



Supporting  
document 14.5

# Public Lighting Asset Management Plan

2020-2025  
Regulatory Proposal  
January 2019



SA Power Networks

# Asset Management Plan – 6.1.02 Public Lighting



## 2019-2024

Version 01 – Issued January 2019

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## Document version

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0.2			
0.3			

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## Ownership of standard

Name of Standard/Manual: **Public Lighting Asset Management Plan 6.1.02**

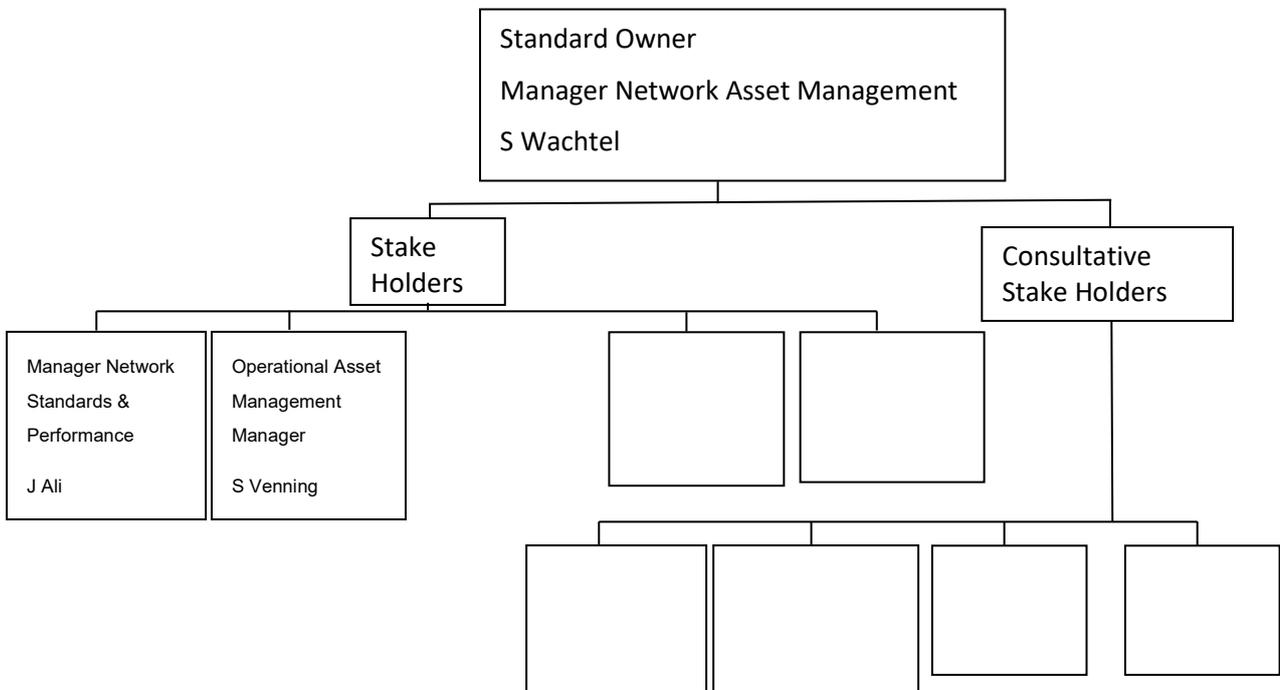
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Review Period 5 Years

Next Review Due August 2024 *(ie. When the next review process is due to commence)*

### STANDARD/MANUAL OWNERSHIP STRUCTURE



### OTHER RELATED MANUALS

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### COMMENTS

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## Abbreviations

Abbreviation	Definition	Description
CLER	customer lighting equipment rate	A CLER tariff is applicable for a customer installed, owned and maintained luminaire. When a standard SA Power Networks lamp is used and the luminaire is in a position where SA Power Networks has unrestricted, all weather access, and the lamp is an SA Power Networks standard lamp, SA Power Networks will replace failed lamps.
GIS	geographic information system	This collection of specialised systems and applications is for maintaining spatial and (electrical) connectivity information for assets  GIS systems and applications include G/Tech, Esri ArcGIS, GeoMedia and GEO Cortex
HID	High Intensity Discharge lamp	High-intensity discharge lamps are a type of electrical gas-discharge lamp which produces light by means of an electric arc between tungsten electrodes housed inside a translucent or transparent fused quartz or fused alumina arc tube.
LED	light emitting diodes	A semiconductor device that converts electricity into light.
PE	photo electric	A PE cell used to control the operation of public lights; low light levels trigger the PE cell to turn the street light on.
PLC LED	Public Lighting Customer LED tariff	A PLC LED tariff is applicable to a public light that is elevated and powered by SAPN infrastructure but the LED luminaire and labour to install the luminaire have been paid for by the customer.
NEMA PE Cell	National Electrical Manufacturers Association	PE cell in a rated enclosure which provides more precise lighting control and stable performance – reported 20 year life.
SAPN LED	SA Power Network LED tariff	A SAPN LED tariff is applicable to a public light that is elevated and powered by SAPN infrastructure and the LED luminaire and labour to install the luminaire have been paid for by SAPN
SLO	single light out	An event relating to a failed street light.
SLUOS	Street Light Use of System	A standard tariff is applicable for all HID (non-LED) SA Power Networks installed, owned and maintained luminaires irrespective of the location of the luminaire
TFI	Transferred Infrastructure	A TFI tariff is where a customer gifts a public lighting asset and SAPN recovers the cost of a future replacement each year.

## Executive summary

### Introducing the 2018 Public Lighting Asset Management Plan

The Public Lighting Asset Management Plan (PLAMP) defines SA Power Networks' approach to managing the public lighting assets over the planning period 2018–2025.

### The assets and services provided

There are approximately 230,000 luminaires installed across our network. The delivery of public lighting services requires the ongoing maintenance, inspection, and operation of these public lighting installations, and the design, procurement and construction of new public lighting installations as requested by public lighting customers.

Each public lighting installation has several asset components:

- **Lamp:** Light globe that produces the illumination, lamps are mounted inside traditional (High Intensity Discharge (HID)) luminaires.
- **PE Cell:** Photo-electric cell which switches the light on in low light conditions.
- **Luminaire:** Distributes, filters or transforms the light transmitted from a light source, including lamps or LED modules.
- **Bracket:** Supporting structure to hold or extend the luminaire from a pole.
- **Pole / Column:** Elevates the luminaire assembly above the ground, may be distribution poles or dedicated lighting columns and poles.

Public lighting services are defined as:

- the operation, maintenance, repair and replacement of public lighting assets;
- the alteration and relocation of public lighting assets; and
- the provision of new public lights.

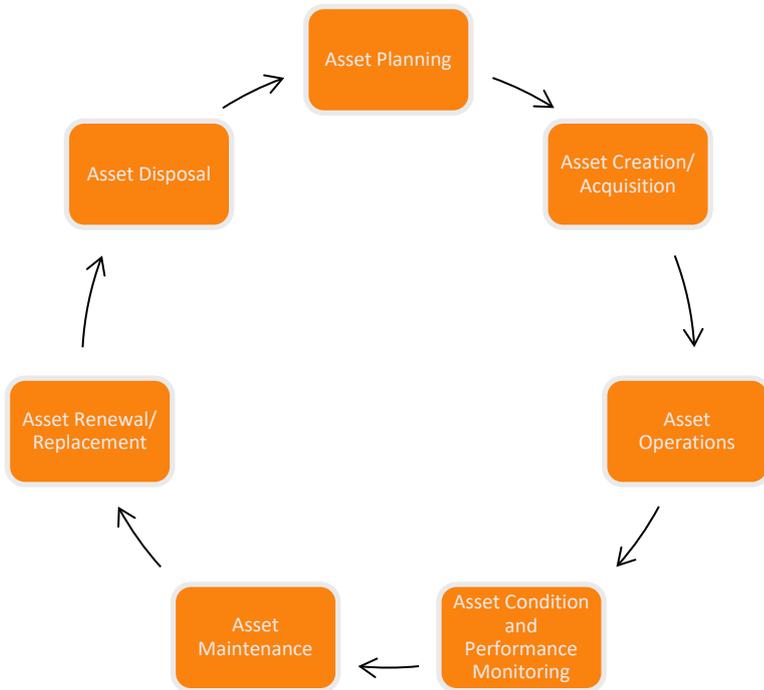
The public lighting service is funded via tariff arrangements where the cost is calculated for each luminaire type via a building block methodology. The tariffs vary according to asset ownership and responsibilities with customer having the choice for higher or lower tariffs for capital and operational responsibility inputs.

### Life cycle management approach

The PLAMP describes how cost is balanced against levels of service and risk throughout each asset's life cycle. SA Power Networks has traditionally benchmarked well in efficiency and reliability in the Australian Energy Regulator (AER) annual benchmarking process against other distribution network service providers.

This efficiency largely stems from taking a risk-based life cycle management approach. This includes optimising the use of existing assets and undertaking cost effective refurbishments to extend asset life and defer the costs of asset replacement while maintaining service levels. Consequently, SA Power Networks operates one of the most efficient, but also one of the oldest, electricity distribution networks in Australia.

The life cycle process applied to power networks assets by SA Power Networks is shown below.



**Asset planning:** asset requirement definition, planning investigations, demand and asset capacity assessments with consideration of viable options

**Asset creation/acquisition:** where the asset is purchased, constructed or vested to SA Power Networks

**Asset operations:** keeping the electricity supply flowing through monitoring, switching and load control while keeping the public safe from the risk of electricity supply assets

**Asset condition and performance monitoring:** assessing the asset to identify any defects and required corrective actions

**Asset maintenance:** includes planned minor work carried out to prevent more expensive work in the future and reactive maintenance where an asset defect or failure is fixed

**Asset renewal/ replacement:** refurbishment or replacement of an asset to ensure it continues to deliver the required level of service

**Asset disposal:** disposal of decommissioned assets

### Key strategic issues

The public lighting industry is in a state of fundamental change with light emitting diode (LED) lighting creating overwhelmingly compelling cases to change from traditional high intensity discharge (HID) lighting, particularly for the pedestrian (P Category) lighting where the energy usage of LEDs is typically a third to a quarter that of HID lights.

LED rollouts are underway, both customer and SA Power Networks initiated, and it is expected that at least all P category lighting will be replaced in under 5 years, with V category being changed more slowly resulting in 76% of all luminaires forecast to be converted to LED by 30 July 2025. This luminaire replacement will reduce the age of the luminaire fleet (0-7 years), meaning typical age-based failure rates will have little value. The supporting infrastructure, brackets, wiring / cables, and columns, have not been renewed and will continue to exhibit age / aging-based failure rates.

### 5-year expenditure forecasts

Total network expenditure is forecast to average \$21.2M per annum over the 2018- 2025 planning period with 63% being capital expenditure (capex) to augment or renew / replace existing assets, and 37% forecast for ongoing operation and maintenance (opex) activities.

### **Capital expenditure programs**

The planned capital investment for the 2018-2025 planning period (detailed in Chapter 5) reflect a blend of investment across network augmentations, asset renewal and non-network categories. Major capital investment for the 2018-2025 planning period are:

- LED rollouts – large investment is being undertaken by both SA Power Networks and customers to replace the existing HID fleet with LED lighting
- Column replacement – the aging column fleets requires increased expenditure to reduce the current high failure rates and the risks this represents
- Lighting cable replacement – the power cable failure rates in lighting columns continue to increase, targeted replacement programs where the cable has failed multiple times will be undertaken.

### **Operating expenditure programs**

The opex for the 2018–2025 period (detailed in Chapter 5) reflect recent historical costs with future forecasts based on the 2018 forecast operating expenditure and recent observed rates of change in actual expenditure for the various operation and maintenance activities. Key observations from recent historical operations and maintenance expenditure include the following:

- Period of transition with the 2 of the 3 large OPEX spends being affected (reduced) by the LED rollout namely single light out (SLO) and bulk lamp programs
- SLO expenditure will reduce over the period as LEDs replace HID lights. SLO luminaire expenditure will remain associated with the LED failure rates. The non-luminaire related failures will continue to occur; fuse / tap, vandalism, third party (column damage).
- Bulk lamp change will reduce as LEDs replace HID lights. LED globes are integrated into the luminaire and do not require any component replacement over the life of the luminaire. The luminaire is cleaned at the time of the bulk lamp change, with a dedicated screen cleaning program completed for LEDs.
- Cable Faults are unchanged by LED and as the cable fleet continues to age without material cable replacement programs the fault rate will continue to increase.

## 1 Introduction

### 1.1 Purpose

The PLAMP outlines the strategies and plans SA Power Networks employs to effectively manage public lighting assets to deliver value to customers. It summarises the approach to asset management to ensure the strategic and asset management objectives are achieved.

