WEL NETWORKS

2021 Asset Management Plan

0800 800 935

wel.co.nz

WEL Networks

OUR PURPOSE

Enabling our communities to thrive

OUR VISION

Creating an innovative energy future

FOREWORD

3 March 2021

Dear Stakeholders,

Thank you for taking the time to review the WEL Networks Limited 2021 Asset Management Plan (AMP).

The 2021 AMP is an overview of our capital and operational expenditure over the next decade. It outlines the investment rationale and performance measurement of our assets that enables our community to thrive through the provision of a strong, safe, efficient and reliable electricity supply.

WEL acknowledges that sustainable business practices are fundamental to our future. We strive to minimise the environmental impact of our operations and embrace initiatives to protect our consumers and reduce energy hardship within our community.

The AMP reflects our vision to create an innovative and sustainable energy future. This vision is clearly demonstrated through projects focused on safety, sustainability and continuous improvement. By aligning our activity to four of the United Nations' Sustainability Development Goals (SDGs 3, 7, 9 and 13); we've placed an increased focus on understanding new technologies and how they can benefit our network and our customers.

For our business to progress, your feedback is essential and I'd invite you to comment on the initiatives outlined in this document either by emailing me (**garth.dibley@wel.co.nz**) or phoning **0800 800 935**.

Garth Dibley

Chief Executive


TWO PERSON
BUCKET ONLY
BUCKET CAPACITY
227KG
INSULATION
46KV
MAX WIND SPEED
100% Electric
VERSALIFT
WEL
Networks
ISUZU
MJP981

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Asset Management Plan (AMP) describes the nature and characteristics of our assets and investment requirements. It also provides an overview of our asset management planning, systems, procedures and practices.

The AMP provides a clear description of the objectives, measures, and targets we aim to achieve on behalf of our stakeholders.

It describes the investments we need to make over the next 10 years and how these activities will be managed to meet the requirements of our current and future customers.

Purpose

The purpose of this AMP is to communicate with our stakeholders by:

- Providing readers with an appreciation of the nature and characteristics of the assets we own and operate.
- Recording the investment requirements we foresee over the AMP period so we can continue in accordance with our purpose of “enabling our communities to thrive” and with our vision to “create an innovative energy future”.
- Providing an overview of how stakeholder interests are incorporated into our asset management planning, systems, procedures and practices.
- Demonstrating the interaction between the plans, our corporate vision and our asset management objectives.
- Conveying our asset management and planning processes, which have been set in place to meet our asset management objectives of safety, high quality customer experience, cost efficiency and asset performance.
- Describing the relationship of the AMP with our strategic plan and its importance as a key planning document.

Where there is technical information in this AMP we aim to explain it in a way that provides meaning and value to all our stakeholders.

Period Covered by the AMP

This plan covers a 10 year period from 1 April 2021 to 31 March 2031 (AMP period). As with any long-term plan, the details tend to be more accurate in the earlier years as it is easier to predict the near-term state of our assets and required actions, plans and expenditure.

Approval Date

This plan was reviewed and approved by the WEL Networks Limited Board of Directors on 3 March 2021.

Scope of the AMP

This AMP covers the WEL assets used in the delivery of electricity distribution services to the customers connected to our network.

Intended Audience

The intended audience for this AMP includes: our community, our customers, the Commerce Commission, the Electricity Authority, our staff, our contractors and other interested parties.

OVERVIEW OF WEL NETWORKS

WEL is owned by the WEL Energy Trust (Trust). WEL supplies electricity to the Waikato and small networks in Cambridge and Auckland. Hamilton is the main electrical load centre. Outside of Hamilton the network area consists of several smaller townships, rural centres and countryside.

Our network is supplied by three Grid Exit Points (GXP) owned by Transpower and two large embedded generators at Te Rapa and Te Uku. Our 33kV subtransmission network connects the GXPs with zone substations which in turn supply our 11kV distribution network. This network feeds our low voltage network supplying the majority of our customers. Our network is more than 5,500km in length and consists of more than 200,000 individual asset components. Within the network we maintain and operate 26 zone substations and 17 switching stations (11kV) to enable a reliable supply of electricity to our customers.

The total electricity delivered in 2020 was 1,284 GWh with a coincident peak demand of 271MW. We have nine broad groups of stakeholders - our customers, electricity retailers, community, regulators, Transpower including in their role as System Operator (SO), service providers, staff, our Board of Directors and Trust. We have identified our customers' expectations through surveys and direct interaction to ensure we continually focus on what is important to our customers. Our stakeholder requirements drive our expenditure plans as discussed in detail in Section 3.1.

KEY THEMES AND INITIATIVES

Throughout this document we describe and explain our key themes and initiatives for the AMP period. They are:

Safety

WEL aims to be the 'Best in Safety'. This aim means that we regularly assess our safety maturity and look for ways to develop and improve. We do this using insights from staff feedback, external and internal audits and benchmarking and through the use of investigation findings. The next phase in our safety journey will include looking at how safety can evolve to be seen as simply part of how we do 'good work'.

We have produced plans and actions to ensure we have a strong focus on continuous improvement. This includes the development of a health and safety strategic road map underpinned by shorter term (annual or biennial) health, safety and wellbeing plans. These plans incorporate the safety of members of the public and our communities along with that of our staff and contractors working on our network. We actively collaborate with our network contractors to share safety learnings and improvement opportunities. We have developed public safety campaigns to provide critical safety information to people living and working around our network.

Sustainability

WEL is continuing to develop a strong sustainability stance and has embarked on a programme of activities in support of this. Underpinning our approach are four of the United Nations (UN) Sustainable Development Goals (SDG). These goals were agreed as being appropriate areas of focus by management and the Board and are aligned to the goals of the WEL Energy Trust.

UN SDG 3	Good Health and Wellbeing
UN SDG 7	Affordable and Clean Energy
UN SDG 9	Industry Innovation and Infrastructure
UN SDG 13	Climate Action

Focussing on sustainability is not a compliance activity rather it is an approach to doing business that considers stakeholder needs and values and ultimately delivers positive results for the organisation.

- WEL wants to be an employer of choice that embraces diversity and where employees are valued and treated well ensuring that the attraction and retention of staff does not become an obstacle to running a successful business.
- WEL also wants to be an ethical, values–based business that recognises our community as a key stakeholder and implements aspects of the strategy to explicitly support the community, particularly those suffering energy hardship.
- Additionally, WEL wants to be a sought after commercial partner, recognised for our innovation in steering the business into the future, embracing new ways of managing the changing energy market and providing **customer-centric** solutions.

Continuous Improvement

We are continually improving our asset lifecycle strategies to ensure effective risk management, delivery of customer service levels and optimal deployment of expenditure. Opportunities for improvement are identified through a range of sources including:

- Performance monitoring
- Internal audit
- External audit and review
- Feedback from staff
- Interactions with external groups including vendors, peer group companies and industry working groups
- Changes in legislative or regulatory requirements

Through the operational excellence programme a structured process for prioritisation, resource management, project delivery, closeout, and benefits realisation has been established. This framework has prioritised the following capability initiatives:

1. Measurement

This project delivered performance reporting which provides feedback on the effectiveness and efficiency of all aspects of asset management and supports a broad range of stakeholders from executive leadership to personnel working directly on our assets. Power BI Dashboards were created to track all stages of the Asset Lifecycle and assist with decision making.

2. Asset Management Planning

This project, which is still underway, will enable WEL to improve the decision making and planning processes in relation to cost, reliability and risk for WEL's investment

3. Works Management

This project completely redesigned the works management process flow and control documentation. The result is greater certainty that competent people are dispatched to the right job at the right time with all the information and resources they need to complete the job safely and efficiently.

4. Customer Initiated Works

The Customer team have mature processes for managing WEL's customers' requirements and the delivery of customer initiated works projects. This project focused on the refinement of managing works and subdivision planning from customer enquiry through to delivery.

5. Maintenance Inspections and Data Configuration

This project, currently nearing completion, has revitalised WEL's asset inspection and maintenance strategies, asset health tracking and maintenance interventions. This includes the creation of Maintenance Engineering Standards, Standard Maintenance Procedures, measurement points, guiding documentation and training material. In essence we have revisited 'how our assets degrade and/or fail', how we will inspect and address this degradation and how often we will need to inspect our assets. The result is an Asset Maintenance Strategy for each of our 14 major asset classes, implemented in SAP and accessed through mobile devices such as tablets.

6. SAP Data Quality Management

This project created a SAP governance framework and governance group to enable control of the areas such as: Data principles and policies, data stewardship and data management.

7. ISO 55001 Certification

This project aims to align our asset management systems to the ISO 55001:2014 standard with the end goal of certification. The first step on this journey was a gap analysis carried out by an external party to inform the cost/benefit analysis for becoming accredited and the creation of a roadmap to accreditation. Alongside this the framework of a Strategic Asset Management Plan has been created to set up the foundation of our alignment to the ISO 55001 standard.

As well as these headline projects WEL continues to improve our smart data analytics and emerging technology capabilities. Chapter 7 provides further detail on these improvements.

Expenditure Forecast

Our forecast expenditure for the 10 year AMP plan is shown below in constant price[1].

Capital Expenditure

Capital expenditure has reduced by an average of $3M annually over the 10 year planning period compared with the 2020 AMP forecast. This is primarily driven by changes to our asset replacement strategy that is discussed further in Chapter 8.

