Power Networks
Strategic Asset Management Plan

Endorsed By:	Approved By:	Version	1
		Date	28/2/2018
Stephen Vlahovic	Djuna Pollard	Description	
Manager Network Assets	General Manager Power Networks	File No	D2017 414572

Executive Summary v

1 Introduction 6

1.1 Business context 6
1.2 Purpose of this document 6
1.3 Scope of this document 7
1.4 Structure of this document 8

2 Strategic Context 10

2.1 Engagement with Stakeholders 10
2.2 Network Management Framework 11

3 Network overview 17

3.1 Overview 17
3.2 Network description 17
3.3 Historical development of the network 19
3.4 Asset overview 20
3.5 Current Performance 20

4 Summary of challenges 32

4.1 Regulatory environment 32
4.2 Changing customer expectations 32
4.3 Economic outlook 32
4.4 Climate change 33
4.5 Operational challenges 34
4.6 Emerging technologies 35
4.7 Data and information 36

5 Asset Management Strategies and Objectives 37

5.1 Overview 37
5.2 Asset Management Objectives 39
5.3 Asset Management Methodology 39
5.4 Asset Management System 41
5.5 Lifecycle asset management 44
5.6 Asset Management [class] Plans (AMP's) 50
5.7 Asset Management Spares 51

6 Implementation 53

6.1 Approval and accountability 53
6.2 Roles and responsibilities 53
6.3 Power Networks Asset Management boundaries with other functional areas 57
6.4 Communication 59
6.5 Monitoring and Improvement 60

Appendix A. Definitions, Acronyms and Abbreviations 62
Appendix B. Stakeholder Engagement 64
Appendix C. AM Governance framework 66
Appendix D. Strategy and Asset Management Objectives 69

Table of figures and tables

Figure 2-1: Network Management Framework overview 11
Figure 3-1: Overview of the Power Network 17
Figure 3-2: Regulated Electricity Supply Systems within the Northern Territory 18
Figure 3-3: Asset overview 20
Figure 3-4: Network SAIDI performance. 22
Figure 3-5: Network SAIFI performance 23
Figure 3-6: Top three causes of outages showing and increasing trend of the asset failure. 24
Figure 3-7: RMS Voltage Distribution Histogram showing the levels Pre January 2017 change (LHS) and Post the January 2017 Changes (RHS) 25
Figure 3-8: Summary of asset classes showing the percentage of each class near or exceeding End of Life (EOL). The life of each class uses economic life. 26
Figure 3-9: Asset population exceeding design life by class 28
Figure 3-10: Zone substation Growth 31
Figure 5-1: Asset management framework - line of sight 37
Figure 5-2: Power Network results from the AMCV Benchmarking study 38
Figure 5-3: Asset Replacement Strategies and the associated asset risk profile 40
Figure 5-4: Asset Classes and Replacement Strategies 41
Figure 5-5: AM Council, Asset Management Systems Model 42
Figure 5-6: Embedding the Asset Management Discipline 43
Figure 5-7: Relation between asset renewal modelling and Capital Expenditure Category 49
Figure B-1: Overview of stakeholder engagement 64
Figure C-1: AM Governance framework 66

Table 1-A: Physical network assets 7
Table 3-A Worst Performing Feeder 2016/17 23
Table 3-B: Design lives for each asset class 27
Table 6-A: Organisational roles and responsibilities 53
Table 6-B: Key organisational interfaces 57
Table A-A: Definitions 62

Table B-A: Stakeholder groups 64
Table B-B: Internal stakeholders 65

Executive Summary

This Strategic Asset Management Plan (SAMP) provides the asset management framework for how assets are managed in Power Networks. The asset management framework supports the Power and Water Corporation (Power and Water) vision of being a best practice, commercially focused and customer centric multi-utility operating in the long term interest of consumers. It has been developed to be consistent with:

- our legislative and regulatory obligations;
- current standards for asset management systems; and
- the existing management systems and frameworks of Power and Water, including our safety management system, environmental management system and emergency management framework.

We aim to understand the requirements of our customers and to operate our network to deliver the required functionality, specified performance and compliance requirements in a sustainable manner. Our network management framework consists of a set of interrelated documents, systems and processes that provide the essential information that enables our business practices. Our asset management system and asset management capability combine to enable effective asset management practices that deliver on the Power Networks vision of being a respected and customer centric utility provider.

1 Introduction

In this section the purpose and scope is provided as context to the remainder of this document.

1.1 Business context

1.1.1 Power and Water Corporation (Power and Water)

Power and Water became the Northern Territory's (NT's) first government owned corporation (GOC) under the *Government Owned Corporations Act* on 1 July 2002. In accordance with the Act, Power and Water's objectives are to:

- operate at least as efficiently as any comparable business; and
- maximise the sustainable return to the Northern Territory on its investment in Power and Water.

It has responsibility for electricity transmission and distribution network services and water and sewerage services across the Northern Territory; an area of more than 1.3 million square kilometres. Power and Water also provides electricity, water and sewerage services for 72 remote communities through its not-for-profit subsidiary, Indigenous Essential Services Pty Ltd.

In servicing its customers, Power and Water supplies a geographic area larger than that supplied by any other single network company in Australia.

Our vision is to be a best practice, commercially focused and customer centric multi-utility respected by the community for its contribution to the Northern Territory economy and its pursuit of the long-term interests of consumers.

1.1.2 Power Networks, a division of Power and Water

Power Networks (PN) is a ring-fenced electricity transmission and distribution business within Power and Water and is responsible for planning, building and maintaining reliable electricity networks to transport electricity between generators and consumers in the Northern Territory.

Our vision is to be a respected and customer centric utility provider. Our purpose is to achieve this in a safe, reliable and affordable manner.

1.1.3 Implications to Power Networks

As a multi-utility business, Power and Water has implemented a governance framework that applies to each of its operating divisions and across each of the utility services: electricity, water, and sewerage. Accordingly, the governance framework that applies to Power and Water as a multi-utility business similarly applies to Power Networks and is reflected in this document.

1.2 Purpose of this document

The purpose of this Strategic Asset Management Plan (SAMP) is to describe how Power Networks systems and strategies are aligned to the Power and Water Asset Management Policy.[1]

[1] D2016/139372 Power and Water Asset Management Policy

This document provides alignment of our stakeholders' requirements, the organisational objectives and asset management objectives; to ensure that the assets are being managed to provide the value required of them by the organisation and stakeholders. This provides "line of sight" between the plans that Power Networks has developed, including the Asset Management Plans (AMPs) and Network Management Plans. This is further explained below.

1.3 Scope of this document

The scope of the SAMP covers the Power Networks asset portfolio including the physical assets, systems and processes that are required for the provision of electricity network services as defined in Schedule 2 of the Network Licence. The assets described and the volumes specified in this Strategic Asset Management Plan are for the regulated network only. The physical assets to which this plan relates are described in **Table 1-A** below.

Power Networks owns and maintains transmission and distribution assets in three separate regulated electricity supply systems within the Northern Territory.

The electrical networks operate at transmission voltages of 132kV and 66kV and high voltage reticulation at 22kV and 11kV. The majority of the Northern Territory, except for the Darwin and Alice Springs regions, has a very low customer density.

The three major Power and Water electrical systems (Darwin - Katherine, Tennant Creek and Alice Springs) are not connected to the national grid and operate as separate stand-alone systems. Power Networks also maintains various unregulated transmission and distribution assets, some of which are owned by Power Networks and others on behalf of external parties.

Table 1-A: Physical network assets

Physical Network Asset	Description
Substations	Assets contained within zone, terminal or switching substation facilities, such as HV switchgear, power transformers, capacitor banks, instrument transformers, auxiliary supplies, battery systems, cables and conductors, buildings, climate control, fire systems, etc.
Distribution Lines	Lines or cables emanating from substations at distribution voltage level (11kV or 22kV), as well as LV lines and cables. Includes poles and pole tops, voltage regulators, cable tunnels, metering units and LV pillars.
Transmission Lines	Lines or cables emanating from a substation at transmission (132kV) or subtransmission (66kV) voltage levels. Includes poles, towers and pole tops.
LV Services	LV service is the final cable or conductor dedicated to connecting a customer into the shared network. This is usually a cable from a pillar to the customer's metering box, or a conductor from a nearby pole to a connection box mounted on the customer's roof. This includes the connection hardware such as Clamps and Overhead Service Protection Devices (fuses and circuit breakers)
Distribution Substations	Distribution facilities that transform voltage from HV distribution levels (22kV or 11kV) to LV. This includes other associated assets such as LV switchgear, earthing, equipment enclosures, footings, locks, signage, etc. Where the facility is indoors, this category includes costs associated with maintaining the room's fixtures and fittings.

Distribution Switchgear	Assets which perform switching at distribution voltage levels (22kV or 11kV). This includes switching facilities such as switching stations, RMUs, modular switchgear, air-break switches, gas-break switches, reclosers, fusesavers, EDOs and links.
Protection	Protection relays and protection panels (including auxiliary relays, test blocks and panel wiring) in substation facilities.
SCADA	RTUs and RTU panels in substation facilities, as well as the Energy Management System hardware and software in the control centres.

The asset management system is focused primarily on the management of the physical network assets as listed above. Other asset types (e.g. financial assets, information assets and human assets) are only considered in so far as they affect the optimal management of the physical network assets. This plan also describes the environment in which the network is operated and the asset management systems and processes used to meet the business obligations and targets.

The preparation of this document has taken into consideration the requirements of the ISO 55000 series of asset management standards.

1.4 Structure of this document

This document is structured into the following sections:

- Section 1 (this section) – Details the vision set by Power and Water as a ring fenced multi-utility GOC and describes the frameworks used by Power Networks for its operations. This section describes why the SAMP is required and what systems and activities are required to align strategies between PN, Power and Water and stakeholders and achieve a line of sight. It describes what the and where asset are along with the system and processes to operate in the current environment.
- Section 2 Strategic context – Identifies the strategic context including the stakeholders, regulations, codes and standards and briefly describes the customer engagement that has been undertaken and the feedback we received. The Network management framework is provided that provides the conversion of the external environment into goals key result areas in the form of corporate strategic plans. Strategic plans are further refined to asset strategies and then approved works to deliver outcome for customers
- Section 3 Network assets – This section outlines the size of the business provides and overview of the assets and the physical environment in which they operate. The historical development of network assets is described including the historic investment periods which are impacting spend today. Four key areas relevant to asset management are detailed where performance is measured along with metrics including reliability performance, asset age and condition and capacity the capacity of the network to supply the future requirements.
- Section 4 Current challenges/drivers – This section identifies the challenges faced by the network including the changing regulatory environment and increasing requirements for data and increasing customer expectations. A slowdown in growth due to increased PV is discussed. The physical environmental of the tropics and dessert country is identified as a challenge not only for the assets but also the people that services them. The challenges and opportunities associated with emerging and disruptive technologies are listed.

- Section 5 Asset management strategies and objectives – This section details the 'line of sight' through the asset management strategies that links physical plans to the key result areas and goals of the BU and Corporation. The requirements of the external environment, stakeholders and customers during the development of strategy are identified. The asset management journey of Power and Water and PN is provided along with results of participation in industry benchmarking. The asset management system is provided and the asset life cycle stages are discussed in the PN context. Details of renewal methodologies and asset replacement forecast techniques are given. Consideration of the various types of inventory and improvement projects is provided.
- Section 6 Implementation – An overview into the roles and responsibilities for implementing the Strategic Asset Management plan is provided in addition to the asset management systems, processes and interfaces with corporate roles. The internal and external communications of Power Networks are listed for a range of activities that the network undertakes. The monitoring and improvement activities are discussed.

2 Strategic Context

This section sets out the standards for the strategic context that the Power Network operates within, including the legislative requirements that apply and the supporting corporate elements, plans, policies and management systems and methodologies that have been established. This sets the context for the asset management system that is explained in Section 5. The most significant influence on the Power Network is the stakeholders.

2.1 Engagement with Stakeholders

Power Networks engagement with stakeholders and the wider Northern Territory community continues to be a priority in order to build productive working relationships. Understanding their needs and points of view, identifying continual improvement opportunities and focusing on the issues seen as being most important.

To ensure that Power Networks engagement is consistent with the approach taken by the Australian Energy Regulator (AER), as well as Australian engagement standards. Power Networks utilises the IAP2's Public Participation Spectrum[1] which is quickly becoming the international standard for engagement.

In May 2017 Power Networks established the *Power and Water Customer Advisory Council* (CAC) which is made up of a broad range of participants, including consumer and environmental advocates, industry and business organisations, developer and building associations and large energy users. Engagements were undertaken through focus groups, in-depth interviews, forums and the CAC and these will continue, led by the Power and Waters corporate team.

During the above engagements Power Networks presented information to inform customers and stakeholders regarding the electricity supply chain and the roles and responsibilities associated with the asset ownership. The information included network planning forecasts and reliability and cost performance. Opinions were sought on a range of issues with the most notable feedback received including:

- maintaining current reliability and responsiveness levels for the majority of customers (at a system level) and focus on improving poorer performing feeders;
- strong support to roll out smart meters to all customers on a new and replacement basis;
- not to pursue any discretionary user funded initiatives such as in home energy audits;
- not to pursue further undergrounding of overhead power lines; and
- improve outage communications by utilising SMS and email technology.

All Power Networks engagement activities and the feedback received from our customers and stakeholders can be found on our website at powerwater.com.au/engagement.

[1] www.iap2.org.au/Tenant/C0000004/00000001/files/IAP2_Public_Participation_Spectrum.pdf

2.2 Network Management Framework

Power Networks operates within the framework and oversight of Power and Water Corporation. Structures have been established that allow the Corporation to establish control through reporting lines, delegations, processes and systems. These allow strategy and direction to be established in response to the external environment.

The transmission and distribution networks are managed to comply with the broad external requirements of legislation, codes and standards. This is achieved within an internal framework of policy, strategy and plans that are enabled through interrelated documents, systems and processes that establish the Networks Management Framework. The framework shown diagrammatically in **Figure 2-1** is followed with each element discussed in the following sections.

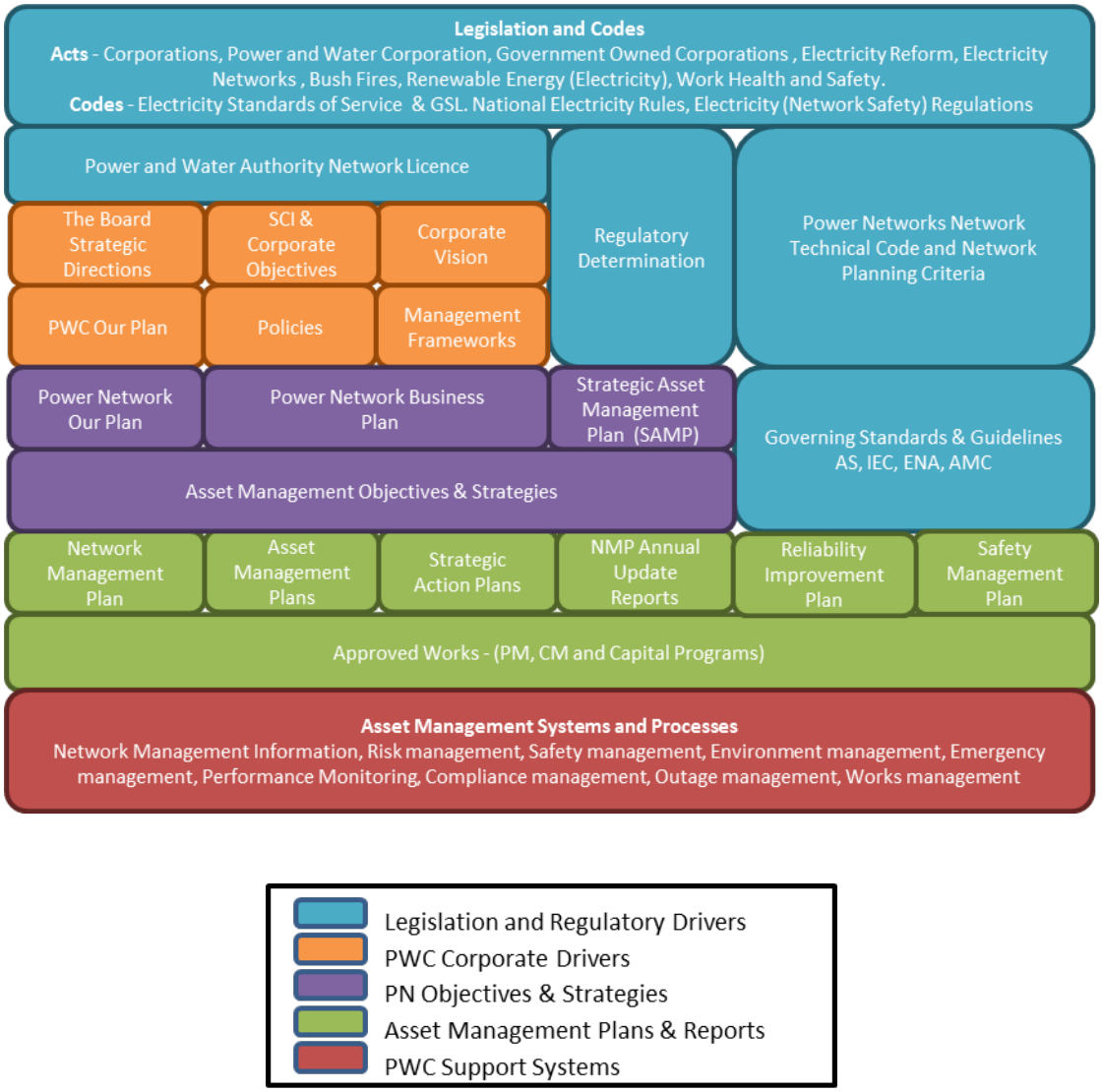


Figure 2-1 Network Management Framework overview

2.2.1 Legislation, Regulation and Codes

Legislative Framework -As a key objective, Section 9 of the Electricity Networks (Third Party Access) Code, set out in the *Electricity Networks (Third Party Access) Act*, requires Power and Water to comply with good electricity industry practice when providing network access services and in planning, operating, maintaining, developing and extending the electricity network. It also requires Power and Water to publish and maintain a Power Network Technical Code and Planning Criteria.[2]

Section 24 of the Power and Water Network Licence requires preparation and compliance to a Safety Management and Mitigation Plan[3] detailing the policies, procedures, systems and strategies that ensure the safety of the public, employees and contractors around electricity infrastructure.

The primary drivers of investments in the network within the period of this plan are safety, growth and security of supply, and service performance. Service performance is primarily related to maintaining reliability of supply and the environment. Key factors include condition and performance of assets and the associated risk of critical asset failures.