The specific objectives of this PLAMP are to:

- express the levels of service SA Power Networks aims to deliver to customers and stakeholders;
- describe the public lighting assets and their current condition and performance;
- describe the plans to deliver strategic and asset management objectives;
- explain how public lighting assets are managed throughout their life cycle;
- outline how risk is managed while delivering on levels of service;
- show the expenditure required to meet the strategic and asset management objectives; and
- identify improvement opportunities to asset management practices.

### 1.2 Scope

The purpose of this document is to describe the asset management for public lights that exist within the electricity distribution network owned and/or maintained by SA Power Networks including:

- Luminaire
- Lamps
- Columns
- Brackets
- Wiring
- Photo-electric cells
- Customer Lighting Equipment Rate (CLER) lamps

The PLAMP specifically excludes:

- CLER, EO and Metered luminaires, columns, wiring and photo-electric cells (as these are customer owned assets) however does include CLER lamps and PE cells.

The PLAMP excludes non-network related assets such as business and commercial telecommunications systems, motor vehicles, properties, office buildings and building equipment (e.g. furniture, computers). It forms part of a suite of documents used by SA Power Networks in the delivery of asset management programs.

Reference will be made to other assets within the PLAMP where they are associated with the management of public lighting.

### 1.3 Audience

The target audience for this PLAMP is primarily:

- SA Power Networks' employees including senior management, asset managers and other employees who play a role in the delivery of public lighting services to customers;
- regulators including the Australian Energy Regulator (AER), Essential Services Commission of South Australia (ESCoSA) and Office of the Technical Regulator (OTR); and
- SA Power Networks' stakeholders wanting to understand how we manage our public lighting assets.

## 1.4 How to use this document

The structure and content of this PLAMP is presented in Table 1.

**Table 1: PLAMP structure**

Section	Description
Executive summary	Summary of the key issues and financial forecasts contained in the body of the PLAMP
<b>1</b> Introduction	Background, context and purpose of the PLAMP
<b>2</b> Asset description	Overview of the public lighting assets
<b>3</b> Levels of service	The levels of service SA Power Networks provides customers in relation to public lighting.
<b>4</b> Asset history	Overview of the evolution of the public lighting assets
<b>5</b> Key issues and risks	The key issues and risk associated with public lighting assets
<b>6</b> Public lighting lifecycle management	Overview of the asset lifecycle strategies applied to public lighting assets
<b>7</b> Public lighting strategies	The strategies employed on the public lighting assets to balance cost and service (based around the asset lifecycle management framework)

## 1.5 Relationship to other plans and strategies

A number of SA Power Networks' plans and strategies are related to and inform the PLAMP, including:

- **Strategic Plan and other corporate strategies:** details our strategic direction, key priorities and core areas of focus, and sets the overarching direction for the organisation. Includes Customer Engagement Strategy, Future Network Strategy and Digital Strategy.
- **Asset Management Policy:** sets out the principles we apply to our asset management activities.
- **Strategic Asset Management Plan:** outlines the operating environment and the challenges faced by SA Power Networks in delivering the service now and into the future, and the overarching strategies implemented to deliver a valuable service to customers.
- **Power Asset Management Plan:** defines SA Power Networks' approach to managing the electricity distribution assets over the planning period 2018–2030.
- **Detailed strategies, plans, manuals, policies, processes and procedures:** gives detailed guidance for maintenance and day-to-day operation activities.

## 1.6 Context to Data

The graphs and statistics used throughout the Asset Plan are based on data extracted from SA Power Networks SAP, GIS, Regulatory information Notices (RIN) and other sources within the organisation.

Dates and numbers for older assets are likely to be less accurate than newer assets.

The age data used in the profiling of the public lighting assets reflects the date of manufacture or where available the more accurate date of installation.

## 2 Asset description

### 2.1 General description

The purpose of public lighting is to reliably provide a customer set level of lighting illuminance at street level. The public lighting luminaire assets provide this service whilst the poles, column and bracket elevate and support the luminaires and the electrical wiring and cabling provide the power and elevation.

The role and responsibility of SA Power Networks in relation to public lighting is to maintain the luminaire output to nominally 70% above the original design output as lighting is typically designed to output 130% of the AS1158 requirement of the period.

A public lighting follows 2 basic configurations. The first is shown in Figure 1, in this configuration the Public Light is mounted to a Stobie pole via a bracket to a crossarm, the luminaire is attached to the bracket and wired through the bracket to the low voltage supply on the Stobie pole. Typically the luminaire is controlled via a PE cell or in older installation via switchwire.

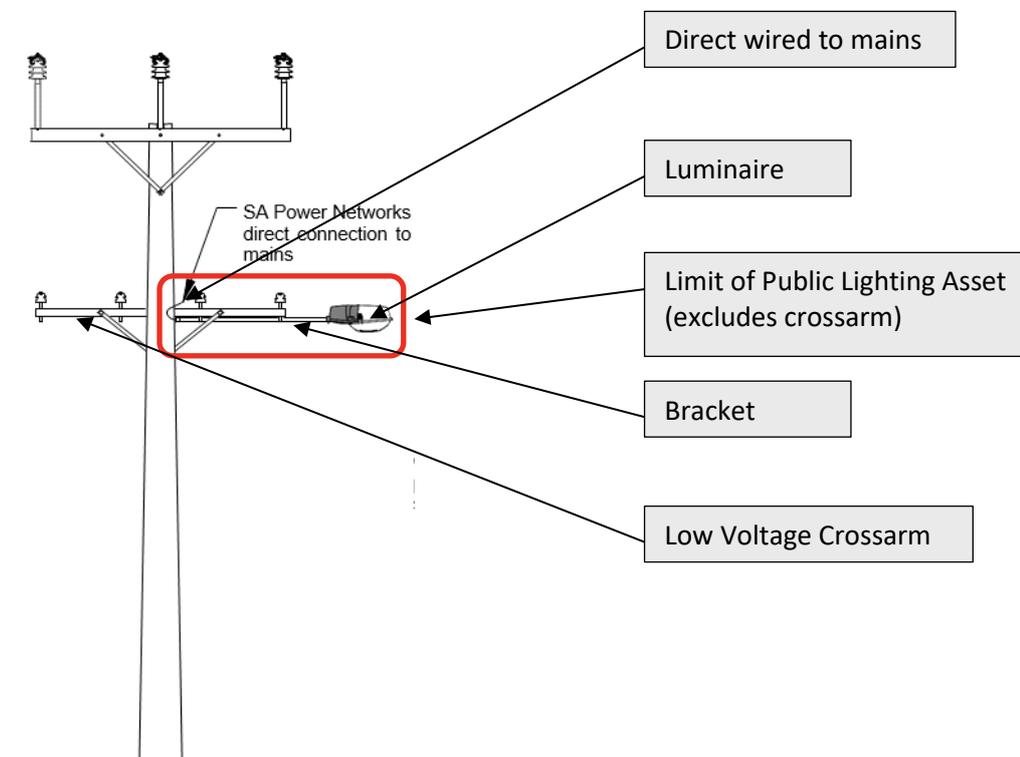


Figure 1: Stobie pole mounted public lighting configuration

The second configuration is shown in Figure 2, in this configuration the Public Light is mounted on a public lighting column, the luminaire is attached to the end of the column and wired down through the column (via an electrical cable) to a switch and fuse at the base of the column behind an inspection hatch. The wiring then continues down the column under the ground and then is connected to the electricity network via a LV service pit. Typically the luminaire is controlled via a PE cell or in older installation via switchwire. Public lighting columns are either galvanised or powder coated and range in height from 4.5m to 10.5m. Public lighting cable is typically 2.5mm squared Copper Twin and 6.0mm squared Copper Earth, although this may vary depending on age. Some wiring is in conduit but the majority is not.

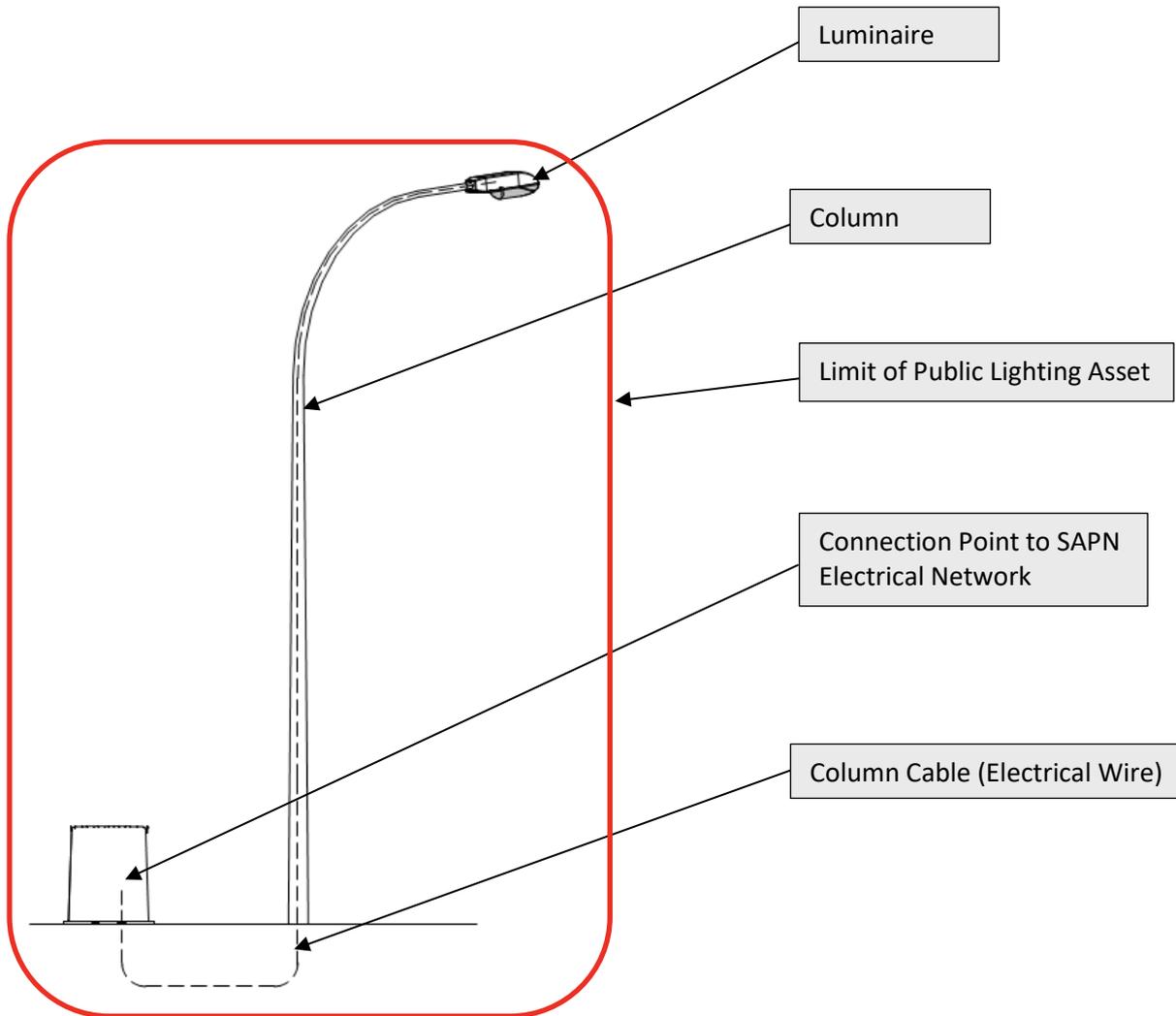


Figure 2: Column mounted public lighting configuration

Public lighting luminaires are categorised by the level of lighting intended to be provided in accordance with *AS1158:2005 Lighting for roads and public spaces* as follows:

- **Vehicular traffic (V category):** relate to arterial roads
- **Pedestrian area (P category):** relate to minor roads

For the purposes of this plan, the following category of lighting is also discussed:

- **Floodlighting area (F category):** relate to floodlighting

## 2.2 Luminaires

As at December 2018 there were 229,989 luminaires under management across the network, a significant portion are 30+ years old and with newly installed LEDs 2-3 years old. SA Power Networks has never kept records of when luminaires were installed hence there is no meaningful age profile of the luminaires, additionally with the LED rollout it is expected most if not all old technology luminaires will be replaced in the

next 5 years meaning the age profile today is not particularly useful for any sort of analysis. Since January 2017, the official time when LED became a standard luminaire on the network, the install dates have been recorded in the asset management systems,

Records of all SA Power Networks owned public lighting luminaires and columns are contained within SAP. Luminaire history was determined from information supplied in 'SA Power Networks Public Lighting Luminaire Identification' manual, known historical installation details and information from GIS.

A summary of SA Power Networks owned and customer owned luminaires is shown in Table 2 below.