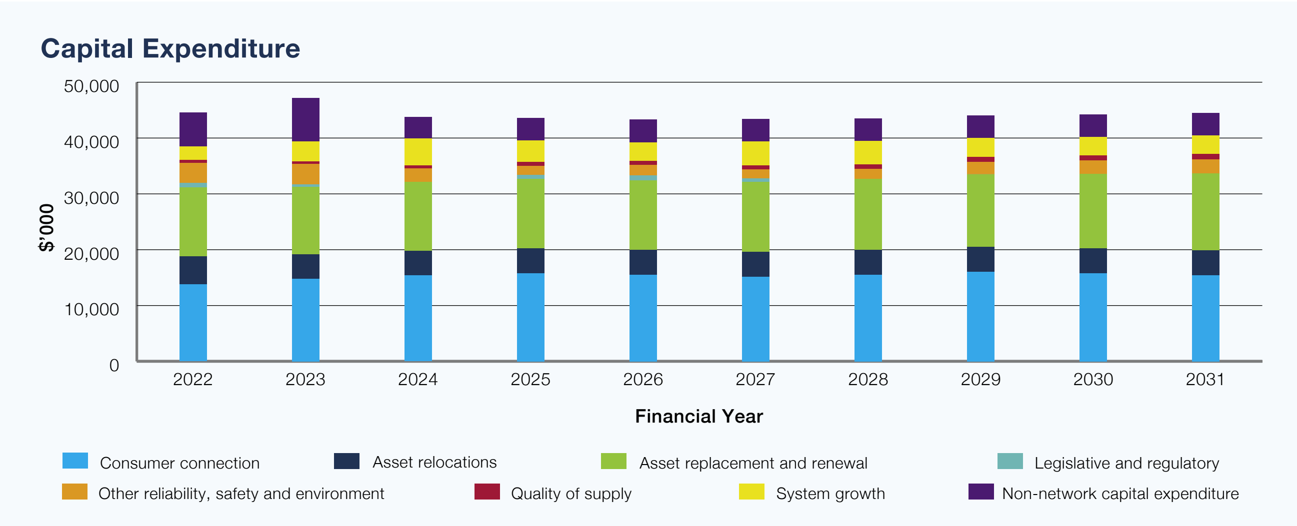

Figure 1: Capital expenditure forecast

Operational Expenditure

Our network OPEX forecast is in line with the 2020 AMP budget. The Vegetation budget has increased in response to greater traffic management costs. A budget has been provided for the new cable testing regime. These costs are largely offset by a decrease in project driven expenses and cost saving from the automation of battery monitoring.

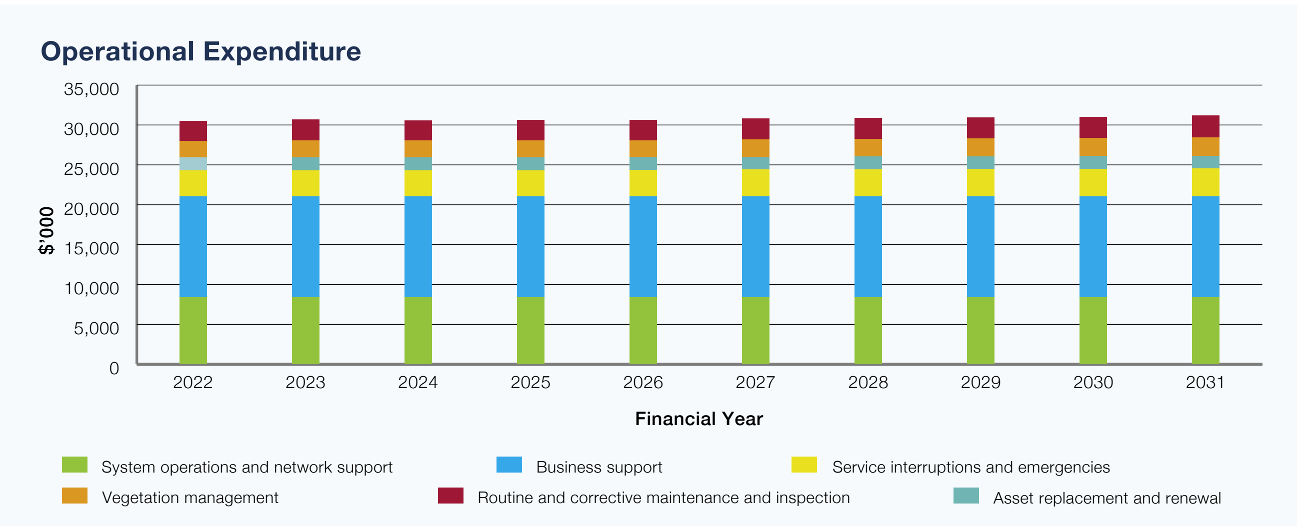

Figure 2: Operational expenditure forecast

[1]Constant Price is the cost expressed at current dollar value and are not indexed for cost inflation

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BACKGROUND

1 BACKGROUND

This chapter introduces WEL Networks Limited (WEL) and our customers. It provides an overview of our distribution network that serves our customer base.

1.1 WEL OVERVIEW

WEL and its direct predecessors have supplied electricity to the northern Waikato for over 100 years. The network area includes the major population centre of Hamilton, and the regional centres of Raglan, Gordonton, Horotiu, Ngaruawahia, Huntly, Te Kauwhata and Maramarua. Our distribution area map is shown in Section 1.2.

The following sections describe WEL's ownership and governance structure, along with our vision, purpose and values.

1.1.1 Ownership and Governance

WEL Energy Trust

WEL Networks is 100% community-owned, with the WEL Energy Trust as our sole shareholder. The Trustees are elected by WEL's customers, with elections held every three years. The Trust is responsible for appointing WEL's Board of Directors. As the Trust is community-owned the income it generates benefits the community that WEL serves.

Hamilton City Council, Waikato and Waipa District Councils, and ultimately their respective communities, are our capital beneficiaries.

For more information about the Trust go to: **www.welenergytrust.co.nz.**

1.1.2 Corporate Objectives and Values

Our corporate purpose, vision and values align with the Trust's purpose statement outlined below. This ensures there is a clear line of sight between the aspirations of the Trust and how we operate as a business.

WEL Energy Trust's Purpose:

"Growing investment for our community"

The Trust's purpose is to grow investment for our community by being diligent shareholders and by utilising our profits effectively in our community through a programme of community grants.

WEL Purpose and Vision:

As our communities grow WEL Networks continues to play an essential role in the region's long-term economic and social development. We do this by identifying and investing in new technologies that benefit our people, modernise our network and future proof our communities.

Our purpose expresses why we exist as a business while our vision describes our future state. Our values describe the mindset required of our people to ensure our success in this aspiration.

Our Purpose

"Enabling our communities to thrive"

Our Vision

"Creating an innovative energy future"

Our Values

A	**Agile**	We listen to ideas, we explore opportunities and we adapt to changing situations with an open mind. When change is needed we make sure we understand why and we make it work. We're flexible and we respond professionally to change.
B	**Build the business**	We make sure our day to day activity is sound while exploring ways to improve the way we work or things we do. We often ask "is there a better way to do this?" and we investigate options.
C	**Care for our people, customers and assets**	We work as a team across the business to do things the right way. We treat others with respect, listening to their needs so we can deliver a safe and reliable service to our communities.
D	**Do the right thing**	We make decisions with integrity and when we can, we help others make the right decision for their situation. We're open, honest and trustworthy. We speak up if we feel we should and we listen to others.
E	**Every day – Home safe**	We lead by example to keep ourselves, our workmates and our communities safe. We use the right equipment, we challenge unsafe acts and we say no if we think it's not safe.

As a business we take pride in these values and demonstrate them in every interaction with our customers and the community.

1.1.3 Corporate and Organisation Structure

This section describes the governance arrangements, organisation structure and key responsibilities of our Executive Management, Asset Management, Operational teams and supporting functions. The aim of the governance and organisation structure is to ensure the necessary accountabilities are in place for good asset management.

Board of Directors and Governance Arrangements

The Trust appoints the Board of Directors, who govern the company and appoint the Chief Executive.

These are the key Board level governance activities relating to asset management:

- Approval of strategic plans.
- Approval of the annual business plan and budgets.
- Approval of the Asset Management Plan (AMP) and corresponding work plan.
- Individual project approval (for projects greater than $2M).
- Monitoring performance against the strategies, objectives and targets in relation to the above governance activities.

The Board receives regular reports and information on strategy, the operational revenue and expenditure of the company, capital expenditure and progress against established timeframes, risk management and compliance, sustainability, performance and any customer complaints.

Organisation Structure

WEL is structured into eight groups: Finance; Asset Management; WEL Services; People and Performance; Commercial Engagement; Technology; Works Programme and Energy Services. Figure 1.1.3.1 illustrates our organisational structure.

