

Energy Queensland Group

Asset Management Plan

Public Lighting

October 2018



Part of the Energy Queensland Group

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1 Introduction

Energy Queensland Limited (EQL) was formed 1 July 2016 and holds Distribution Licences for the following regions:

- South East Region (Legacy organisation: Energex Limited); and
- Northern and Southern Regions (Legacy organisation: Ergon Energy Corporation Limited).

There are variations between the EQL regions as a result of geographic influences, market operation influences and legacy organisation management practices. This AMP reflects the current practices and strategies for public lighting assets managed by EQL, recognising the differences that have arisen due to legacy organisation management. These variations are expected to diminish over time with integration of asset management practices.

1.1 Purpose

The purpose of this document is to demonstrate the responsible and sustainable management of public lighting on the EQL networks. The objectives of this plan are to:

1. Acknowledge and adapt to the changing technology, customer expectations and external market forces that will require conventional public lighting to be superseded by LED technology
2. Deliver customer outcomes to the required level of service.
3. Demonstrate alignment of asset management practices with EQL's Strategic Asset Management Plan and business objectives.
4. Demonstrate compliance to regulatory requirements.
5. Manage the risk associated with operating the assets over their lifespan.
6. Optimise the value EQL derives from the asset class

This asset plan will be updated periodically to ensure it remains current and relevant to the organisation and its strategic objectives. Full revision of the plan will be completed every five years as a minimum.

This Asset Management Plan is guided by the following legislation, regulations, rules and codes:

- QLD Electricity Act 1994
- National Electricity Rules (NER)
- QLD Electrical Safety Act 2002
- QLD Electrical Safety Regulation 2013 (ESR)
- QLD Electrical Safety Code of Practice 2010 – Works (ESCOP)
- QLD Work Health & Safety Act 2014
- QLD Work Health & Safety Regulation 2011
- Ergon Energy Corporation Limited Distribution Authority No D01/99
- Energex Limited Distribution Authority No. D07/98

This asset management plan forms part of EQL's strategic asset management documentation. It is part of a suite of asset management plans, which collectively describe EQL's approach to the lifecycle management of the

various assets which make up the network used to deliver electricity to its customers. Appendix 1 contains references to other documents relevant to the management of the asset class covered in this plan.



Figure 1: EQL Document Hierarchy

1.2 Scope

This plan covers the following assets:

- Public Lighting

This AMP relates to EQL owned and operated public lighting assets and the routine inspection and maintenance of public lighting assets whose maintenance is the Company's responsibility.

The public lighting assets are installed as directed by the customers who are accountable for public lighting illumination standards. It is the public lighting customers' responsibility to decide on what lighting is required for public roads and to ensure that lighting levels are appropriate in consultation with the road and traffic authority and in accordance with AS/NZS 1158 series of standards.

1.3 Total Current Replacement Cost

Energex proposed opening PLAB (Public Lighting Asset Base) for the next regularity period is \$155.60M as at 1 July 2020. This opening value has been calculated in accordance with clause 6.5.1 of the National Electricity rules (NER) and using the Australian Energy Regulator's Roll Forward Model (RFM).

Ergon Energy proposed opening PLAB (Public Lighting Asset Base) for the next regularity period is \$85.46M as at 1 July 2020. This opening value has been calculated in accordance with clause 6.5.1 of the NER and using the Australian Energy Regulator's RFM.

1.4 Asset Function and Strategic Alignment

The function of public lighting assets is to provide a reliable level of artificial illumination to public thoroughfares at the correct time of day and / or when the level of ambient illumination has fallen below a prescribed level. The public lighting asset management plan provides the necessary framework for the installation, operation and

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maintenance of our assets to the required industry standards. This enables safe and effective public lighting alternatives are provided for our customers and Queensland communities

EQL recognises the importance of public lighting to its customers, the community and other stakeholders for the provision of a safe, secure and attractive visual environment for pedestrian and vehicular traffic, whilst taking into consideration energy efficiency, economic efficiency, and appropriate technology choices.

EQL will endeavour to work with our public lighting customers to help provide them with the best possible service standards and is committed to achieving best practice asset management strategies to ensure the safe and reliable operation of its public lighting assets.

Table 1.4 details how public lighting contributes to the corporate strategic asset management objectives

Asset Management Objectives	Relationship of Asset to Asset Management Objectives
Ensure network safety for staff, contractors and the community	Diligent and consistent maintenance and operations supports asset performance and hence safety for all stakeholders
Meet customer and stakeholder expectations	Continued asset serviceability supports network reliability and promotes delivery of a standard quality electrical energy service.
Manage risk, performance standards and asset investment to deliver balanced commercial outcomes	Failure of this asset can result in increased public safety risk. Asset longevity assists in minimising capital and operational expenditure.
Develop Asset Management capability and align practices to the global ISO55000 standard	This AMP is consistent with ISO55000 objectives, and drives asset management capability by promoting a continuous improvement environment
Modernise the network and facilitate access to innovative energy technologies	This AMP promotes replacement of assets at end of economic life as necessary to suit modern standards and requirements

Table 1.4: Asset Function and Strategic Alignment

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1.5 Owners and Stakeholders

Role	Responsible Party
Asset Owner	Chief Financial Officer
Asset Operations Delivery	EGM Distribution
Asset Manager	EGM Asset Safety & Performance

Table 1.5: Stakeholders

2 Asset Class Information

2.1 Asset Description

2.1.1 Public Lighting

EQL undertakes public lighting services that cover the operation, maintenance, repair and replacement of assets, the alteration and relocation of assets and the provision of customer requested new installations.

Public lighting customers include Local Government Authorities (LGA) and Department of Transport and Main Roads (DTMR). EQL does not maintain lights that are owned by customers or 3rd parties. Public lighting responsibilities are currently categorised as follows:

Rate 1 Unmetered, non-contributed public lighting supplied, installed, owned and maintained by EQL. Ergon Owned & Operated (EO&O)

Rate 2 Unmetered, contributed public lighting for which all supply and installation costs are funded by the customer and then ownership is vested in and maintained by EQL; or public lighting gifted to and thereafter owned, operated and maintained by EQL. Gifted & Ergon Operated (G&EO)

Rate 3 (or Rate 8) Unmetered customer owned and operated public lighting supplied, installed, owned and maintained by the customer. Customer Owned & Operated (CO&O)

Minor road public lighting (also known as Category P installations) includes lighting on minor roads used primarily for the visual requirements of pedestrians. Typically the responsibility of the LGA.

Major road public lights (also known as Category V installations) includes lighting on major roads is used primarily for the visual requirements of motorists (e.g. traffic routes). Typically the responsibility of a state or territory road authority (DTMR).