**Table 2: Summary of SA Power Networks and customer owned luminaires**

Base Lamp	Description	Road Category	SA Power Networks Owned	Council Owned
cf-42	42W Fluorescent	P	8,532	777
cf-42 PT	42W Fluorescent (Post Top)	P	265	22
F-40	40W Fluorescent	P	13,654	609
LED	LED P Category	P	25,134	8,555
LED-V	LED V Category	V	229	2,193
MV-80	80W Mercury Vapour	P	59,394	3,806
MV-80 PT	80W Mercury Vapour	P	4,301	27
MV-80+	>80W Mercury Vapour	V	4,476	694
S-HP Other	High Pressure Sodium (Other)	V	389	3,196
S-HP100	100W High Pressure Sodium	V	13,486	4,280
S-HP150	150W High Pressure Sodium	V	8,496	4,963
S-HP250	250W High Pressure Sodium	V	2,655	11,633
S-HP360f	360W High Pressure Sodium Floodlight	F	1,124	80
S-HP50	50W High Pressure Sodium	P	20,042	2,515
S-HP50 PT	50W High Pressure Sodium (Post Top)	P	1,339	94
S-LP18	18W Low Pressure Sodium	P	10,891	544
S-LP90	90W Low Pressure Sodium	V	11,352	242
<b>Total</b>			<b>185,759</b>	<b>44,230</b>

## 2.3 Columns

There are approximately 68,437 SA Power Networks owned public lighting columns. These range in mounting height, colour and outreach. The exact breakdown of each type is not available. However, this information can be captured during bulk lamp change programs and entered into GIS for future use.

The age profile of columns need to be accurately established from URD records. The oldest columns were installed in 1956. It is not known how many were installed each year and it cannot be assumed that growth to the present population of 68,437 has occurred evenly over the last 50 years.

(There are approximately 30,000 customer owned columns that support lights which SA Power Networks provides a service for)

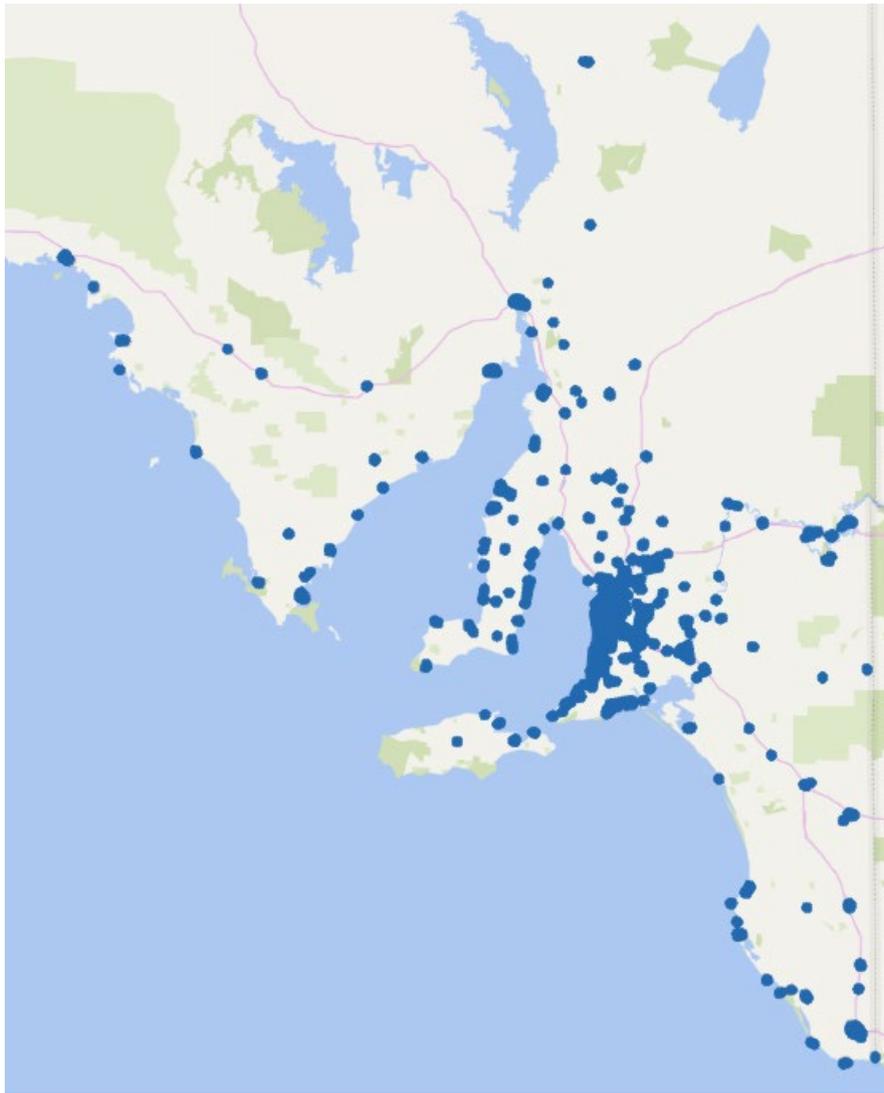


Figure 3: Geographic distribution of SA Power Networks Owned Columns

## 2.4 Brackets

There are approximately 119,000 public lighting brackets in service. Of those, 8,000 are Long Pipe brackets which attract a SLUoS (Street Light Use of System) tariff.

It is not possible to accurately establish the age profile of existing public lighting brackets because brackets are often re-used during public lighting upgrades

## 2.5 Cable (Wiring)

There are approximately 2,750km of underground public lighting wiring (based on an estimated 50m spacing between each column).

The age profile of public lighting wiring needs to be accurately established from URD records.

The oldest public lighting wiring would be approximately 50 years old; however, it cannot be assumed that growth to the present 2,750km has occurred evenly over the last 50 years.

### 3 Tariffs

The provision of public lighting services, and associated maintenance and replacement responsibility, is determined in accordance with asset ownership and arrangements in place with public lighting customers as detailed in Table 3 below.

SA Power Networks have funded the installation and provide a full maintenance service for approximately 85% of installed public lighting assets (poles and lights), with these lights charged SA Power Networks (SAPN) or Street Light Use of System (SLUOS) pricing. Public lighting customers or developers may fund the installation of new lights and gift the installed lights to SA Power Networks following completion, we will then assume full maintenance responsibility for the assets, including responsibility for future replacement of the asset at the end of its useful life, these lights are subject to a reduced Transferred Infrastructure (TFI) price. Alternatively, public lighting customers may choose to fund the installation of the assets and retain ongoing responsibility for maintenance and replacement of these assets. Our responsibility for these assets is administrative only, with the assets recorded in our GIS system and any faults received forwarded to the public lighting customer for their action, as a result these lights are charged an Energy Only (EO) price.

In some cases, SA Power Networks has agreed to maintain assets (including replacement of minor components (eg PE cells)) owned by the customer, with the customer retaining responsibility for the future replacement of all major public lighting asset components, these lights are charged Customer Lighting Equipment Rate (CLER) prices. With the introduction of LED lighting, a further service offering for Public Light Customer (PLC) was introduced, whereby we undertake routine maintenance of the public lighting assets and have responsibility for future replacement of public lighting infrastructure (poles), while the public lighting customer retains financial ownership of and is responsible for replacement cost of the luminaire.

**Table 3: Public Lighting and Replacement Responsibilities**

Service Category	Description	Ownership	Installation / Replacement	Operation and Maintenance
<b>SAPN / SLUOS</b>	SA Power Networks funds luminaire / infrastructure installation or upgrade	SA Power Networks	SA Power Networks	SA Power Networks
<b>TFI</b>	Lighting luminaire / infrastructure is transferred ('gifted' or 'vested') to SA Power Networks	SA Power Networks	SA Power Networks	SA Power Networks
<b>PLC</b>	Customer funds the luminaire installation or upgrade SA Power Networks funds the installation and upgrade of infrastructure SA Power Networks maintains assets over their life	Public Lighting Customer (Luminaire) SA Power Networks (Infrastructure)	Public Lighting Customer (Luminaire) SA Power Networks (Infrastructure)	SA Power Networks
<b>CLER</b>	Customer funds all public lighting assets SA Power Networks maintains assets over their life	Public Lighting Customer	Public Lighting Customer	SA Power Networks (minor components)
<b>EO</b>	Customer funds and retains ownership of all public lighting	Public Lighting Customer	Public Lighting Customer	Public Lighting Customer

Service Category	Description	Ownership	Installation / Replacement	Operation and Maintenance
	equipment and maintenance responsibilities			

## 4 Levels of Service

### 4.1 General services provided for public lighting customers

Table 4 below sets out the levels of services customer value, how SA Power Networks delivers these values, and the KPI to demonstrate performance.

**Table 4: General services for all public lighting customers (EO, SLUoS, CLER, SAPN LED, PLC LED and TFI LED)**

Customer requirement	SA Power Networks service	KPI
Ability to report public lighting not meeting basic requirements	General Enquiries Help Line Single Light Out Online Reporting Tool EO light owners are notified of the SLO and the online reporting tool resets in 5 days.	Call Centre provided 131261 Reporting tool provided and operational <a href="https://slo.apps.sapowernetworks.com.au/">https://slo.apps.sapowernetworks.com.au/</a>
To receive a public lighting bill within 30 days of the billing period that describes the lighting asset and associated tariffs that makes up the bill.	SAPN bill issued by the 6 <sup>th</sup> working day of the month for the preceding month and contains the lamp types, numbers of lamp types and associate tariffs.	12 bills sent per year in month succeeding the billing period.
Ability to quickly and easily change between tariff types (for example changing from SAPN LED to PLC LED tariff)	Future 1: LED tariffs types shown on bill, customer manually requests – via email these PLs be transferred to PLC. SAPN creates invoice and sends to customer, on payment tariffs change. Future 2: All done through portal	Invoice sent to customer within 30 days of request Tariff changed within 30 days of payment.
To calculate the energy usage of the public lighting in their area of responsibility and send this data to their nominated energy retailer.	Utilising the Asset Data for the public lighting, SAPN tabulates all the lamp types in the customers area and applies the AEMO load table values per lamp creating a energy usage table for the customer. This is sent to the customers retailer.	12 Energy usage reports sent to retailer on a monthly basis. System under oversight and audited by ESCOSA.
To understand geospatially the location of public lights in their area of responsibility and get this data in a format that can be used with their GIS / Asset Management systems	All Public Lights are mapped in SAPN's GIS system. This data is maintained and provided to customers on request or annually.	1x GIS file sent to customers annually or on request.
To understand / report carbon / energy usage from public lighting in their area of responsibility	On a six monthly basis provide energy / carbon reporting to all major customers.	2x Energy / Carbon reports sent per year.
Power is provided to public lighting assets	EO lighting has a connection point supplied, SAPN responsibility is to keep power to the connection point and does not extend past connection point.	Forms part of lighting performance below.

	<p>CLER and PLC LED, SAPN will attend and determine if fault exists between luminaire and the connection point and notify customer of their responsibility to repair.</p> <p>SLUoS, SAPN LED and TFI LED SAPN has full responsibility to repair and restore power to public lighting. (including cable faults)</p>	
Light output of each public light is at 70% of original output, or in line with the requirements of AS1158	<ul style="list-style-type: none"> <li>• Bulk lamp change to renew lamps and clean visors.</li> <li>• Illuminance testing in planning phase of bulk lamp change.</li> <li>• Bulk PE Cell change</li> <li>• Repair 98% of SLO reports in 5 working days in metro and 10 working days in regional areas.</li> <li>• Change of luminaire if failed for SLUoS, SAPN LED and TFI.</li> </ul> <p>Reporting to owners of failed CLER and PLC LED lighting.</p>	<ul style="list-style-type: none"> <li>• 1x Bulk lamp / PE change report per year</li> <li>• Reported 12x monthly reporting, 1x annual performance review.</li> <li>• Reported 12x in monthly reporting. Systems in place to notify.</li> </ul>
Public Lighting service provided cost effectively	<ul style="list-style-type: none"> <li>• Warranty management, asset information stored with warranty information and system in place to ensure luminaires returned to manufacturers for warranty claims.</li> <li>• Minimise whole of life costs by extensive testing on lighting asset prior to approval onto network.</li> <li>• Maximising economies of scale (by limiting lighting options per class) and leveraging purchasing power to minimise capital costs.</li> <li>• Providing common systems to all customers</li> </ul>	<ul style="list-style-type: none"> <li>• Lighting asset in SAP, warranty functionality enabled?</li> <li>• Standards Group systems.</li> <li>• Procurement group systems – namely tendering processes.</li> </ul>
Public lighting is elevated and this elevation structure is correctly maintained to minimise risk to the public.	<ul style="list-style-type: none"> <li>• For SLUoS, SAPN LED and TFI LED SAPN has full responsibility to inspect, maintain / repair / replace and restore (after accident) public lighting elevation structures</li> <li>• CLER and PLC LED, SAPN does not have responsibility for the structure other than attending an emergency and making the site safe and notifying the customer.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
Understanding the Public Lighting asset	<ul style="list-style-type: none"> <li>• Future – SAPN to provide access to PL asset information from SAP.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
Contact for general enquiries relating to Public Lighting	<ul style="list-style-type: none"> <li>• Attend to asset condition enquiries.</li> <li>• Attend to enquiries raised by residents/constituents for Council, MP's etc.</li> <li>• Attend to enquiries relating to legal issues pertaining to lighting (e.g. vehicle collisions etc.)</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
Contact for designs	<ul style="list-style-type: none"> <li>• Designs to AS1158</li> <li>• Lighting audits</li> <li>• Construction</li> <li>• Project management</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
Want limited / no involvement in the O&M management of public lighting in their area of responsibility	<ul style="list-style-type: none"> <li>• Replacement of a failed luminaire (for any reason) with modern equivalent at no cost to customer.</li> </ul>	<ul style="list-style-type: none"> <li>• 12x Monthly reporting of luminaire replacement per year</li> </ul>

## 5 Asset History

### 5.1 Identification of Sub-Classes

There are a number of sub-classes for public lighting luminaires. These are determined by their priority in area lighting (e.g. V category – arterial road lighting would have a higher priority than P category – minor road lighting) luminaires which have displayed significant failure rates have been assigned their own sub-class because emphasis would be placed on their replacement (e.g. F40, L90, L135). Public lighting asset sub-classes are identified in Table 5 below.