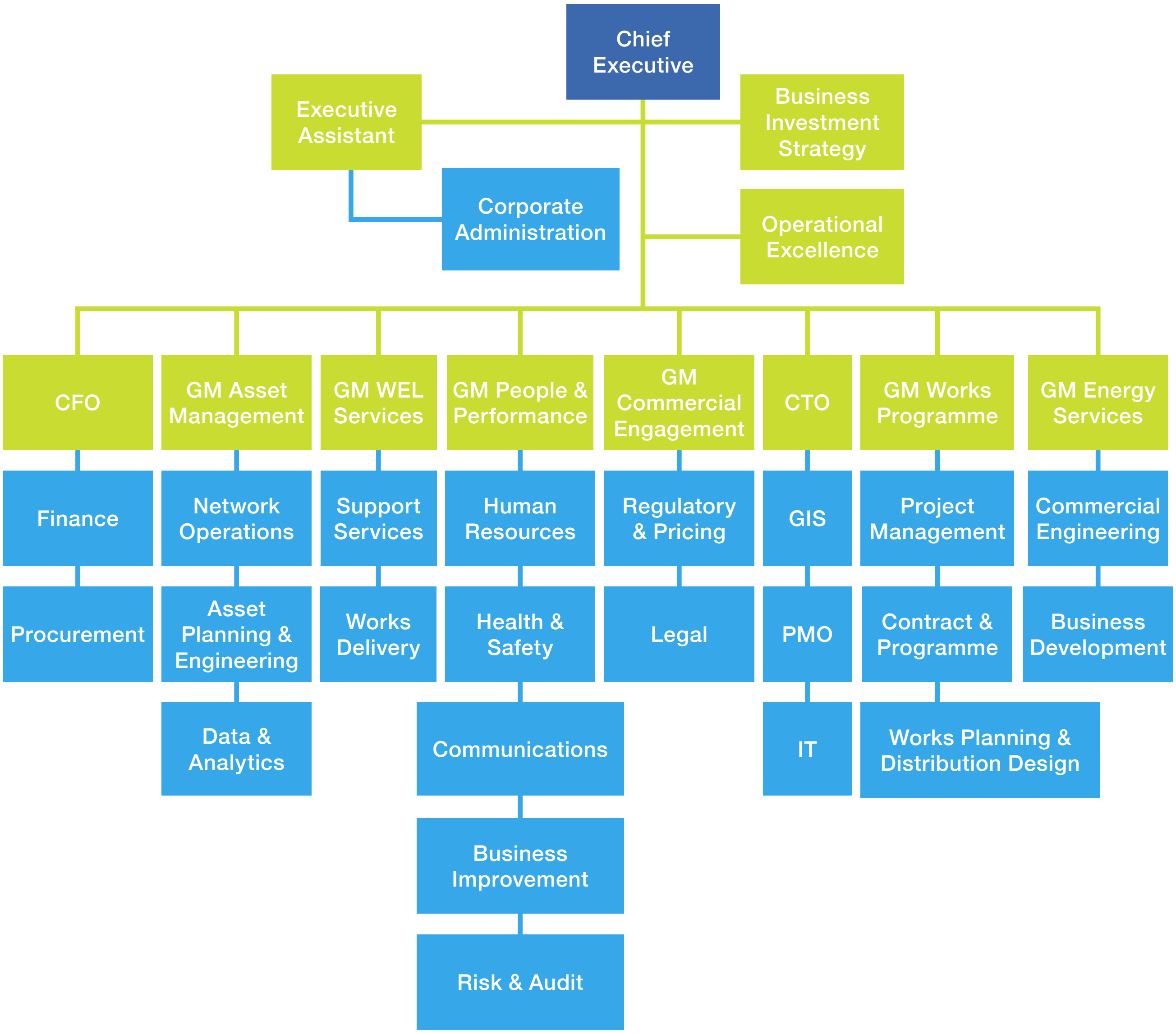


Figure 1.1.3.1: Organisation Structure

Executive Management Team

Chief Executive, Garth Dibley, heads up an executive management team who are responsible for developing and leading the delivery of WEL's business strategy.

Asset Management Group – has overall responsibility for the management and operation of the network assets. This includes ensuring the assets are developed, renewed, maintained, operated and used on a long-term sustainable basis to meet the needs of all stakeholders. Their key responsibilities are set out in the following table.

Teams	Key Responsibilities
Asset Planning and Engineering	▪ Investment planning to meet the needs of stakeholders ▪ Technical and engineering standards ▪ Protection, control and network communication ▪ Inclusion of sustainability initiatives across the network
Maintenance Strategy	▪ Renewals and Maintenance strategy ▪ Development of maintenance standards, policies and procedures ▪ Optimisation of lifecycle costs of network assets ▪ Management of the renewal and maintenance programme
Network Operations	▪ 24/7 monitoring and operation of the network ▪ Control and permitting of access to the network
Data Analytics	▪ Business intelligence and analysis ▪ Asset data management ▪ Data quality management
Distribution Automation	▪ SCADA/Network Management System (NMS) and network automation
Distribution System Operation and Engineering	▪ Strategy – DSO transition strategy and planning and technical standards ▪ Tactical – DSO project delivery, integration and optimisation with DNO functions ▪ Operation – DSO system operation, system support and enhancement

Table 1.1.3.2: Asset Management Group Responsibilities

WEL Services Group – is responsible for works delivery including the build, maintenance and faults restoration of WEL's network.

People and Performance Group – provides the health and safety function to the business, manages the employee life cycle, provision of benefits and workforce planning support. Also included is sustainability management, facilities management, business improvement, communications and risk and audit.

Commercial Engagement Group – sets pricing and provides a commercial perspective on capital investment and third party developments. Has responsibility for regulatory compliance and legal services for the business.

Finance Group – is responsible for financial modelling, reporting, business partnering and treasury management. Additionally manages procurement and the Distribution Centre for WEL.

Information Services Group – is responsible for information technology, the graphical information system and a range of business support systems.

Works Programme Group - provides front-end Customer Initiated Works engagement, design services, project and contract management, annual works plan management, planning and scheduling services.

Energy Services Group – a new group seeking to reduce the cost of energy for WEL's customers and increase unregulated revenue through diversity of investment. With technological changes and movement to increase Distributed Energy Resources (DER), WEL Networks intends to be involved for the benefit of the community.

Delivery

Starting in 2019 WEL Networks undertook a review of our delivery structure and established the Works Programme Group to manage the annual works plan. This model provides clear accountabilities across Asset Management, Works Programme and WEL Services. Work scope is provided to Works Programme from Asset Management prior to the start of the financial year and the delivery of work is planned in collaboration with WEL Services and external service providers as required. Monitoring of delivery is carried out monthly by key stakeholders across the three business units in order to achieve desired outcomes.

WEL Services, as the operational arm of WEL Networks, completes the Dispatch and Delivery of all planned and unplanned work scope including maintenance, customer work, vegetation management, faults and capital projects along with the reconciliation of work order costs, SAP processing and reporting.

1.1.4 Capability

WEL has developed a work type competency standard based on the ENA Common Competency Framework. The purpose of this Standard is to reduce risk to workers and the public by setting the minimum levels of knowledge, skills, and experience (competency) required for WEL employees working on or near WEL network assets. We have commenced a gap analysis which will lead to a training and development programme for each craft and individual. We have introduced “WEL Educated” a Totara learning management system to record staff competencies and provide a platform for our workplace learning. E-Learning modules are being produced in-house, using the skills and experience of our own staff to provide training and assessment on a range of competencies in the framework.

1.2 WEL NETWORKS’ DISTRIBUTION AREA

This section describes our network and provides an overview of our assets grouped according to their function.

Network Overview

Our network stretches from Hamilton in the southeast, to Raglan in the west to Maramarua in the north. We also own and operate small embedded networks in Cambridge and Auckland. Our coverage area is illustrated in Figure 1.2.1.

Figure 1.2.1: WEL Networks boundary and small embedded networks in Cambridge and Auckland

The network assets that are used to provide electricity to the WEL distribution area consist of five main components:

1. Grid Exit Point (GXP)

We take supply from three GXPs (owned by Transpower) located at Hamilton, Te Kowhai and Huntly as described below:

GXP	General Description
Hamilton	Hamilton GXP supplies electricity at both 33kV and 11kV. Hamilton GXP supplies part of Hamilton and the eastern part of our distribution area. Our 33kV subtransmission network from Hamilton has a degree of interconnection with both Te Kowhai and Huntly providing an additional level of backup and security.
Te Kowhai	The Te Kowhai GXP supplies electricity at 33kV. Te Kowhai GXP supplies the remaining part of Hamilton and the western part of our network. There are two large embedded generations in this region, the Te Rapa gas fired generator and the Te Uku Wind Farm. As mentioned above, the 33kV subtransmission network from Te Kowhai has a degree of interconnection with Hamilton and Huntly GXPs.
Huntly	Huntly GXP supplies electricity at 33kV to our northern distribution area. There are five zone substations in this region and Huntly can provide an alternative supply to one zone substation within both the Hamilton and Te Kowhai regions.

Table 1.2.2: General description of GXPs supplying WEL

Overview

Legend

Grid Exit Point (GXP)
Zone Substation
Huntly Network
Te Kowhai Network
Hamilton Network
33kV Subtransmission
WEL Networks Boundary
Proposed New Subtransmission Circuit
Proposed New Substation

Figure 1.2.3: WEL Network Boundary, 33kV subtransmission, GXP and zone substation

2. Distributed Generation

Two large distributed generators are connected to our network.

Distributed Generator	Generator Type	Rating	GXP supported
Te Uku	Wind	64MW	Te Kowhai
Te Rapa Cogeneration	Thermal	44MW	Te Kowhai

Table 1.2.4: Large distributed generators supplying WEL

3. 33kV Subtransmission and Zone Substations

Our 33kV subtransmission network transports electricity from Transpower's GXPs to our zone substations that in turn supply the 11kV distribution network. The subtransmission network is 443km in length and consists of an interconnected mesh around Hamilton, with double and single radial circuits. Zone substations that are supplied with single radial circuits have 11kV distribution circuits providing partial backup.

The level of security provided in the majority of the subtransmission network is known as N-1. This means that the network can withstand the loss of one component and continue to supply electricity to customers.