The maintenance requirements apply to the following primary items:

- Poles and brackets.
- Luminaires and lamps.
- Low Voltage supply cables and connections.

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- Control equipment (including PE Cell)

EQL's public lighting includes:

- management of public lighting assets;
- procuring and maintaining a standard range of public light offerings;
- outage detection (via patrols or via customer advice);
- luminaire maintenance (bulb and PE cell replacement and clean);
- pole inspection and proximity testing on cyclical basis;
- cyclical bulk replacement or replace on failure; and
- technology development and trials.

EQL's public lighting operating and maintenance programme has been developed to align with the relevant Public Lighting Standards and Codes, Council public lighting guidelines and sound industry practice.

2.2 Asset Quantity and Physical Distribution

Energex has approximately 360,000 public lights connected to our distribution network in South-East Queensland. We own and operate more than 325,000 public lights, with the remaining public lights being owned by local government authorities and other government entities. The main types of public light luminaires in our inventory are fluorescent, mercury vapour (MV) and high pressure sodium; which account for 98% of all public lighting. The remaining public lights are fluorescent, incandescent or metal halide lamps.

Energex's major customers for public lighting include the 12 local government authorities (LGAs) in Energex's area, the Department of Transport and Main Roads (DTMR) and other Government entities such as Queensland Rail.

Ergon Energy has more than 150,000 public lights connected to our distribution network area. We own and operate more than 140,000 public lights, with the remaining public lights being owned by local government authorities and other government entities. The main types of public light luminaires in our inventory are mercury vapour (MV) and high pressure sodium vapour; which account for 98% of all public lighting. The remaining public lights are incandescent, metal halide or fluorescent lamps.

Ergon Energy's major customers for public lighting include the 56 local government authorities (LGAs) in Ergon Energy's area and the Department of Transport and Main Roads (DTMR).

Table 2.2 provides details on quantities and types of lights for both Energex and Ergon Energy.

ENERGEX					ERGON ENERGY				
Lamp Type	R1	R2	R3	Grand Total	Lamp Type	R1	R2	R3	Grand Total
Fluorescent	33667	17921	1537	53125	Compact Fluorescent	63	569	59	691
Incandescent	0	255	45	300	Fluorescent	56	28	33	117
LED	1623	1140	1996	4759	Incandescent	2	0	0	2
Mercury Vapour	59896	84437	4975	149308	LED	264	240	113	617
Metal Hallide	344	333	3172	3849	Mercury Vapour	62110	29985	2614	94709
Sodium Vapour	53524	70713	27152	151389	Metal Hallide	169	464	555	1187
Grand Total	149054	174799	38877	362730	Sodium Vapour	27888	22765	9828	60481
					Grand Total	90551	54051	13202	157804

Table 2.2: Asset Quantity

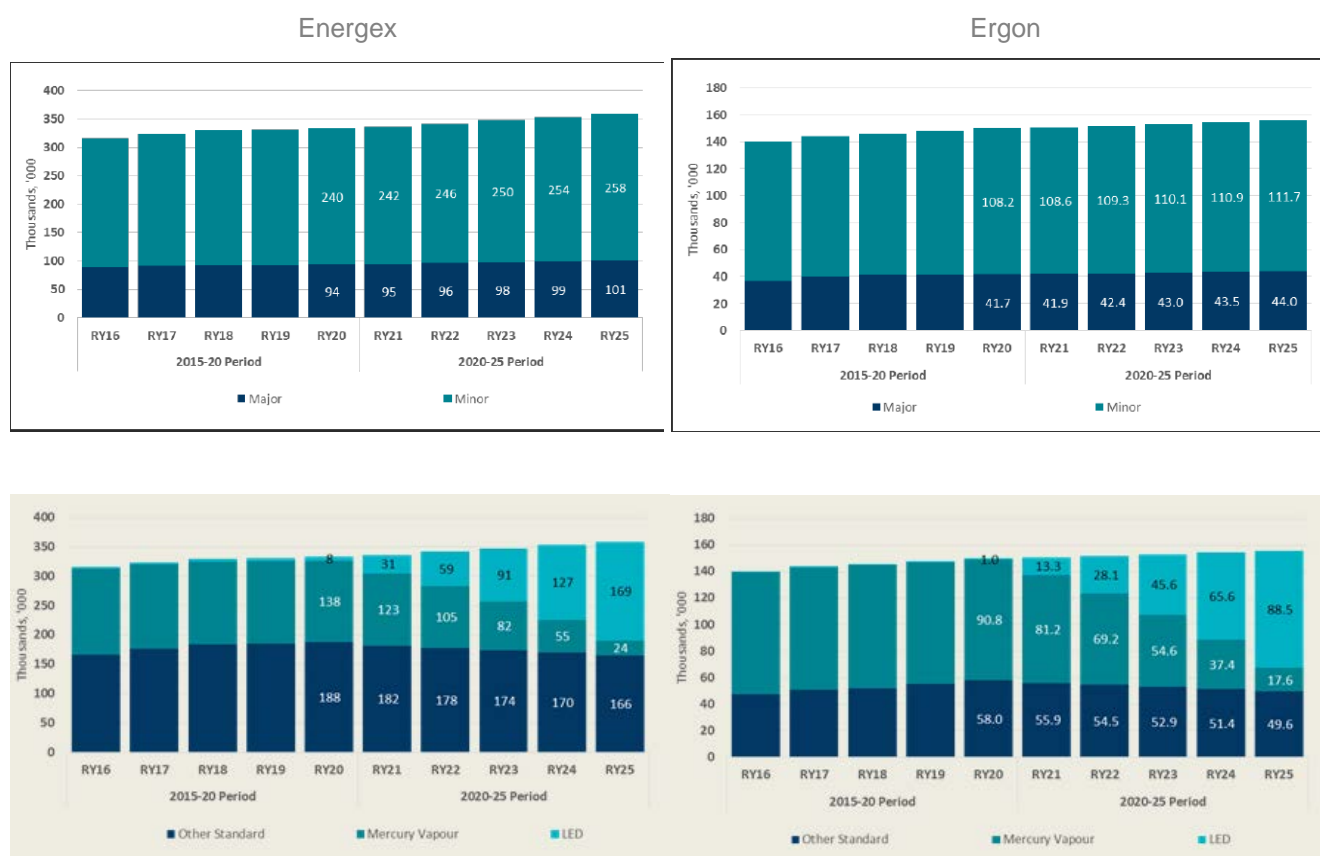
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2.3 Asset Age Distribution

The age profile of public lighting assets varies considerably taking into account that poles, brackets and luminaires have been installed or replaced over an extended period of time, either cyclic maintenance programs, condition based or on failure replacements. The profile is also impacted by the operating environment (e.g. coastal vs inland) and 3rd party damage to asset replacements. Asset Management of public lighting is not driven by age distribution, rather by cyclic preventative maintenance activities. Appendix 4 provides some further detail on the Asset Age profiles for public lighting

2.4 Population Trends

EQL is forecasting only steady growth projections in the total public lighting population through till the end of the next regulatory period and trended on previous years as depicted in Graph 2.4. The split of individual types of public lighting populations is expected to shift with LED replacement and new installations increasing through to 2025. In many instances, LGA and DTMR are already using and specifying only LED public lighting for all new installations



Graph 2.4: Forecast Population Trends for Public Lighting (Base Case)

2.5 Asset Life Limiting Factors

2.5.1 Asset Type Public Lighting

The following table 2.5.1 describes the key factors that influence the life of Public Lighting and as a result have a significant bearing on the programs of work implemented to manage the lifecycle.