To meet this key business objective and to respond to the drivers for investment, this plan aims to achieve the following:

- safety of employees, customers and the public;
- optimised asset performance;
- optimised asset lifecycle costs;
- timely replacement of assets; and
- environmental compliance.

Senior managers in each business unit are accountable for ensuring compliance with legislative parameters and government policies, including (but not limited to) the:

- *Electricity Networks (Third Party Access) Act;*
- *Work Health and Safety Act;*
- *Dangerous Goods Act;*
- *Government Owned Corporations Act;*
- *Power and Water Corporation Act;*
- *Competition and Consumer Act;*
- *Electricity Reform Act;*
- *Environment Protection and Biodiversity Conservation Act;*
- *Utilities Commission Act;*
- *National Greenhouse and Energy Reporting Act;*
- *Information Act;*
- *Waste Management and Pollution Control Act;*
- *Work Health and Safety (National Uniform Legislation) Act;*

[2] D2017/187772 Network Technical Code and Planning Criteria V3.1

[3] CONTROL0198 Safety Management and Mitigation Plan

- *NT Aboriginal Sacred Sites Act;*
- *Bushfires Act;*
- *Renewable Energy (Electricity) Act;*
- *Clean Energy Act; and*
- *Bushfire Management Act.*

2.2.2 Regulation and Codes

- *Utilities Commission Network Licence issued to Power and Water Corporation varied 28 October 2011;*
- *Power Networks Network Technical Code and Network Planning Criteria;*
- *Utilities Commission's Guaranteed Service Level (GSL) Code;*
- *System Control Technical Code;*
- *Electricity Standards of Service Code;*
- *Electricity (Network Safety) Regulations;*
- *Network Access Code;*
- *Ring Fencing Code;*
- *National Electricity Rules (Northern Territory) (NT NER); and*
- *Bushfire Regulations.*

2.2.3 Power and Water Corporate Drivers

The Board's Strategic Direction - The Board's Strategic Directions 2016-2020, sets out the Board's plans for achieving this transformation. These are articulated in the form of the Power and Water vision, strategies, strategic objectives, goals, KPI's and targets. Priorities are determined through the identification of key risks and the application of the Corporate Risk Framework.

Statement of Corporate Intent (SCI) - Power and Water Corporation was established under the Power and Water Corporation Act 2002 and is a Northern Territory government owned corporation under the Government Owned Corporations Act 2001.

The Board of Directors is responsible to the Shareholding Minister for the corporation's operational and financial performance and is required to provide an agreed Statement of Corporate Intent (SCI) each financial year.

The SCI sets out our vision, strategies, strategic objectives, goals, KPI's, targets, and key risks over a five-year period. The content of the SCI is derived from the Board's Strategic Directions 2016-2020 with further refinement and detail at a business unit level. Within the SCI the goals and strategies are described in terms of five Key Result Areas; health and safety, people and culture, financial performance, operational performance and customer. Priorities are determined through the identification of key risks and the application of the Corporate Risk Framework.

Power and Water Our Plan – This is a summary document that outlines the vision for the multi-utility. It provides the strategic direction, guiding principles of change, long term goals, and performance expectations. The organisational Key Result Areas are identified along with the strategies by which they will be improved. As a short summary of the SCI the Power and Water

Our Plan provides an opportunity for employees to understand where and how their contributions, identified in individual performance plans, help achieve corporate goals.

Asset Management Policy – The Asset Management Policy reflects Power and Water's intentions and direction expressed by the senior management team and applied at every stage of the asset management process, from the development of plans to their execution. It applies to all levels of the organisation including the Asset Owner, General Managers and all staff.

2.2.4 Power Networks Business Plans and Asset Strategies

Power Networks Business Plan - The Power Networks Business Plan sets out the business unit vision, strategies, strategic objectives, goals, KPI's, targets, plans and key risks over a five-year period. The content of the Business Plan is derived from the Board's Strategic Directions 2016-2020 and SCI with further refinement and detail at a business unit level using the Key Result Areas defined in the SCI including the setting of KPI's.

The Power Networks Business Unit Plan implements the SCI strategies, investment plans and performance targets at a business unit level. This approach ensures the various Power Networks plans; Strategic Action Plans, Finance, AMPs, NMP and MyPlans (individual performance plans), are aligned to the SCI and capture our operating environment requirements. Priorities are once again determined through the identification of key risks and the application of the Corporate Risk Framework.[4]

To further embed decision making across the business and achieve a truly customer centric focus, the Power Networks Executive Leadership Team developed these customer drivers which are applied across the plans:

- safe power supply;
- reliable power supply;
- affordable power supply; and
- a positive customer experience.

Power Networks Our Plan – is a summary document of the Power Networks Business Plan that reiterates the vision for the multi-utility. It provides the strategic direction, guiding principles of change, long term goals and performance expectations. The organisational Key Result Areas (KRA) are identified along with the goals and Key Performance Indicators (KPIs) that will be used to measure success against the KRA. Targets for the Power Networks KPIs are present for a four year period. This provides an opportunity for employees to understand where their contributions, identified in individual performance plans, help achieve corporate goals.

Strategic Asset Management Plan (SAMP) – The SAMP provides a central function within the Power Networks business process. Through the application of a common strategic asset management process across the whole corporation, business unit SAMPs convert organisational objectives (and their subsequent revisions) into asset management objectives for the development of asset management plans (AMPs).

[4] D2016/163080 Risk Assessment Guide

The SAMP considers attributes of the asset portfolio including current age, condition, capability and actual and forecast performance to highlight key areas that need to be addressed through the AMPs. It specifies the approach of the asset management system in the development of AMPs through the application of the risk management framework and the requirements of the Asset Management Policy.

Asset Management Strategies and Objectives – These documents provide and interpret Power and Water's and Power Networks KRA's and goals into a strategic intent, where asset management objects are developed. The specific strategies containing asset management objectives include:

- Health and Safety
- People and Culture
- Environment Strategy
- Reliability Strategy
- Quality of Supply Strategy
- Financial Strategy
- Network Asset Integrity Strategy
- Network Standards Strategy
- Maintenance Strategy
- Vegetation Management Strategy
- Network Capital Investment Strategy
- Metering Strategy
- Protection Strategy
- Network Supervision and Control Strategy
- Operational Communication Strategy
- Risk Management Strategy

The strategies identify the plans required to deliver or implement the asset management objectives; e.g. Network Management Plan, Asset management Plans, Strategic Action Plans and Safety Management Plans. The plans are developed in consideration of the management system and Information Technology system required to support the plan.

2.2.5 Power Networks Asset Management Plans and Reports

Network Management Plan – The Network Management Plan[5] (Plan) explain Power and Water's intentions for the next five years in relation to network reliability, capacity, security and supply quality and the accompanying development of the network.

The NMP provides insight into the important challenges Power Networks faces and how Power Networks will respond. It also provides information on network management practices and proposed development of the network over the next five-year period.

The NMP has two parts:

- Part A: Network Management – this part of the Network Management Plan provides information on network performance and capacity, along with background and contextual information, including details of asset management policies and strategies.
- Part B: Network Development – this part of the Network Management Plan provides detailed information regarding the capability and development planning of Power and Water's electricity supply network. Part B is also intended to facilitate a process of public consultation and stakeholder feedback on network constraints, supply issues and

[5] D2017/58810 Network Management Plan 2013/14 to 2018/19 – January 2017 Update

proposed solutions and thereby provide awareness of potential investment opportunities which may be cost effective in avoiding or postponing network expansion.

Asset Management Plans - AMPs are developed and updated using the latest information aligned with the approach outlined in the SAMP using the basis of 'objective need'. Each AMP proposes a recommended implementation strategy that optimally meets the organisation and asset management objectives for a horizon up to 12 years. A consolidation of all AMPs is then assessed for deliverability with constraints identified in terms of resource or access availability. Once this is completed, the AMPs financial constraints are applied in terms of funding and affordability. As every organisation has to apply constraints on the basis of the competitive tension from its different drivers, a constrained plan will require the implementation of alternative proposals to those identified and recommended in the AMPs. These alternative strategies need to be considered in terms of their impact on the asset management objectives in the SAMP. Once considered, the outcomes are communicated to stakeholders and the identified gaps are used to inform the next iteration of the SAMP.

Strategic Action Plans – SAPs are business improvement plans that do not have a direct impact on network assets or may go across a range of assets. These plans are aligned with the key result areas through the Asset Management strategies.

2.2.6 Assets Management Systems and Processes

Power and Water has established an asset management framework as an enabler to the achievement of the objectives set for the network and its responsibilities as an asset *owner*; also to achieve a return on capital invested and to manage its assets in a safe manner. The framework incorporates elements that demonstrate that assets are to be managed in a sustainable manner, in accordance with applicable law, and to meet the current and changing needs of customers.

The asset management framework has been developed to provide consistent standards for asset management systems across the multi-utility and to be consistent with the other management systems that exist within Power and Water; i.e. Safety Management System, Environmental Management System and Emergency Management Framework.

3 Network overview

3.1 Overview

Our network:

- consists of three standalone systems with no connection to the national electricity grid;
- has 9,122 kilometres of lines, of which the largest system is Darwin-Katherine;
- operates in diverse climates, each of which brings unique challenges such as cyclones, over 22,000 lightning strikes a year, tropical storms with winds in excess of 100 kilometres per hour in the north and dust storms and drought in Central Australia; and
- includes various unregulated transmission and distribution assets, some of which are owned by Power Networks and others on behalf of external parties.

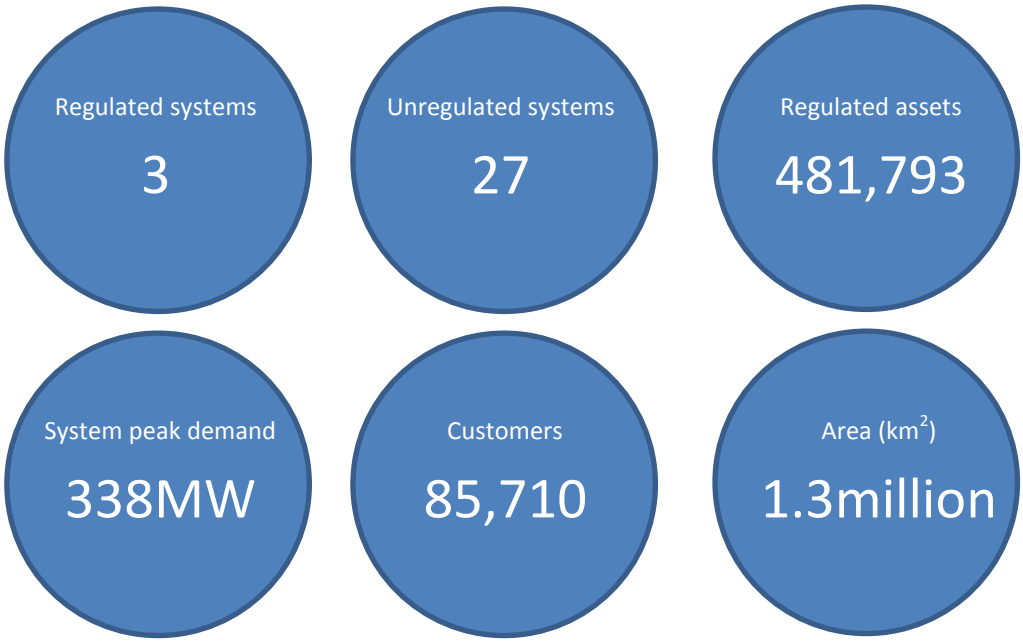


Figure 3-1 Overview of the Power Network

3.2 Network description

Power Networks transports electricity from generators to customers via its transmission and distribution networks across three regulated electricity supply systems (Figure 3-2):

- the **Darwin–Katherine system** which is the largest system and supplies the city, suburbs and surrounding urban and rural areas of Darwin and the township of Katherine and its surrounding rural areas. The system provides service to a population of approximately 150,000. The Darwin–Katherine 132kV line links these two centres with intermediate 132kV substations at Manton and Pine Creek. There are power stations located at Channel Island, Weddell, Pine Creek and Katherine;
- the **Tennant Creek** system that supplies the township of Tennant Creek and surrounding rural areas from its centrally located power station. This electrical grid is located in the

middle of the Northern Territory and services approximately 7,000 people in and around Tennant Creek; and

- the **Alice Springs** system that supplies its township and surrounding rural areas, from the Ron Goodin Power Station[6] and the Owen Springs Power Station. It is the southernmost electrical grid, servicing the Alice Springs area, which is home to approximately 28,000 people.

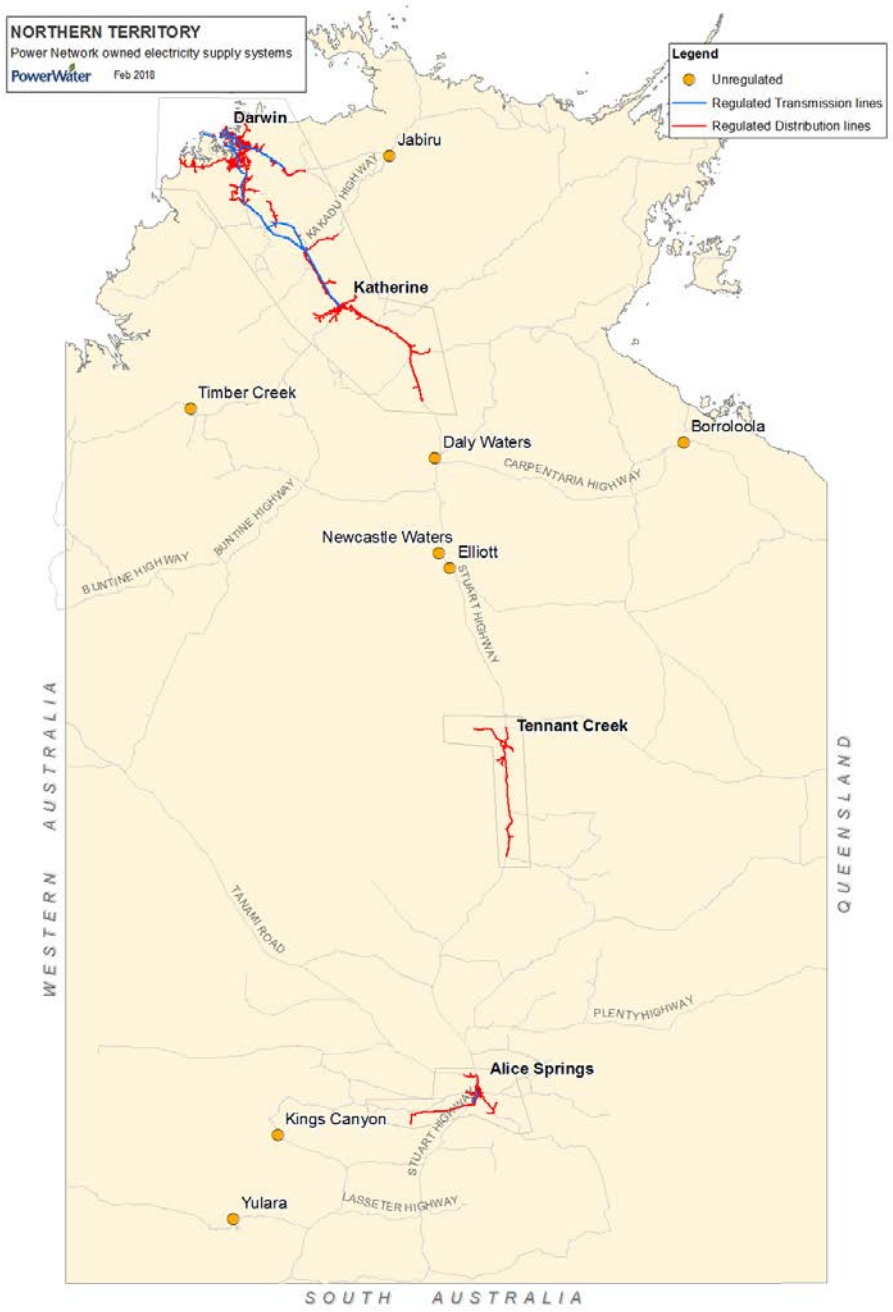


Figure 3-2 – Regulated Electricity Supply Systems within the Northern Territory

[6] Ron Goodin Power Station is scheduled to close in 2019

3.3 Historical development of the network

In 1912, Darwin was the last capital city in Australia to establish a power supply. However, it would not be until after the influx of thousands of defence personnel and the Second World War that many residents could enjoy the benefits of lighting, fans and refrigeration.

After the Second World War and through to 1978, electricity supply in the NT was arranged by the Commonwealth Department of Works (under a number of guises). However, revenue was set and collected by the NT Administration. Concern was expressed that this split arrangement was inefficient and not effective. Several inquiries recommended the establishment of a vertically integrated utility and this took place on 1 July 1978 with the formation of the Northern Territory Electricity Commission (NTEC).

In the 1960s there was rapid expansion in the Top End and the "YELLOW REPORT" was prepared which was a plan for the provision of High Voltage (HV) underground supply in the Darwin CBD; based on quite high load densities over the next 30 years and the use of a tunnel backbone to facilitate new connections without the need for digging up the streets.

In 1971, load growth was 17% per annum (doubling every five years) and there was frantic activity to add generation and augment the network. Several new zone substations (ZSSs) were built in the 1970s and 1980s including City Zone, Casuarina, Snell Street rebuild, McMinns rebuild, Berrimah and Palmerston.

The consequences of Cyclone Tracy in December 1974 changed life in the Top End significantly. The rebuild of the system was by way of any means and resources available, to restore electricity supply as quickly as possible. This was followed by a systematic rebuild to tougher standards over three years, under the auspices of the Darwin Reconstruction Commission.

In the 1980s when Palmerston Township was on the drawing board, there was a decision to have a complete review of the Underground Residential Distribution (URD) design for the new satellite town. A "Master Plan" for Palmerston was developed which included three phase Low Voltage (LV) and using pregnant poles as per Prospect County Council. The HV cable network was a mesh network with loops of HV cable installed at the site of potential future distribution substations. Traditional three phase paper/lead cable was initially used based on simple economics.

In terms of the overhead system there was an assumption made that the fabricated steel poles used would have a near infinite life as they were not subject to termite attack. However, when some were found with serious ground line corrosion a full scale multi-year program was commenced to repair the poles and, thereafter, the requirements insisted that concrete was always finished above ground level.

A network undergrounding program began in the northern area of Darwin in 2002 replacing the overhead assets in a number of suburbs. The program halted in 2010 with subsequent phases of the program left incomplete when concerns over the programs costs were raised.