There are 26 zone substations on the network. All zone substations have two transformers (N-1) except Whatawhata, Glasgow, Finlayson, Raglan, Hampton Downs and Hoeka. These are smaller rural zone substations that supply smaller loads with a single transformer (N security).

The level of security available at each zone substation is in accordance with WEL network security criteria discussed further in Chapter 6.

4. 11kV Distribution

Our distribution system takes supply from zone substations and the Hamilton GXP at 11kV. The distribution system is comprised of 11kV overhead lines on poles and crossarms, underground cables, distribution transformers and switching stations, and consists of approximately 2,652km of 11kV cables and overhead lines, generally known as feeders.

The Hamilton CBD 11kV distribution network consists of 11kV underground trunk feeders interconnecting within the CBD network. The interconnection of the 11kV feeders provides an additional level of security, over and above that provided in the subtransmission network. The CBD distribution system has provided a high level of reliability to the CBD and its urban customers.

In other areas the 11kV distribution network is primarily overhead lines except where they traverse the newer residential areas. All recent and new subdivisions, whether they are rural or urban, are reticulated with underground cables in accordance with district plan requirements.

There are four main types of distribution substations on the network. These are industrial and commercial, residential berm, residential pole mounted and rural substations. Each has different characteristics as outlined below.

- **Industrial and commercial distribution substations** typically consist of enclosed, ground mounted transformers with integrated high voltage switchgear integral to or adjacent to the unit. They are site specific or only distribute electricity to a small number of customers. Low voltage distribution to these customers is protected using either fuses or circuit breakers (CBs) located within the unit.
- **Residential berm substations** consist of enclosed ground mounted transformers with integrated high voltage switchgear integral to or adjacent to the unit. Customers are typically supplied from these units via fuses and underground low voltage (LV) cables.
- **Residential pole substations** consist of pole mounted transformers with high voltage fuses above the unit. Customers are supplied from these units via fuses to LV overhead lines or underground cables.
- **Rural pole substations** consist of pole mounted transformers with high voltage fuses adjacent to the unit. Customers are supplied via fuses and LV overhead lines.

A number of our large customers own distribution networks within their sites. WEL only maintains and operates these where it is contracted to do so.

5. Low Voltage Network

We manage approximately 3,763km of low voltage (LV) lines and cables. Approximately 90% of rural and 40% of the urban low voltage network is overhead lines. All new residential subdivisions, whether they are rural or urban, are reticulated with underground cables.

LV assets include overhead lines, poles, insulators, cables, supply pillars, fuses and other ancillary equipment.

1.3 OUR OPERATING ENVIRONMENT

The environment we operate in is an important factor in delivering our services. There are a range of factors that determine the operational environment. These include:

- Topography
- Climate
- Land access
- Vegetation
- Regulation

The sections below discuss each environmental factor.

Topography

The topography of our region varies greatly from the gently undulating landscapes of Central Waikato, South Auckland and the Hauraki Plains to the steep slopes of the western hill country towards Raglan. The soil of our region is largely free-draining and cultivated. However, there are also areas of peaty loam, peat soils with wetlands in the Waikato lowlands and large tracts of native forest in the western hill country. This adds complexity to the design, construction and operation of our network.

Climate

The Northern Waikato region enjoys a moderate climate with prevailing winds from the west. On occasions unpredictable extreme weather conditions negatively impact the performance and reliability of our assets. Weather related events cause a significant proportion of all interruptions to our customers, particularly in rural areas. This is due to the presence of overhead lines and outdoor assets which are subject to interference from windblown debris and failure during weather events.

Land Access

Our ability to gain access to our existing assets or secure land for new assets is fundamental to our continuing operations. As a Network Operator WEL has special rights under the Electricity Act 1992 for assets built prior to 1992. These special rights give equipment established prior to 1992 existing use rights and the ability for WEL to access and maintain the equipment. WEL is also permitted to access designated road reserves for installation, maintenance and repair of electrical equipment under the Electricity Act.

We acquire easements for the installation of new assets on private property in order to formalise both the landowner's and WEL's legal rights. Obtaining an easement is usually straightforward when a private land owner will directly benefit from the easement e.g. a new connection. However, obtaining an easement for new assets to transit private land where the landowner gains no benefit is often challenging and time consuming.

As such, our planning systems ensure work commences on obtaining the necessary easement as soon as practical in the planning process. A conservative approach is taken to the amount of land required for an easement in order to reduce expense and any delay in the delivery of new assets.

Vegetation

Vegetation located close to our assets has the potential to interfere with the safe and reliable supply of electricity to our customers. We manage all vegetation in accordance with the requirements of The Electricity (Hazards from Trees) Regulations 2003. We do this by patrolling, monitoring and recording sites where vegetation could interfere with the safe and reliable supply to our customers. We trim or remove vegetation accordingly or advise customers of their obligations if at-risk lines cross private property.

Regulation

We operate in a highly regulated environment. As we are community-owned and our size is below the threshold contained within Part 4 of The Commerce Act 1986, we are exempt from direct price and quality control by the Commerce Commission. We remain subject to all other regulatory controls including significant Information Disclosure requirements.

1.4 ELECTRICITY DELIVERED AND DEMAND

As illustrated in Figure 1.4.1, the total electricity delivered at the end of financial year 2020 was 1,284 GWh with a coincident peak demand of 271MW. The total energy delivered by WEL is growing year on year. At the same time WEL is managing peak load to similar levels across the 10 years. This shows effective load management in line with our utilisation KPI in Section 5.5.3.

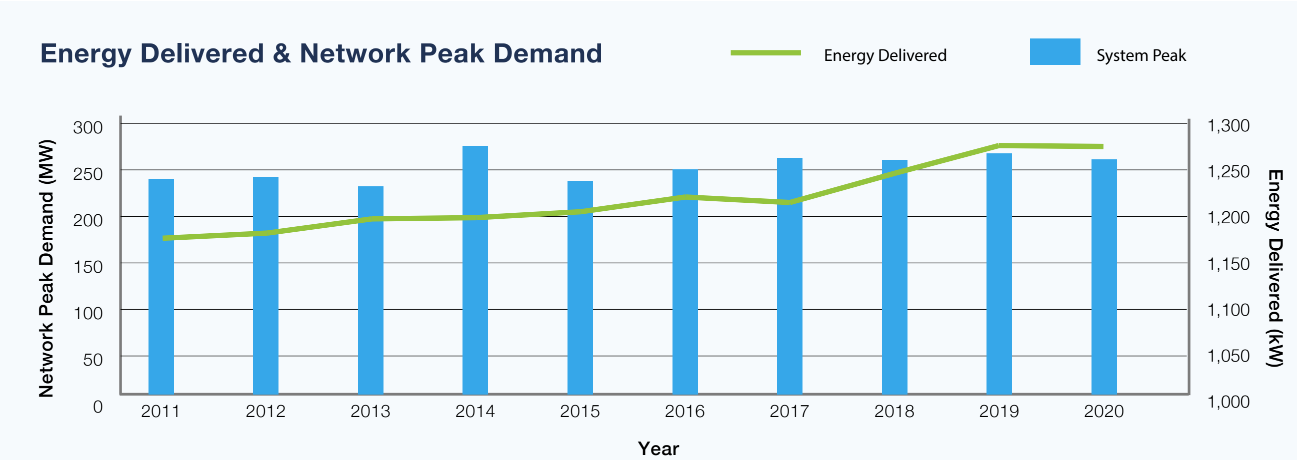


Figure 1.4.1: Electricity Delivered and Peak Demand

The majority of customers across our network have two distinct load profiles throughout the day. For urban customers load is generally high in the morning with a trough during the day and then increasing again in the late afternoon and early evening. Peak load occurs during winter. The rural profile follows a similar pattern with an additional energy and demand peak in summer during early morning and mid-afternoon in line with dairy farms milking times.

.STAKEHOLDERS

As a community-owned company we consider our stakeholder requirements to have utmost importance. Accordingly, we have a considerable focus on identifying and meeting stakeholder expectations. We have nine broad groups of stakeholders:

1. Customers
2. Community
3. Regulators
4. Transpower (including in their role as System Operator)
5. Electricity retailers
6. Service providers
7. Staff
8. Board of Directors
9. WEL Energy Trust

Section 3.1 details these stakeholders and their requirements.

1.5 OUR CUSTOMERS

WEL supplies electricity to a mix of customers across our CBD, urban and rural environments. Our customers range from low-use domestic through to very large users such as the Waikato District Health Board. Effective engagement with customers requires a targeted approach. Our largest customers are regularly consulted on a range of issues important to them through our key account and customer works teams.

Customer Profiles

There are over 92,000 connections across WEL's traditional network area with an additional 1,900 within our networks located in Auckland and Cambridge. This is a 2.5% year on year increase over the 2019 financial year. We are continuing to see strong growth in new connections, both residential and commercial, on the network. The breakdown of load by customer group for the end of 2020 financial year is set out in the table below.