**Table 5: Public lighting asset sub-classes**

Sub Class	Description	Quantity	Average Range (years)
1	Fluorescent Luminaires (P Category)	22,011	
2	Low Pressure Sodium Luminaires (P Category)	9,774	
3	Low Pressure Sodium Luminaires (V Category)	10,556	
4	Mercury Vapour Luminaires (P and V Category)	61,308	
5	Other HID P Category Luminaires	20,723	
6	Other HID V Category Luminaires	26,219	
7	LED (P Category)	30,317	0-5
8	LED (V Category)	986	0-5
9	FLOOD Lights	5,697	
10	Lamps (Globes) and PE cells	312576	
11	Columns	68,437	
12	Brackets	119,000	
13	Cable (km)	2,750	

### 5.2 Key issues

#### 5.2.1 Sub-Class Conditions

Cable failure is increasing as the cable fleet ages, see Figure 4 below. More replacement of cable is planned as per the strategy section of this document.

#### 5.2.2 Sub-Class Conditions

Column failure is unacceptably high primarily due to ground level corrosion. On average 60 columns fail unassisted per year which is a failure rate of 0.09%. When the first columns were installed in South Australia, they were installed directly into the ground or a caisson, in recent years a tar based tape (Denso tape) has been used to encase the column from 150m above the ground down to 300mm below the ground see Figure 4 below. This effectively stops ground level corrosion while the Denso tape remains undamaged.

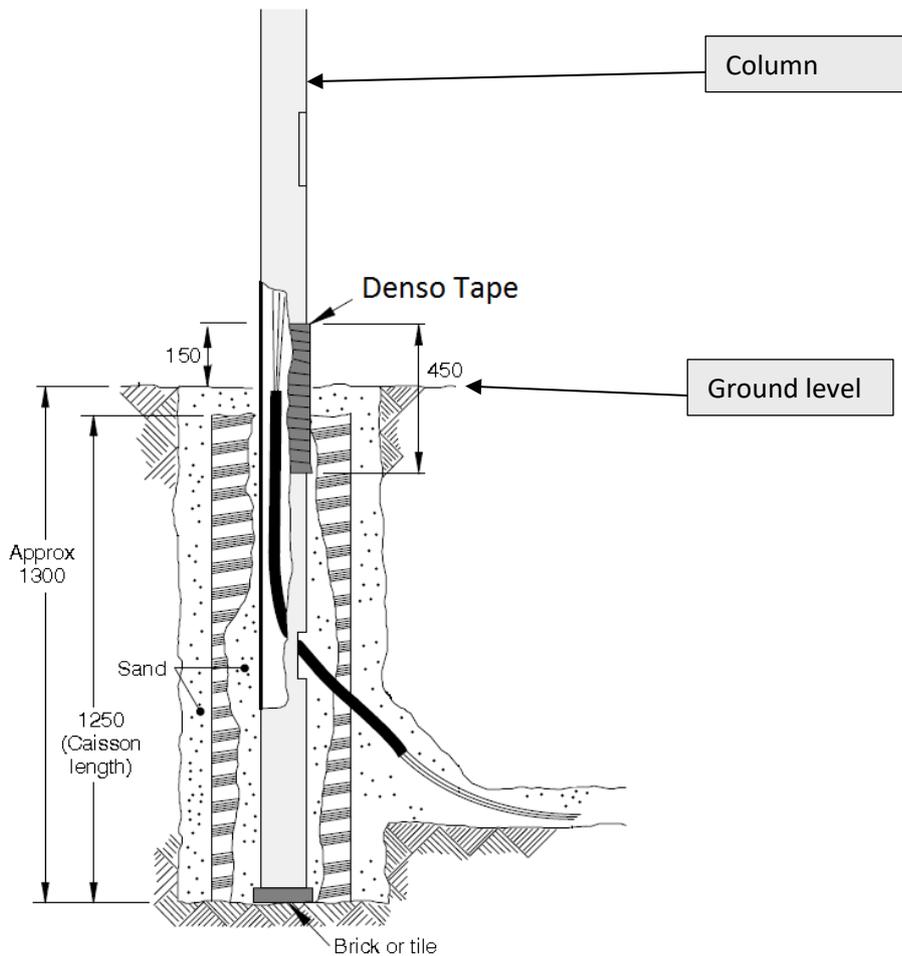


Figure 4: Footing drawing for standard column installation

## 5.3 Risk

### 5.3.1 Public Lighting Switch Wire

Switch wire is an outdated technique where by groups of public lights were connected together by an electrical circuit, this could be either overhead or underground. The switchgear circuit went back to a switch which turned all the lights on the circuit on or off. Typically, the thing that triggered the switch was a PE cell that monitors the light output and triggers when the light level dropped below a set value. This technology has been superseded by each luminaire having individual PE / NEMA cells or smart PE cells attached or embedded.

Overhead Public Lighting Switch Wire is generally considered superfluous and should be removed. The main risk is that if the conductor fails and falls to the ground, during the day there will be no current flowing through it, but this conductor can be energized unexpectedly.

Additionally, one fault in the lighting circuit can result in a lot of lights being out in a single area which presents risks to the community, the location of the switching mechanism can be hard to find as it may have been installed 40 – 50 years ago causing delays in repairs.

Anecdotal information from various depots indicates that there are pockets of switch wire left on the public lighting network both overhead and underground as per Table 6 below.

Table 6: Switchwire locations/ volumes

Location / Area	Number of Lights Affected	Spans / Cable
West Lakes Underground	1,500	1,500 x 50m (cable)= 75km
Elizabeth	1,700	1,700 x 50m (cable)= 85km
Older O/Head Country #	2,837	2,837 x 50m (o/head spans) = 142km
Older O/Head Metro #	8,511	8,511 x 50m (o/head spans) = 426km
Total	14,548	14,548 X 50m (cables and o/h spans) = 728km

### 5.3.2 Unassisted Column Failure

Columns have been failing at higher rates than poles. On average 60 columns fail unassisted per year, which is a failure rate of 0.09%. Whilst the columns are much lighter than poles when they fail they always fall to the ground as there is nothing holding them up (as opposed to conductors for stobie poles). This risk is deemed unacceptable, an inspection program to inspect all column has been developed and commenced, with the highest risk areas (high corrosion, oldest asset, highest failure rates) inspected first.

### 5.4 Spares/Stock/Resource Availability

Stock managed through the main SA Power Networks logistics supply chain with typical 3 month stock on hand for operational use and emergency stock held as directed by Network. Refer to the Power Line Asset Management Plan for full details.

### 5.5 Disposal

Disposal is managed centrally through the main SA Power Networks supply chain with appropriate disposal for all assets. Refer to the Power Line Asset Management Plan for full details.

## 5.6 Historical / Forecast Spend and Failure History

The numbers of Planned and Unplanned OPEX expenditure for SLOs and Bulk Lamp change, are shown in Table 7 & Table 8 below.

\* Cable fault expenditure included in SLO figures or charged to general cable faults

OPEX (\$m)	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025
<b>Bulk Lamp Change</b>	1.51	0.80	2.26	1.58	0.98	0.67	0.68	0.68	0.69	0.69
<b>SLO</b>	5.86	6.66	11.48	4.70	3.95	2.80	2.10	1.67	1.30	1.21
<b>LED Cleaning &amp; Testing</b>	0	0	0	0.00	0.03	0.40	1.10	1.70	2.23	1.71
<b>Column Inspection</b>	0.00	0.00	0.00	1.62	1.63	1.64	1.65	1.66	1.67	1.68
<b>Cable Fault</b>	0.98	2.49	1.52	1.58	1.62	1.66	1.72	1.76	1.80	1.84
<b>Total</b>	8.36	9.95	15.27	9.48	8.21	7.17	7.23	7.48	7.69	7.13

Table 7: OPEX History and Forecast in dollars

OPEX (units)	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025
<b>Bulk Lamp Change</b>	31,162	32,973	32,600	25,984	15,364	9,861	9,861	9,861	9,861	9,861
<b>SLO (excluding cable fault)</b>	39,569	49,093	42,746	31,075	24,997	17,301	12,660	9,898	7,338	6,807
<b>LED Cleaning &amp; Testing</b>				-	2,000	14,103	34,017	51,142	60,358	47,468
<b>Column Inspection</b>	0	0	0	9,000	9,000	9,000	9,000	9,000	9,000	9,000
<b>Cable Fault</b>	604	1,172	846	1,040	1,060	1,080	1,110	1,130	1,150	1,170

Table 8: OPEX History and Forecast in units

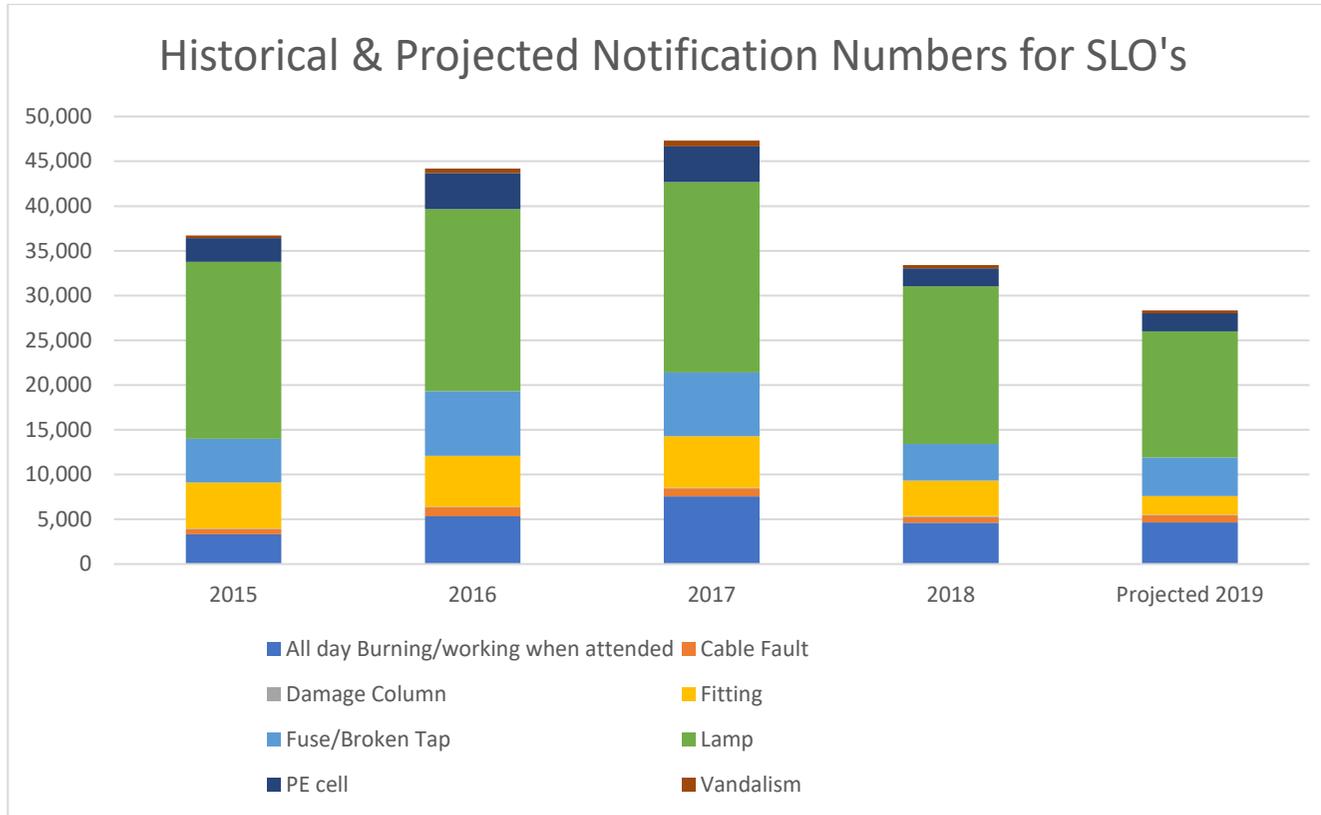


Figure 5: OPEX History and Forecast in units

The numbers of Planned and Unplanned CAPEX expenditure for Luminaire Replacement, excluding those due to third parties, are shown in Table 9 & Table 10 below.