In 2008 an asset failure at a zone substation resulted in a fire and widespread loss of electricity supplies. The independent investigation that followed resulted in recommendations[7] to replace

[7] D2013/39618 Independent Enquiry Into Casuarina Substation Events And Substation Maintenance across Darwin

aged assets (particularly those that were oil filled), improve the asset management capability, increase preventative maintenance and expand the condition monitoring capability.

The majority of the oil filled switchgear on the network has been replaced with modern equipment, using different technologies. Oil filled switchgear, with its attendant high risk of catastrophic failure and ensuing fire, is being replaced with more compact and reliable vacuum and Sulphur Hexafluoride (SF6) equipment. This will eventually flow through to a greatly reduced risk of failure.

3.4 Asset overview

The three regulated electricity networks comprise network comprises the assets as described below in Figure 3-3.

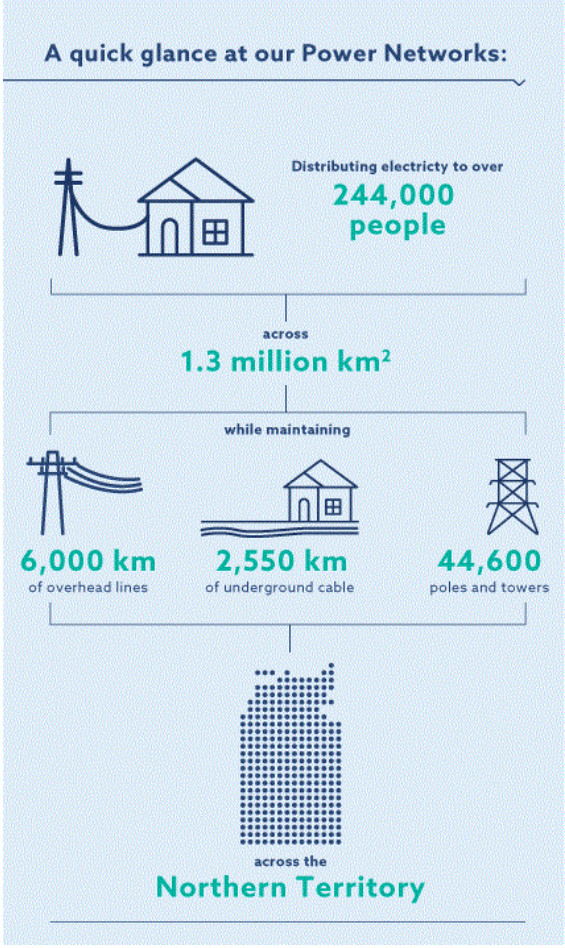


Figure 3-3 – Asset overview

3.5 Current Performance

Power Networks monitors the performance of the network by reporting on a number of Key Performance Indicators that are aligned to the business Key Result Areas. These are reported to stakeholders through a range of documents and report such as the Statement of Corporate Intent and Standards of Services. There are a number of lower level metrics that are used to provide

additional resolution for business improvement activities. The summary of current performance focuses on those items that are material to presentation of performance and specific to the Health and Safety and Operational Performance Key Result Areas. The summary does not represent an exhaustive list of performance indicators, their mapping or comprehensive assessment of performance. The performance can be described by focusing on four key areas:

1. safety and environmental performance;
2. reliability of supply and power quality performance;
3. asset age and condition; and
4. capacity of the Network to supply future demand.

The performance of the network is subject to significant fluctuation due to the environmental factors of the Northern Territory, as described in Section 4. Overall, Power Networks meets its network performance obligations against existing targets. Where specific groups of customers and/or network feeders fall below expected performance levels a program of worst performing feeders is developed to address poor performance.

3.5.1 Safety and Environmental performance

Power Networks measure it safety and environmental performance using a range of measures including Lost Time Injuries (LTI), LTI Frequency Rate (LTIFR), Field audits completed and outstanding environmental actions completed.

Indicator		2014	2015	2016	2017
Lost Time Injuries (LTI)	Actual	7	4	2	5
Lost Time Injuries (LTI)	Target	4	4	3	2
Injury/ Near Hit Reports	Actual	*	*	8	3
Injury/ Near Hit Reports	Target	*	*	*	3.8
Outstanding Env Compliance	Actual	*	*	*	0
Outstanding Env Compliance	Target	*	*	*	<1
Safe Act Observations (SAO)	Actual	*	*	*	209
Safe Act Observations (SAO)	Target	*	*	*	252

Figure 3-4 Safety and Environmental Performance. (* information unavailable)

Power Networks safety performance demonstrates a performance below target (Figure 3-4) in most cases. This is mainly due to injury management events where small cuts or abrasions are resulting in days of work after the event. Muscle/skeletal injuries are well represented that occur typically in response to a procedural breach.

3.5.2 Reliability of supply and power quality performance

A Network Reliability

Power Networks measure the reliability performance of the power network using a range of industry stand measures including System Average Interruption Duration Index (SAIDI) and

System Average Interruption Frequency Index (SAIFI). Annual reports[8] are presented to the Utilities Commission (UC) detailing the reliability, it causes and plans for improvement where required.

The Power Networks' performance against the current UC Targets for SAIDI and SAIFI across each of the four feeder categories has been strong since the formal targets were set (Figure 3-5 and Figure 3-6). This is mainly due to the increased investment in zone substation and distribution assets over the period. The Power and Water board mandated the target to be the industry mean of Australian utilities. To provide a target we have calculated the ESAA mean from the calendar years 2012-17 and this is plotted on the figures below.

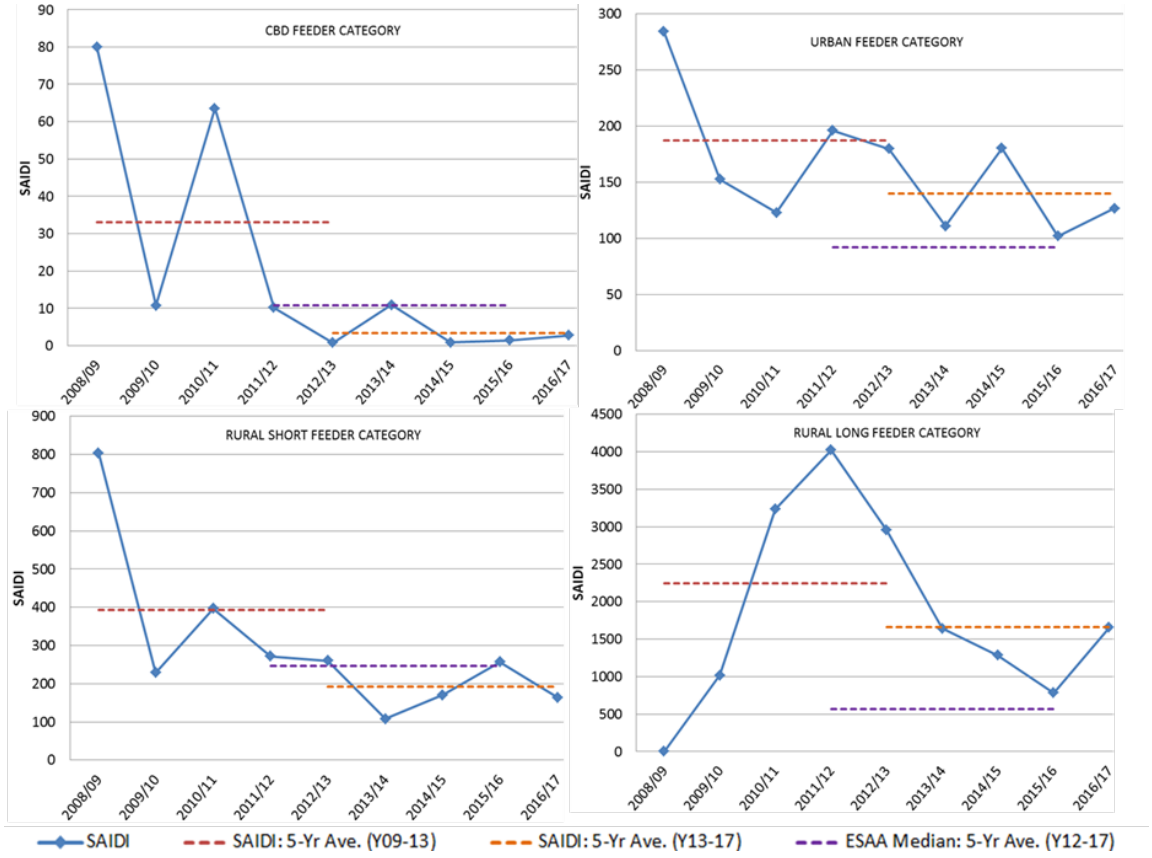


Figure 3-5: Network SAIDI performance.

[8] D2017/414647 – Standards of Service Report 2016-17

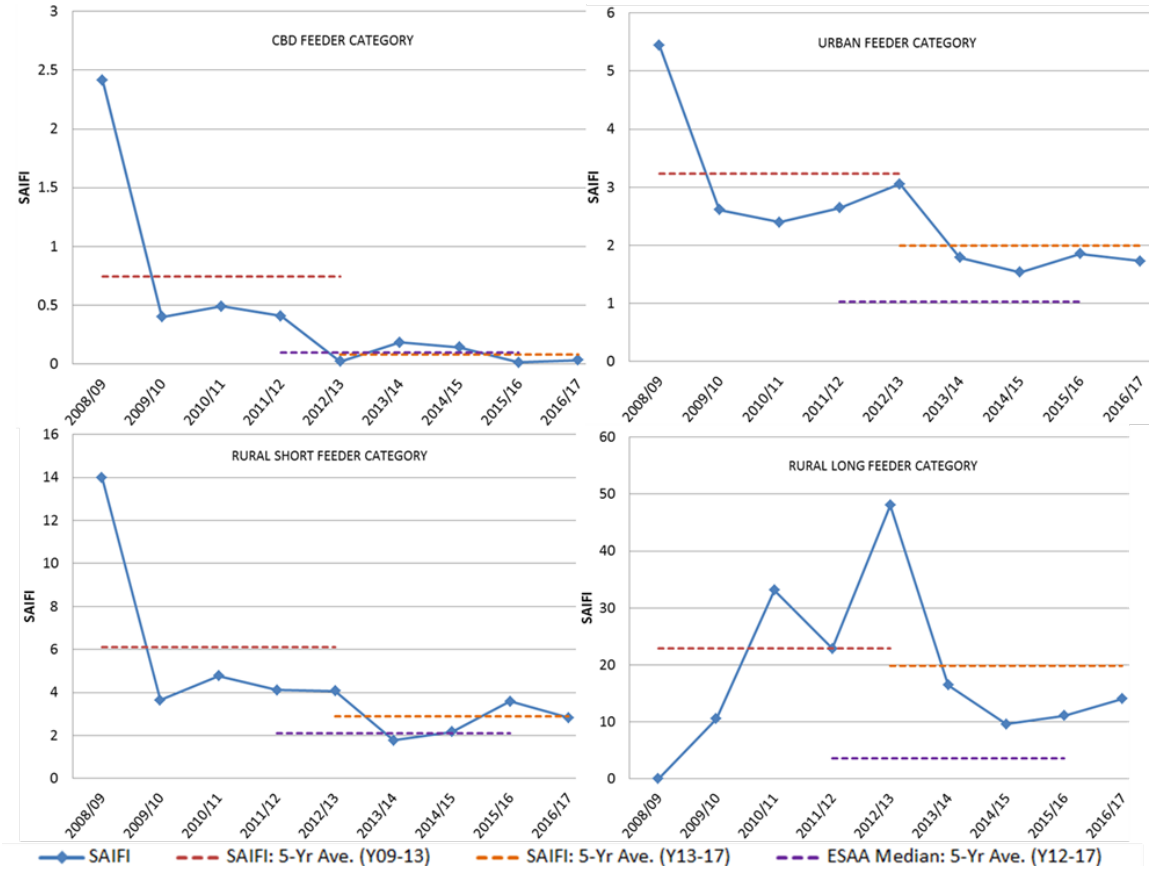


Figure 3-6: Network SAIFI performance

Through our customer engagement we are informed that our customers have noticed the improving reliability of the network. Customers are generally satisfied with the current level of reliability and are not willing to pay more for it to improve further but do not wish it to decline. Customers have expressed a willingness to pay for poor served customers to receive and improved level of performance.

The poorly served customers are identified using the feeder performance ratio which identifies the worst feeders in each category. Use of this approach for the financial year 16-17 determines that those on rural short feeders are the worst served (Table 3-A). Rural Short feeders continue to be the category where the majority of poorly served customers are located.

Table 3-A Worst Performing Feeder 2016-17

Feeder Category	Total Number of Feeders	Number of Feeders exceeding threshold performance ratio
CBD	21	3
Urban	65	1
Rural Short	85	6
Rural Long	3	0

Project or programs designed to address poor reliability typically involve asset solutions and fit into the categories of asset replacements, asset upgrades or feeder sectionalising. This is because the most dominating influence of outages is assets and the trend is increasing (Figure 2-1). The regulatory submission contains a program to address these issues.

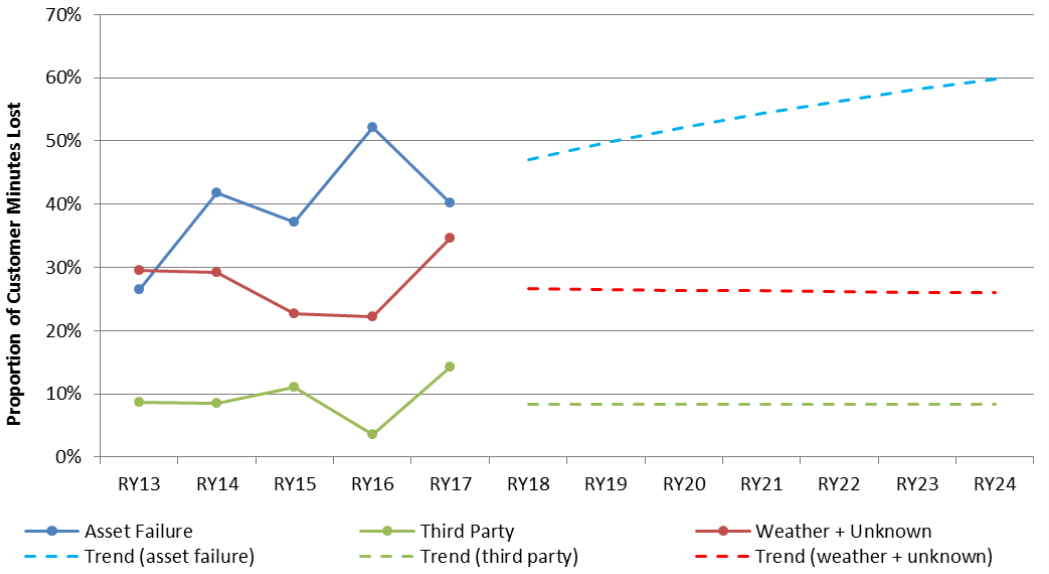


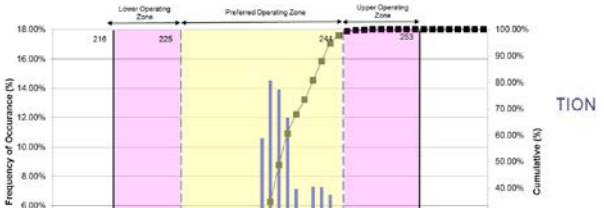
Figure 3-7 Top three causes of outages showing and increasing trend of the asset failure.

B Power Quality

In addition to SAIDI and SAIFI, Power Networks must comply with the quality of supply requirements, principally concerning voltage management so as to enable customer's electrical equipment to function as designed and without damage or reduction in expected service life.

Traditional design assumptions in regards to voltage drop in the low voltage network are no longer always applicable largely due to the influence of PV systems exporting via the low voltage network. Although an improvement on previous years, the higher voltage values within the low voltage network are evident in the histogram above where almost 50% of voltages are above the preferred range. To address this, Power Networks have to date been adjusting local transformer tap positions and investigating a broader solution of a significant reduction of the medium voltage at zone substations.

In 2015, Power Networks began to reduce the voltage regulating set points at zone substations across the 11kV network in the Darwin region. The following histograms indicate the success of this approach at a customer's supply point. In this instance, prior to the change less than 40% of sampled voltages were within the preferred range during normal conditions. Subsequent to the change more than 95% of sampled voltages fell within the preferred range. Further work is being conducted for this approach to be applied in the rural 22kV networks as well as in the Alice Springs and Tennant Creek power networks.



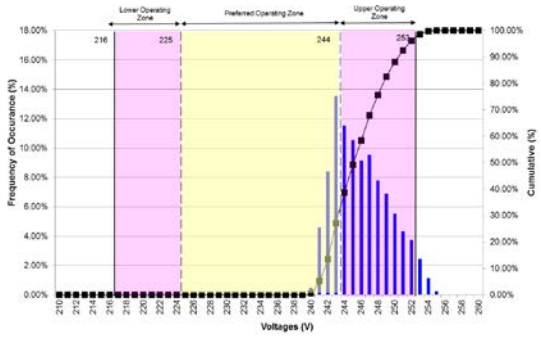


Figure 3-8 RMS Voltage Distribution Histogram showing the levels Pre January 2017 change (LHS) and Post the January 2017 Changes (RHS)

The 11kV voltage set-points in the Darwin network have been reduced at the transformers from a nominal set point of 11.2kV to 10.7kV, resulting in a reduction in the low voltage levels supplied to customer.

The 22kV networks predominantly supplies the rural network and requires additional study to ensure that transformer voltage regulating set-points and voltage regulators function in unison to provide suitable voltages across the full range of electricity demand, networks configuration and seasonal conditions.

The Alice Spring Networks currently experience major issues in regards to low voltage regulation. Resolving the issue in the short term is complicated by the nature of the embedded generation at the Ron Goodin Power station on the 11kV network, the recent implementation of the remote automated generator control in the region, the closure of Brewer power station and the expansion of the Owen Spring Power Station. Minor changes are planned in the short-term; however more significant changes will occur on the decommissioning of Ron Goodin Power Station post 2018. Changes to supply voltage will require direct generation action and coordination.

To achieve the organisational objectives and meet the requirements of the Asset Management Policy this means delivering the correct voltage to all customers under all conditions. There are two Business Needs Identification proposing work in the next regulatory period including;

- improving modelling work on 11kV and 22kV to proactively identify areas requiring work
- improving sampling of LV voltages for reporting
- identification of non-network solutions
- studying rural and southern region areas to see if adjustment of set points for power transformers in these areas will be beneficial
- continue to rectify where customer complaints are identifying voltage issues or as identified through modelling
- find appropriate solutions to high voltages due to transmission network under light load conditions in Katherine and Alice Springs

3.5.3 Asset age and condition

Power Networks tracks the asset age and condition using the Maximo asset management system. Whilst the use of asset age provides some indication of the health of the assets it is condition and risk being the main factors that ultimately trigger the requirement for replacement as described in

Section 5.5.5 (Renewal). The use of asset age and condition are discussed below followed by a summary of some capex projects demonstrating where condition has been used for significant items of spend.