Customer Group	Number of Active ICPs	Electricity Delivered (GWh)	Demand (MW)
Domestic	77,787	514 (40%)	187 (69%)
Non-Domestic	12,234	220 (17%)	
Small Scale Distributed Generation	1,183	11 (1%)	
Streetlights and Unmetered	334	7 (1%)	
Large Commercial	846	517 (40%)	84 (31%)
Embedded Networks	1,898	15 (1%)	n/a
Total	**94,282**	**1,284**	**271**

Table 1.6.1: Electricity Delivered and Demand by Customer Group

1.5.1 Major Customers

We remain in regular contact with all of our major customers to ensure their needs are considered in our asset planning and service delivery. In some instances the specific needs of these customers influence the design and operation of our network for example, additional security levels may be required in the connection of some customers, while others require fast response times to fault events to ensure that essential operations can continue. Our 10 largest major customers are:

- Hamilton City Council
- Waikato District Health Board
- Fonterra/Canpac International
- Datacom Group
- AFFCO
- BT Mining
- Foodstuffs
- University of Waikato
- Pact Group Holdings
- Progressive Enterprises

	Electricity Delivered (GWh)	Peak Time Demand (MW)
Top 10 Customers	157.5	16.3
Percentage of WEL Traditional Network	12.3%	6.0%

Table 1.6.1.1: Major Customers Electricity Delivered and Peak Time Demand

Our two largest customers Hamilton City Council and Waikato District Health Board are suppliers of essential services. They have several sites that require a high level of reliability. Sites such as hospitals will have an alternative supply route. Communications, potable water and sewerage sites all receive priority restoration and reliability provisions under the Civil Defence and Emergency Management Act 2002.

2

ASSET OVERVIEW

2 ASSET OVERVIEW

This chapter describes the population, age profile, and condition of our assets. This chapter should be read in conjunction with Chapter 8 as this discusses the maintenance and renewal methodology and expenditures.

For the last five years, WEL has been capturing the asset condition data using measurement points through the mobility solution and other third party systems (i.e. Omicron Test Manager) that are linked in the Computerised Maintenance Management System (CMMS) function in SAP. Traditionally, condition data was captured in hard copies then saved against the asset record in CMMS. Current methodology minimises inaccuracies and discrepancies in the condition data.

Data sets presented in this document reflect higher accuracies due to the following improvement implemented as part of the data management continuous improvement programme:

- Use of SAP configured measurement points in capturing asset condition through the mobility solution
- SAP master data validation, verification and re-structuring in SAP for ease in generating disclosure and asset management reports

2.1 ASSET POPULATION SUMMARY

A summary of the population and condition of our assets is shown in Table 2.1.1. The condition is presented in the scale we use for grading our assets. Condition 5 represents an asset in ‘as new’ condition and an asset is at condition 0 when it is ‘due for immediate replacement’’[1]. A full explanation of the condition grading can be found in Section 8.2 Table 8.2.1.1.

[1] For regulatory reporting purposes these condition profiles are translated into the Commerce Commission’s H1 to H5 condition scale in the schedules attached to this AMP. The translation from our 0 to 5 condition scale to the Commerce Commission’s prescribed H1 to H5 scales is: WEL Condition 0 and 1 is translated to H1 and 2-5 are H2-H5.

Section	Asset Category	Unit	Quantity	WEL Condition Score					
				0	1	2	3	4	5
2.2	**Subtransmission**								
2.2.1	Poles	No.	2,687	0	0	0	14	163	2,510
2.2.2	Crossarm	No.	2,802	0	0	0	155	478	2,169
2.2.3	Subtransmission Lines	km	187	0	0	0	0	105	82
2.2.4	Subtransmission Cables	km	256	0	0	0	3	28	225
2.2.5	Subtransmission CBs	No.	143	0	0	0	2	2	139
2.3	**Zone Substations**								
2.3.1	Power Transformer	No.	49	0	0	0	0	9	40
2.3.2	Switchboards	No.	55	0	0	0	6	4	45
2.3.3	Substation Buildings	No.	31	0	0	0	4	21	6
2.4	**Distribution and LV Lines**								
2.4.1	Poles	No.	36,520	0	0	34	342	2,861	33,283
2.4.2	Crossarms	No.	70,670	0	0	585	5,326	14,498	50,261
2.4.3	Distribution and LV Conductors	km	3,248	0	0	454	132	600	2,062
2.5	**Distribution and LV Cables**								
2.5.1	Distribution Cables	km	726	0	0	71	60	197	398
2.5.2	LV Cables	km	2,434	0	0	0	533	860	1,041
2.6	**Distribution Substations and Transformers**								
2.6.1	Distribution Switching Stations	No.	17	0	0	0	1	9	7
2.6.2	Distribution Transformers	No.	6,235	7	3	21	167	592	5,445
2.7	**Distribution Switchgear**								
2.7.1	Ring Main Units	No.	1,125	0	0	0	28	141	956
2.7.2	Distribution Circuit Breakers	No.	440	0	0	7	45	30	358
2.7.3	Distribution Air Break Switches	No.	869	0	2	4	7	17	839
2.7.4	Distribution Sectionalisers and Reclosers	No.	175	0	0	0	0	0	175
2.8	**Other Network Assets**								
2.8.1	LV Pillars	No.	28,461	0	0	139	764	22	27,536
2.8.2	Protection Relays	No.	678	0	2	16	106	12	542
2.8.3	Network Management System Remote Terminal Units (RTU)	No.	502	0	0	0	26	0	476
2.8.4	Load Control Equipment	No.	6	0	0	0	0	6	0
2.8.5	Meters	No.	68,009	0	0	0	0	0	68,009

Table 2.1.1: Asset Population and Condition Summary

2.1.1 Asset Health Index (AHI)

Our asset renewal strategy discussed in Chapter 8 utilises the Condition Based Risk Management (CBRM) methodology. In implementing the CBRM approach we have established an Asset Health Index (AHI) for some of the asset categories.

AHIs combine age, condition, environment and location criticality to generate a more comprehensive measure of asset health than a condition score. A Probability of Failure (PoF) is derived from the AHI and combined with consequential losses in order to establish a risk level. An AHI of 0 means the asset is in 'as new' condition with a very low PoF, whereas an AHI of 10 means it is near the end of its life with a high probability of failure. This is illustrated in Figure 2.1.1.1.

Condition	Health Index	Remnant Life	Probability of Failure
Bad	10	At EOL (<5 years)	High
Poor		5-10 years	Medium
Fair		10-20 years	Low
Good	0	>20 years	Very Low

Figure 2.1.1.1: CBRM Health Indices

Where an AHI exists for an asset category it has been included along with the population, age profile and condition information in the following sections.

As part of WEL's continuous improvement initiatives through its Capability Projects (CPs), WEL is streamlining the processes and systems for capturing condition data in the field to improve data quality. This will provide insightful information essential in developing robust maintenance strategies.

2.2 SUBTRANSMISSION

The subtransmission system transports bulk electricity across the region. It connects Transpower's GXPs to our zone substations. It also provides a level of interconnection between zone substations.

The subtransmission network operates at 33kV and is 443km in length, of which 187km is overhead and 256km is underground. The majority of the overhead lines are in the rural areas while the underground network is split between the urban and rural areas.

The following asset categories are included within the subtransmission category:

- Subtransmission poles
- Subtransmission crossarms
- Subtransmission lines
- Subtransmission cables
- Subtransmission circuit breakers

2.2.1 Subtransmission Poles

Population

We have 2,687 subtransmission poles. This has decreased by 15, from 2018, as these were replaced by underground cables. Figure 2.2.1.1 shows the distribution by construction material. The majority are concrete poles, with 29 softwood, 7 hardwood and 102 steel poles in service.

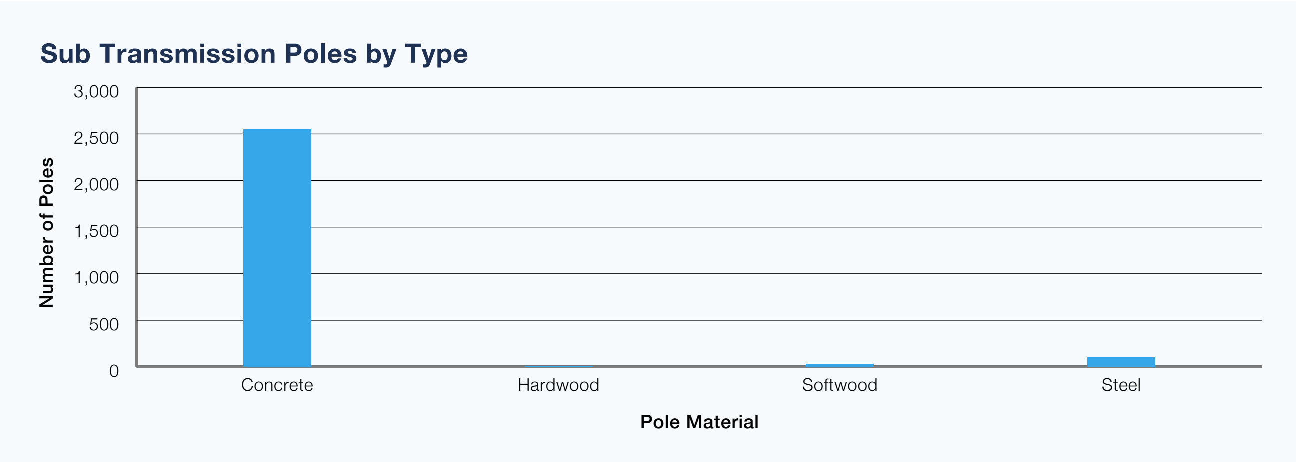


Figure 2.2.1.1: Subtransmission Pole Types

Age Profile

Subtransmission poles share the same age profile as subtransmission lines, shown in Figure 2.2.3.2, as they are installed at the same time. The exception to this is wooden and steel poles that have a shorter life expectancy and therefore require earlier replacement. Our current practice ensures that any new poles installed are concrete in order to provide an increased life expectancy, unless site considerations dictate otherwise. The average age of all poles is 31 years.