Key failure modes	Definition
Luminaires in operation constantly	This typically is due to a control device failure such as ripple control relay, PE cell of control wire failure which results in positive failure mode where the light is latched on. This failure mode results in unnecessary energy consumption.
Luminaires not operational	There are many causes of luminaire failure including lamp failure, fuse operation, control device failure, network damage, environmental factors including storm damage rise in voltage on the network etc. This results in asset failure and loss of service
Damaged light fixture	Malicious or unintentional damage: Malicious damage is usually a result of contact by a targeted projectile. Unintentional damage includes damage by motor vehicle and other unintentional impacts. This damage usually results in loss of service.
Defective brackets	Bracket defects are usually age related and detected as part of the inspection programs. It is unlikely that a bracket defect will cause a loss of service.
Streetlight pole defects	Streetlight pole defects are detected and rectified under the Overhead Asset Inspection Program.

Table 2.5.1: Public Lighting Life Limiting Factors

3 Current and Desired Levels of Service

3.1 Legislative Requirements

Regulatory performance outcomes for this asset include compliance with all legislative and regulatory standards, including the Queensland Electrical Safety Act 2002, the Queensland Electrical Safety Regulation 2013 (ESR), and the Queensland Electrical Safety Codes of Practice.

The Queensland Electrical Safety Act 2002 s29 imposes a specific Duty of Care for EQL, which is a prescribed Electrical Entity under that Act:

- 1) An electricity entity has a duty to ensure that its works -
 - a. are electrically safe; and
 - b. are operated in a way that is electrically safe.
- 2) Without limiting subsection (1), the duty includes the requirement that the electricity entity inspect, test and maintain the works.

This document describes the maintenance standards for public lighting assets to meet the obligations under the following:

Legislation, regulations, rules, and codes
Electrical Safety Code of Practice 2010 – Works
Electrical Safety Act 2002
Electrical Safety Regulation 2013
AS/NZS 1158 Lighting for roads and public spaces

EQL has a legislative obligation to connect public lighting to the network, but the provision of public lighting services in Queensland is currently characterised by:

- no legislated service standards in relation to the connection and ongoing maintenance
- no legislative instrument setting out the roles and responsibilities of public lighting service providers and the relationship between DNSPs and customers
- the lack of a legislated contestability framework that authorises third party providers
- a mix of non-binding operating codes and policies

3.2 Performance Requirements

Preventative maintenance programs are comprised of the following elements:

- Patrols of Public Lighting
- Bulk Lamp Replacement (BLR)
- Pole/Asset inspection

Preventative maintenance programs do not include customer owned (Rate 3) lights.

Ergon Energy Network's inspection and maintenance of public lighting assets includes:

- Public lighting on defined major roads, high intensity lighting and lighting in built-up areas shall be subject to routine patrols. Routine patrols shall identify any safety hazards to the public and defective equipment. Where possible, defects shall be corrected at the same time.
- PE cells shall be replaced at the same time as lamps except where bulk lamp replacements are carried out, in which case they may be replaced at every second cycle.
- Public lighting shall be subject to bulk lamp replacement depending on location.

The aim of the BLR is to reduce the frequency of ad-hoc repairs in addition to maintaining lumen output. The BLR program encompasses all street lighting not previously identified as part of the road patrol program.

The street lighting lamp is replaced every three years based on the OEM provided mortality rates and lumen depreciation calculation per AS/NZS1158:2010 so that service levels can be achieved.

Changing of PE cells occurs every second lamp replacement cycle (e.g. on a six-year cycle) based on OEM performance data, past experience and benchmarking with other electricity utilities.

Public lighting asset maintenance will include all Rate 1 and Rate 2 Public Lighting and Pedestrian Crossings. All Ergon Energy owned (Rate 1 and Rate 2) streetlight assets will either be part of a Streetlight Patrol Program, Bulk Replacement Plan or a combination of both. Rate 3 lights will not be included.

Current preventative maintenance programs

Program Name	Interval or Criteria
Road Patrol Program	
Routine streetlight patrols	Two night patrols of major roads or defined pedestrian crossing or intersection every 12 months
Bulk Lamp Replacement Program	
Routine bulk lamp replacement	3 year cycle 6 year cycle – PE cell replacement
Pole Inspection Program	
Routine light pole inspection Wood pole urban Wood pole rural (high rainfall) Steel pole (direct buried urban/coastal)	4 year cycle
Wood pole rural	6 year cycle
Steel pole and tower Concrete pole	8 year cycle

The primary trigger for forced or corrective maintenance is public notification via the EQL contact centres or electronic notification of public lighting failures or defects via Websites or mobile apps available

Ergon Energy Network's targets to rectify all detected or reported defects within designated timeframes depending on the location of the light and or potential to cause public safety issues, typically

- Urban – 3 business days
- Rural – 7 business days
- Remote – 10 business days

Ergon Energy Network aims to resolve faults that have the potential to cause major public safety issues within 48 hours:

- All streetlights are out on a major intersection or thoroughfare e.g. highways, roundabouts, pedestrian crossings, T-intersection
- Where the road has high levels of traffic
- All lights in a public venue e.g. all lights on a wharf or jetty

The replacement of all defective street lighting luminaires and brackets or cross arms identified during the preventative maintenance program is capital expenditure and completed in accordance with the L1 defect policy to be repaired within 14 days of being identified.

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Energex generally undertakes light source replacements on a *replace on failure* basis but there are some remote areas where there are *bulk change replacements* in place for lamps and PE Cells.

