no maintenance on the service lines
2. Condition monitor the service lines based on smart meter data, with replacement on defect
3. Five-year proactive replacement program
4. Ten-year proactive replacement program
5. Inspect and maintain the service lines with replacement on failure (for service lines without smart meters).

The total annual life cycle costs for these options were assessed for each material type using a discounted cash flow methodology. The total annual life cycle costs represent the sum of the asset installation cost, inspection and failure costs. Inputs were based on historical failure data and defect rates, and historical unit costs.

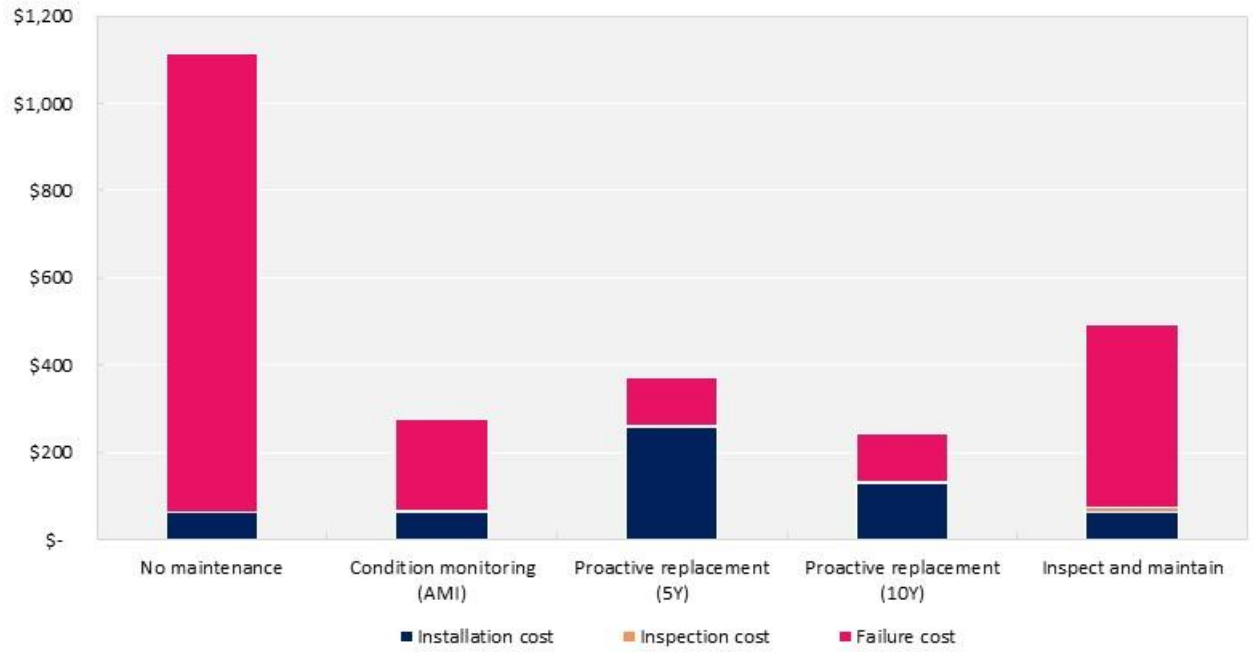
As shown in figure 3.1, a condition monitoring regime using smart meter data, with replacement based on failure is typically preferable for aerial bundled cable and bare conductor service types (i.e. option two shows the lowest total annual life cycle cost). Figure 3.2 and figure 3.3, however, demonstrate that the proactive replacement of neutral screen and PVC twisted services is more efficient for these material types (i.e. option four represents the lowest total annual life cycle cost).