Asset age

Strong consideration is required when using asset age to manage assets. Asset End of Life (EOL) can reference the economic (or book) life, design life or average life of a range of organisations such as DNSP's. In some cases terms such as 'condition based aged' are used so as to communicate the condition of the asset and the likelihood of the end of life or replacement event. As stated above condition and risk ultimately determine the replacement recommendations. The work below uses the economic asset life to discuss the relative ages of assets and connect the construction and replacement history.

Although the development of the electricity networks in the NT was initially ad-hoc, events such as the Second World War, the creation of NTEC, Cyclone Tracy and the Casuarina zone substation event of 2008 which drove replacement activity. These events had an impact that is unique in Australia and results in asset age profiles that may differ from other electricity network owners and operators.

Cyclone Tracy is now over 40 years ago and the assets installed in that period are now beyond or approaching the end of the expected service life. This can be seen in asset classes such as services and distribution switchgear where 45% and 30% respectively are approaching end of life (Figure 3-9). The maturing of these asset classes occurs first as they typically have the shortest of lifespans of distribution assets.

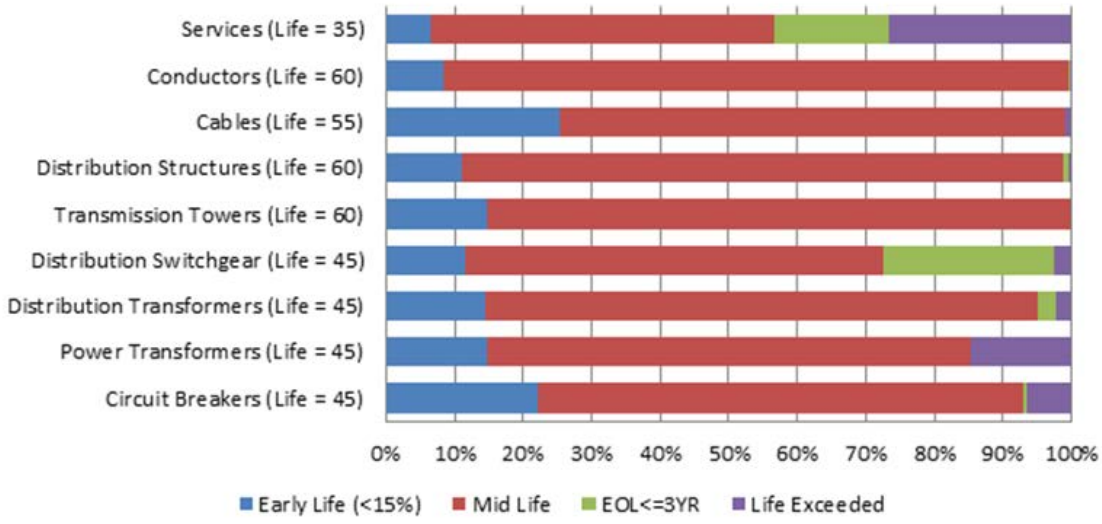


Figure 3-9: Summary of asset classes showing the percentage of each class near or exceeding End of Life (EOL). The life of each class uses economic life.

The Casuarina event initiated a step change in replacement activity. Aging zone substations, housing oil filled switch gear in poor condition were targeted for replacement along with oil filled distribution switchgear due to concern over operator and public safety. The impact of these activities can be in in the asset age profiles of where less 4% of the distribution switchgear is exceeding its design life, mainly due to the targeted replacement of the oil filled assets.

The replacement of zone substation assets, after the Casuarina event, can be seen on the asset classes of Power Transformers and Circuit Breakers where 15% and 6% of the classes respectively are approaching or exceed the EOL. It should be noted that most of the assets of these classes have exceeded EOL, due to the replacement program being driven by oil filled switchgear and site criticality.

Most interesting of all is the lack of assets approaching EOL in the classes of distribution structures and cables which are targeted for significant replacement spend. This is due to the condition of these assets which is described below.

In Table 3-1 below the population of the assets in each class is listed. This provides the context as to the volumes that may require a closer examination of condition. Notable, are the services class of which a significant percentage will be beyond the EOL at the end of the next regulatory control period (Figure 3-10).

Table 3-B: Design lives for each asset class

Asset class	Design life (years)	Population	% population outside of design life (as at 2017)
Circuit Breakers	45	562	6.4%
Power Transformers	45	75	14.7%
Distribution Transformers	45	4,809	2.3%
Distribution Switchgear	45	6,559	27.9%
Transmission Towers	60	3,545	0.0%
Distribution Structures	55	42,380	0.4%
Cables	55	1,692 km	0.8%
Conductors	60	5,558 km	0.1%
Services	35	1,571 km	26.7%

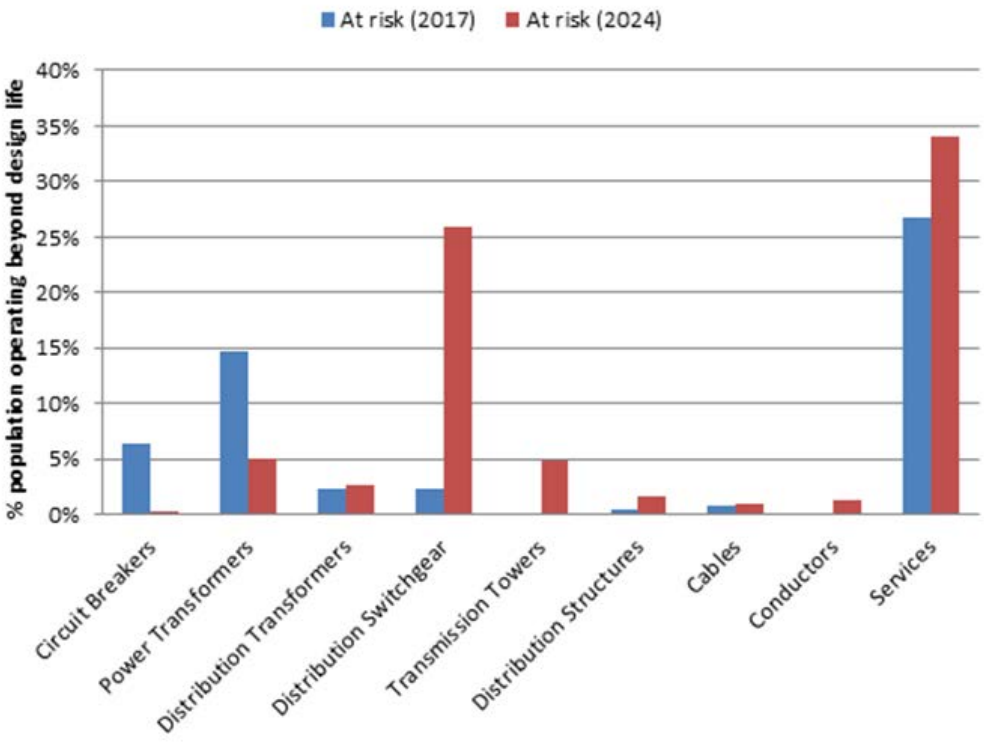


Figure 3-10 – Asset population exceeding design life by class

Asset condition

As stated above, to date Power Networks has undertaken asset renewal program focusing on the replacement of zone substation sites and distribution switchgear mainly in response to the Casuarina substation failure. Replacement activity is still required at a number of zone substation sites to replace whole site, specific classes or discrete components. Asset failure of distribution assets such as cables and structures typically involve smaller numbers of customers than that of significant zone substation failures, however, the combined contribution to performance or safety can be significant. Understanding asset failure mechanisms is the first step in being able to quantify the asset condition.

Corrosion is an important phenomenon that plays a part in many asset failures. Cable screens eroded due to moisture ingress, insulators fail as the metal components corrode due to moisture and voltage, pole cross arms corrode due to moisture and salinity near costal sites and pole bases corrode when in contact with saline soil in Alice Springs. All of these corrosive failures occur over many years as a result of the requirement to perform service in harsh environments conditions. Most of the failures can be observed thereby providing opportunities to measure the asset condition.

Moisture and heat are combined in laboratory tests to accelerate deterioration in ageing experimentation. In the tropical north of Australia these conditions exist naturally with annual rainfall of over 2.5 metres expected during the months of the wet season when temperature climb to 36 Degrees Centigrade. Some oil circuit breakers have been found to have equal amounts of free water and oil during maintenance events. High moisture levels inside of power transformers are common place and some of the tools and techniques that prove effective in removing moisture in the southern and eastern states are ineffective or problematic in the tropical north.

Assets are able to be condition monitored for moisture ingress. Power Networks runs effective oil condition monitoring programs that tests for moisture, combustible gases and other indicators that provide a conditional age in the case of power transformers.

In addition to the above Power Networks monitors a number of electrical and mechanical condition observables. Some of these measurements, such as insulation resistance, can only be taken when humidity falls below defined thresholds. Surface discharge (which precedes flashovers) initiates above known humidity levels in some switch boards and dehumidifiers have been installed to keep the humidity down and the assets dry.

The above failure modes and condition observables are used in the Asset Management Plans to describe the asset condition and recommend the activities and programs to ensure continuity of service from the assets. The works and programs that result are listed comprehensively in the Power Networks business cases and can be found in the Capex Overview document[9]. The follow provide a summary of the financially most significant works are required due to deteriorating condition.

A Pooled Assets

Pooled assets are replaced when the need is identified through periodic inspections by field crews. These assets are typically low in value with a high volume replaced each year, and the individual replacements being relatively low in cost. This scenario does not justify the collection of condition data, other than the failure event, and therefore there is no information available to trend the deterioration of condition or prepare a condition-based forecast. The methodologies used to forecast the volume of replacements and the cost is outlined in Section 5.5.5 (Renewal) and is applied to the following classes.

- overhead conductors;
- pole top structures;
- underground cables;
- service lines;
- distribution transformers;
- switchgear;
- connectors;
- surge arrestors; and
- pillars.

B Cables

Significant difficulty has been experienced with Cross Linked Polyethylene (XLPE) cables in URD designs. The failures are due to moisture ingress and the subsequent corrosion of aluminium screens, which cause swelling and cracking of the cable sheathing. The damaged sheathing exacerbates moisture ingress resulting in screen corrosion and water treeing of the XLPE insulation. These failure modes have led to accelerated cable insulation and cable termination failure. In addition, cable screens are an integral component to the high voltage

[9] PWC04.1 - Capex Overview Document - 31 Jan 18 - CONFIDENTIAL

earthing system. The loss of cable screen continuity reduces the effectiveness of the earthing system as a whole and increases step and touch voltages. As corrosion continues, the earthing system performance will continue to degrade and increase the risk to the public and field crews during abnormal system conditions. Testing of the cables and inspection of replaced cables has confirmed the concerns associated with the damaged sheathing throughout the population. The program will replace approximately 46 kilometres of the target XLPE cable in the next regulatory period.

C Alice Spring Poles

The failure of a steel power pole in Alice Springs in December 2014 drew concern regarding the condition of pole assets in the Alice Springs area. The pole had been in service for approximately 40 years before it failed, which is considerably less than the expected service life. This incident triggered an investigation of the condition of pole footings for poles of similar design in Alice Springs and specifically the soils identified in the High Salinity Area (HSA), as this was a significant contributing factor to the failure.

D Berrimah Zone Substation

Berrimah Zone Substation is a 66/11kV zone substation containing many assets in poor condition. The ASEA HLC minimum oil 66kV circuit breakers are in the poorest condition of the installed assets presenting a high risk of explosive failure. Two 20/27MVA transformers have condition indicators that suggest they are end of life. Consistent with good industry practice, our asset management strategy requires prudent replacement of zone substation primary plant and secondary systems prior to failure to reduce safety and reliability risk and to optimize the whole-of-life cost of the assets. A recent safety related event resulting in staff injury at Berrimah Zone Substation has highlighted the risk associated with operating obsolete assets.

3.5.4 Capacity of the Network to supply future demand

The demand profile across our Darwin-Katherine network is reasonably flat and is generally consistent across each day, with a load factor of more than 60 percent. Daily peak demand is also reasonably flat and consistent between 8am and 10pm, and is driven largely by the use and continual operation of air conditioners. This indicates that all assets are utilised reasonably consistently.

The expected growth of the Darwin-Katherine power system is predicted by AEMO to grow at 0.1% over the regulated period due to a small increase in population and increases in the roof top PV. The Darwin-Katherine system is characterised by wet season peaking due to high air-conditioning load which also flattens the load profile. The residential and commercial PV is expected to grow between 2017 and 2027 from 10 per cent to 30 per cent of maximum demand. This is expected to push maximum demand peak to later in the day and may result in its occurrence in the evening.

Whilst the overall growth is slow augmentation is required to manage localised growth occurring at specific locations. Projects have been slated in the areas of localised growth identified in the demand forecast (Figure 3-11), specifically Wishart and Archer zone substations where capacity

constraints will exist. Augmentation of many of the feeders associated with these sites is also required.

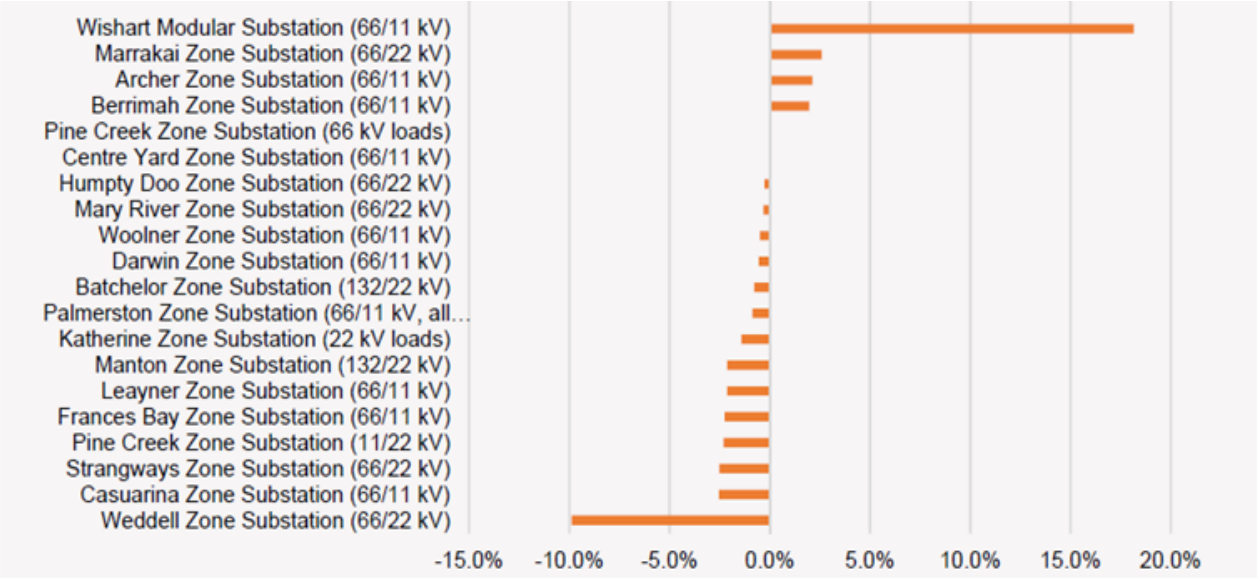


Figure 3-11 Zone substation Growth

Demand growth during the regulated systems of Tennant Creek is expected to be flat and Alice Springs is expecting a small decline due to the increases in PV. Growth in connections across the Territory is expected to number approximately 3000.

4 Summary of challenges

We have identified a number of challenges that influence the way that we undertake our asset management planning decisions.

4.1 Regulatory environment

The regulatory environment has fundamentally changed.

We will commence our first regulatory control period with the Australian Energy Regulator on 1 July 2019, in compliance with the National Electricity Rules (Northern Territory) (the Rules). The Rules have required a step-change investment in improving processes and systems to generate the necessary data and information to meet our regulatory obligations. These changes will continue to occur in our business as we near the commencement date and will become embedded during the regulatory control period.

The Regulator will expect us, like other network operators, to have timely access to a range of data and information from its network and assets to effectively plan and operate the network to minimise costs whilst delivering on service outcomes for customers.

This will demand continuous improvement of our asset management strategy and systems, as we discover and implement new and innovative solutions.

4.2 Changing customer expectations

The Power Networks Business Plan highlights a future where up to 50% of all electricity will be generated by customers by 2050, which is at the opposite end of the system from its original design. This will present a very significant range of technical, economic and regulatory challenges. An integrated set of actions are required to enable balanced, long term outcomes for customers, enable the maximum value of customer distributed energy resources and position Australia's networks for resilience in uncertain and divergent futures.

To become increasingly customer centric, customers are placed at the centre of our future electricity systems. They are empowered with greater choice, control and autonomy while enjoying the security and benefits of a grid connection. Transformed electricity networks actively connect customers with a growing range of market actors and customised electricity solutions that are supported by a modernised customer safety net (protection frameworks) designed for the 21st Century energy system.

4.3 Economic outlook

Economic growth is cyclic by nature, and following a period of high economic activity in the Territory, the next period is forecast to decline.

4.3.1 Declining network demand but with growth corridors

Meeting the peak electricity demand is typically one of the major drivers of Power Networks' capital investment program. However, peak demand growth rates are expected to ease over the planning period.

Demand is forecast to decline across the network except for growth corridors at Wishart zone substation with a forecast growth of 18% and Marrakai, Archer and Berrimah zone substations with a growth of approximately 3%.

A reduction in growth/augmentation projects is expected due to a downturn in economic activity and the proliferation of solar photovoltaic (PV) systems, resulting in a significant lower demand forecast. Peak demand growth rates are expected to continue at recent levels over the planning period.

4.3.2 Relatively flat load profile

The load profile across the network is fairly flat and consistent across each day. The daily peak is fairly flat and consistent, between 8am and 10pm, and is driven by the use of air conditioners. As a consequence, all assets are utilised consistently and, therefore, it is more difficult to remove assets from service for prolonged periods of time.

During the wet season the load profile becomes flatter (more consistent) with less difference between the peak and the trough and demand is approximately 10% higher.

This also results in greater difficulty in load shifting, or demand side management initiatives.

4.4 Climate change

Climate change sets the scene for an increasingly challenging environment for Power Networks. The main impacts on the network are expected to arise from:

- increasing summer/wet season temperatures and an increase in the number of hot days causing disproportionate increases in network demand;
- the capacity of most items of network equipment to supply that demand is dependent upon the ambient temperature and will be adversely affected;
- increased monsoonal rainfall across the Top End of the Northern Territory will narrow the dry season 'window of opportunity', during which major equipment maintenance must be performed ; and
- increased rainfall in the central regions will escalate the incidence of flooding, causing equipment damage and impairing access.