Energex will conduct inspection patrols on the following basis:

Off By Night:

These inspection programs ensure that all public lighting systems (excepting remote areas where bulk replacements are conducted) are inspected and assessed as follows:

- on a 6 week cycle for major roads
- on a 12 week cycle for minor roads

On By Day:

These inspection programs ensure that all public lighting systems (excepting bulk replacement areas) are inspected and assessed (patrolled) as follows:

- on a 6 monthly cycle for major roads
- on a 6 monthly cycle for minor roads

Energex currently performs public lighting system maintenance as a result of an inspection patrol or reports. However, reports from the general public, local authorities and staff members are used in addition to this baseline approach to further identify faults.

In certain situations (e.g. rural towns or island communities, isolated roads), it is not cost effective or efficient to patrol the public lighting systems at the above intervals. In these cases an annual inspection is undertaken followed by spot replacement of defects identified.

Energex will maintain the Public Lighting Network, efficiently and effectively over the economic life in accordance with 'in-service' values specified for 'Category V' and 'Category P' lighting detailed in the Public Lighting Codes pertaining to the lighting of roads and public spaces.

Energex will:

- Operate a Monday to Friday general enquiry number to receive public and customer fault reports (emergency calls will be handled on a 24/7 basis);
- Repair public lighting assets (excluding network supply faults) within five business days on average per Customer per year from receipt of a Fault Report. Some lights may take up to 2 weeks, particularly if it is has high traffic density and traffic control is required, and
- Undertake cyclic maintenance of public lighting assets to ensure the efficient and safe operation of the system

Longer response times may be unavoidable in the following circumstances:

- Severe weather conditions, large scale power outages and high risk situations where public safety and the restoration of power to consumers receive priority; and
- Where repairs are required in remote locations.

3.3 Current Levels of Service

Asset failures occur where the programs in place to manage the assets do not identify and rectify an issue prior to it failing in service. Failures typically result in or expose the organisation to risk and represent the point at which asset related risk changes from being proactively managed to retrospectively mitigated.

EQL has established process and systems in place to meet legislative and Performance Requirements and standards outlined in section 3.2 for the ongoing operation and maintenance of public lighting assets.

3.4 Desired Levels of Service

Public Lighting will be managed, consistent with corporate asset management policy, to achieve all legislated obligations and any specifically defined corporate key performance indicators and to support all associated key result areas as reported in the Statement of Corporate Intent (SCI).

Safety risks associated with this asset class will be eliminated SFAIRP, and if not able to be eliminated, mitigated SFAIRP. All other risks associated with this asset class will be managed ALARP.

This asset class consists of a functionally alike population differing in age, brand, technology, material, construction design, technical performance, purchase price and maintenance requirements. The population will be managed consistently based upon generic performance outcomes, with an implicit aim to achieve the intended and optimised life cycle costs contemplated for the asset class and application.

All inspection and maintenance activities will be performed consistent with manufacturers' advice, good engineering operating practice, and historical performance, with intent to achieve longest practical asset life overall.

Life extension techniques will be applied where practical, consistent with overall legislative, risk, reliability and financial expectations. Problematic assets such as very high maintenance or high safety risk assets in the population will be considered for early retirement.

Assets of this class will be managed by population trends, inspected regularly and allowed to operate as close as practical to end of life before replacement. End of asset life will be determined by reference to the benchmark standards defined in the Defect Classification Manuals and or Maintenance Acceptability Criteria. Replacement work practices will be optimised to achieve bulk replacement to minimise overall replacement cost and customer impact.

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EQL will be required to review the current maintenance strategy in accordance with relevant legislation, standards and customer expectations as emerging LED technology expands and the LED luminaire population grows during the 2020-2025 regulatory period. The life-expectancy of an LED luminaire will impact on the current frequency and levels of maintenance currently undertaken for

- Road patrol
- Bulk Lamp Replacement (BLR)
- Pole/Asset inspection
- Failed in Service

4 Asset Related Corporate Risk

As detailed in Section 3.2, Queensland legislation details that EQL has a Duty to ensure its works are electrically safe. This safety Duty requires that EQL take action So Far as is Reasonably Practical (SFAIRP) to eliminate safety related risks, and where it is not possible to eliminate these risks, to mitigate them SFAIRP¹.

Many potential threats are unable to be controlled (e.g. third party damage), although EQL undertakes a number of actions to mitigate them SFAIRP. Failure of a Service risks public and staff safety in several ways, most notably:

- Bringing energised electrical conductors or equipment to easily accessible heights, risking public contact, shock and electrocution
- Neutral circuit failure leading to potential shock and electrocution
- Loss of supply to customer equipment
- Failure to illuminate to design standards where applicable for vehicular and pedestrian safety

EQL's safety Duty results in most inspection, maintenance, refurbishment and replacement works and expenditure related to Services being entirely focused upon preventing and mitigating Service and Service connection failure.

The asset performance standards described in Section 3 detail EQLs approach to date in respect of this safety Duty. The following sections detail the ongoing asset management journey necessary to continue to achieve to this performance into the future.

¹ Queensland Electrical Safety Act 2002 s10 and s29

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5 Health, Safety & Environment

EQL have established Safe Work Method Statements, work practices, design and construction standards and procedures in place to safely manage all physical, electrical and environmental hazards that may present with public lighting assets. This includes installation, testing, maintaining and handling the removal and disposal of public lighting equipment, in particular the associated hazardous materials with Mercury Vapour lights and safely managing the potential risks associated with mercury.

6 Current Issues

6.1 Current Issue

EQL does not identify any current issues that would have the potential to impact on our ability to meet the requirements of the Public Lighting Asset Management Plan.

6.2 Next Current Issue

EQL does not identify any foreseeable issues that would have the potential to impact on our ability to meet the requirements of the Public Lighting Asset Management Plan.

7 Emerging Issues

7.1 Emerging Issue

The **Minamata Convention** is an international treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. This Convention was a result of three years of meeting and negotiating, after which the text of the Convention was approved by delegates representing close to 140 countries on 19 January 2013 in Geneva. While Australia is yet to confirm its final position in relation to the Minamata Convention, countries that produce and supply Mercury Vapour (MV) lamps have adopted the Minamata Convention and as such will no longer produce replacement lamps. While EQL has existing stocks of replacement MV lamps, and there is no immediate requirement under the Minamata Convention to remove all Mercury Vapour lamps in service, it is recognised that we will be forced to phase out replacement MV lamps due to availability as we move into the next five year regulatory period from 2020. There are no requirements under Minamata to remove all MV lamps, however they will need to be phased out and the only available suitable replacement option on the market at present that maintains the lumen output and lighting levels at the required standards is an LED luminaire.

EQL have also identified and are offering as an alternative, a LED luminaire that has a higher impact rating capability and less susceptible to damage that can be inflicted on conventional lighting. This may be particularly attractive to customers where vandalism of public lighting is an issue.