Figure 3.1 Aerial bundled cable and bare conductor service lines: annual life cycle costs ($ per asset, 2019)



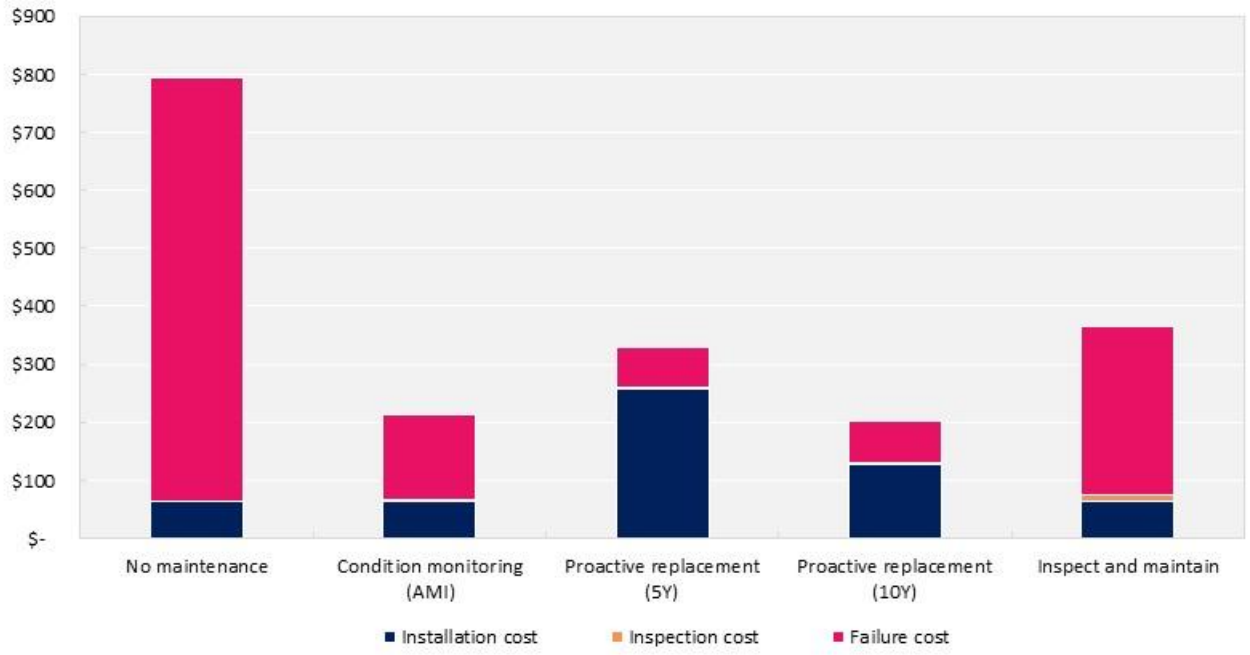
Source: United Energy

Figure 3.2 Neutral screen service lines: annual life cycle costs ($ per asset, 2019)



Source: United Energy

Figure 3.3 PVC twisted service lines: annual life cycle costs ($ per asset, 2019)



Source: United Energy

Further detail on our investment options is provided in our attached services model.[2]

22 UE MOD 4.05 - Service lines - Jan2020 - Public.

4 Replacement forecast

This section details our service lines replacement forecast for the 2021–2026 regulatory period. These forecasts are included in our plant, station and lines model.[3]

4.1 Replacement volumes

We forecast replacement volumes based on the methods set out in table 4.1. This is consistent with the asset management approach outlined in section 3.

Table 4.1 Replacement volume forecast method

Asset management type	Forecast volumes
Inspection-based and fault response	Forecast based on the average of services replaced over the period 2015–2018 or 2016–2018, as set out in our unitised cost model.[4] Earlier periods (e.g. pre-2015) have been excluded as these reflected higher replacement volumes due to the impact of historic proactive programs. We have also increased our service line replacement volumes to account for services replaced as part of our incremental risk-based pole replacement program (i.e. as we replace more poles, we will find more non-preferred service line types). These service line replacements represent a small percentage of our total service line expenditure. Our incremental pole replacement forecasts do not capture the replacement of these services.[5]
Proactive program: neutral screen services	Forecast based on existing population of neutral screen services. Volumes have been set to remove a constant number of services per annum such that all neutral screen service types will have been removed from our network after 10 years. These volumes have subsequently been adjusted downwards to ensure neutral screen services captured in our inspection-based forecast are not double-counted.
Proactive program: PVC twisted services	Forecast based on existing population of PVC twisted services. Volumes have been set to remove a constant number of services per annum such that all PVC twisted service types will have been removed from our network after 10 years. These volumes have been adjusted downwards to ensure PVC twisted services captured in our inspection-based forecast are not double-counted.