Asset	Life expectancy (Years)
Concrete poles	70
Wooden poles (both softwood and hardwood)	45
Steel Poles	45

Table 2.2.1.2: Life Expectancy of Subtransmission Poles

Condition

The condition profile of the subtransmission poles is shown in Figure 2.2.1.3 below. Field inspections indicate that in general the condition of subtransmission poles is good.

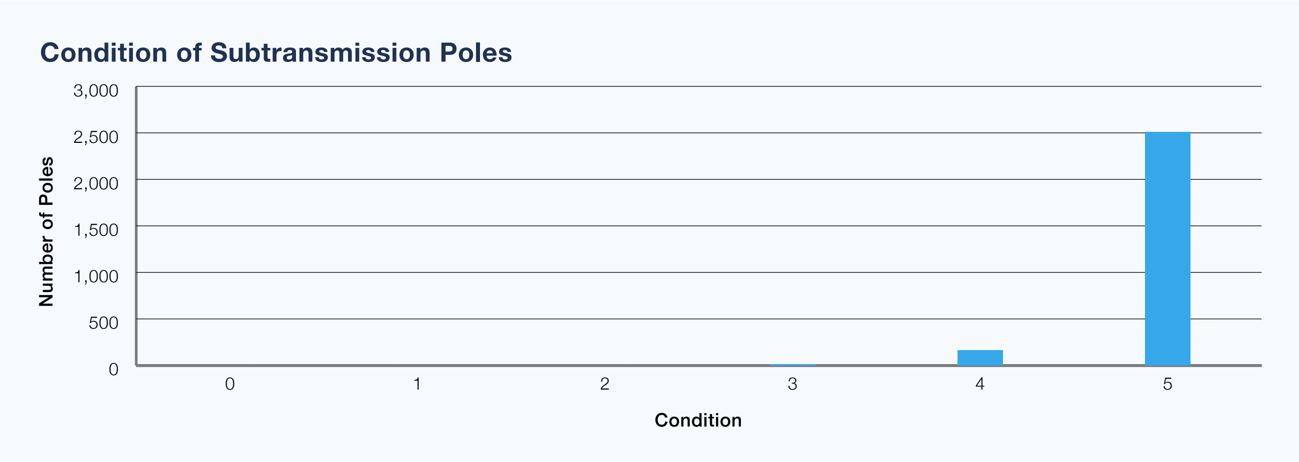


Figure 2.2.1.3: Condition of Subtransmission Poles

2.2.2 Subtransmission Crossarms

Population

We have 2,802 subtransmission crossarms, which decreased by 48 from 2018. This is driven by the undergrounding of sections of the overhead line in conjunction with roading projects. The vast majority are hardwood and our current practice is to install galvanised steel crossarms for new subtransmission poles due to their increased life expectancy and lower resultant whole of life cost.

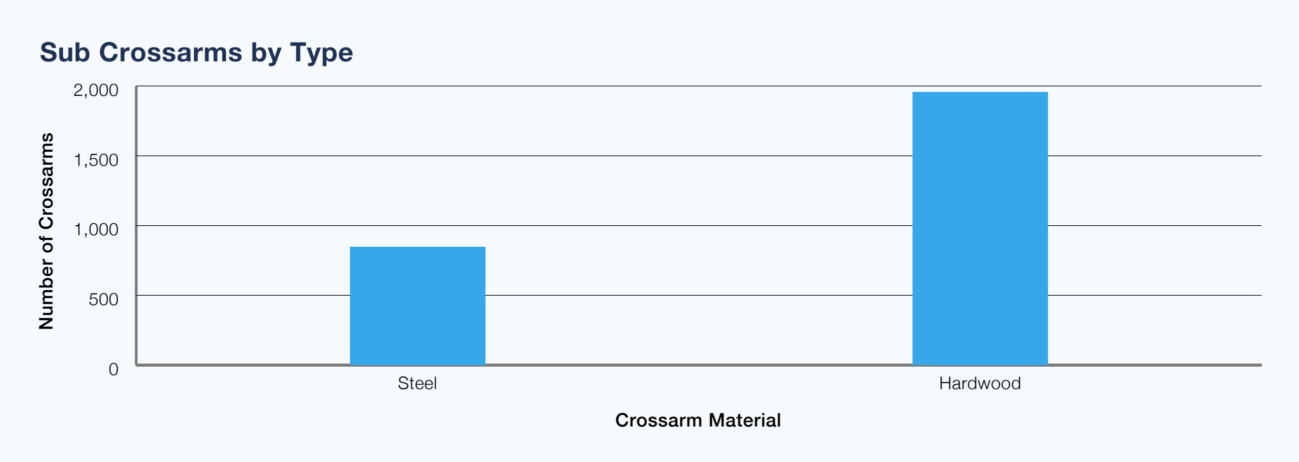


Figure 2.2.2.1: Subtransmission Crossarm Types

Age Profile

The age profile of the subtransmission crossarms is shown in Figure 2.2.2.2. The average age of subtransmission crossarms is 27 years.

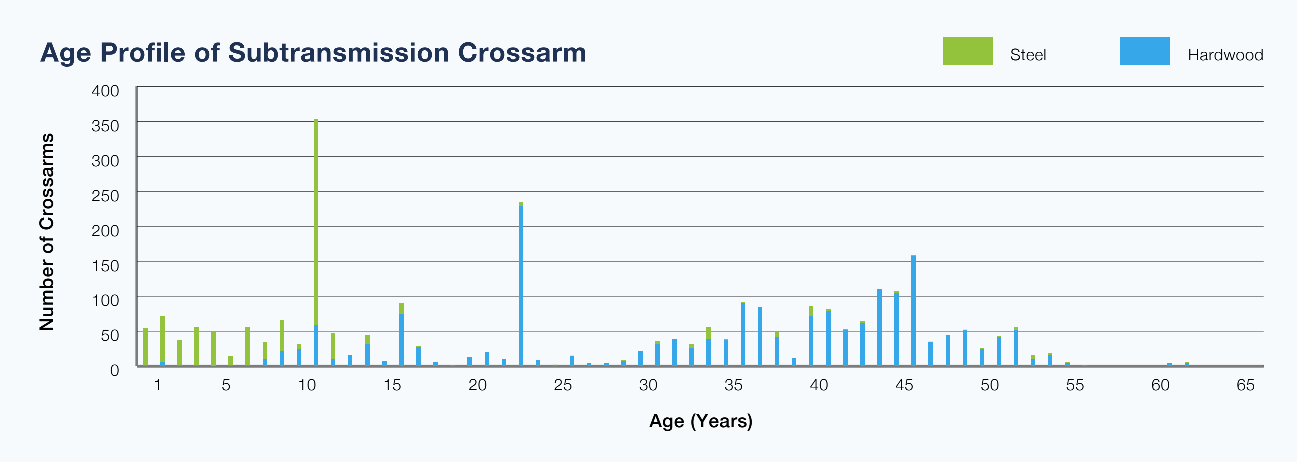


Figure 2.2.2.2: Age Profile of Subtransmission Crossarm

Wooden crossarms have half the life expectancy of the line so must be replaced at least once during a line's lifetime.

Asset	Life expectancy (Years)
Steel crossarms	60
Hardwood crossarms	35

Table 2.2.2.3: Life Expectancy of Subtransmission Crossarms

Condition

The condition profile of the subtransmission crossarms is shown in Figure 2.2.2.4. Field inspections indicate that in general the condition of subtransmission crossarms is good.

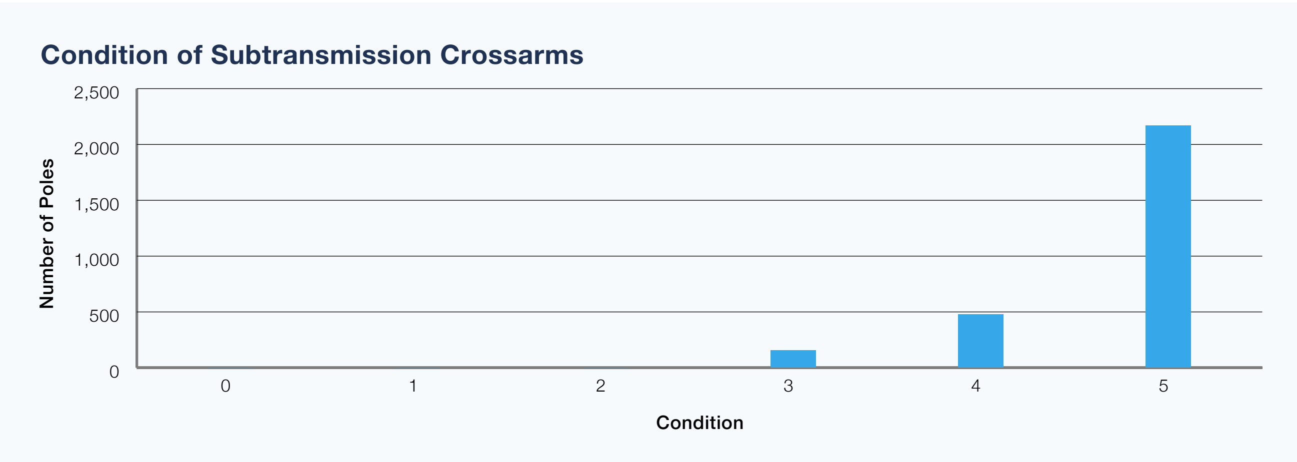


Figure 2.2.2.4: Condition of Subtransmission Crossarms

2.2.3 Subtransmission Lines

Subtransmission lines connect GXPs to the zone substations at 33kV, and are overhead conductors.