4.4.1 Environmental challenges

Power and Water operates in diverse climates, each of which brings with it unique challenges such as cyclones and tropical storms in the north, and dust storms and drought in Central Australia. In addition, high termite activity occurs throughout the Northern Territory which dictates the use of steel and concrete power poles.

These geographic and environmental variations influence the design criteria for infrastructure as well as Power Networks' ability to respond to incidents on the transmission and distribution systems. The low load density and geographical spread impact on network topography, with much of the transmission and distribution network being characterised by long radial lines. The climatic and environmental conditions of the Northern Territory lead to the accelerated deterioration of assets.

The external environmental factors and the age of the assets represent increased hazard for a number of risk domains for the Power Networks business. This risk can only be managed by maintenance composed on the objective need principle and replacement activity. This must all be considered when developing the AMPs.

Specific areas of environmental concern are:

- approximately 80% of Power and Water's network is located in a coastal tropical environment that is prone to cyclones. High humidity and annual rainfall have multiple negative impacts on the condition of transformers. The issues are a challenge that is unique to Power and Water compared to other distribution networks throughout Australia;
- the tropical environment increases the rate of deterioration of assets and also reduces the ability for Power and Water to undertake maintenance for six months of the year during the wet season;
- the impact of the environment is a more rapid rate of deterioration compared to peer distribution businesses, driving an increased level of opex to maintain and manage the asset fleet; and
- damage from trees and wildlife, especially flying foxes (bats).

4.5 Operational challenges

Operational challenges in the Northern Territory pose unique challenges to Power and Water, and drive increased expenditure to manage the network, are listed below.

4.5.1 Accessing assets for maintenance

Power and Water is limited from accessing its assets due to both operational constraints imposed by System Control and environmental constraints during the wet season. For example:

- Hudson Creek (where System Control is located) is the central node for conversion from 132kV to 66kV for distribution of electricity to Darwin. The majority of generation is located on the 132kV network, and Hudson Creek provides the only switchyard connecting to the 66kV network supplying Darwin. Any outage for maintenance puts the stability and security of the network supplying the Darwin area and CBD at risk; and
- there are a number of remote substations with only a single transformer which are difficult for appropriately skilled field crews to access due to distance and/or monsoonal conditions. This can result in prolonged outages due to slow response times.

4.5.2 Operational effectiveness of field crews due to heat and humidity

Power and Water operates in both hot and humid environments. The environments are not comparable to other networks around Australia and have a significant impact on the productivity of the field crews. To assess and quantify the impact of the climatic conditions, Power and Water undertook a study in selected locations across Australia.

Workability is the term used to describe the productivity impact of climate in both northern and southern regions[10,11]. It is the percentage of time for which work of different physical exertion can be effectively undertaken.

4.5.3 Availability of capability and skills in remote areas

The majority of Power and Water's work force is centred in Darwin. Most technicians with expertise in specialist areas, such as protection, are also based in Darwin. As a result, there is an increased need for the skilled technicians to travel to remote sites in other areas of the network that can be up to 1,500km away. This increases the time and cost of undertaking maintenance and/or installation of assets. This situation is unique to Power and Water and is not experienced by the distribution businesses in the eastern and southern states of Australia and places increased pressure on locating and securing the required capability.

At times of strong economic growth in other parts of Australia, the competition for skilled labour becomes more difficult.

This will be further complicated as the design and operation of the future network requires a different set of skills and a new way of thinking, placing increased pressure on a limited labour pool.

4.6 Emerging technologies

Investment in new standards and/or technologies may be required to achieve better or more efficient outcomes, or to meet changing customer expectations. Equipment and technology obsolescence may also result in changing standards.

Investments applied in response to other drivers, such as load growth, new connections, asset condition and reliability or power quality improvements, can all impose obligations to bring existing assets up to current standards. However, there may also be cases where a gap with current standards represents a level of risk that justifies separate investment to ensure assets are brought into compliance.

Power Networks recognises the potential for benefits to be obtained from smart metering and so-called 'smart grid' technology. The term smart grid is loosely used to cover a range of developments that, when coordinated, can improve the performance of the distribution network and the customer experience. Smart grid technology may involve:

- the use of communications, in parallel with the distribution network, for various monitoring, control and protection functions;
- using communications to improve the performance of the network, by automatically switching to rearrange its configuration when and where there is a fault;
- using communications to inform the network operator of the status of the network and any loss of supply to customers' premises; and
- smart metering, equipped with communications, a customer interface and the ability to control certain loads within the customer's premises.

[10] D2017/493408 - Labour Efficiency and Work Management in Hot Humid Climates, Thermal Hyperformance.

[11] D2018/91720 - Labour Efficiency and Work Management in humid climates – Power Networks

Additional areas considered by Power Networks include:

- residential PV, alternative energy generation/storage;
- network automation/self-healing;
- mobility;
- new technology – e.g. fuse savers, and how we ensure we keep abreast of industry shifts more generally;
- Distribution Management System/Outage Management System (DMS/OMS);
- new loads – e.g. electric vehicles;
- communications/metering technology; and
- power quality equipment.

4.7 Data and information

Power Networks has a lack of comprehensive asset condition assessment data to fully understand the impact of corrosion deterioration on the functional integrity and strength of the assets. Whilst this capability is rapidly maturing we do not yet have a complete end- to-end view of the data requirements and management systems required. This continues to inhibit development of new management approaches.

5 Asset Management Strategies and Objectives

In this section Power Networks asset management objectives and asset management strategies are outlined.

5.1 Overview

The asset management strategies and objectives are developed within the Power and Water planning framework to provide the linkage and "line of sight" from the Board's Strategic Direction, SCI and Power Networks Business Plan. This requires further refinement to describe the strategic intent for a range of Power Networks asset strategies from which the asset objectives are determined. These objectives are then implemented through the plans of the power network such as Asset Management Plans or Strategic Action Plans. These Plans describe how the asset objectives are to be implemented and the expected outcomes are tracked using measures of success and targets. During the development of the implementation plans the requirements of the Power and Water policies (including the Asset Management Policy) and corporate risk frameworks are utilised, further ensuring strategic alignment with the requirements of the corporate stakeholder including the Power and Water Board. The linkage between asset management practices and plans to the strategic direction and vision of the organisation is depicted in Figure 2-3 below.

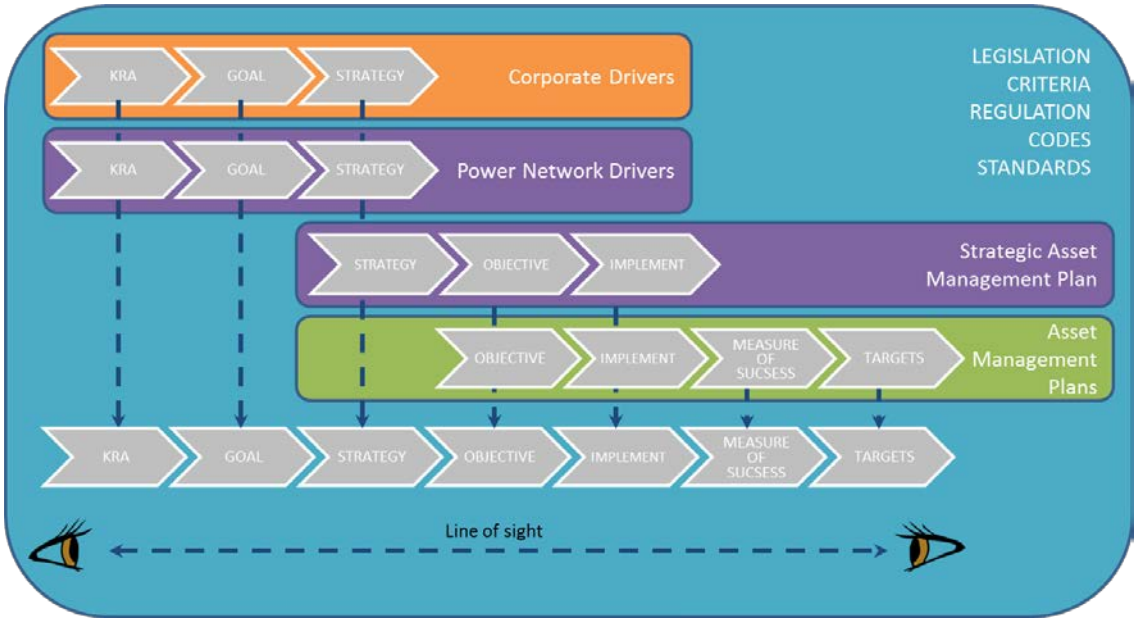


Figure 5-1 – Asset management framework - line of sight

The implementation of the approved plans is monitored through measures of success. Whilst high level measures of success are well established, Asset Management Plans are new to Power Networks and the low level measures of success have recently been introduced. Over time their contribution to the high level measures will become apparent and provide an opportunity to refine the strategies and plans.

Power Networks develops its strategies and plans in accordance with Good Electricity Industry Practice as defined in the National Electricity Rules. That is "*The exercise of that degree of skill, diligence, prudence and foresight that reasonably would be expected from a significant proportion*

of operators of facilities forming part of the power system for the generation, transmission or supply of electricity under conditions comparable to those applicable to the relevant facility consistent with applicable regulatory instruments, reliability, safety and environmental protection. The determination of comparable conditions is to take into account factors such as the relative size, duty, age and technological status of the relevant facility and the applicable regulatory instruments." Information relating to the asset management practices is obtained through participation in a variety of Energy Networks Australia (ENA) groups and the Industry Working Group (IWG).

Power Networks measures its success by participating in the 2016 Asset Management Customer Value (AMCV) benchmarking of its asset management framework.[12] This allowed all of the Power and Water business units to including Power Networks to compare it asset management process maturity with the other participants who were mainly water utilities and DNSP's. The results (Figure 5-2) for Power Networks indicated reasonable maturity and identified the 'big opportunities' to be:

1. Development of processes for consultation with customer
2. Linking of SAMP's and AMP's to lifecycle management plans to improve asset renewal process
3. Rationalisation of data collection process and databases
4. Improvement to renewal forecasting risk analysis

Figure 5-2 Power Network results from the AMCV Benchmarking study

Since the completion of the AMCV there has been signification progress on items 1, 2, and 4 of the big opportunities. Item number 3 Rationalisation of data collection processes is planned for 2018 as part of the corporate 'data as an enterprise asset' project.

Power Networks is developing a customer centric culture by considering the implementation plans in terms of the customer drivers that are articulated in the Business Plan. These have been developed by Power Networks to ensure that the outcomes defined by the business are important to the customer and include:

[12] D2017/109730 AMCV participant Final Report Power and Water Corporation - Power Networks

- **safe power supply** – addressing the highest priority public safety risks, recognising that all public safety risks will not be immediately eliminated and need to be controlled;
- **reliable power supply** – maintaining current service standards and improving service to achieve median performance with peers, only where it is valued by the customer and efficient to do so, in compliance with statutory regulations;
- **affordable power supply** – improving our asset management maturity and the ability to demonstrate lowest cost of ownership of our network, and addressing the need to expand the network capacity to meet growth and connect new customers sustainably; and
- **a positive customer experience** – minimising the impact of network tariff charges to end user customers whilst achieving the expected returns on assets to the shareholder, the NT Government.

The application of the asset management objectives are used in the production of strategically aligned; Asset Management System, Asset Management Plans, Network Management Plan, Operational Budgets, Capital Budgets and enablement of Service Delivery.

5.2 Asset Management Objectives

The Key Performance Indicators (KPI's) and targets within the Business Plan that are directly asset or network related are insufficient for the purposes of driving AMPs. This has resulted in the establishment of the asset management objectives and targets.

These asset management objectives (Appendix D) are set against the same Key Result Areas (KRA's) and goals and supplement those already in the Business Plan. To demonstrate operating in accordance with good industry practice, the development of the asset management objectives has drawn from the knowledge and experience of asset management objectives used by electricity network operators in other jurisdictions.

5.3 Asset Management Methodology

The costs associated with each phase of an assets life changes depending on the asset type, and the age and condition of the asset class. Infant mortality (failure well before expected life) results in early capital expenditure. Assets that have not reached their expected life incur a greater proportion of maintenance expenditure; and asset populations that are reaching the end of life incur a greater proportion of replacement expenditure. Most asset classes are managed through routine inspection with identified defects categorised by severity. The severity classification has defined timescales for defect rectification to maintain the expected life of the assets and meet the safety and reliability outcomes required.

As assets age, their condition deteriorates and the expected failure rate increases; therefore, eventually, it is more economical to replace the asset than to continue maintaining it. The economic factors include the cost of maintenance, cost of replacement and cost to customers of reduced service levels such as safety and network reliability. However, not all assets have the same impact on safety and network reliability and, accordingly, to manage the network as efficiently as possible. Potential strategies are RTF, condition-based, planned proactive replacement, demand driven and customer driven. The asset risk profile suitability for each of

these replacement strategies is provided in Figure 5-3 below. The RTF and condition based strategies are further discussed in the following sections.

Figure 5-3 Asset Replacement Strategies and the associated asset risk profile

Replacement Strategies	Asset risk profile suitability
Run-to-failure (Functional failure)	- Asset has low criticality, low consequence - Asset condition information is difficult to gather
Condition-based (Conditional failure)	- Asset is critical and cost of risk exceeds replacement cost - Asset condition is measurable
Planned (Pro-active replacement)	- Other risks result in action (e.g. network need is changing, emerging safety or environmental risks, change in technology, legislative and compliance changes) - Asset condition may be measurable and can be used to prioritise replacements or spread replacement activity over longer timeframes to eliminate significant spikes in expenditure and associated resources.
Demand-driven	- Planning process identifies that the existing installed capacity is insufficient to supply the forecast demand
Customer-driven	- Individual customer requests new/increased capacity

5.3.1 Condition based (conditional failure) replacement

Assets that have been identified as having significant impact on safety, reliability, the environment or economic aspects of the business are classed as condition based assets. These can be considered critical assets and are subject to routine inspection and maintenance programs designed to keep the assets in an operating condition for extended periods of time. They are proactively replaced prior to failure to ensure the performance level of the network is maintained and significant consideration of spares holding is afforded them.

AMPs describe the asset strategies implemented to achieve asset integrity and safety, network performance and cost efficiency objectives and specify maintenance and replacement requirements of each asset class. This is based on the Asset Management objectives described earlier.

The end of life and replacement criteria is different for each network asset. An appropriate combination of the following driving factors is considered during asset assessment in line with the corporate risk management framework[13]:

- safety and the environment;
- condition (defect history, testing results, type issues);
- expected/nominal asset service life;
- regulatory compliance;
- historical rate of failure for a specific asset group;
- maintainability factors (obsolescence, availability of spares);
- planning optimisation (criticality, voltage conversion);

[13] D2017/163080 Risk Assessment Guide

- delivery optimisation (completing projects in the same substation or on the same circuit concurrently to gain efficiencies); and
- Economic benefits (reduction in maintenance costs, benefits of network reliability).

Power Network's assignment of replacement strategies are provided in Figure 5-4.

Figure 5-4 Asset Classes and Replacement Strategies

Asset Class	Run-to-failure	Condition-based	Planned	Demand-driven	Customer-driven
Circuit Breakers		✓	✓	✓	
Power Transformers		✓	✓	✓	
Distribution Transformers	✓		✓		✓
Distribution Switchgear	✓		✓		
Transmission Towers		✓	✓		
Distribution Structures		✓	✓		
Cables	✓		✓	✓	✓
Conductors	✓		✓	✓	✓
Services	✓		✓		✓

5.4 Asset Management System

Power and Water has adopted the Asset Management Council's asset management system model (Figure 5-5) for its organisation.[14] The model identifies the components of the asset management system and provides guidance on how those components interact. This model begins with stakeholders who are placed at the top. Stakeholders are defined as those who are influenced by or have influence over the organisation. This is followed by the leaders who have a pivotal role in determining whether an organisation will be successful at asset management. Leadership undertakes the function of interpreting the stakeholder requirements, converting them into organisational objectives and driving the way the components of the model are held together. The organisational objects are achieved through their conversion into asset management objectives which are specific to the asset management functions.

The central and core components of the model are competency and engagement, process and organisational roles and these are significantly interrelated. The decision making and risk management components surround the core of the model and combine them such that decision makers, who have an organisational role in managing risk, are competent and engaged and exercise their decisions made within processes. In this way the decision making and risk management are linked to the core components of the model. All of the central elements are supported by decision making and risk management frameworks which all take place in a background of performance monitoring and improvement.

[14] Asset Management Council – AMBOK Publication – Framework for Asset Management Page 19

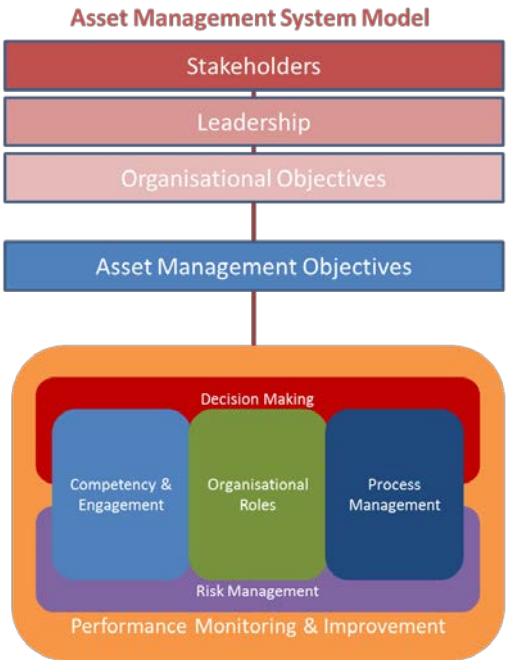


Figure 5-5 AM Council, Asset Management Systems Model

Power Networks determines the competency of its maintainers though the application of a job model system that is tied to pay progression. Maintainers attend the management information sessions (road shows) and participate in Asset Management forums where information is exchanged. This aligns with the competency and engagement components of the model. Field crews are organised according asset function or type (underground, overhead, sub stations, etc.) and have job descriptions which identifies the responsibilities of their roles. The work teams have a hierarchical structure with team leads, scheduler, departmental heads, group manager and general manager that define the organisational roles. Authorisations are granted after training and field based instruction (in some cases) further defining the roles. Power Networks operates the Promapp process management software where process, activity and task are defined and activities (and sometimes tasks) are allocated to roles to be Responsible, Accountable, Consulted and Informed (RACI).