Source: United Energy

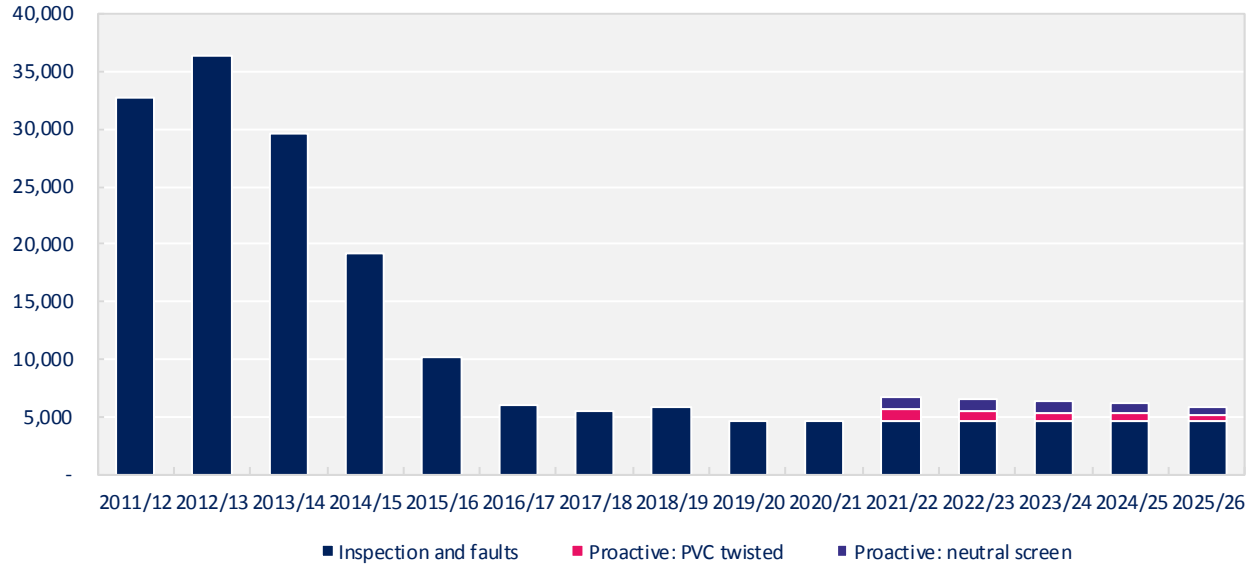
A summary of our historical and forecast service line replacement volumes is shown in figure 4.1. This chart includes the investment made in 2011–2015 to remove the bulk of our neutral screen services.