Population

We have 187km of subtransmission lines in total, 152.7km in rural areas, 29.7km within the Hamilton urban area and 4.5km in Huntly. A decrease of 4km from 2018 is due to replacement of overhead lines with underground cables.

Subtransmission lines consist of conductors (wire). Four types of conductors are used on our network.

- Copper
- Aluminium conductor steel reinforced (ACSR)
- All aluminium (AAC)
- All aluminium alloy (AAAC)

Copper was the original conductor installed on the network. Since the 1980s the relatively high cost of copper precluded its use and the installation of various aluminium conductors commenced. ACSR was the first aluminium conductor utilised, but more recently AAC and AAAC have been adopted as network standards.

Figure 2.2.3.1 shows the quantity of subtransmission conductor by type.

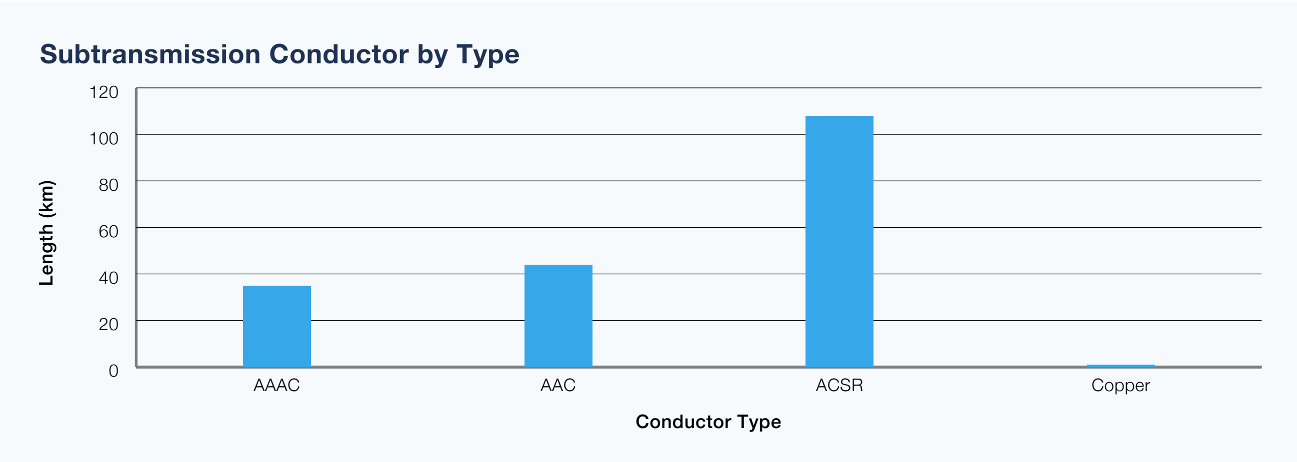


Figure 2.2.3.1: Subtransmission Conductor Types

Age Profile

Figure 2.2.3.2 shows the age profile of our subtransmission lines. The life expectancy of conductors is 58 years and the average age is 27 years. The graph shows the length of line installed in each year. There have been periods of major investment in our subtransmission lines. The spike at year 10 (2010) corresponds to the construction of a subtransmission line to the Te Uku Wind Farm. In year 22 (1998), the link between Horotiu and Weavers substations was constructed. A number of areas of the subtransmission network were strengthened in year 43 (1977). The oldest conductors are 60 years old and located at Horotiu and Dey Street.

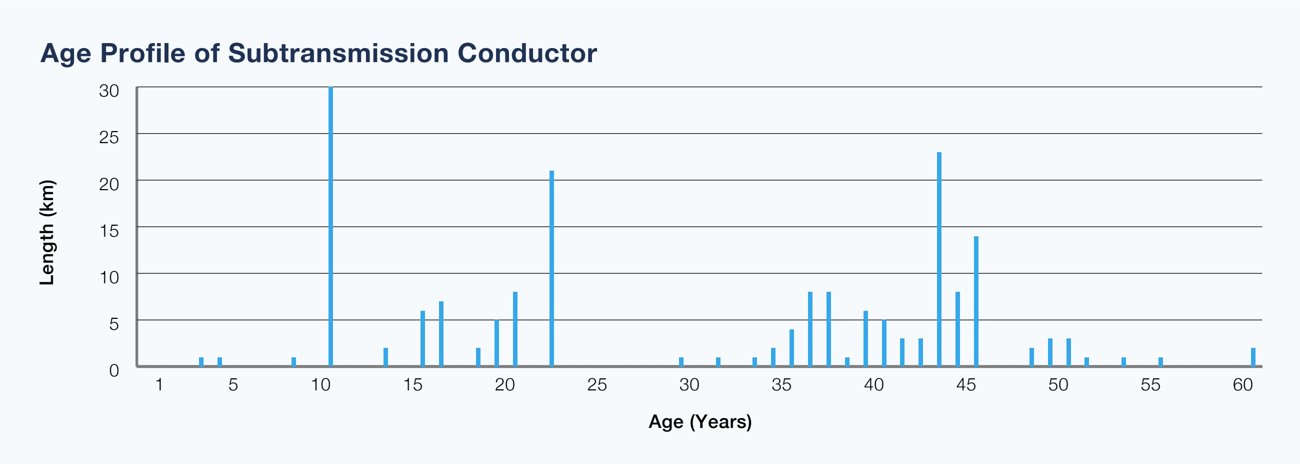


Figure 2.2.3.2 Age Profile of Subtransmission Conductor

Condition

The condition profile of the subtransmission lines is shown in Figure 2.2.3.3. Field inspections indicate that in general, the condition of subtransmission lines is good.

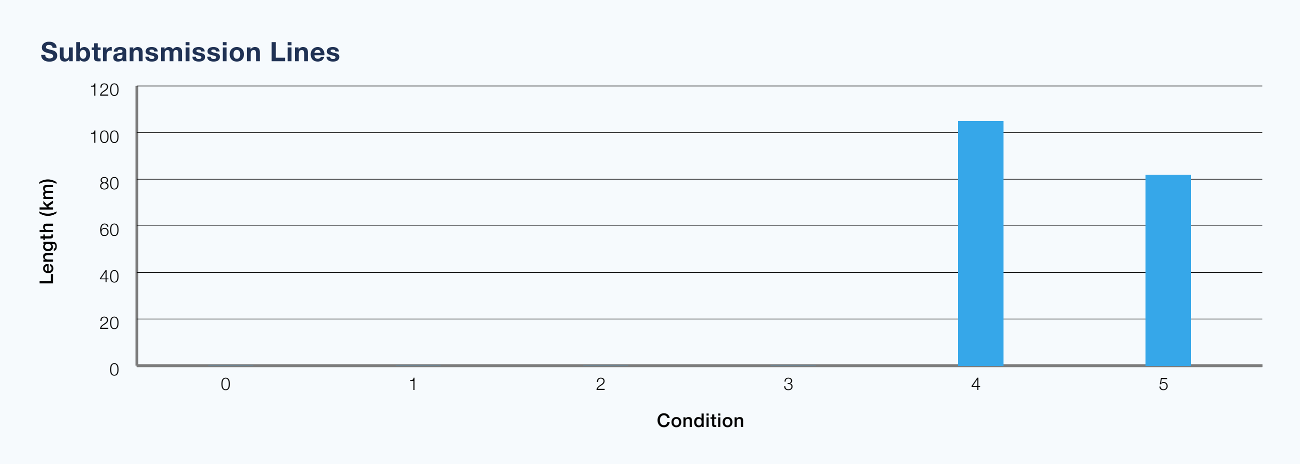


Figure 2.2.3.3: Condition of Subtransmission Lines

2.2.4 Subtransmission Cables

Subtransmission cables connect GXPs to the zone substations at 33kV and are placed underground.

Population

We have 256km of subtransmission cables, with 112km in Hamilton. Figure 2.2.4.1 shows the geographical location of our subtransmission cables. There are two types of subtransmission cables in use. Cross-linked polyethene (XLPE) aluminium cables comprise 90% of cables in use. The remainder are various types of paper insulated, lead covered (PILC) copper cables. The move from copper PILC cables to aluminium XLPE insulated cables began in the mid-1970s. We have standardised on the use of XLPE insulated single core aluminium conductor cables with copper wire screens.

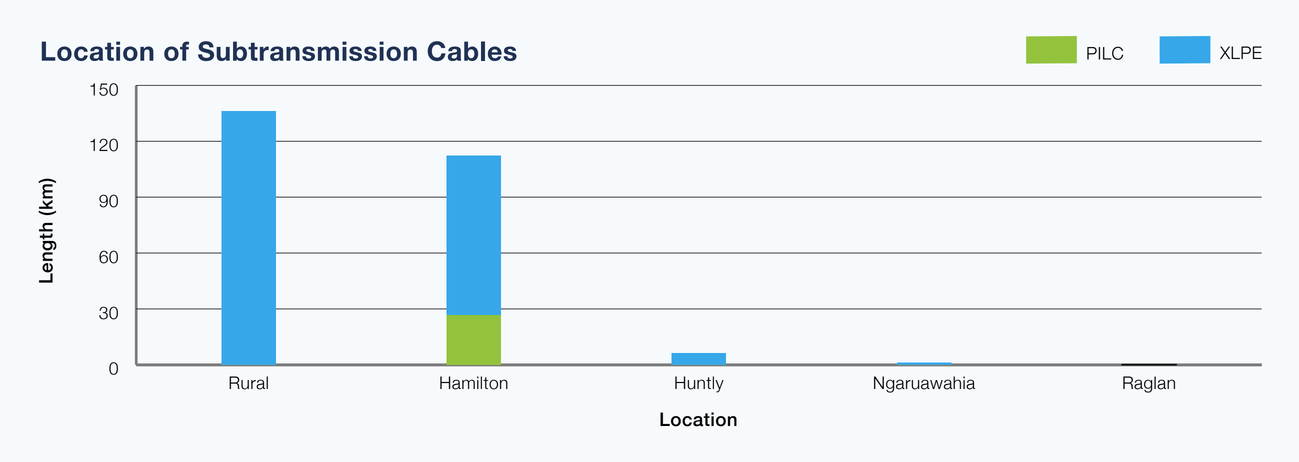


Figure 2.2.4.1: Location of Subtransmission Cables

WEL does not have any gas or oil-filled subtransmission cables in the network.