	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025
<b>CAPEX Planned (\$m)</b>	3.82	4.08	3.82	3.65	4.01	1.80	1.79	2.00	2.01	2.02
<b>CAPEX LED</b>	0.00	0.00	3.66	16.60	22.81	14.38	7.54	8.25	0.14	-
<b>CAPEX Unplanned (\$m)</b>	2.89	2.97	2.71	2.48	1.79	1.05	0.71	0.43	0.42	0.42

Table 9: CAPEX History and Forecast in dollars

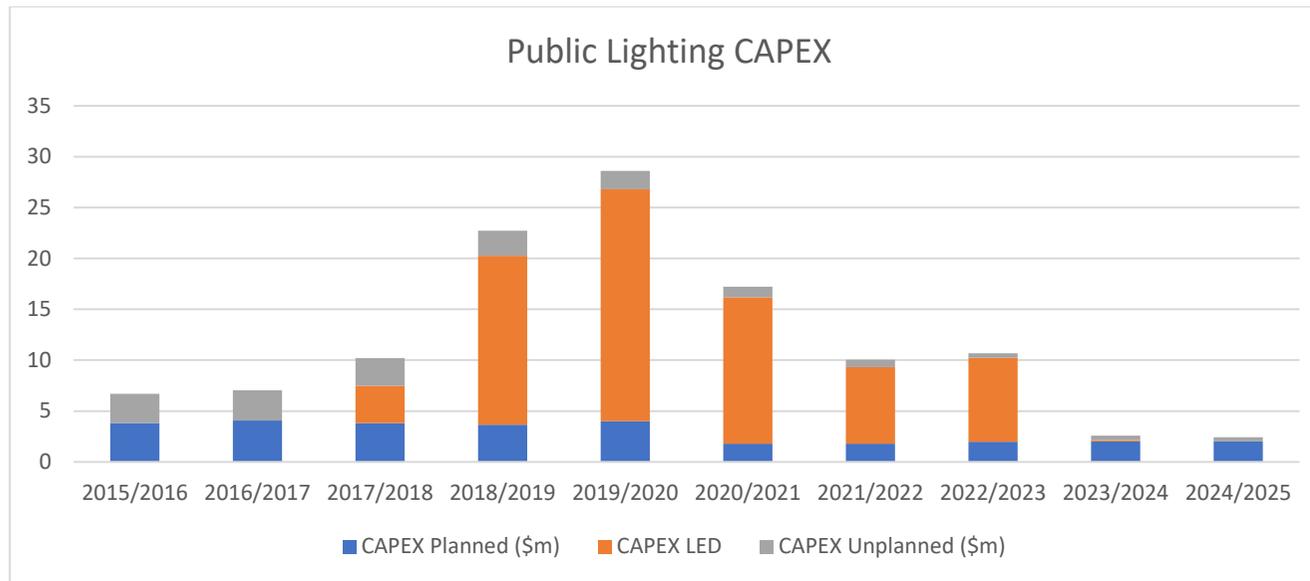


Figure 6: Historical expenditure on Luminaire Replacement and Upgrade

	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025
<b>Cable Replacement Planned (km)</b>	<b>0</b>	<b>0</b>	<b>0</b>	0.6	2.5	3.5	4.5	5.5	5.5	5.5
<b>Column Planned *</b>	<b>0</b>	<b>0</b>	<b>0</b>	554	554	150	150	150	150	150
<b>Bracket Replacement Planned</b>	<b>0</b>	<b>0</b>	<b>0</b>	120	120	120	120	120	120	120
<b>LED Conversions</b>	<b>0</b>	<b>6287</b>	<b>31243</b>	33000	44679	25743	10006	10878	182	0
<b>Column Unplanned</b>	<b>54</b>	<b>61</b>	<b>11</b>	73	73	73	73	73	73	73
<b>Bracket Replacement Unplanned</b>	<b>346</b>	<b>474</b>	<b>282</b>	246	246	246	246	246	246	246
<b>Luminaire Unplanned</b>	<b>5026</b>	<b>6010</b>	<b>4948</b>	4953	3121	1172	481	19	0	0

Table 10: CAPEX History and Forecast in units

\*Column planned figures excludes the columns vested to SA Power Networks (typically vested from Underground Residential Developments). The RIN includes these.

## 5.7 Failure Modes SLO (Refer Table 8 & Table 10)

Most public lighting SLO work originates from the online Single Light Out reporting tool. Typically members of the public (some councils use their night time security patrols to identify and report SLOs) report a single light out and this creates a general LO notification that is assigned to the workgroup responsible for the maintenance of the public light in question. The workgroup will plan to rectify the public light within the specified time frames and on completion of the work, code the cause into the workorder. This section goes through the causes of SLO and the historical failure rates.

### 5.7.1 Lamp and Luminaires

On average over half the SLO failures have been as a result of the lamp failing. HID lamps have well documented expected failure curves, as discussed in Section 7 SA Power Networks balances SLO and bulk lamp change to try and minimise the overall cost. Figure 7 below shows the historical and forecast lamp replacement rates.

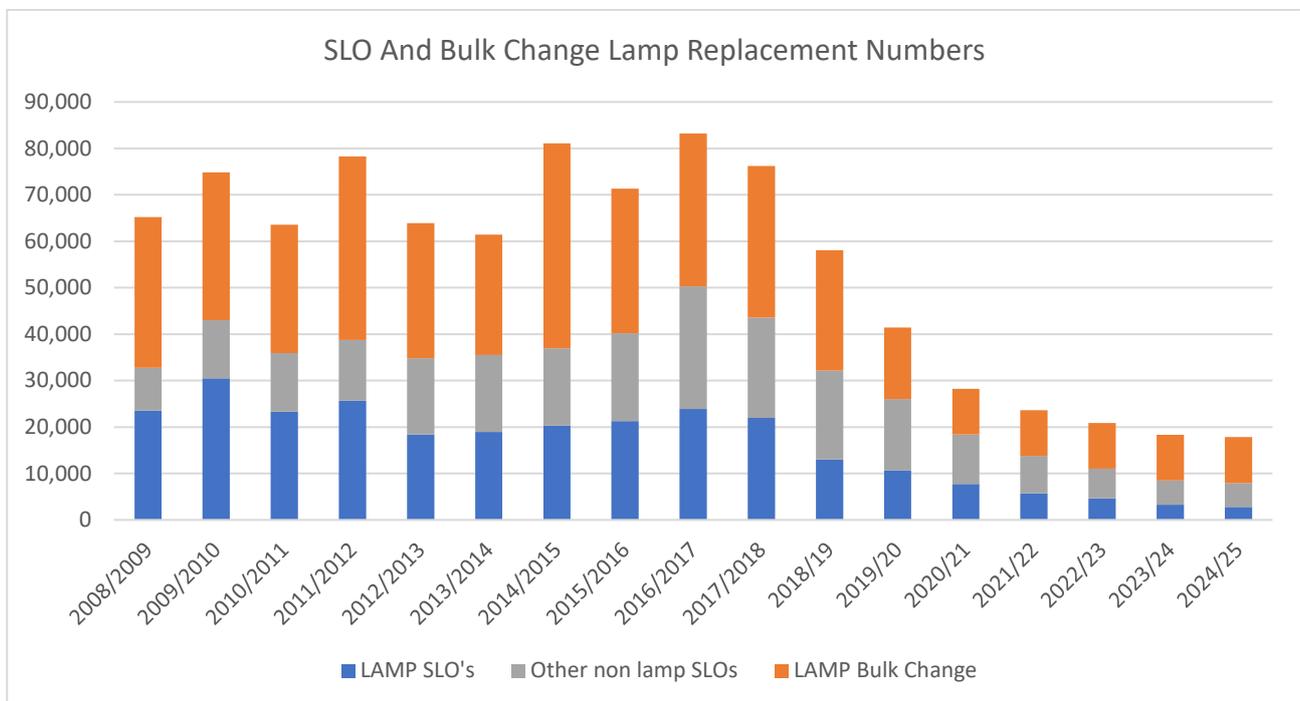


Figure 7: SLO & Bulk Change Replacement Numbers

After verifying power is to the luminaire and a new lamp does not work in the luminaire the luminaire will be replaced with the modern like for like luminaire. The reason the luminaire fails is not investigated or reported for any old (>10 years), for LED lighting with the 10 year warrantee all failed luminaires will be sent back to the manufacturer for investigation and repair / replacement. Figure 8 shows the historical numbers of luminaires replaced per year.

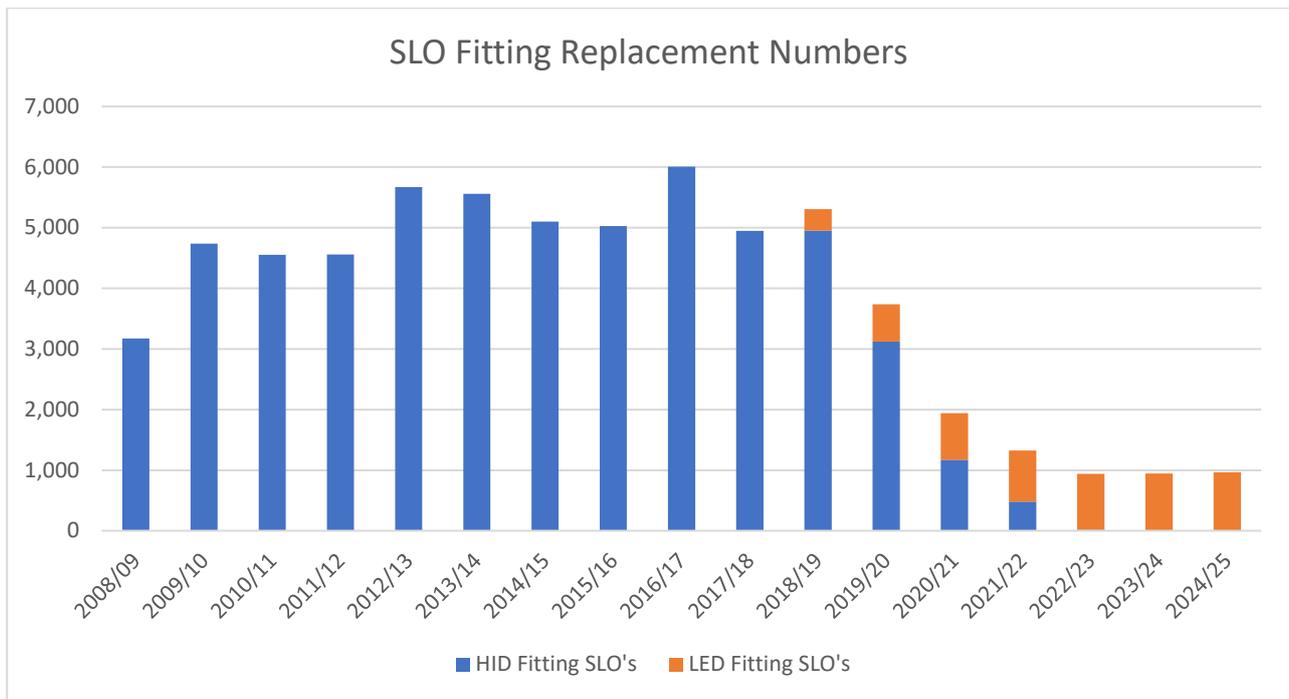


Figure 8: Unplanned Luminaire Replacement Numbers

### 5.7.2 Columns

A column failure is classified as the failed either if it has catastrophically failed resulting in the column on the ground or it has been called through as a breakdown meaning the column present immediate and unacceptable risk of catastrophic failure. Typically the failure mode is ground level (GL) corrosion, the original columns installed in the public lighting network were direct buried into the ground and these columns are very susceptible to this form of corrosion. In later years petroleum based tape (Denso) was used to wrap around the base of the column to protect it from GL corrosion. Column also get damaged by third parties, typically vehicles accidents. Figure 9 shows the historical amount of column replacements.