3 UE MOD 4.03 - Plant, stations and lines replacement - Jan2020 - Public.

4 UE MOD 4.02 - Unitised volume model - Jan2020 - Public.

5 Further detail is provided in UE BUS 4.02 - Pole replacement - Jan2020 - Public.

Figure 4.1 Service lines: replacement volumes

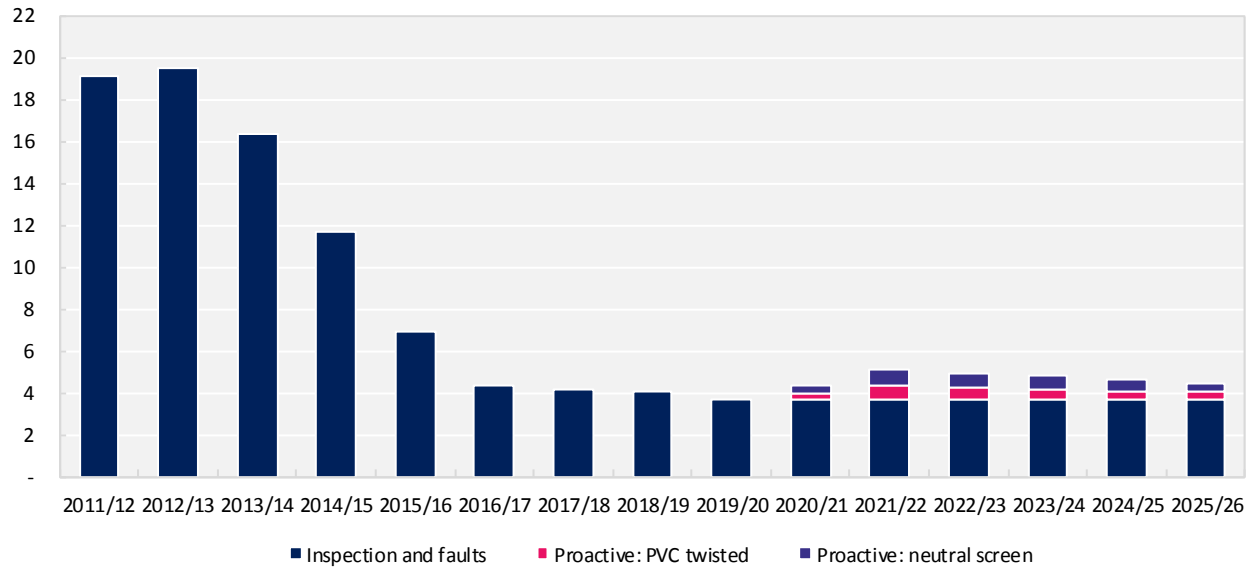


Source: United Energy

4.2 Replacement expenditure

We have forecast replacement expenditure for all service types based on historical unit costs over the period 2016–2018 (to align with our volume forecasting period), and the volumes identified above. A summary of our total historical and forecast service line replacement expenditure is shown in figure 4.2.

Figure 4.2 Service lines: replacement expenditure ($ million, 2021)



Source: United Energy

A Compliance obligations

An overview of the relevant compliance obligations for service line asset group is provided below.

A.1 National Electricity Rules

The National Electricity Rules (**the Rules**) set out the capital and operational expenditure objectives, factors and criteria.[6] The key requirements are to prudently and efficiently manage the network to maintain safety, maintain reliability and comply with all applicable regulatory obligations.

A.2 Victorian Electricity Distribution Code

Clause 3.1 of the Victorian Electricity Distribution Code (**the Code**) requires us to manage our assets in accordance with principles of good asset management. Under this provision, we must, among other things, develop and implement plans for the acquisition, creation, maintenance, operation, refurbishment, repair and disposal of its distribution system assets:

- to comply with the laws and other performance obligations which apply to the provision of distribution services including those contained in the Code
- to minimise the risks associated with the failure or reduced performance of assets
- in a way which minimises costs to customers taking into account distribution losses.

A.3 Electricity Safety Act 1998

The Electricity Safety Act 1998 (**the Act**) makes provisions relating to:

- the safety of electricity supply and use
- the reliability and security of electricity supply
- the efficiency of electrical equipment.

Under section 98 of the Act, we (as a major electricity company) must design, construct, operate, maintain and decommission its supply network to minimise as far as practicable:

- the hazards and risks to the safety of any person arising from the supply network
- the hazards and risks of damage to the property of any person arising from the supply network
- the bushfire danger arising from the supply network.

Section 99 of the Act requires that we prepare and implement an electricity safety management scheme, which specifies our safety management system for complying with obligations under section 98.

A.4 Electricity Safety (Bushfire) Regulations 2013

Clause 7(1)(i) requires major electricity companies to inspect electricity assets located in hazardous bushfire risk areas at intervals not exceeding 37 months and inspect electricity assets located in other areas at intervals not exceeding 61 months.

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6 NER, clauses 6.5.6 and 6.5.7.

Clause 7(2) clarifies that the assets that must be inspected under the schedule specified in clause 7(1)(i) do not include assets located in a terminal station, a zone substation or any part of the major electricity company's underground supply network that is below the surface of the land.

A.5 Electricity Safety (Management) Regulations 2009

Electricity Safety (Management) Regulations 2009 (made under section 150 of the Act) set out the requirements for an Electricity Safety Management Scheme (**ESMS**), including an electrical safety management system. An ESMS is compulsory, and effectively covers all documentation, procedures, accreditation, monitoring and reporting of work on or for designing, installing, operating, maintaining and decommissioning network assets. The ESMS must be submitted to Energy Safe Victoria (**ESV**) every five years for acceptance, and is audited by ESV.

The Safety Management System incorporates all network asset policies, procedures, systems, standards and controls in place to manage network safety.