There are limitations in the rated capacity of brackets to support the additional weight associated with an LED luminaire compared to existing conventional lighting. While a majority of existing brackets will support the LED alternative, in some cases the bracket needs to be replaced and represent an additional cost to be met by the customers.

7.2 Next Emerging Issue

Customer consultation as part of the EQL regulatory submission for 2020-2025 period has captured their expectations for the options and flexibility to influence the rate of change from conventional lighting alternatives to LED technology. A key enabler for customers are the financial incentives and balancing the costs of changing luminaires prior to end of practical life and any potential savings associated with choosing to move to LED options. While customers will make informed choices regarding uptake of LED lighting based on their specific circumstances managed outside of an Asset Management Plan, EQL recognises that our approach to the ongoing management of the installation, operation and maintenance of public lighting assets will be influenced by this rate of change to LED technology.

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As part of the 2020-2025 Regulatory period submission, EQL is proposing the following Network Tariff classes where NPL refers to “Network Public Lighting” and NPL1 & NPL2 represent network Tariffs applicable to the existing Rate 1 and Rate 2 lights, NPL4 is a proposed new network Tariff that represents a new “Rate 4” LED lighting alternative. Customers will need to take into account the revised Tariffs to inform their strategy and funding requirements for adoption of LED alternatives.

	Conventional Lights Tariff	LED Specific Tariff
NPL1 – Minor	NPL1C Minor – funded by EQL	NPL1L Minor – funded by EQL
NPL1 - Major	NPL1C Major – funded by EQL	NPL1L Major – funded by EQL
NPL2 – Minor	NPL2C Minor – funded by Customer	NPL2L Minor – – funded by Customer
NPL2 - Major	NPL2C Major – funded by Customer	NPL2L Major – – funded by Customer
NPL4 - Minor	N/A	NPL4 Minor – – funded by Customer
NPL4 - Major	N/A	NPL4 Major – – funded by Customer

8 Improvements and Innovation

EQL have and continue to participate in trials of LED public lighting in partnership with customers to better understand the performance and alternatives offered by LED technology. A number of Councils are including LED technology as part of positioning themselves with “Smart City” technology.

EQL has an approved range of minor and major road LED lights and floodlights for pedestrian crossings that are able to accept a NEMA 7 pin socket. The NEMA 7 pin socket supports a plug-in control unit that can be programmed or remotely operated to provide the customers with flexible options to control the LED operation, including dimmable driver for lighting level control.

The colour temperature for the current LED lights is 4000 K (cool white). EQL has supported research and negotiating with the contract suppliers to provide a “softer” 3000 K (warm white) alternative for customer options.

LED luminaires have a bank of LEDs and failure or damage to an individual or series of LEDs may not necessarily render the light inoperable and still provide a level of lighting, recognising at a reduced output.

9 Lifecycle Strategies

The EQL Street Light Strategy focuses on supporting and partnering with customers in relation to public lighting alternatives and solutions. Within regulatory, safety and technical boundaries, EQL will approach public lighting in a flexible manner, offering smart technology and tariff solutions to meet customer expectations whilst balancing commercial outcomes. This document focus upon the three main areas of: streamline customer engagement, standardise product offerings and advancement in technology. Bulk Lamp Replacement and road patrol cycles and effort will be reduced as LED luminaire saturation occurs consistently across an area.

Customer engagement for the EQL 2020-2025 regulatory submission proposes a Base Case approach for LED luminaire installations moving forward that includes:

New / additional lights installed: All assumed to be LED

MV lights: LEDs replace 80% of all MV lamps and luminaires during the 2020-25 regulatory period
Year 1: 10%, Year 2: 12.5%, Year 3: 15%, Year 4: 17.5% and Year 5: 20%

Existing conventional lights: In 2020 LEDs replace 20-25% of life-expired / failed lights (modelled at 5% of portfolio), gradually increasing to 30-40% by 2025

Targeted to minimise costs: conversion limited to where only lamp and luminaire can be replaced

Very limited bracket and/or pole replacements

EQL will manage the impacts on our approach to public lighting accordingly subject to AER approval of the proposal.

9.1 Philosophy of Approach

EQL recognise as LED luminaire populations will grow across an area, they will reach a saturation point in the future that supports a shift in the preventative maintenance programs, both volume of work and frequency of activities currently being applied to conventional public lighting. EQL expect the maintenance strategy will evolve and undergo significant change leading into the following regulatory period and based on the lifespan and reliability of LED public lighting.

9.2 Supporting Data Requirements

EQL will continue to maintain a public lighting inventory to record the location, type, rated power, date installed and infrastructure required to support the luminaire and any other information that is required to identify charges and ownership status. The shift in maintenance regimes and asset management decisions must be supported by the data captured for LED public lighting installations. This in turn must be enabled by ICT platforms and mobile computing capability and platforms.

The typical data requirements for the public lighting inventory are:

Pole ID and type ; Energised date (initial installation) ; Connection type ; Luminaire type ; Lamp type and nominal rating ; Asset billing rate ; Support type (pole type) ; Bracket type and length ; Street ; Suburb ; Customer & Council area

9.3 Acquisition and Procurement

EQL adopts standard government procurement practices for public lighting equipment to be sourced through competitive tender process to achieve value for money by leveraging volume purchase opportunities and medium term period contracts. EQL maintains adequate stock holding to meet forecast equipment demand to deliver preventative, corrective and forced maintenance activities.

EQL identify, select, and procure equipment that best meets the expectations of EQL, industry and legislative standards and specifications and public lighting customers, taking into account developments in new technologies and customer expectations.

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9.4 Operation and Maintenance

EQL's public lighting operating and maintenance expenditure covers:

- management of public lighting assets;
- procuring and maintaining a standard range of public light offerings;
- outage detection (via patrols or via customer advice);
- luminaire maintenance (bulb and PE cell replacement and clean);
- pole inspection and proximity testing on cyclical basis;
- cyclical bulk replacement or replace on failure; and
- technology development and trials.

EQL's public lighting operating and maintenance programme has been developed to align with the relevant Public Lighting Standards and Codes, Council public lighting guidelines and good industry practice.

EQL will safely operate and maintain its public lighting asset base efficiently and effectively over the economic life in accordance with relevant legislation, standards and customer expectations.

The objective of this approach includes:

- Ensuring public safety through meeting public lighting availability requirements to minimise failed lamps in service
- Maintaining an acceptable corporate risk profile, ensuring public safety through addressing lumen depreciation issues
- Optimising operating expenditure spend through effective and efficient preventative maintenance programs
- Maintaining public lighting data capture and record compliance through effective ICT systems and mobility platforms
- Ensuring effective deployment and application of business procedures and processes

The maintenance levels and activities that shall be applied to prevent failure and ensure that public lighting assets remain serviceable and fit for purpose.