Risk management and decision making are guided by the corporate risk manual and the RACI for each asset class provided in the AMP. A corporate 'delegations manual[15]' provides guidance as to maximum financial delegation. Performance monitoring occurs throughout the organisation with a monthly performance report[16] that contains low level measurements that contribute to Power Network and Power and Water Corporation Key Result Area's. Asset Management and organisational objectives as aligned as described above with leadership making the connection between stakeholder and the organisational objectives.

The introduction of the asset Information Technology (IT) systems (Maximo and ESRI) in September 2012 shone a spotlight on the processes and data of the organisation. It was the start of the journey, that still continues, which centred on improving the organisations Asset Management Capability (AMC). A project (the AMC project) was established and ran for a

[15] : http://intranet.powerwater.com.au/news/latest_news2/latest_news/2017/changes_to_delegation_of_authority

[16] D2018/92853 Power Network Performance Report – June 2017

number of years which focused on embedding the asset management as a discipline for all of Power and Water.

Embedding asset management as a discipline began by establishing an asset management policy[17], strategy, governance frameworks (Appendix C) and asset management process (Figure 5-6) below. Power and Water asset management processes have been designed around the AM Capability Delivery Model[18]. These inform the strategic (SAMP) and class specific (AMP's) that are implemented in the business. Performance, benchmarking and compliance evaluation are completed as checking functions that feed the business improvement, community of practice and change management elements of the business. This forms a Plan-Do-Check-Act approach for the organisation.

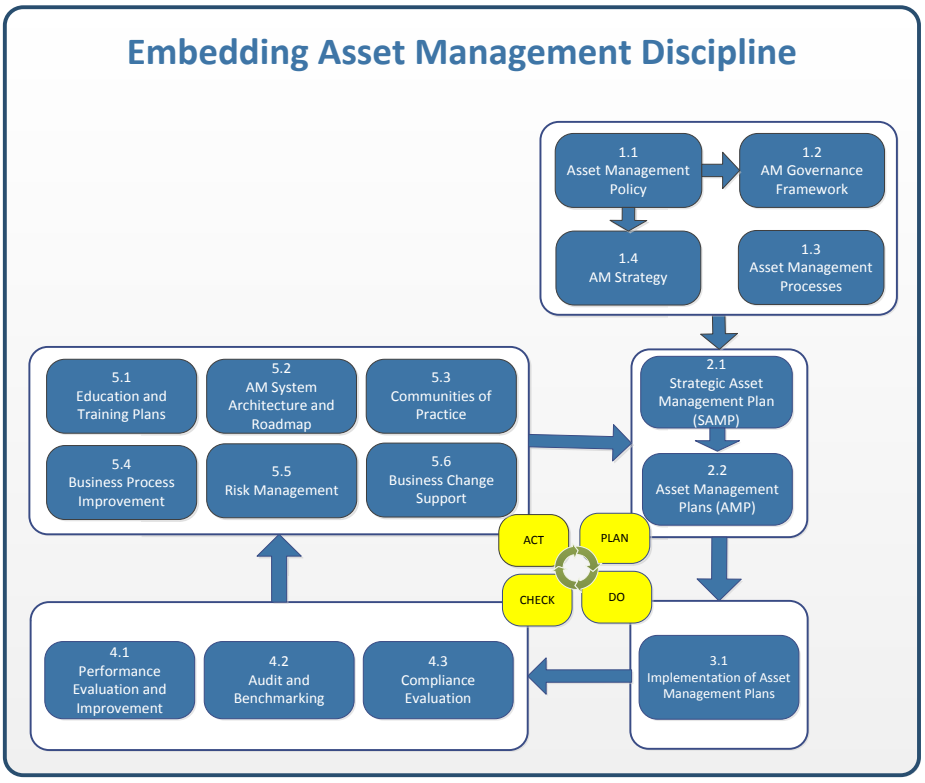


Figure 5-6 – Embedding the Asset Management Discipline

The objectives of these processes are to:

- deliver timely, fit-for-purpose reporting on past, current and future performance and risk of network assets to inform business decisions and meet business reporting obligations;
- deliver strategies for asset classes, assets systems and network objectives through the SAMP, AMPs and NMP. Support the deployment of the strategies and monitor their effectiveness;
- support regulatory and funding submissions with strategies for asset classes and assets systems, and forecasted asset performance;

[17] D2016/139372 PowerWater - Asset Management Policy

[18] Asset Management Council, AMBOK Publication, Framework for Asset Management, Page 31.

- provide the means to conduct stakeholder engagement in relation to network asset performance, risk and strategies;
- provide technical support for asset failures and incidents;
- manage compliance obligations;
- maximise value from existing network asset knowledge and grow network asset knowledge; and
- develop our capability to contribute to delivering Power and Water's strategic intent and its customer objectives of safe, reliable, affordable and customer focused through continuously improving processes, tools, documentation, asset knowledge and skills.

The implementation of these processes is driven by the annual business planning cycle.

Power Networks operates a number of IT systems that support the asset management systems model and life cycle asset management as described below. This includes, but is not limited to:

- the asset and maintenance system – Maximo;
- Geographic Information System (GIS) – ESRI;
- Finance System – FMS – Oracle;
- Human Resource System – MyHr;
- Process Management/incident/improvement system – ProMapp; and
- small systems – PV data base.

All of these systems are assets of the business and support the asset management process.

5.5 Lifecycle asset management

The life cycle asset management approach applied by Power Networks is aimed at making prudent asset management decisions such that its assets do not cause harm to any person, have minimal environmental impact, and meet agreed service performance outcomes, consistent with current and future needs.

The approach includes:

- maximising the utilisation of its assets throughout its life cycle;
- optimising life cycle asset management costs;
- reducing asset risks as low as reasonably practical; and
- continually improving its knowledge in respect of its assets.

A key to lifecycle management is to identify the triggers that lead to the adoption of a particular asset strategy. Triggers such as poor asset condition lead to a process where options are evaluated and a strategy is adopted to manage the assets over the remainder of their life.

The following asset management activities details Power and Water's life cycle management of its network and assets.

5.5.1 Planning

Similar to network service providers in other jurisdictions, Power Networks produces and publishes a Network Management Plan (NMP) to explain its intentions for the next 10 years in

relation to network reliability, capacity, security and supply quality and the accompanying development of the network. The Plan is updated annually and is made available on Power and Water's website.

The NMP contributes towards meeting the annual performance monitoring and review process of the AER in their determination regarding the adequacy of demand forecasts, transmission and distribution network plans, asset management practices and customer service levels.

The Network Technical Code and Network Planning Criteria set out the supply contingency criteria used to plan Power and Water's network. Supply contingency criteria relate to the ability of the supply system (network and generation) to be reconfigured after a fault, so that the supply to customers is restored. The criteria apply to generation used to support the network and to the network interconnections to generators.

Network development considerations include:

- forecast peak demand growth;
- interaction with generation;
- demand management;
- photovoltaic systems;
- network modernisation; and
- customer connections.

Power Networks develops demand forecasts for the network at the following levels:

- high voltage feeders (including major customer connections);
- zone substations (supplying the HV network);
- transmission (supplying groups of zone substations, major customers and major generators); and
- regional, covering the separate supply systems.

The higher level network forecasts must make allowance for the diversity of demand, that is, that individual loads at lower levels may occur at different times and so cannot be directly aggregated. As a consequence, while individual forecast demands may be summed to develop a total for the system, this is useful mainly as a comparison of the overall growth trend, rather than the magnitude of demand forecasts at higher levels.

More recently Power Networks has had the demand forecasts updated by AEMO, [19] and relied on these forecasts in its network planning requirements.

Further details on the demand forecasts, constraints and proposed augmentations are included in the Network Management Plan.

The asset planning stage defines the need for an asset to exist. It also establishes the functional requirements of the assets and ultimately the number of assets, design, function, criticality, configuration, level of redundancy, capability, and capacity.

[19] D2017/463414 – Power and Water Corporation, Maximum Demand, Energy Consumption and Connections - AEMO

Key criteria to ensure optimal line route selection, establishing prudent, cost efficient, intrinsically safe, and sustainable corridors for the life cycle management of the pole and tower assets include consideration of:

- optimised utilisation of existing poles and towers;
- schedule and cost impacts from existing adjacent infrastructure;
- transport and logistics;
- project cost implications;
- safety and reliability risks;
- environmental and approvals risk;
- stakeholder and community requirements;
- design and execution requirements; and
- operation and maintenance requirements.

An example of the planning approach is the proposed replacement of the 22kV Lake Bennett feeder where the replacement of the feeder involves the use of a combination of new and existing assets to optimise the cost efficient replacement of the feeder. It involves the installation of mid-span poles, the refurbishment of existing poles and pole tops, and the potential construction of sections of new line in parallel to the existing, where appropriate, to reduce impact of customer outages.

Asset Management decision making within Power Networks follows the processes defined within the Power and Water Capital Investment and Delivery Framework.[20] The Framework uses a formal gated process consistent with many other organisations to ensure Power and Water investments achieve value for money through prudent investment decisions and efficient and effective project delivery. It recognises that decision making is required at the various life cycle stages in the development of plans, programs and projects. The Framework includes guidelines, processes, templates and tools to assist in the journey of completing the defined key activities within each life cycle stage.

Approvals take place in accordance with the Power and Water Investment Review Committee (IRC) Charter and the approved financial, procurement and human resource delegations.

Power and Water investment is on the basis of objective need which is, from a **top down** investment planning perspective, driven by the Levels of Service and Asset Management objectives defined earlier.

Any risk to the delivery or achievement of these objectives is considered in the context of the Power and Water Corporate Risk Framework[21] and the Power Networks Customer Drivers.

5.5.2 Design

The design phase is where decisions around the physical characteristics and functioning of the asset are made. This life cycle stage defines the quality and reliability of the asset and the whole of

[20] D2018/86248 – Capital Investment Delivery Framework

[21] QDOC2009/194 – Corporate Risk Framework

life cycle costs that can be realised. It influences the total cost and the level of service that the assets can deliver to customers and stakeholders.

Power and Water's approach to the whole of life cycle prudent and efficient design of assets include the standardisation of designs. Standardisation is defined as the process of developing and agreeing upon uniform technical design criteria, specifications and processes and is a key aspect of Power and Water's asset management process.

Along with continuity, leverage and scalability, standardisation enables consistent application of best industry practise and continuous performance improvement. It establishes technical commonality that allows for an off-the-shelf, best practice, and fit-for-purpose approach to engineering solutions. It also allows for interchangeability that provides operational and asset management benefits.

Power and Water's design standardisation offers the following specific benefits to the business by:

- helping with the ranking and prioritisation of investment projects;
- giving confidence in the safe and reliable functioning of the assets;
- providing assurance that the assets will do the job they were intended for;
- boosting production and productivity;
- encouraging higher quality of engineering leveraging specialist knowledge and optimum solutions;
- allowing for the uniform execution of projects; and
- enabling standardisation of construction equipment and processes.

Examples of continuous improvement in this design approach are demonstrated in the new two piece spliced pole and associated improved construction methodology introduced by Power and Water in 2016. The design leverages standard transmission lattice pole design and construction methodology where the pole is delivered in two sections and assembled on site. The benefits of this design include transport and site construction improvements, cost efficiencies from mid-pole extensions to allow for additional ground clearances, cost efficiencies from half pole replacements to address both pole-top and in-ground degradation issues.

5.5.3 Operations

Asset operations include activities associated with the monitoring, operation and control of the asset to adapt to the changing requirements of the network. These include:

- planned switching of the network for scheduled works (e.g. maintenance);
- emergency switching of the network in response to incidents (e.g. fault events);
- real time switching to operate the asset within its design parameters (e.g. loading); and
- monitoring of the condition of the asset (e.g. alarms).

Planning for contingencies is a requirement of both the Network Technical Code and Network Planning Criteria[22] for Power Networks; and the System Control Technical Code[23] for

[22] D2017/187772 Network Technical Code and Planning Criteria V3.1

[23] D2018/76140 System Control Technical Code V5

System Control. Business continuity considerations and emergency management within Power Networks include the impacts of bushfires and cyclones. Security and Emergency Management (SEM) within Power Networks provides support and advice to the business.

Cyclone and storm preparation has a dedicated page within the SEM Power and Water intranet page. In addition, SEM circulates information to assist business units to prepare infrastructure and acquaint themselves with the threat posed by bushfires during an upcoming dry season. This information includes:

- the Bushfire and Natural Hazard Cooperative Research Centre (CRC) Northern Australia Seasonal Bushfire Outlook (usually published in July each year);
- a bushfire preparation and site condition assessment checklist, which provides advice on what to check and actions to take to mitigate the risk posed by bushfires; and

This information is also made available to all staff via the Power and Water intranet.

5.5.4 Maintain

Asset maintenance involves the care of assets to ensure they will function to their required capability in a safe and reliable manner from their commissioning to their disposal. The maintenance requirements evolve as the condition and performance requirements of the assets change throughout its life. It monitors and provides feedback on asset condition, incorporates upkeep and repair activities to maintain the condition of the asset and includes the monitoring and management of the deterioration of an asset over time. Three main types of maintenance activities are defined; preventative, corrective, and unplanned.

- **Preventative maintenance** - involves the controlled care and repair activities carried out to reduce the probability of failure or degradation of asset performance. It includes routine inspection and monitoring, upkeep and repair, testing and component replacements. Preventative maintenance expenditure increases over time as assets age.
- **Corrective maintenance** - involves activities to repair asset defects identified as result of condition assessments or failures. Corrective maintenance expenditure increases over time as assets age and deteriorate.
- **Unplanned maintenance** - involves activities to immediately restore supply or make a site safe in response to unplanned failures. Unplanned maintenance expenditure increases over time as assets age and deteriorate.

Power and Water undertakes a three yearly ground based visual inspection and an annual visual/aerial inspection cycle to assess the health of pole and tower assets. Included in these inspections is an assessment of the above ground and accessible components of the assets and the structure earthing systems. An inspection involves a judgement of condition and risk of failure based on a visual assessment and, in conjunction with system performance tracking, provides a pointer to potential asset integrity issues. High risk assets are prioritised for further investigation and testing.

5.5.5 Renewal

Risks associated with assets in the network change over time and are often unique to the class of asset. Changes in the level of risk are linked to the age of the asset compared with its design life

and the condition of the asset. Asset renewal is the establishment of a new asset in response to an existing asset's condition or risk. The risk is strongly dependent of the criticality of the service provided by the asset and the impact of loss of that service. The need for the renewal of existing assets is assessed in response to an assets performance, the economy of performing its function and the risk associated with the loss of that service. The condition of the asset is typically identified during the asset maintenance stage of the asset lifecycle. Asset renewal provides an opportunity to review current and forecast use in order to optimise the utilisation of an asset whilst managing the safety and reliability risks associated with the failure of the asset.

There are three approaches taken to forecasting capital expenditure associated with asset renewal and these are pooled, programed or scoped (Figure 5-7). Typically, different asset modelling methodologies are used to predict when assets will need to be replaced for each of the forecasting approaches. The choice of the approach depends on the volume, value, availability of information and the risk. The type of modelling used is detailed in the AMPs as they are specific to the asset class.

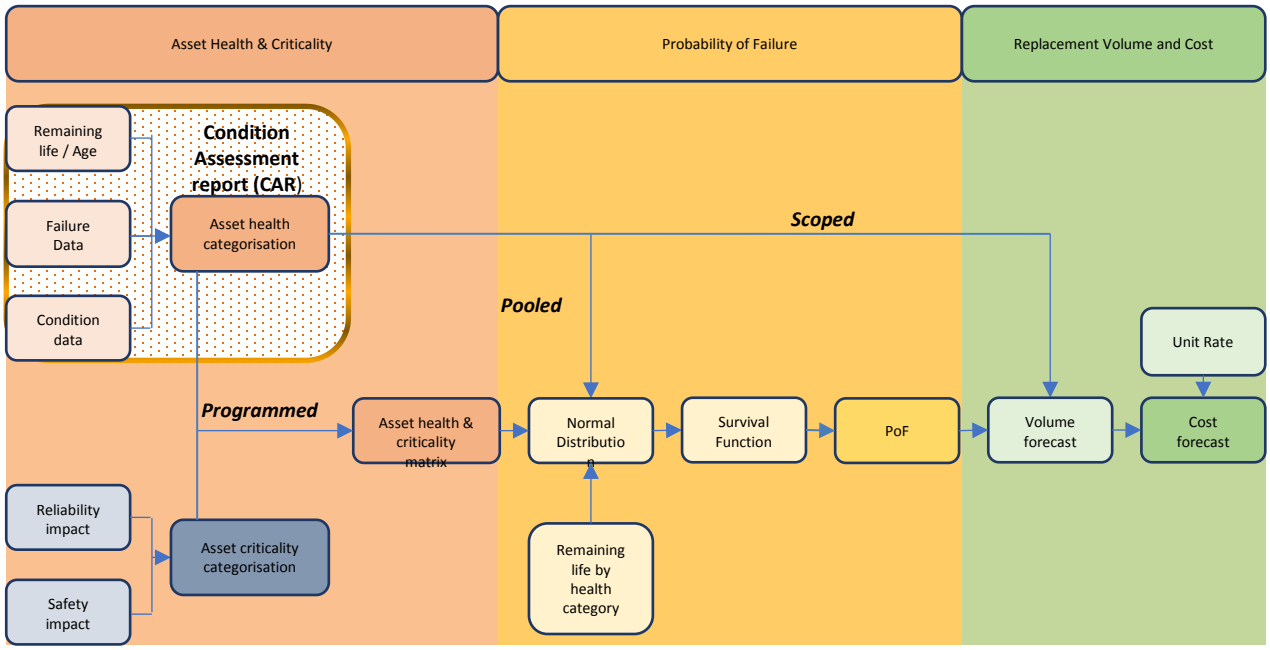


Figure 5-7: Relation between asset renewal modelling and Capital Expenditure Category

Pooled capital is used for asset classes that are typically run to end of life although it should be noted that 'end of life' may be functional or conditional (not meeting minimum specification). The approach used is probabilistic. When the age at which an asset fails is known a normal distribution is applied which is converted into a survival curve allowing the probability of failure to be determined and the volumes forecast. When the asset age at the time of failure is unknown the annual fail rates are trended to provide the replacement volumes. The unit rates are again applied to obtain the forecast cost.

In the case of scoped replacements the asset health is determined in a very detailed manner. It considers age, condition information, operating performance, reports and failures which are formally reported in a Condition Assessment Report (CAR). This is used to forecast the remaining life (in years) in the broad categories of less than 5, 5-15 and greater than 15. As scoped programs

are usually applied at asset rich sites, such as zone substations, it aids in the determination of extent of replacements activity at the site. The options for asset rich sites typically include a comparison of total replacement, staggered or piece meal approaches. It should be noted that in these assessments the criticality is applied at a whole of site perspective.