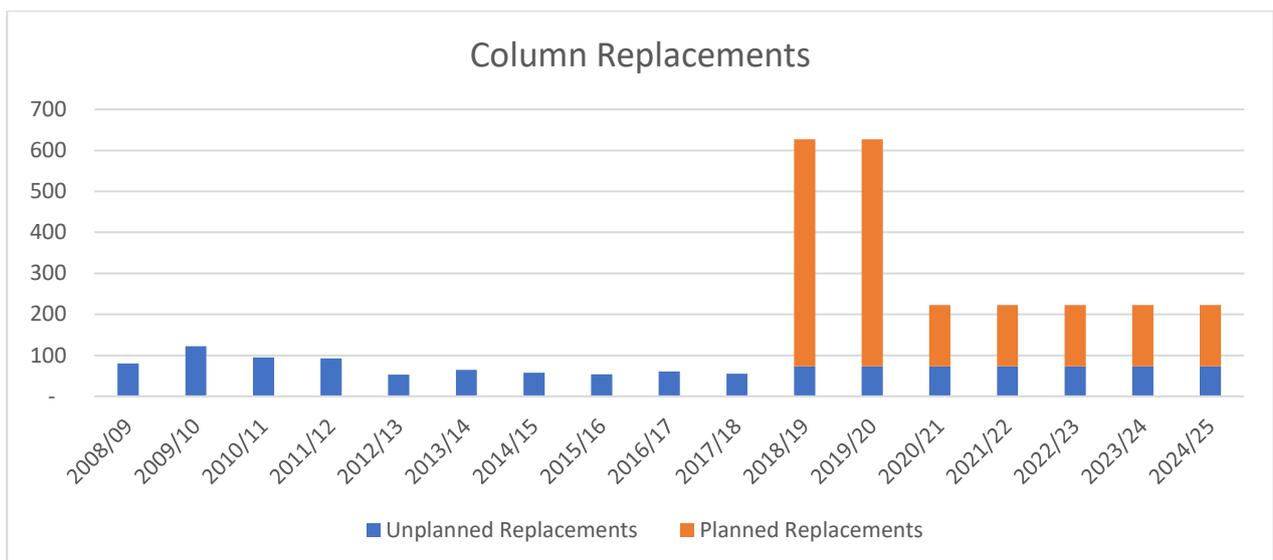


Figure 9: Number of column replacements on each financial year

### 5.7.3 PE cell

A failure of a PE cell typically results in the public light staying on, referred to as an ‘All day burner’, this is a design feature that highlights the PE has failed and also keeps the light on during the night. PE cells are replaced on SLO and Bulk Lamp change, Figure 10 below shows the historical replacement rates.

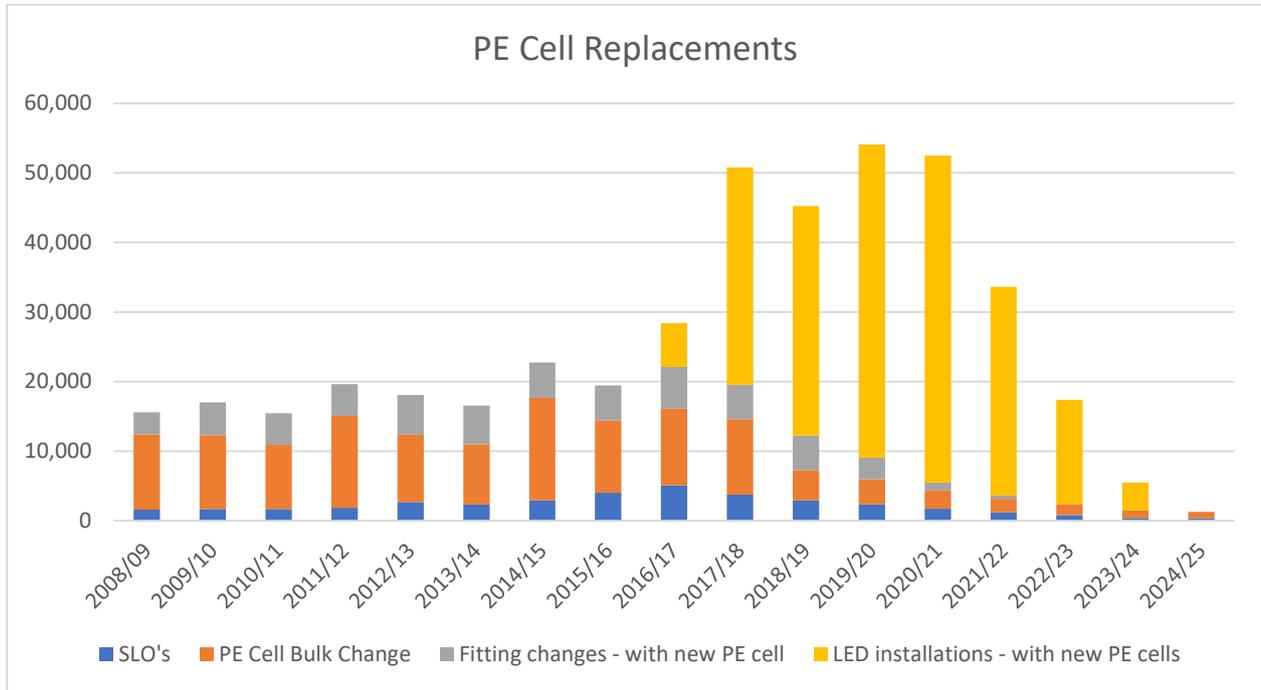
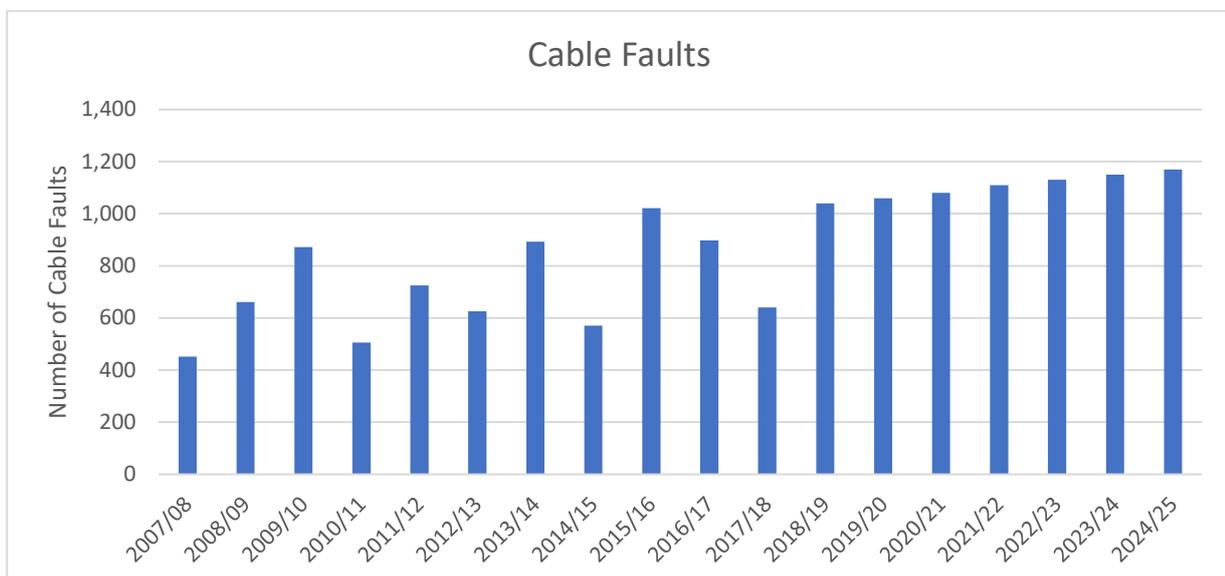


Figure 10: PE Cells replaced annually

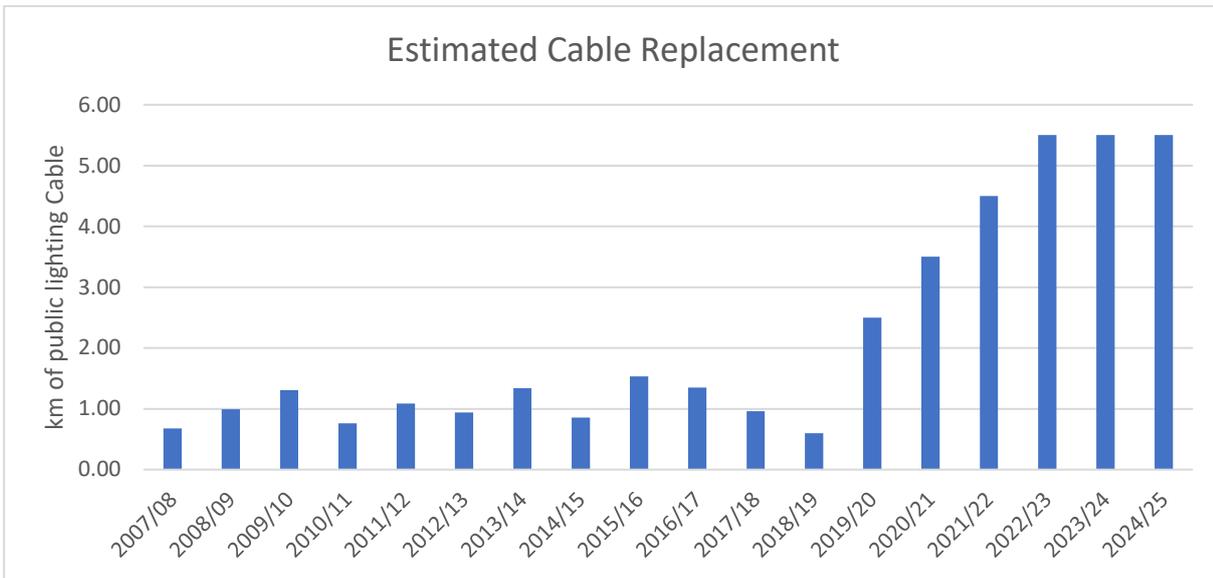
### 5.7.4 Cable Faults and Wiring Issues

Cable faults occur where the protective coverings are broken down over time by soil conditions, animals / insects (termites) or defective equipment / workmanship and moisture then enters the cable and cause a fault to earth. A cable fault is identified as part to the SLO process and a job raised to repair the cable. The crews locate the fault, and remove cable until they find good cable on each side of the fault and join in a new piece of cable. It is very rare to replace large sections of cable directly from a SLO. Analysis of public lighting cable fault data drives cable replacement. Figure 11 shows the cable fault numbers across the public lighting network.



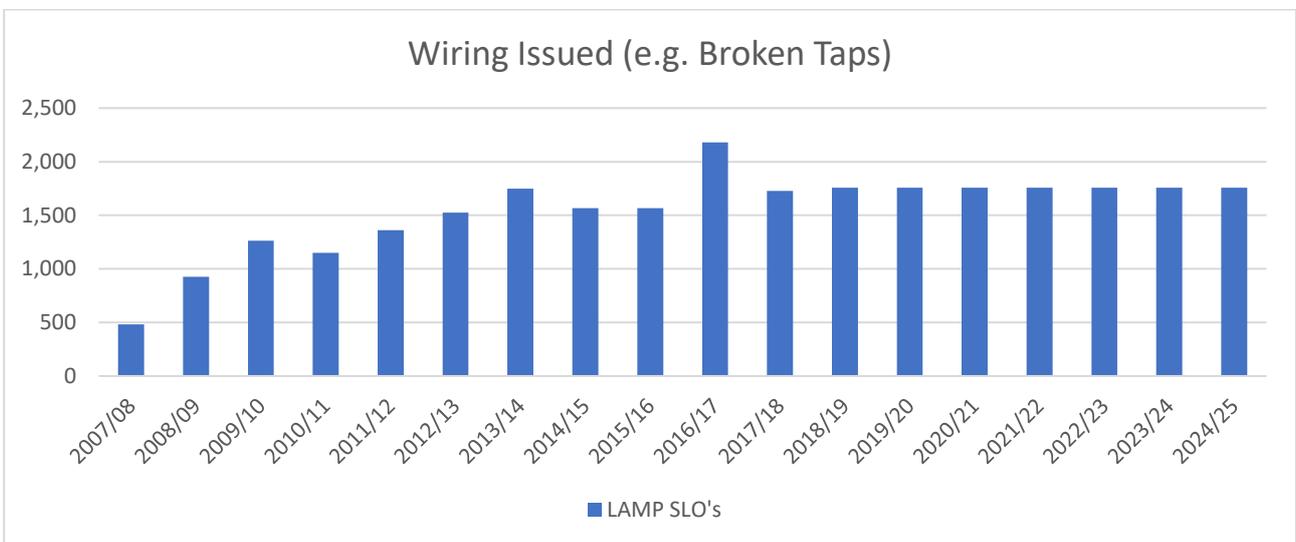
**Figure 11: Number of cable faults annually**

Figure 12 below provides an estimate of the distance of cable replaced per year by assuming that 1.5m of cable is repaired during each cable fault and the forecast for the next regulatory period.