Public lighting assets shall be subject to the levels of routine inspection and maintenance activity summarised in the following Table 9.4.

Maintenance level	Maintenance level description	Maintenance
Level 9	Patrol / Security and Hazard Inspection	Public Lighting Night Patrol
Level 9	Patrol / Security and Hazard Inspection	Public Lighting Day Patrol
Level 8	In-Service Condition Assessment	In-Service Condition Assessment (Lights Structural)
Level 8	In-Service Condition Assessment	In-Service Condition Assessment (Lights Electrical)
Level 2	Other Specific Maintenance	Bulk Lamp Replacement (In-Service)
Level 2	Other Specific Maintenance	Bulk Lamp Replacement Plus PE Cell Replacement (In-Service)

Table 9.4 Summary of maintenance levels – Routine Maintenance

The maintenance regime consists of periodic operational checks and condition assessment activities supplemented by remedial maintenance or, alternatively, bulk component replacement. The following sections should be read in conjunction with STNW1144 Maintenance Standard - Standard for Public Lighting Assets

EQL will actively respond and outwork special operational or maintenance requirements, hazards or defects identified by manufacturer or industry standards alerts to be carried out in addition to preventative, corrective or forced activities outlined in the following sections.

9.4.1 Preventative Maintenance

Preventative maintenance programs incorporate the following elements:

- Patrol of Public Lighting Assets
- Bulk Lamp Replacement (BLR)
- Pole/Asset inspection

Preventative maintenance programs do not include customer owned (Rate 3) lights.

The road patrol program and the BLR program do not include provision to respond to defective streetlights reported by the public. These are addressed in the forced and corrective maintenance program.

Other public lighting hardware such as wiring will be assessed during the preventative programs and replaced on an 'as needs' basis.

When lamps are replaced, we inspect each luminaire and rectify:

- Lenses that are opaque or substantially discoloured, cracked, improperly secured, damaged or missing;
- Damaged or missing seals;
- Moisture within the Luminaire;
- Damaged or corroded supports, Luminaries, brackets or connections;
- Improperly aligned Luminaire or brackets; and

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- Other circumstances or defects which may affect the ongoing performance of the Luminaire.

Lenses and reflectors in serviceable condition will be cleaned using appropriate cleaning compounds.

Energex generally undertakes light source replacements on a *replace on failure* basis but there are some remote areas where there are *bulk change replacements* in place for lamps and PE Cells.

Patrol of Public Lighting Assets

The road patrol preventative maintenance program involves patrols of public lighting at pre-defined frequencies. The purpose is to proactively identify lights requiring maintenance and address new install early failures.

A Patrol / Security and Hazard Inspection is a periodic check of public lighting assets to confirm correct operation, in accordance with Network Maintenance Protocol requirements. This activity shall normally be carried out during night time hours or with the equipment in-service. A day time patrol shall be carried out periodically to ensure lamps are off during daylight hours.

- Check that lamp(s) are "on". This inspection is to identify lights that are not working or defective (Night Patrol).
- Check that lamp(s) are "off" (day-light hours only).
- Check that the refractors are secure (day-light hours only).
- Check for signs of damage / deterioration (day-light hours only).

When lamp operation is defective, the cause of the fault shall be investigated and appropriate remedial maintenance shall be carried out to the lamp, control gear or elsewhere to rectify the fault.

When the lamp provides an inadequate level of illumination, the cause of the fault shall be investigated and appropriate remedial maintenance shall be undertaken.

Bulk Lamp Replacement

The aim of the BLR is to reduce the frequency of ad-hoc repairs in addition to maintaining lumen output. It is a periodic replacement to ensure that the asset remains fit for purpose in accordance with relevant standards and carried out with the equipment in-service.

The BLR program encompasses all street lighting not previously managed under the road patrol program and primarily undertaken by Ergon Energy Networks.

The street lighting lamp is replaced every three years based on the OEM provided mortality rates and lumen depreciation calculation per AS/NZS1158:2010 so that service levels can be achieved.

Changing of PE cells occurs every second bulk lamp replacement cycle (e.g. on a six-year cycle) based on OEM performance data, past experience and benchmarking with other electricity utilities.

PE cells may or may not be replaced concurrently with lamp replacements. Current policy is to replace PE cells at every second cycle.

Pole/Asset Inspection

EQL undertakes asset inspections (including below ground pole inspections) on a cyclic basis at which time issues with the poles or public lighting asset base are identified and can be scheduled for maintenance or for forced and corrective maintenance depending on the nature of the issue.

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EQL poles that support public lighting may be timber, concrete or steel, they can be standalone exclusive for the public lighting or support other EQL assets, may be an underground or overhead electrical connection point and steel columns may be buried in ground (limited) or mounted on a ragbolt assembly.

In-Service Condition Assessment is a periodic check on the condition of the asset to ensure it remains fit for purpose in accordance with relevant standards. It shall include a detailed visual inspection of all external components. The inspection shall collect sufficient condition data to allow an accurate health index of the asset to be calculated. These activities shall be carried out with the equipment in-service.

Visually inspect pole:

- Check for signs of damage / deterioration.
- Check the serviceability of the structure
- Check structure is vertical.
- Check foundation for signs of support movement.
- Check that ragbolts are all present and in good condition.
- Check that access hatches are undamaged and secure.

Particular attention should be paid to the risk of unauthorised access and public safety.

Inspect bracket:

- Check for signs of damage / deterioration.
- Check bracket is secure.
- Check bracket is correctly aligned vertically and laterally.

Inspect luminaire:

- Check for signs of damage / deterioration.
- Check that luminaires are correctly aligned
- Check that the luminaires are not obsolete
- Check that adjacent tree branches are not interfering with luminaire.
- Check that adjacent tree branches are not obstructing the light output.
- Check that the diffuser is clean and undamaged.
- Check that the lamp(s) are “off” during daylight hours.
- Check that the lamp(s) work when energised.

Inspect supply cable:

- Check for signs of damage / deterioration.
- Check cable is secure.
- Check for evidence of insulation retraction (shrinkback).

Particular attention should be paid to the risk of unauthorised access and public safety.

Inspect control gear:

- Check for signs of damage / deterioration.
- Check control gear is secure.
- Test that PE cells are serviceable.

Check integrity of connections:

- Test and ensure that the conductive streetlight poles are not energised
- Check for signs of overheating or arcing.
- Check that all electrical components and wirings are securely connected.
- Check that MEN links are correctly installed in conductive streetlight poles

Particular attention shall be paid to checking the integrity of connections in the neutral conductor.