The most advanced modelling approach is applied in programmed replacements and uses a combination of health and criticality to assess the risks across the network. The health and criticality methodology[24] supports the decision-making process for investments required on existing assets by identifying the need for investment, together with the timing of when the investment is most likely to be required. The options (i.e. the "how") are addressed separately from the framework to ensure that there is apposite consideration of all reasonably practicable options that could address the need.

The health and criticality methodology supports the decision-making process by providing a perspective on the risk within an asset group. The addition of a value framework to the health and criticality framework will allows consideration and comparison of risks between asset classes. This will allow for investment decision-making to be prioritised towards those assets and issues that comprise the greatest risk on the network. The review of risks between classes is often referred to as the 'top down challenge' whilst Power Network has matured a reasonable 'bottom up' approach it is still maturing its top down thinking.

5.5.6 Disposal

The decision to reuse or dispose of an asset is made with consideration of the potential to:

- re-use the asset;
- utilise the asset as an emergency spare; or
- salvage the asset components as strategic spare parts.

The remaining asset is disposed of in an environmentally responsible manner.

5.6 Asset Management [class] Plans (AMP's)

As outlined in Section 2.2.5 (Power Networks Asset Management Plans and Reports), the purpose of the asset management plans (AMP) is to define Power and Water's approach to managing the life-cycle activities for each asset class. AMPs are developed and updated using the latest asset failure and cost information aligned with the approach outlined in the SAMP using the basis of 'objective need'. A recommended implementation strategy that meets the organisation and asset management objectives is assigned for a horizon up to 12-years. A consolidation of all AMPs is then assessed for deliverability with constraints identified in terms of resource or access availability.

The AMPs financial constraints are applied in terms of funding and affordability. The constrained plan will require the implementation of alternative proposals to those initially identified and recommended in the AMPs. These alternative strategies need to be considered in terms of their impact on the asset management objectives in the SAMP. Once considered, the outcomes will be

[24] D2018/72550, Asset Health and Criticality Method

communicated to stakeholders with the identified gaps used to inform the next iteration of the SAMP. The list of AMP's includes;

- Cables
- Vegetation
- Poles and Towers
- Power Transformers
- Distribution Substations
- SCADA & Communications
- Distribution Switchgear
- HV Circuit Breakers
- Other Zone Substation Assets
- Protection
- Conductors
- Poletops/Hardware
- Metering

5.7 Asset Management Spares

Spares Categories

- **Essential spares** - Inventory held for the specific purpose of restoring the network security in the event of a credible contingency event, as defined in the Network Strategy Plan and the Network Technical code and Planning Criteria documents. These items are flagged in the system and clearly identified so that they are not used for general consumption and the stock levels are determined by the Asset Management Group.
- **Project stock** - Inventory purchased specifically for use in the construction of a major project and may be held within the stores system for security or to facilitate testing prior to installation at site.
- **Insurance spares** - Items or assets purchased as part of a major project to specifically support that project's assets in the event of an operational failure whilst the project is in its early operational years. These items are costed directly to the project and held in the stores system at zero cost.
- **Disaster recovery spares** - Inventory purchased to facilitate the restoration of the network following a major event such as a cyclone. In general it consists of, but is not limited to, a range of overhead conductors for the transmission and distribution networks, overhead transmission and distribution hardware, residential connection hardware and fuses. It is a measured increase in the related inventory for the cyclone season based upon the recommendations of the Service Delivery teams.
- **Wet season spares** - This type of inventory is primarily made up of long lead-time items such as pole transformers that are replaced during the wet season due to lightning strikes. The stock levels are increased in November/December and held at this level until March the following year when the reorder points are returned to normal and stock levels reduced through consumption.
- **Repairs and maintenance consumables inventory** - This type of inventory is held within the stores system to facilitate the normal day to day operation of the network. It consists

of general consumable items used on a regular basis such as fuses, poles, conductor, cable and general transmission and distribution network hardware.

- **Repairs and maintenance asset inventory** - This asset inventory is held to facilitate the restoration of services in the event of a failure. It consists of transformers, Ring Main Unit's (RMU's), Gas Break Switch's (GBS's) and Reclosers. In most cases it is used for repairs and maintenance work but can also be consumed for projects to allow stock to be turned over within the stores system.

Power Networks is reviewing their current strategic sourcing arrangements as part of the routine management review process. This review is recognised as a formal project within the Power Networks Business Plan - Strategic Action Plan. Implementing improvements to the management of asset management spares supports the development of the Asset Management (Class) Plans and also aims to improve the ability to demonstrate compliance to the requirements of clause 14.6 - Supply contingency criteria of the Network Technical Code and Network Planning Criteria.

6 Implementation

This section describes the implementation, monitoring and review of the Asset Management framework and systems.

6.1 Approval and accountability

This document has been approved by the General Manager Power Networks

The Group Manager Networks Strategy is accountable for the implementation, review and continuous improvement of the SAMP.

6.2 Roles and responsibilities

Power and Water operates using an Asset Owner/Asset Manager/Service Provider business model. Table 6-A presents an overview of the roles and responsibilities in relation to the management assets. Although there is extensive collaboration and interfacing between the roles, generally speaking:

- the Asset Owner establishes the overall objectives for the assets;
- the Asset Manager develops the strategies and plans to achieve the objectives; and
- the Service Provider performs activities on the ground to deliver the plans.

Table 6-A: Organisational roles and responsibilities

Role	Description	Comments
Asset Owner	**Executive Manager** The primary responsibility for driving asset management and coordinating its links with service delivery objectives and cost lies with each General Manager, or as delegated from the Chief Executive. The Chief Executive chairs the Asset Management Steering Committee (AMSC) to provide the authority to meet the above responsibility.	The Executive Manager has overall responsibility for the underground cable assets, and typically exercises this responsibility through committee and delegation. The Executive Manager is responsible for: • signing off to endorse the AMP; • signing off to endorse all expenditure (capex and opex) in relation asset • attending the quarterly Asset Management Steering Committee (AMSC) meetings to discuss the status assets.
Asset Manager	**Asset Working Group** The Asset Working Group considers the management of assets at a tactical level, mainly to implement the directions of the AMSC and coordinate activities among the asset management practitioners in the organisation. It includes representatives from a range of disciplines across the asset lifecycle: • finance; • compliance; • network planning (transmission); • distribution planning;	Roles and responsibilities include: • Manage, implement and control the asset management program including asset management improvements. • Coordinate the consistent preparation of budgets for maintenance, operation, and replacement / rehabilitation for the assets. • Monitor and report on facility / asset operating and maintenance expenditure against annual allocations, to review the effectiveness of programs and identify any cost benefit improvements. • Coordinate and liaise with Asset Management colleagues.

Role	Description	Comments
	• underground network design; • network protection; • renewal and maintenance planning; • procurement and project management; • field supervisors; • program optimisation; • finance; and • compliance.	• Review and disseminate information on asset management.
	Asset Teams and Communities of Practice Asset teams generally operate within functional service groups to manage specific asset classes. Coordination is needed at the Asset Working Group level because asset types are managed across the overall asset base that require common approaches; e.g. network-type assets or mechanical/electrical plant. These teams aim for a multi-disciplined / multi-skilled workforce that optimises combined operations and maintenance activities for all assets. These groups act as general practitioners of assets under their control, retaining sufficient skills and staff to operate and maintain assets, drawing on expert specialist advice as required.	Roles and responsibilities include: • investigation and analysis in relation to network requirements; • investigation and analysis in relation to asset performance; and • developing detailed plans for the management of assets (augex, repex and opex).
Service Provider	**Field Crews** Field crews are distributed at depots throughout Power and Water's network footprint and perform manual work (e.g. inspections, maintenance, and construction) in relation to the assets as detailed within the asset plans.	Field personnel in relation to assets requiring specialist skill sets: • excavation crews; • cable laying crews; and • cable jointers.

6.2.2 Asset Management Owner

The Asset Management Owner role is a 'Strategic Role' that provides Asset Management direction and governance. The purpose of this role is to lead and develop the Asset Management capability of Power and Water Corporation.

The Asset Management owner is accountable for the following:

- ensuring that the all of business Asset Management Strategy, Asset Management Policy and Asset Management Framework are established, and are in line with Power and Water objectives;
- ensuring that the Asset Management processes are effective and support the organisational and business unit objectives;
- appointment of all Process Owners and monitors the effectiveness of processes;
- undertaking the Asset Management System Business System Owner role and ensuring that the system is effective for the organisation;
- promoting continual improvement for Asset Management;

- communicating the importance of effective asset management and conforming with the asset management processes and practices;
- promoting cross-functional collaboration across and within Power and Water Corporation business units;
- overseeing the structure and rules governing the Asset Hierarchy;
- supporting other management in demonstrating their leadership as defined in the asset governance framework; and
- engaging with Operational General Managers on the effectiveness and changes to the Asset Management direction.

6.2.3 Process Owner

The purpose of this role is to provide leadership around a process across Power and Water.

The Process Owner is accountable for:

- ensuring the asset process is effective, well-defined and supports all Power and Water's business units;
- defining and sponsoring business process change;
- approving changes to the process;
- engaging with other Operational General Managers on effectiveness of the process;
- defining the process strategy, and periodically reviewing the process strategy to ensure that it is still appropriate and change as required;
- periodically auditing the process to ensure compliance to policy and standards;
- communicating process information or changes as appropriate to ensure awareness;
- addressing issues with the process (including implementation);
- working with the Process Managers to review and prioritise improvements to the process;
- overseeing the process performance metrics;
- being the ultimate decision-maker and contact for the process;
- reporting to the Asset Management Owner on process maturity, strategy and performance;
- engaging with Operational General Managers on the effectiveness and issues of the process within their areas; and
- engaging with Process Managers on process issues and implementation.

6.2.4 Functional Roles

Operational General Manager

The purpose of this role is to lead the delivery of services and asset management for their business unit.

The Operational General Manager is accountable for:

- development and implementation of Business Unit Strategic Asset Management Plans (SAMP's) and Asset Management Plans (AMP's);
- performance of the services and assets their business unit manages;

- effective management of their assigned services (and associated assets) in accordance with strategic objectives, legislation and regulatory requirements;
- ensuring that current asset strategies and plans are in place for all critical assets, supported by an appropriate Capital Program;
- ensuring their business unit is compliant with the Asset Management Policy and Strategic Asset Management Plan;
- embedding appropriate Risk Management, Safety, Environmental and other practices within their business areas;
- the accuracy of the asset information that is provided to inform decisions;
- effective implementation of the Power and Water Asset Management processes; and
- the appointment of Business Unit Process Managers for each of the asset processes.

Asset Managers

The Asset Managers are accountable for:

- overseeing the process of defining the maintenance and replacement practices for business unit assets;
- managing the development, implementation and monitoring of maintenance policies, procedures and plans using the corporate Asset Management System (AMS);
- overseeing the auditing of maintenance processes, the investigation of asset failures and the implementation failure investigation recommendations;
- assisting in the development and management of the maintenance and refurbishment budgets; and
- consulting with business unit staff and business partners to identify areas of improvement on existing operational processes.

Process Manager

The purpose of this role is to lead and implement a process within a business unit.

The Process Manager is accountable for:

- working with the Process Owner to plan and coordinate all process activities;
- assisting with process design;
- defining and agreeing with the Process Owner the appropriate policies and standards to be employed throughout the process;
- ensuring that Process Practitioners have the required knowledge and the required technical and business understanding to deliver the process and understand their role in the process;
- ensuring that appropriate process and work instruction documentation is available and current;
- ensuring that all activities are carried out as required throughout the process lifecycle;
- working with the functional Business Managers to:
    - appoint people from their business unit to the required practitioner roles;
    - manage resources assigned to the process; and

  - ensure the role and performance expectations is built into the process practitioners MyPlans;
- working with other Process Managers to ensure the smooth running of processes across all business units;
- monitoring and reporting on process performance;
- working with the Process Owner to identify, review and prioritise process improvements;
- making improvements to the process implementation;
- maintaining awareness of the business priorities, objectives and business drivers;
- maintaining awareness of the role the process plays in the enterprise model and enabling the business unit and corporate objectives to be met;
- actively maintaining the knowledge and information necessary to complete their role;
- managing process practitioners and maintaining operational forums;
- understanding and interpreting concepts from within the Power and Water asset management practice to ensure adherence to procedures within the process;
- providing the Operational General Manager with;
  - performance reporting on process;
  - advice on any issues raised with Process Owner; and
  - status of the implementation and monitoring of the process; and
- working with the Process Owner on improvements and raising Business Unit related issues.

6.3 Power Networks Asset Management boundaries with other functional areas

The application and implementation of Power Networks asset management activities requires collaboration with other Power and Water Business Units identified in the previous section. In addition, the asset management policy and framework supports, and is consistent with, other management policies, strategies and frameworks within Power and Water. The key interfaces are illustrated in the table below.

Table 6-B: Key organisational interfaces

Business Unit	Asset Management related aspects			
System Control	Has a statutory role in monitoring and controlling the operation of the power systems in the Northern Territory.	Responsible for overseeing the safe, secure, and reliable operation of the Territory's regulated power systems.	Compliance with statutory obligations are as per the System Control Licence issued by the Utilities Commission.	Responsible for real time operations, operations planning, power system technical assessments, incident reviews, and operational and technical regulatory reporting.
Chief Financial Officer	Provides strategic financial advice on financial and budgetary management across	Financial control and capital structure, the capital investment process, and taxation	Balancing financial resources against changing and competing demands within the context of	Alignment of financial and asset registers.

	the Corporation, including financial and risk management strategies, interpreting financial information.	matters.	the Corporation's defined business goals and in relation to various business units' requirements.	
People and Culture	Stewardship of the Safety Policy, strategy and SMS Framework including its application to electrical network assets and associated activities.	Human resources and employee relations, organisational capability and culture surveys and analysis for the development and implementation of asset management plans.		
Customer and Stakeholder	The business leads key responsibilities within Power and Water including our brand, our marketing, our relationship with Ministers and Government, customer insight, social media and digital projects.	Operation of the Customer Service Centre, managing the direct interface with customers, dispatching field resources in response to customers' loss of electricity supply and other incidents.		
Business Support	Business systems and information management.	Strategic Sourcing and procurement processes.	Non-network Facilities Management.	
PMO, Risk and Environment	Project Management Office processes and Governance including Business Case approvals.	Stewardship of the Risk Management Policy, strategy and Framework including its application to electricity network assets and associated activities.	Stewardship of the Risk Management Policy, strategy and Framework including its application to electricity network assets and associated activities.	
Strategic Projects	Co-ordination and implementation of Strategic Action Plans			

6.4 Communication

6.4.1 Awareness

To reinforce management's commitment to the asset management objectives as stated in this SAMP and the importance of meeting customer, statutory and regulatory requirements, management will ensure that this SAMP and associated documents are consistently and effectively communicated throughout the organisation; using any, or all, of the following means:

- management roadshows in accordance with the developed communications plan;
- Communities of Practice;
- Power and Water intranet; and
- training sessions.

6.4.2 Internal Communication

Being an electricity network operator, many of the asset management operational aspects for Power Networks are primarily associated with the Safety Management System or the Environmental Management System. Employees are informed of safety related events, initiatives, achievements and performance via a range of sources including the following:

- weekly addresses by the Chief Executive, which are published on the intranet;
- Promapp notifies relevant employees of safety incidents that have occurred in real-time. This includes members of the Executive Management Team, Chief Executive and WHS Manager and occurs by email shortly after the incident is recorded in the system;
- a Corporate Safety Bulletin is issued by email to all Power and Water employees for high risk events. These safety bulletins are also displayed within the Power and Water intranet page with a "safety bulletin" banner. Further communication is included into a Power and Water monthly newsletter with a link to the appropriate bulletin;
- business units also issue safety bulletins locally that are business unit specific. These are discussed at toolbox talks and safety committee meetings along with any other corporate safety bulletins that may have been issued;
- the Power Networks Performance Report is published monthly on the intranet News and Publications page;
- Safety Bulletins are placed on Notice Boards throughout Power and Water;
- corporate WHS personnel attend all business unit safety committee meetings, where a representative will discuss/highlight any high risk events that have occurred during the previous month;
- the Safety Bulletin is issued via the Corporate Communications Team;
- safety events are discussed at safety committee, team meetings, training sessions, toolbox and management forums; and
- email correspondence.

6.4.3 External Communication

In addition to the Stakeholder Engagement Project, Power Networks provides notification to customers about planned works. Planned works advertising is not the only way affected customers are informed. Advertising in the newspaper, internet, radio, Power and Water app and Twitter complements the notification process followed by business units usually undertaking a letterbox drop and/or direct phone calls.

Planned interruptions are usually advertised as follows:

- Saturday edition of the **NT News** - electricity outages - Planned works advertisement;
- Top End **radio stations** (Mix 104.9, Hot 100 and Territory FM) on Monday mornings - electricity outages - Planned works live read - script;
- the **Power and Water internet** Planned Works page is updated daily - all outages and project works;
- the **Power and Water App** is updated daily – all outages and project works;
- **Twitter** notifications (tweets - a maximum of 140 characters) are scheduled every Friday to appear 24 hours prior to an outage – e.g. *Power supply may be interrupted for works in Darwin River on Sunday 3 March, 8am to 1.30pm bit.ly/Power and Waterworks #TopEnd #DarwinNT*; and
- advertising for emergency planned works is dealt with on a case by case basis depending on the impact and number of customers affected.

Where outages are unplanned or last minute, support is available through Marketing and Communications.

6.5 Monitoring and Improvement

The SAMP is regularly reviewed to ensure that it remains up to date and relevant. During the annual (regular) reviews of the SAMP the agreed amendments shall be recorded, together with the approver. The review needs to consider the structure and content of the SAMP as well as the data and information.

The SAMP is set in an environment of continuous improvement from which it informs itself through:

- constant feedback through performance monitors;
- benchmarking and asset management strategies adopted by other utilities (CIGRE, ENA, IWG's, etc.); and
- feedback from third party asset management system reviews such as the AMCV.

The structure and content of the SAMP is:

- aligned with international best practice through the ISO55000 suite of standards; and
- incorporates the guidance established within the Asset Management Council's Asset Management Body of Knowledge (AMBoK).

6.5.1 Monitoring Plan performance

Power Networks are implementing a wide range of business improvements during the period covered by this version of the SAMP. The Asset Management Objectives and the associated implementation measure have been identified and most assigned through the Asset Management Plans or Strategic Action Plan. Ongoing activity is required to ensure that all implementation measures are assigned and to track the progress of the implementation plans. Monitoring the performance of the plan will identify numerous learning opportunities.