**Figure 12: Cable replacement distance**

Wiring failures occur on public lighting elevated by Stobie poles when the wire that connects from the luminaire, through the bracket to a tap on the low voltage supply fails. As part of the SLO process this failure is determined, the wire replaced and the cause code updated on close out. Figure 13 shows the historical number of wire faults.



**Figure 13: Number of wire faults annually**

## 6 Lifecycle management

### 6.1 Introduction

SA Power Networks has a focus organisationally on asset management and employs good industry asset management practices, guided by its Asset Management Policy, objectives, strategies and plans. This section discusses the strategies developed for asset lifecycle management activities.

### 6.2 Asset lifecycle activities

The lifetime of an asset starts with planning and ends with disposal. The network asset life cycle is continually repeated as assets move in and out of the asset base.

The objective of life cycle asset management is to maximise the asset life and minimise the costs of acquisition, use, maintenance and disposal of assets. Figure 13 shows the typical asset life cycle process.

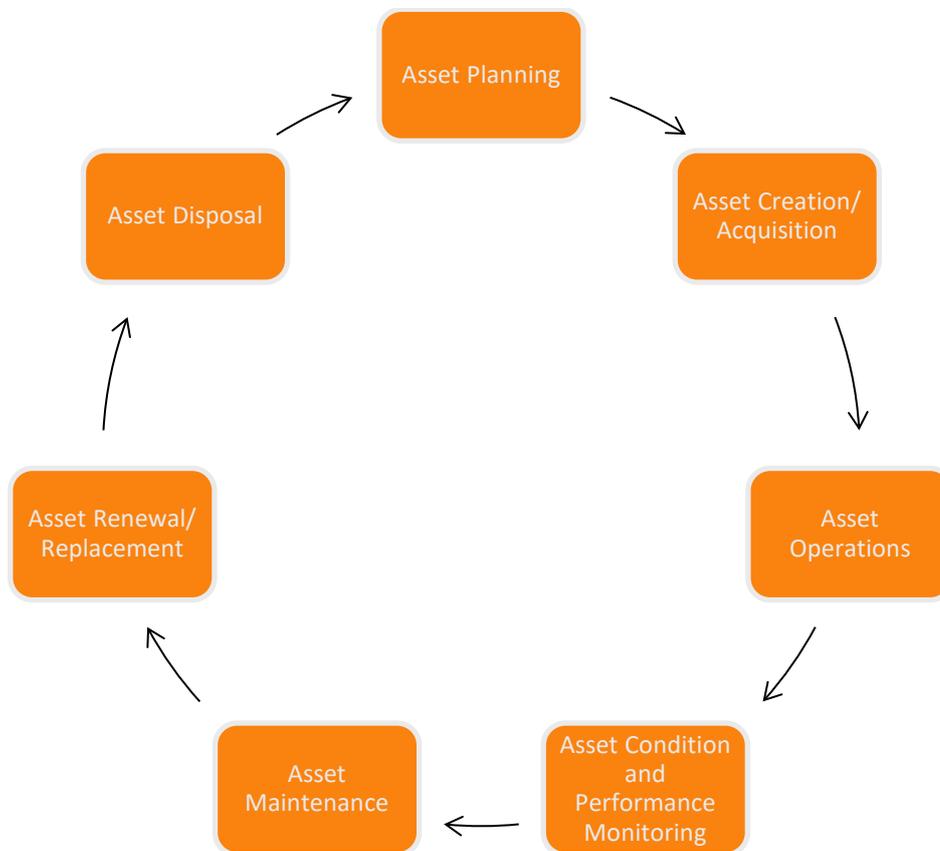


Figure 14: Typical asset life cycle stages

Table 11 summarises these stages as applied by SA Power Networks to distribution network assets.

Table 11: Power network asset life cycle stages - application within SA Power Networks

Asset life cycle stage	Description
<b>Asset planning</b>	<ul style="list-style-type: none"> <li>The process of asset requirement definition, planning investigations, demand and asset capacity assessments with consideration to viable options.</li> </ul>

Asset life cycle stage	Description
	<ul style="list-style-type: none"> <li>Projects are ranked based on risk to ensure the available funding is directed to projects that will generate the maximum benefits to stakeholders and achieve the strategic direction of the business.</li> <li>Only technically feasible options are considered in a business case. The ‘do nothing’ option is always the first option analysed as this option sets the scene for the present and forecast risks and constraints. The option that minimises life-cycle costs is selected as the preferred option. The discounted cash flow technique is applied in evaluating all classes of proposed capital investment.</li> </ul>
<b>Asset creation/acquisition</b>	<ul style="list-style-type: none"> <li>The process where the asset is purchased, constructed or vested to SA Power Networks.</li> <li>Historical asset risks, performance and standardisation of asset types are considered in developing equipment standards. Technical drawings ensure the asset design, construction and commissioning complies with the legislative requirements outlined in the Safety, Reliability, Maintenance and Technical Management Plan (SRMTMP), and industry codes of practice. This also applies to new and altered customer connections.</li> <li>When external service providers are required, panel type arrangements are established to minimise the number of tenders issued and to minimise the overhead requirements of tendering.</li> <li>Testing and commissioning procedures are developed to ensure that new assets are safe and ready to connect to the network.</li> <li>Updating the information systems is an ongoing task in the life cycle asset management. A critical stage in the life cycle is when the asset is commissioned on the network at which point key and relevant business systems are updated with the assets and their attributes.</li> </ul>
<b>Asset operations</b>	<ul style="list-style-type: none"> <li>The process of keeping the lights working.</li> <li>Typical operational activities undertaken on the network include:                             <ul style="list-style-type: none"> <li>Receiving reports on SLO via the online reporting tool and call centre and restoring within the agreed timeframes</li> </ul> </li> </ul>
<b>Asset condition and performance monitoring</b>	<ul style="list-style-type: none"> <li>The assessment of the asset to identify any defects and required corrective actions</li> <li>Comprehensive asset inspection and condition monitoring programs</li> <li>Regular monitoring the network reliability and performance and emerging trends.</li> <li>Investigating and monitoring equipment failures and emerging trends.</li> </ul>
<b>Asset maintenance</b>	<ul style="list-style-type: none"> <li>The process of undertaking planned minor work carried out to prevent more expensive work in the future and reactive maintenance where an asset defect or failure is fixed</li> <li>Maintenance work is prioritised based on risk profile and return on investment.</li> </ul>
<b>Asset renewal/replacement</b>	<ul style="list-style-type: none"> <li>The process of refurbishment or replacement of an asset to provide required functionality taking into consideration current and forecast network requirements to ensure it continues to deliver the required level of service.</li> <li>Assets are replaced when they fail.</li> <li>A risk based approach is taken in renewing/replacing assets with condition defects prior to failure. Asset risks are assessed based on the probability of the asset failing and the consequence(s) of its failure.</li> </ul>

Asset life cycle stage	Description
<b>Asset disposal</b>	<ul style="list-style-type: none"><li>• Renewal work is prioritised based on the risk profile and return on investment.</li><li>• The decision whether to refurbish or replace is based on remaining whole of life-cycle costs. Refurbishment can significantly extend the expected life of the asset prior to requiring replacement but does not restore the asset to 'as new' condition.</li></ul> <hr/> <ul style="list-style-type: none"><li>• The disposal of decommissioned assets. Above ground assets are removed with components salvaged for reuse where possible with the remainder disposed for scrap value. Below ground assets are typically left in the ground unless they can easily be removed (e.g. cables in conduits) or if there are environmental considerations that require the decommissioned asset to be removed.</li></ul> <hr/>

## 7 Public lighting strategy

### 7.1 Purpose of the Public Lighting Business

At the highest level, the Public Lighting customer decides the lighting output required at any given location, designs / pays for a lighting design to achieve this lighting level and then constructs / pays for a third party (including SA Power Networks – can only be SA Power Networks for regulated asset ie Stobie poles) to construct the lighting. This asset is either vested or remains customer owned and then SA Power Network's responsibility is to maintain the lighting output at least 70% of the original lighting output. All the following strategies are undertaken to fulfil this requirement.

### 7.2 HID luminaire Strategies

The HID strategy revolves around 2 key processes, the first is reactive, fix lights on failure via the Single Light Out (SLO) system and the second is the proactive bulk lamp change process. The labour cost of SLO vs Bulk lamp change is roughly 3.5 fold.

#### 7.2.1 Run to Fail – Single Light Out System

Failures are reported via the Online SLO Reporting Tool. SA Power Networks does not inspect or patrol for lamp / luminaire operability, we completely rely on reporting from public. SLO are required to be fixed within 5 days in the metro area and 10 days in the regional areas. The target compliance rate is 98%.

SA Power Networks utilise contractors with training and equipment to optimise cost efficiency in the metro area and use local depot staff in regional for timeliness / efficiency due to distance and low density of lighting. The SLO work also offers useful fill-in type work for the regional depots.

#### 7.2.2 Preventative – Bulk Lamp Change

Bulk lamp change is planned per year and is based on age of lamps and their associated failure rates and expected outputs. Typically 30,000 lamps are changed per year and covers metro and rural P category Lights.

The primary goal of the bulk lamp change is to minimise the total combined cost of bulk lamp change and SLO. If more bulk lamp changes are undertaken this reduces SLO frequency, however there is a diminishing return. The opposite is also true, if less bulk lamp changes occur, the frequency of SLOs increase. Excluding the cost of the lamp, the cost of bulk lamp change is one third that of a SLO. During a bulk lamp change the lamp is changed and the visor cleaned, PE cell changed where necessary.

No bulk lamp change is required for LEDs. LED lighting has very low failure rates which are expected to remain stable throughout the life of the luminaires (20 years). Additionally, the output of the luminaire degrades very slowly and should be above 80% of initial output after 20 years

#### 7.2.3 Bulk Change to LED

HID technology is at end of life, LED technology uses less energy for same or greater outputs, maintenance costs are significantly lower and the costs for the luminaire are dropping significantly making LED changeover highly desirable for most luminaire types.

Manufacturers of HID equipment are responding by closing HID manufacture meaning lamps are increasingly becoming not available forcing the replacement of luminaires on lamp failure.

Government regulation is likely to ban the importation of mercury vapour lamps into Australia from 1<sup>st</sup> January 2021 once the Australian Government ratifies the Minamata convention for mercury, this class of lamp currently is the largest in the public lighting fleet so targeting this lamp type makes sense to reduce risks from 2021. Additionally, the 80W mercury vapour lamp consumes 96W of energy making it one of the highest P category lamps that can be replaced with a 17W LED which is a very compelling energy saving argument to replace this lamp type also. A copy of The Minamata Convention on Mercury paper from the Department of Environment and Energy is available on request

There are three methods of change over from HID to LED

- Unplanned replacement – when responding to a SLO, where the luminaire has failed or the lamp is no longer available the luminaire will be replaced. SA Power Networks replaces the luminaire with an equivalent output LED luminaire, placing this luminaire on a SAPN LED tariff.
- Planned Customer Initiated – customers may engage SA Power Networks to replace, on bulk, large areas of lighting to LED lighting. If customers fund the LED rollout the lights are placed onto a PLC LED tariff. If SA Power Networks fund the rollout the luminaires are placed onto a SAPN LED tariff.
- Planned SA Power Networks initiated. SA Power Networks instigates rollouts when luminaires are at end of life. Typically this is when the luminaire fails in service or the lamp is no longer available, however in the regional areas lights cost roughly 3 times the amount of metro lights to maintain due to the travelling distances and utilising powerline crews who use more expensive equipment (replacing lamps whilst out doing powerline maintenance or customer connection work). LED lighting is much more reliable so once installed SA Power Networks won't have to respond to SLO as frequently which will reduce costs significantly. The SA Power Networks strategy is to replace any luminaire that is efficiently replaceable (typically a side entry P category luminaire) whenever a regional luminaire is attended for bulk lamp change or SLO. Additionally, whenever a SA Power Networks crew travels further than 10km from depot in a regional area to a location that has less than 20 luminaires the SA Power Networks crew will replace as many of the luminaires as their work plan allows (whilst picking up any high risk powerline maintenance or customer connection work in the locality).

### **7.3 LED Luminaire Strategies**

The LED strategy revolves around 2 key processes, the first is reactive, fix lights on failure via the Single Light Out (SLO) system and the second is the proactive with visor cleaning and lux readings at ground level.