Luminaire cleaning and inspection:

When lamps are replaced, Energex will inspect each luminaire and rectify:

- Lenses that are opaque or substantially discoloured, cracked, improperly secured, damaged or missing;
- Damaged or missing seals;
- Moisture within the Luminaire;
- Damaged or corroded supports, Luminaries, brackets or connections;
- Improperly aligned Luminaire or brackets; and
- Other circumstances or defects which may affect the ongoing performance of the Luminaire.

Lenses and reflectors in serviceable condition will be cleaned using appropriate cleaning compounds.

9.4.2 Corrective Maintenance

Corrective and forced maintenance:

The primary trigger for forced or corrective maintenance is public notification via the EQL contact centres or electronic submission via apps available on the Website or mobile phone allowing for notification of a public lighting asset failure or defect. EQL will respond within prescribed timeframes under section 3.2 Performance Requirements, to effect necessary repairs or replacement of equipment outside of the preventative maintenance activities and cycles

9.4.3 Spares

Maintenance of the inventory is at levels that support street lighting customer initiated works, preventative, forced and corrective maintenance. There is always a quantity of stock held in stores of the various lighting types to support preventative programs or corrective/forced repairs. Strategic spares are not necessarily held for street lighting assets due to volumes held BAU and they are able to be sourced in acceptable timelines

9.5 Refurbishment and Replacement

EQL public lighting assets are managed based on a replacement strategy in accordance with Section 3.2 Performance Requirements and both preventative proactive and forced reactive replacements on failure.

9.5.1 Refurbishment

EQL does not typically undertake refurbishment activities with public lighting assets.

9.5.2 Replacement

To generally maintain design compliance, EQL adopts a like-for-like replacement basis for luminaires. With Mercury Vapour to be phased out and adoption of new technology being driven by customer expectations, our future direction will include greater volume of LED luminaire replacements for both preventative and forced maintenance activities. There is an LED alternative available to replace MV lamps and maintain equivalent lumen output.

A percentage of luminaire replacements also require replacement of the bracket or cross arm due to condition, or compatibility with modern luminaires.

Assets requiring replacement are detected either during preventative maintenance and inspection programs or reported by customers, staff or the general public.

9.6 Disposal

Both MV and sodium vapour (SV) lamps contain mercury, which is a hazardous waste requiring careful disposal in accordance with relevant legislation. Lamps containing mercury that are no longer serviceable must be disposed of appropriately. EQL has established SWMS, work practices, equipment and procedures for the safe and environmentally responsible handling and disposal of public lighting waste.

10 Program Requirements and Delivery

The programs of maintenance, refurbishment and replacement required to outwork the strategies of this AMP are documented in Network Program Documents and reflected in corporate management systems. Programs are typically coordinated to address the requirements of multiple asset classes at a higher level such as a substation site or feeder to provide delivery efficiency and reduce travel costs and overheads. The Network Program Documents provide a description of works included in the respective programs as well as the forecast units.

Program budgets are approved in accordance with Corporate Financial Policy. The physical and financial performance of programs is monitored and reported on a monthly basis to manage variations in delivery and resulting network risk.

11 Summary of Actions

No follow up actions have currently been identified under the public lighting AMP

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APPENDIX 1 – REFERENCES

It takes several years to integrate all standards and documents after a merger between two large corporations. This table details all documents authorised/approved for use in either legacy organisation, and therefore authorised/approved for use by EQL, that supports this Management Plan.

11.1 Energex controlled documents

Document number or location (if applicable)	Document name	Document type
STNW1144	Standard for Public Lighting Assets	Standard
STD01226	Energex Limited Public Lighting Management Standard	Standard
BMS 3595	Network Asset Management Policy	Policy
BMS 3596	Network Maintenance Protocol	Protocol
STD00707	Standard for Network Assets Defect / Condition Prioritisation	Standard

11.2 Ergon Energy Network Controlled Documents

Document number or location (if applicable)	Document name	Document type
PLNW0014	Network Optimisation Street Lighting Management Plan	Plan
CD000901R106	Ergon Energy Street Lighting Minimum Service Levels	Reference
STNW1144	Standard for Public Lighting Assets	Standard
STNW0652	Standard for Public Lighting Bulk Lamp Replacement	Standard
STNW0655	Standard for Public Lighting Patrols	Standard
STNW0656	Standard for Public Lighting Defect Rectification	Standard
STNW065	Standard for Managing Public Lighting L1 Defects	Standard
STNW0718	Standard for Preventative Maintenance Programs 2018-19	Standard
NA000403R167	Public Lighting Types and Control Methods	Reference
EPONW01	Network Asset Management Policy	Policy
PRNF001	Network Maintenance Protocol	Protocol
STNW0330	Standard for Network Assets Defect / Condition Prioritisation	Standard

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11.3 Other Documents

Document number or location (if applicable)	Document name	Document type
Queensland Public Lighting Construction Manual	Energex / Ergon Energy Public Lighting Construction Manual	Manual
AS / NZS 1158	Lighting for roads and public spaces	Australian Standard
Electrical Safety Code of Practice 2010 - Works		
Electrical Safety Act 2002		
Electrical Safety Regulation 2013		

APPENDIX 2 – DEFINITIONS

Term	Definition
7 Pin NEMA	The receptacle used between an external locking type photo control and dimmable driver for lighting level control.
Condition Based Risk Management	A formal methodology used to define current condition of assets in terms of health indices and to model future condition of assets, network performance, and risk based on different maintenance, asset refurbishment, or asset replacement strategies.
Corrective maintenance	This type of maintenance involves planned repair, replacement, or restoration work that is carried out to repair an identified asset defect or failure occurrence, in order to bring the network to at least its minimum acceptable and safe operating condition. An annual estimate is provided for the PoW against the appropriate category and resource type.
Distribution	LV and up to 22kV (and some 33kV) networks, all SWER networks
Forced maintenance	This type of maintenance involves urgent, unplanned repair, replacement, or restoration work that is carried out as quickly as possible after the occurrence of an unexpected event or failure; in order to bring the network to at least its minimum acceptable and safe operating condition. Although unplanned, an annual estimate is provided for the PoW against the appropriate category and resource type.
L1 Lighting Defect	Inoperable Public Lighting on a defined major road or pedestrian crossing (Ergon Energy Networks)
LED	Light Emitting Diode. LED lighting refers to a luminaire using an array of LEDs
Low Voltage (LV)	A Voltage not exceeding 1,000 Volts
Luminaire	means an apparatus that distributes, filters or transforms the light transmitted from one or more lamps and includes, other than the lamps themselves, all the parts necessary for fixing and protecting the lamps and where necessary circuit auxiliaries together with the means for connecting them to the distribution system
Major Lamps	in common use for Major Road lighting mean the following: a) High Pressure Sodium 100 Watt (S100) and above ; and b) Metal Halide 100 Watt (H100) and above (Special Precinct lighting only); c) LED 30 Watt (L30) and above
Major Road	means a main or arterial, or distributor road as defined by the Public Body requiring illuminating to the performance, installation and design requirements of Category V1 – V5 lighting as specified in AS/NZS 1158.1.1
Minor Lamps	are all lamps in common use for Minor Road lighting other than Major Lamps and include Mercury Vapour (maintenance only), High Pressure Sodium, Fluorescent and Metal Halide (Special Precinct lighting only), LED