Appendix A. Definitions, Acronyms and Abbreviations

Table A-A: Definitions

Asset	An item, thing or entity that has potential or actual value to an organization (ISO55000). For this SAMP, an asset refers to the facilities and infrastructure Power and Water uses to deliver electricity services to its customers.
Asset Management	A coordinated approach of an organisation to realise value from its assets. It translates the organization's objectives into asset-related decisions, plans and activities (ISO55000).
Asset Management Plan	Documented information that specifies the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organization's asset management objectives.
Asset Management Objective	'Asset Management' related result to be achieved (ISO55000).
Asset Management Strategy	An approach to achieve the Asset Management Objective.
Asset Management System	A set of interrelated and interacting elements of an organization, whose function is to establish the asset management policy and asset management objectives; and the processes, needed to achieve those objectives (ISO55000).
Computerised Asset Management System	For Power and Water, the Information Technology MAXIMO or ESRI which contains the list of assets. The system holds each asset's key information and allows other functionalities including tracking asset condition and managing maintenance activities.
Networks	Unless stated otherwise, 'refers' to the Power Network
Strategic Asset Management Plan	Documented information that specifies how organizational objectives are to be converted into asset management objectives, the approach for developing asset management plans, and the role of the asset management system in supporting achievement of the asset management objectives. (ISO55000)

Table A-B: Abbreviations

ABS	Australian Bureau of Statistics
AMCV	Asset Management Customer Value
ENA	Energy Networks Australia
GIS	Geographic Information System
IWG	Industry Working Group
NTG	Northern Territory Government
NTRIS	Northern Territory Regional Infrastructure Study
Power and Water	Power and Water Corporation
SAMP	Strategic Asset Management Plan
SCADA	Supervisory Control And Data Acquisition
SCI	Statement of Corporate Intent
SLA	Service Level Agreement

Appendix B. Stakeholder Engagement

Overview

In pursuit of Power and Water's customer centric goal, Power Networks has an ongoing strategic program for continually improving customer and stakeholder engagement.

Engagement involves both external and internal stakeholders as illustrated below.

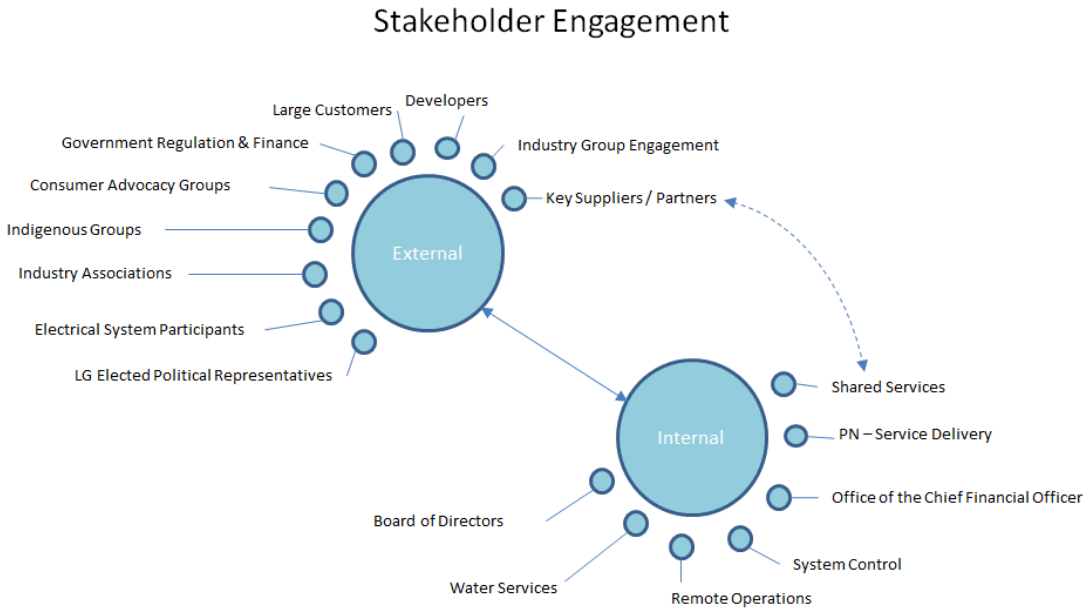


Figure B-1 – Overview of stakeholder engagement

Stakeholders

Regular surveys performed at a corporate level provide valuable information about customer satisfaction levels on services provided.

The following table are the various stakeholder segments currently identified for engagement.

Table B-A: Stakeholder groups

Stakeholder Group	Relationship
Government and Regulation	Build effective working relationships to achieve optimal funding.
Consumer Advocacy Groups	Build and sustain open and transparent flow of information.
Indigenous	Build and sustain open and transparent communication to improve services to indigenous customers.
Industry Associations	Maintain productive working relationships with all industries to achieve mutually beneficial outcomes.
System Participants	Build and maintain open and transparent communication to improve services.
Political	Maintain productive working relationships with all industries to achieve mutually beneficial outcomes.

Large Customers	Build and sustain open and transparent interactions to improve services to provide major users with optimal service levels.

Table B-B: Internal stakeholders

Stakeholder	Relationship
Board of Directors	Sets the corporate strategy and objectives.
Water Services	Power Networks provides network maintenance in accordance with SLA
Remote Operations	Power Networks provides network maintenance in accordance with SLA
System Control	Operates the networks, switching instructions, outage/event/defect recording in accordance with SLA. Operate network in line with Regulatory Obligations such as System Security.
Office of the Chief Financial Officer	Provides Governance and Management Systems for compliance, financial and management accounting, strategy, sustainability and internal audit.
Shared Services	Provides Governance, Management Systems and asset information systems for asset data repository - access, availability, integrity, quality and security. Health, safety, environment and risk, legal services and insurance. People (competencies), sourcing (procurement and outsourcing) and facilities (non-network assets).
Power Networks – Service Delivery	Asset Management Plan implementation. Optimised scheduling and management of resources, network access, inspection, maintenance, repairs and emergency response. Provision of timely and quality asset condition and failure information.

Appendix C. AM Governance framework

Governance Framework and Structure

An effective governance framework is essential for the successful delivery and implementation of asset management systems, processes and practices across Water Services, Power Networks, Gas, Generation and Remote Services. The principal responsibility for driving and coordinating asset management is the Asset Management Capability Steering Group (AMCSG).

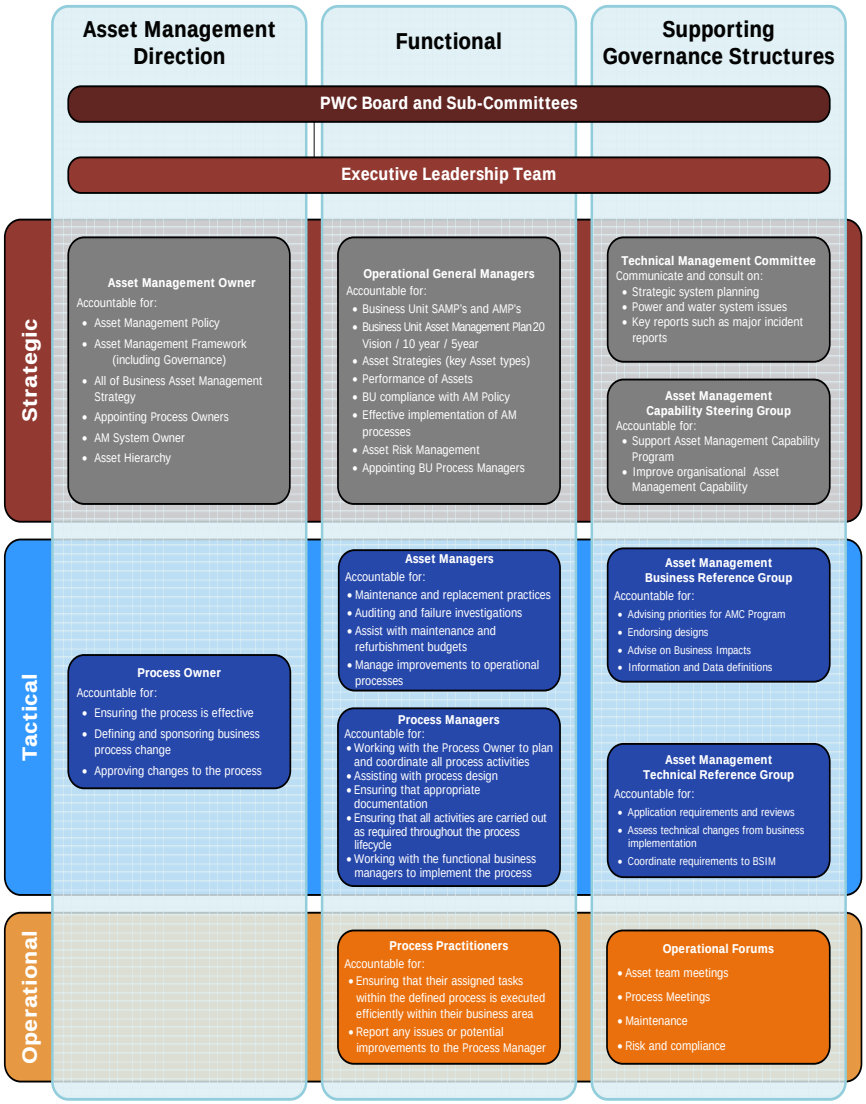


Figure C-1 – AM Governance framework

Technical Management Committee

The Technical Management Committee (TMC) was established in June 2014 and replaces the Procurement, Governance and Strategy Committee, the Power Technical Committee and the System Security and Supply Committee. It reports to the Executive Leadership Team (ELT).

The Technical Management Committee communicates and consults on a wide range of areas including:

- strategic system planning, including reviewing and endorsing business plans and major capital works proposals;
- Power and Water system issues (both planned and unplanned) which pose threats to supply or safety and ensure coordination of appropriate responses to system issues; and
- key reports, such as major system incident reports and ensure that recommendations are actioned.

Asset Management Capability Steering Group

The Asset Management Capability Program Steering Group's role is to:

- ensure that the AMC Program:
    - supports the Power and Water Corporation SCI outcome of 'demonstrate improved Asset Management practices';
    - Improve the effectiveness of Power and Water Corporation's Asset Management Capability to deliver essential infrastructure services to the NT community in a cost effective way;
- assess and make recommendations to program customer on AMC program proposals, deliverables and progress;
- oversee and monitor the AMC program progress, issues and risks;
- provide advice to the AMC Program Director about approaches within the program;
- provide support with and feedback on, the implementation of AMC changes within the business units;
- provide support and solutions to organisational roadblocks which inhibit progress of AMC program implementation;
- engage with the business units and staff on the progress, direction, issues, implementation and requirements of AMC; and
- ensuring the right employees are involved in the various AMC program projects.

Asset Management Business Reference Group

The purpose of the Asset Management Business Reference Group is to:

- advise the AMC Program Director and AMC Steering Group on priorities for implementation;
- endorse AMC project proposals and specifically review priorities associated with the Embedding Asset Management approach;
- advise on development and implementation of Asset Management Discipline across Power and Water Corporation and within Business Units;
- monitor and advise on requirements with respect process development, architecture, data and information cleansing, business and stakeholder impacts;
- regularly provide a review or 'Gap Analysis' against emerging requirements;
- oversee process architecture development and advise process projects on scope, process interfaces and assist with managing risks;

- manage business review and design of application prototypes;
- advise on people and process approach for future AMC Program phases; and
- coordinate between AMC Program and business delivery.

Asset Management Technical Reference Group

The purpose of this group is to:

- review and endorse all 'Current-State' and 'Future-State' ICT architecture definition;
- review and Endorse all AMS requirement specifications;
- assist with management of change of AMS prototype builds and updates;
- advise on technical approach to future AMC Program Phases;
- quality assurance for application, information and integration requirements gathering and definition;
- coordinate between AMC Program, business units and BSIM delivery; and
- escalate risks and issues as required to the Chief Information Officer for AMC Steering Group.

Community of Practice

The purpose of this group is to support the Process Owner in the management of the processes that they are responsible for:

- **Problem solving** – bringing their expertise from a variety of sources to focus on solving the problem, providing benefits to Community of Practice members and their business units.
- **Knowledge creation and sharing** – developing new knowledge that will improve the quality of the processes of the discipline by focusing on finding, collating, organising, evaluating and distributing the knowledge required by process operators to effectively and efficiently use the processes.
- **Best Practice** – developing, validating, documenting and disseminating best practice.
- **Innovation** – focusing on new and emerging areas of knowledge where there may be opportunities to innovate.

Asset Team Meetings

Business Units may establish teams that meet to discuss asset issues and provide an opportunity for maintainers to engage with each other.

Process Meetings

Established as required, these meetings have been defined as a requirement in the work management process development and are generally advised for all the business processes.

Appendix D. Strategy and Asset Management Objectives

Strategy	Asset Management Objectives
Health and Safety	• The workforce has the relevant asset information to safely undertake their role • Ensure the health and safety obligations are addressed in the development of all asset planning activities • Network related operation and maintenance tasks are quantified in terms of risk and used to inform investment decisions that affect Health and Safety outcomes for the organisation
People and Culture	• Develop, mentor and coach personnel though asset management networks to deliver in best practice Asset Management • Apply a workforce that is asset management capable to achieve efficient outcomes and is always seeking improvement • Engage with our customers, community and stakeholders to demonstrate that we have delivered the best possible solutions • Foster collaborative relationships across Power and Water asset professionals to maximise the multi-utility synergies
Environment	• Define environmental responsibilities for the organisational hierarchy to increase ownership across Business Units, leaders and employees • All environmental risks have been defined, mitigation controls implemented and responsibility for risk ownership has been assigned to appropriate leaders • Develop and document clear processes for integration of environmental input into key business processes, including Strategic / Business planning and CAPEX/OPEX planning/SCI/Annual Report • Develop Environmental Improvement Plans for significant risks to reduce risk exposures and tracked through a governance framework • Develop performance indicators for intended environmental outcomes. • Identify and participate in community and industry networks and forums to collaborate on initiatives that collectively achieve environmental performance outcomes. • Participate in formal knowledge share program between Business Units to transfer knowledge, better practices and performance learnings to collectively mature environmental performance
Reliability Strategy	• Manage the delivery of supply reliability to meet the targets and maintain a focus on worst served and vulnerable customers • Deliver the supply reliability at efficient cost through sound planning, design and operations. • Continually improve network standards to guide and drive the planning and design practices for supply reliability. • Ensure that the systems and processes provide sufficient and appropriate data and information to drive optimal asset and operating solutions. • Engage with customers to understand customer satisfaction and willingness to pay for reliability
Quality of Supply	• Establish a set of supply quality standards, based on the network technical specification and standards. • Proactively and systematically measure the network power quality • Ensure electricity networks deliver efficient supply quality requirements appropriate to the supply location.

Strategy	Asset Management Objectives
Financial	• Develop an efficient asset management capability that minimises the long term cost to serve • Ensure that the systems and processes provide sufficient and appropriate financial data • Promote financial awareness and develop disciplined capability • Establish commercial sustainable business practices • Understand the financial risks associated with asset management
Network Asset Integrity	• Meet duty of care requirements • Enhance business and stakeholder engagement in good asset management practice • Develop systems and data that facilitate informed risk based decisions • Ensure that works programs optimise the balance between cost, risk and performance • Ensure the efficient delivery of works programs
Risk Management	• Enable efficient allocation of financial and other resources to achieve optimum benefits and best advance organisational objectives; • Use the corporate risk appetite and tolerances statements to guide asset management decisions and communicate the risk • Identify, review and manage operational and strategic risks • Prioritise projects, programs and plans to achieve efficient and consistent risk mitigation. • Achieve an appropriate balance between cost, performance and risk consistent with regulatory and stakeholder expectations.
Network Standards	• Provide a basis for a uniform and practical approach to network management across Power Networks. • Produce standards that effectively translate required strategy outcomes into low level engineering terms, at a sufficient level of detail to be unambiguously used as working documents for day to day management of the network.
Maintenance	• Ensure that the electricity network assets are maintained in a safe and environmentally responsible manner, contributing to Power Networks safety and environmental objectives. • Ensure that electricity network assets are maintained in a serviceable condition, fit for purpose and contributing positively to Power Networks business objectives. • Ensure that the network asset maintenance program is appropriate in view of the regulatory environment in which Power Networks operates. • Ensure that the network asset maintenance practices are in line with current best practice within Australian and International utilities, where appropriate, and comply with Australian standards and all laws, codes and regulations applying to the Corporation. • Ensure that the costs of network asset maintenance program are consistent with optimum industry benchmarks. • Ensure that network asset maintenance practices embody the principles of the Power Networks risk management policy. • Ensure that the network asset maintenance program contributes to an improved reliability and service outcome for all Power Networks customers. • Ensure continued satisfactory financial return on the investment made in the assets.
Vegetation Management	• Ensure the safety of its employees and the public. • Maintain statutory clearances between network assets and vegetation and deliver duty of care requirements. • Help resolve any issues the public and other stakeholders may have regarding the clearance of vegetation and weed management. • Reduce network system damage and supply interruptions, particularly during storms.

Strategy	Asset Management Objectives
Network Capital Investment	• Provide services to customers at an efficient investment cost • Define and communicate the level of risk associated with the investment program • Provide transparent justification for the capital investment program • Ensure the effective delivery of the capital investment program • Demonstrate sound financial and asset management practices in the creation of new assets
Metering Strategy	• Provide meters to customers in compliance with all relevant statutory requirements. • Provide meters in the most economical manner that is appropriate for the expected loads and tariff structures. • Ensure that all meters maintain the required level of accuracy. • Provide for improved network usage data and the introduction of more appropriate regulated network tariff structures. • Use of meter data to enable better decision making in regard to customer needs, augmentation, fault response, safety, revenue protection, power quality and emerging technologies
Protection	• Detect system faults or abnormal operating conditions and isolate the faulty section of the network. • Safeguard persons, property and equipment in the event of system faults or abnormal operating conditions. • Minimise disruption to supply availability and quality in the event of system faults or abnormal operating conditions • Comply with National Code requirements.
Network Supervision and Control	• To maximise business benefit of the Power Network in the pursuit of the long term interests of consumers • Provide for safe local and remote operation of the network. • Enable routine network switching operations to be carried out effectively and efficiently. • Provide for appropriate and timely responses to system outages and disruptions through automation or the efficient dispatch of field staff. • Develop cost effective network automation solutions that improve customer reliability • Provide data for network management and performance analysis. • Deliver optimum value and life cycle performance from network assets. • Manage operational and associated systems securely and in-line with best practice
Operational Communication	• To maximise business benefit of the Power Network in the pursuit of the long term interests of consumers • Provide communications services to meet the requirements of the business. • Provide communications services to support the safe and efficient delivery of operational activities. • Provide communication services with levels of availability and reliability appropriate for our operations. • Manage operational and associated systems securely and in-line with best practice.