#### **7.3.1 Run to Fail – Single Light Out System**

Strategy is essentially the same as the HID, just with much lower expected failure rates.

Failures are reported via the Online SLO Reporting Tool, SA Power Networks does not inspect or patrol for lamp / luminaire operability, we completely rely on reporting from the public. SLOs are required to be fixed within 5 days in the metro area and 10 days in the regional areas. The target compliance rate is 98%.

SA Power Networks utilise contractors with training and equipment to optimise cost efficiency in the metro area and use local depot staff in regional for timeliness / efficiency due to distance and low density of lighting. The SLO work also offers useful fill-in type work for the regional depots.

#### **7.3.2 Preventative – Lux output maintenance**

Without the bulk lamp change and SLO that cleans the HID luminaire visor, the LED luminaire fleet will require regular cleaning to ensure the lux requirements are maintained at ground level. As such a 5 yearly cleaning cycle, to clean the visor both inside and out, is programmed for LED lighting.

The ultimate purpose of public lighting is to maintain a minimum lux at street level, as such a lux monitoring program has been programmed 4 yearly. The aim of this program is to gauge cleaning and degradation rates. SA Power Networks will monitor / audit 25% of luminaires due for the 4 yearly monitoring, this will be done across residential, industrial, V-category areas to gauge a representative picture of the cleanliness and degradation of the LED fleet. The 4 year cycle corresponds to a year before the first cleaning cycle to ensure lux levels are acceptable with the 5 year cleaning cycle. It is expected that the 5 year cleaning may not be strictly followed. Some industrial and high traffic areas will most likely need cleaning on intervals less than 5 years and some residential areas will likely be able to be pushed out past 5 years. This will be based on the results from the lux monitoring.

## 7.4 Elevation Strategies

The primary objectives around the elevation of public lighting are to ensure the elevation structure is safe for the surrounding community and that the most cost effective method of elevation is applied or the customer requirement is met. The primary elevation methods are either via a Stobie pole, leveraging the powerline asset or on a dedicated lighting column. There are a small number of lighting asset attached to a third party asset (typically a wall) this method is not current construction and SA Power Networks will try to modify or vest back to customers these luminaires as they are typically hard to maintain and to guarantee safety compliance of the elevation.

For efficiency, elevation structures will be maintained – inspected / repaired / replaced – wherever possible with the powerline asset to minimise overall cost.

## 7.5 Column Inspections

Column inspections have initially been set based on the inspection cycle of powerline assets, which is 5 years for high corrosion zones and 10 years for low corrosion zones. This approximately equates to an average 7.5 year inspection cycle.

Column inspections are prioritised using a risk based approach that considers construction method, environmental factors and column performance in the area as inputs into creating the annual column inspection plan.

A column inspection may change based on what is found on site. The major variances at each light column are:

- The correct installation of petrolatum tape and it's condition. If the petrolatum tape is present, installed correctly and in good condition, then it is not necessary to dig around the base of the column.
- The surface type at the base of the column. If there is soil at the base, the soil will be removed to inspect for corrosion below ground level, however if there is concrete/bitumen/paving, the RLS (Relative Loss of Section) meter will be used to perform non-destructive corrosion measurement.
- Access to internal wiring. If the access panel cannot be removed, the internal wiring condition cannot be inspected. A job will be raised for rectification.
- Significant immediate risk of failure. If the column is assessed to be in an extremely deteriorated condition and presents an immediate safety risk, a breakdown job will be raised to address the issue. Inspection of the light column will be limited to visual inspection only.

This variable inspection process is managed through SAP Work Manager, an inspection data collection tool which enables data collected to be immediately attached to the column master records.

The main aims of the inspection program are:

- Determine the overall structural condition of the column, to support decisions to reduce the risk of column failure
- Determine the condition of the wiring and earthing, to support decisions to reduce the risk of electric shock from touching the column
- Determine the wiring type, to enable correct determination of ownership (SA Power Networks wiring is generally indicative of SA Power Networks ownership and customer wiring is generally indicative of customer ownership)
- Updating asset information, to ensure correct billing and asset information can be provided to customers and undocumented assets can be identified and updated.

## 7.6 Replacement

The luminaire replacement strategy for both HID and LED lighting have components of run to failure and preventative the details are provided in the HID and LED strategy sections.

Switch Wire Removal – no specific program is being proposed to remove switch wire from the network. What is planned is that during the LED rollout, luminaires connected to overhead switch wire will be rewired to connect directly to the LV mains and utilise the stand NEMA cells with the luminaire. At the same time the location of the switch wire on the powerline asset will be identified in SAP and a program will be developed to remove the switch wire on a risk based approach. Additionally, the ongoing powerline inspection will identify switch wire conductor. It is not planned for wide scale removal in the 2020-2025 period, proposals for removal will be planned in the follow regulatory period after the LED rollouts are complete and all the switch wire is identified.

### 7.6.1 Column Replacement

Column replacement can be broadly categorised into 2 main areas, reactive or proactive.

Reactive column replacement is driven by either of the column failing and ending up on the ground through third party (eg car hit column) or other (wind, vegetation) or during inspection a column is found that was very high risk of immediate failure. This will be called in as a breakdown for immediate rectification.

The proactive replacement is based on the condition information collected in the column inspection program, as per all the powerline equipment the condition information is fed into the Valuing algorithm and the risk quantified. The replacement / repair work is driven by the value and return of investment (value (risk) of the work divided by the cost). Details of the working valuing systems can be found in the Power Asset Management Plan.

A standard strategy in asset management for SA Power Networks is the deferment of replacement expenditure whenever possible and it makes economic sense. This typically is around asset repair so the replacement can be deferred for later years.

### 7.6.2 Cable Repair / Replacement

Cable replacement can be broadly categorised into 2 main areas, reactive or proactive.

Reactive cable repair is instigated by the SLO process were the crew attending determine the cause of the SLO to be a cable fault and a job is created to repair the cable. Typically, this repair process just fixes the damage to the cable and does not involve any material replacement, however on rare occasion when the cable is found to be in very poor condition cable small sections of cable will be replaced.

Proactive replacement occurs following analysis of the cable fault history across the underground lighting network and applying the rule that if there have been 3 faults or more on a single cable section this cable section will be replaced. As the location data for the lighting cable faults is not accurate it is difficult to go back in time to find the locations however the actual locations are now recorded making analysis straight forward and this will drive increasing cable repair into the future. The forecast for cable replacement is in Table ?? below, once the replacement rates increase to 5.5km per year this will equate to a replacement rate of 0.2% of the underground network, this implies an expect life of 500 years for a lighting column, clearly this is not correct and over time the cable replacement rate will have to increase.

**Table 12: Summary of cable replacements**

	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Planned Cable Replacements (km)							
Metro Cable Replacements	0.5	2.0	3.0	4.0	5.0	5.0	5.0
Regional Cable Replacements	0.1	0.5	0.5	0.5	0.5	0.5	0.5

	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
<b>Total Cable Replacements</b>	<b>0.6</b>	<b>2.5</b>	<b>3.5</b>	<b>4.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>

## 7.7 Forecasting

### 7.7.1 Forecasting Methodologies

A forecasting model referred to as the Public Lighting Pricing Model has been developed to calculate expected replacement / service rates of equipment and the resultant capital and opex requirements. The models' inputs are determined from the following sources:

- Historical expenditure and failure rates for old technology HID luminaires and all elevation infrastructure and
- Original Equipment Manufacturer (OEM) predicted failure / maintenance rates for LED luminaires.
- Subject matter expert's knowledge to help build the required expenditure.

## APPENDICES

**7.8 Abbreviations**

ACCC	Australian Competition and Consumer Commission.
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AS	Australian Standard.
AS/NZS	Australian / New Zealand Standard.
A to O	Authority to Operate SA Power Networks plant by SCADA control.
AWS	Advanced Works Scheduling.
BESS	Best Endeavours Service Standards.
BFRA	Bushfire Risk Area.
BOM	Bureau of Meteorology.
CAIDI	Customer Average Interruption Duration Index. It is the average supply restoration time for each customer calculated as SAIDI / SAIFI.
CAPEX	Capital Expenditure Budget.
CB	Circuit Breaker.
CFS	Country Fire Service.
CIS - OV	Customer Information System – Open Vision.
CLER	Customer Lantern Equipment Rate.
CPI	Consumer Price Index.
CRC	The Capital Review Committee (CRC) comprises the Chief Executive Officer (CEO), Chief Financial Officer and General Manager Corporate Affairs (as the Asset Owner).
Disposal	Removal of assets from the asset base.
DMS	Distribution Management System.
DNCL	Distribution Network Controller Level.
DPTI	Department of Planning, Transport & Infrastructure.
DUOS	Distribution Use of System.
ECR	Emergency Control Room.
ElectraNet	The South Australian electricity transmission network owner and planner.
EMG	Executive Management Group.
ENA	Energy Networks Association.
ESCOSA	Essential Services Commission of South Australia.
ESAA	Electricity Supply Association of Australia.
ESDP	Electricity System Development Plan.
FDI	Fire Danger Index.
FDL	Fire Danger Level.
FS	Field Services is the internal construction workgroup of SA Power Networks.

FSB	Facilities Systems Branch.
FTE	Full Time Employees.
GIS	Geographic Information System.
GSL	Guaranteed Service Level.
HBFRA	High Bushfire Risk Area.
HV	High Voltage.
IEC	International Electro-technical Commission.
IEEE	Institute of Electrical & Electronics Engineers.
IPWG	Inspection Planning Working Group.
IRR	Internal rate of return is discount rate which produces a present value of zero when applied to the proposed cash flows.
IVR	Interactive Voice Response.
JSWM	Job Safe Work Method - Document that describes a safe system of work on a particular item of plant at a particular location.
JSWP	Job Safe Work Procedure - A document that describes a generic safe system of work on plant and equipment used to build and maintain the Electricity Distribution system.
LGA	Local Government Area.
LV	Low Voltage.
MAIFI	Momentary Average Interruption Frequency Index.
MV	Medium Voltage.
NBFRA	Non Bushfire Risk Area.
NER	National Electricity Rules.
NIEIR	National Institute of Economic and Industry Research.
NOC	Network Operations Centre.
NPV	Net Present Value is the present value of all expected benefits, less the present value of all expected cost of the project.
O&M	Operations and Maintenance.
OMS	Outage Management System
OPEX	Operating Expenditure Budget.
PAMP	Power Asset Management Plan. A document that provides the high level asset management framework and lifecycles for SA Power Networks.
PAW	Pre-arranged Work.
PCB	Polychlorinated Biphenyls.
PI	Profitability index is defined as the ratio of discounted benefits to discounted costs.
PLEC	Power Line Environment Committee
PV	Photo Voltaics
QMS	Quality Management System.
RCM	Reliability centred maintenance.

RFP	Request for Proposal.
RIT-D	Regulatory Investment Test – Distribution.
RIT-T	Regulatory Investment Test – Transmission.
RTU	Remote Terminal Unit.
SAIDI	System Average Interruption Duration Index specified in minutes per customer per annum.
SAIFI	System Average Interruption Frequency Index specified in outages per customer per annum.
SAP	Asset and fault records database.
SCADA	Supervisory, Control and Data Acquisition.
SCO	System Control Officer.
SCONRRR	Standing Committee on National Regulatory Reporting Requirements
SNC	Senior Network Controller.
SOC	Senior Operations Controller.
SOP	Safe Operating Procedure – Document that describes safe operating work procedure.
SPS	Service Performance Scheme – see STPIS.
SSF	Service Standard Framework.
STPIS	Service Target Performance Incentive Scheme.
TF	Transformer.
UFLS	Under-frequency load shedding.
UID	Underground industrial development.
URD	Underground residential development.
WARL	Weighted Average Remaining Life.

## 7.9 Definitions

The following definitions apply to this Asset Plan:

<b>Term</b>	<b>Definition</b>
Asset Class	Logical, high-level grouping of assets against which administrative and strategic planning can be undertaken.
Asset Sub-class	Logical sub-group of assets associated with the 'Asset Class'. This lower level of asset groupings is generally for administrative and tactical purposes.
Asset Plan	Document which describes the approach to managing an asset or a group of assets. The Asset Plan includes an asset description, key issues and risks, the asset strategy (new assets, replacement assets, maintenance of existing assets, operational management of the assets, environmental management implications of the asset), and asset disposal.
Power Asset Management Plan (PAMP)	Plan which defines SA Power Networks' approach to managing the electricity distribution assets over the planning period of 2018-2030.
Asset Life Cycle	Group of activities undertaken from the conception stage to disposal stage of the asset life.
Asset Management	Coordinated activities of an organisation to achieve value from assets. Source ISO 55000 Vol 1.