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Minor Road	means a road other than a Major Road as defined by the Public Body requiring illuminating to the performance, installation and design requirements of Category P1 – P12 lighting as specified in AS/NZS 1158.3.1
PCB	Polychlorinated Biphenyls are synthetic chemicals manufactured from 1929 to 1977, and was banned for use in 1979 in transformers, voltage regulators and switches
Photocontrol	A device for turning a roadway or area lighting on and off, with other possible functionalities such as dimming control. On existing conventional lighting PE Cell or photoelectric cell controls ON/OFF state of lights subject to natural lighting levels
Preventative Maintenance	This type of maintenance involves routine planned/scheduled work, including systematic inspections, detection and correction of incipient failures, testing of condition and routine parts replacement designed to keep the asset in an ongoing continued serviceable condition, capable of delivering its intended service

APPENDIX 3 – ACRONYMS AND ABBREVIATIONS

The following abbreviations and acronyms may appear in this asset management plan.

Abbreviation or acronym	Definition
ac	Alternating current
AIDM	Asset Inspection & Defect Management system
ALARP	As Low As Reasonably Practicable
AMP	Asset Management Plan
Augex	Augmentation Expenditure
CBRM	Condition Based Risk Management
CB	Circuit Breaker
CT	Current Transformer
CVT	Capacitor Voltage Transformer
dc	Direct Current
DEE	Dangerous Electrical Event
DGA	Dissolved Gas Analysis
DLA	Dielectric Loss Angle
EQL	Energy Queensland Limited
ESCAP	Electricity Safety Code of Practice
ESR	Queensland Electrical Safety Regulation (2013)
HV	High Voltage
IoT	Internet of Things
ISCA	In-Service Condition Assessment
LDCM	Lines Defect Classification Manual
LV	Low Voltage
LVR	Low voltage regulator
MSS	Minimum Service Standard
MSSS	Maintenance Strategy Support System
MU	Metering Unit
MVAr	Mega-VAr, unit of reactive power
NER	Neutral Earthing Resistor
NEX	Neutral Earthing Reactor

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Abbreviation or acronym	Definition
OLTC	On-load tap -changers
OTI	Oil Temperature Indicators
PCB	Polychlorinated Biphenyls
PD	Partial Discharge
POC	Point of Connection (between EQL assets and customer assets)
POEL	Privately owned Electric Line
PRD	Pressure Relief Device
QLD	Queensland
REPEX	Renewal Expenditure
RIN	Regulatory Information Notice
RMU	Ring Main Unit
SCAMS	Substation Contingency Asset Management System
SCI	Statement of Corporate Intent
SDCM	Substation Defect Classification Manual
SFAIRP	So Far As Is Reasonably Practicable
SHI	Security and Hazard Inspection
SVC	Static VAR Compensator
THD	Total Harmonic Distortion
VT	Voltage Transformer
WCP	Water Content of Paper
WTI	Winding Temperature Indicators
WTP	Wet Transformer Profile

APPENDIX 4 – ASSET AGE DISTRIBUTION (EXTRACT FROM RIN BOP)

		ECONOMIC LIFE (YEARS)	
ASSET GROUP	ASSET CATEGORY	MEAN	STANDARD DEVIATION
PUBLIC LIGHTING BY: ASSET TYPE ; LIGHTING OBLIGATION	Luminaires ; Major Road	20.00	4.47
	Luminaires ; Minor Road	20.00	4.47
	Brackets ; Major Road	40.00	6.32
	Brackets ; Minor Road	40.00	6.32
	Lamps ; Major Road	3.00	1.73
	Lamps ; Minor Road	3.00	1.73
	Poles / Columns ; Major Road	40.00	6.32
	Poles / Columns ; Minor Road	40.00	6.32
	Other	-	-

Public Lighting By: Asset Type; Lighting Obligation

- 1) A report was extracted from DMA which counted each public light broken down by the following information:
 - a. Streetlight age.
 - b. Streetlight rate.
 - c. Billing type.
 - d. Lamp category.

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- 2) This report did not include assets that are in stores or held for spares. Also, only rate 1 and 2 streetlights have been included in the extract. Rate 1 streetlights are designed, constructed, owned and operated (maintained) by Energex. Rate 2 streetlights are customer designed and constructed which are owned, operated and maintained by Energex. Rate 3 and 8 streetlights were not included as they are owned and operated by the customer and not required to be maintained by Energex. Rate 9 streetlights were not included as they are watchman lights and did not fit the criteria of a streetlight for the CA RIN.

Luminaires

- 1) Initial luminaire installations are captured within NFM; however, subsequent streetlight head changes are not captured, so for this reason an age profile had to be estimated. It was assumed that all streetlights installed prior to 1997 have been replaced with an asset with a 20 year life span. For example a 1979 start date was updated to 1999 to indicate that the asset was replaced. A 1934 streetlight will inherit a new asset age of 2014 to represent three head changes with a 20 year life for each.
- 2) Major and minor allocations for luminaires were based on the billing type of the lantern.

Lamps

- 1) Detailed lamp information is not stored within the Energex corporate systems. For this reason estimates were applied based on the average life of assets lamps. Average life of lamps can be broken into two categories, mercury vapour and other lamp types. Mercury vapour lights have an average life of 5 years and all other lights have an average life of 4 years.

All lights that were installed prior to the average life expectancy (prior to 201306 for Mercury Vapour and 201406 for other types) have been accumulated and applied consistently into each year.

Brackets

- 1) It was assumed that a bracket was installed for all streetlights that are mounted on a pole. Due to very limited number of brackets being replaced, all brackets have inherited the original streetlight age profile.

Poles

- 1) Poles were deemed to be a streetlight pole when the specification was public lighting specific and contained a rate 1 or 2 streetlight. The age of the poles was taken as the original streetlight age profile.
- 2) The categorisation of poles to major or minor categories was inherited from the streetlights attached to the pole. Where multiple streetlights existed on the pole the major streetlight took precedence.
- 3) Poles with an installation year less than 1970 were prorated into between the years 1970 – 1999.