Age Profile

Figure 2.2.4.2 shows the age profile for subtransmission cables. The age of PILC cables ranges from 38 to 49 years and XLPE cables range in age from new to 50 years old. The weighted average age of the XLPE cables is 13 years and the weighted average age of the PILC is 43 years old. The peak in year 15 was due to the installation of the cables connecting Avalon, Te Kowhai and Whatawhata. The peak in year 10 was due to the cables installed as part of the Te Uku Wind Farm project. The average age of all cables is 24 years.

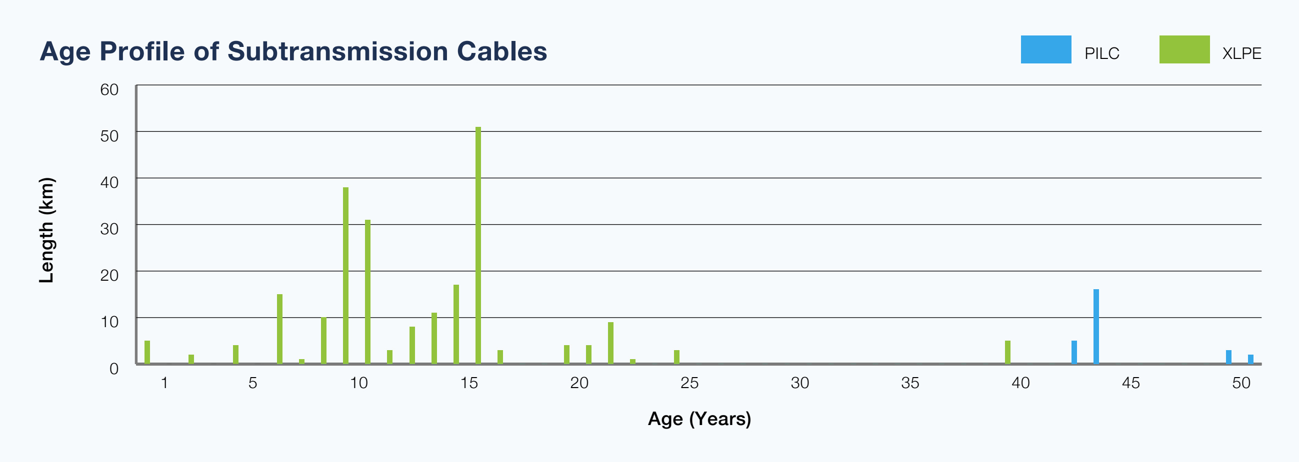


Figure 2.2.4.2: Age Profile of Subtransmission Cables

The life expectancy of the cables is shown in Table 2.2.4.3 below. The oldest cables on our network are 51 years old and are located at Bryce St, Brooklyn Rd and Te Aroha St and their reliability to date is good.

Cable type	Life expectancy (Years)
PILC Cables	70
XLPE Cables	45

Table 2.2.4.3: Life Expectancy of Subtransmission Cables

Condition

The condition of our subtransmission cables is considered to be generally good. The only issues experienced to date are joint failures in a limited number of cables. These failures have been attributed to poor workmanship on that section of the cable network during installation. A programme of partial discharge tests has been initiated to determine the extent of these problems.

2.2.5 Subtransmission Circuit Breakers

The majority of subtransmission circuit breakers (CBs) are located within substations on incoming circuits. Their main purpose is to protect the circuits and equipment from overloads and ensure rapid isolation in fault conditions. A CB is also a switching device that can be operated either manually or automatically. When operated automatically it interrupts the flow of electricity if the current exceeds a predetermined level.

Population

We own 143 subtransmission (33kV) CBs. Three types of CB are in use on our network; oil, vacuum and gas insulated SF_6. Typically the older oil circuit breakers were installed in outdoor switchyards, while the newer types (vacuum and gas insulated) are more often installed indoors. Over recent years, the older outdoor switchgear has been upgraded to indoor switchgear. Consequently, 30% of the fleet remains outdoors. Figure 2.2.5.1 shows the distribution by type.

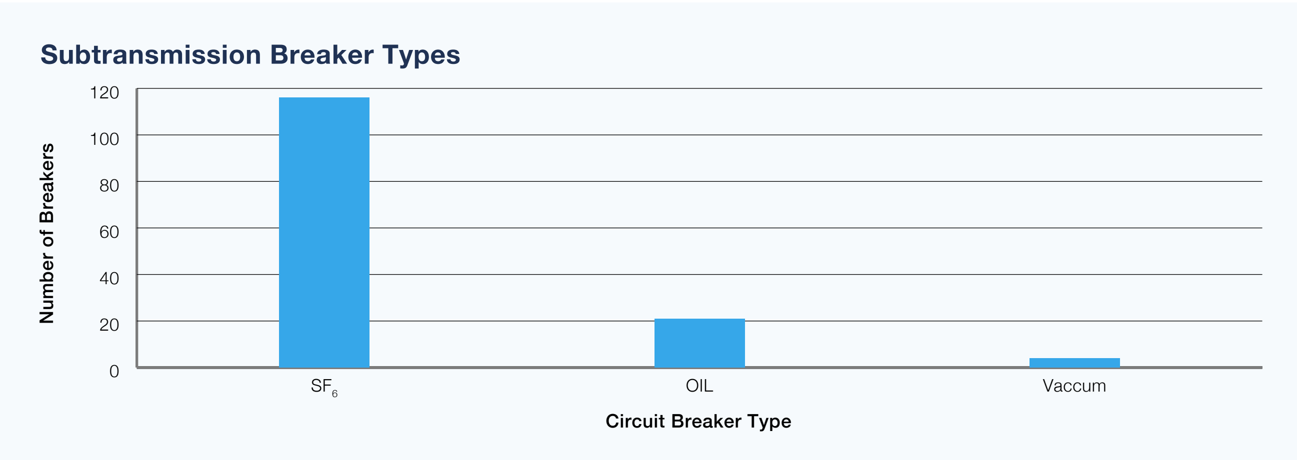


Figure 2.2.5.1: Subtransmission CBs by Type

Age Profile

Figure 2.2.5.2 shows the age profile of the CBs installed on the network. Most 33kV CBs installed over the last 10 years were indoor SF_6 type. The average age of subtransmission CBs is 17 years. This is well below the life expectancy of our CBs shown in Table 2.2.5.3.

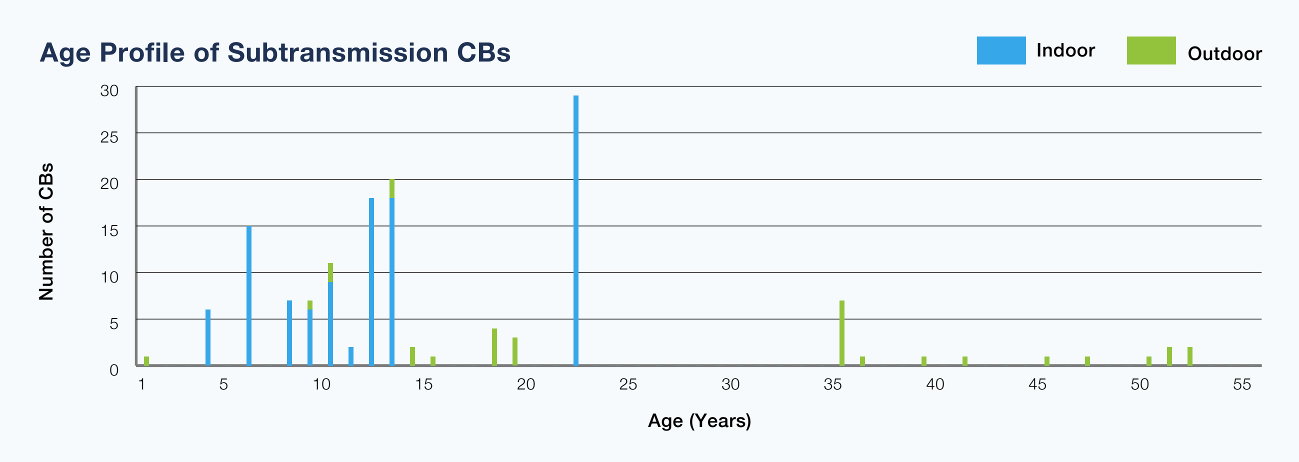


Figure 2.2.5.2: Age Profile of Subtransmission CBs

Asset	Life expectancy (Years)
Outdoor Breakers	45
Indoor Breakers	60

Table 2.2.5.3: Life Expectancy of Subtransmission CBs

Condition

All 33kV CBs are regularly maintained in accordance with recognised maintenance practices and are in good condition. The condition profile of the subtransmission CBs is shown in Figure 2.2.5.4.

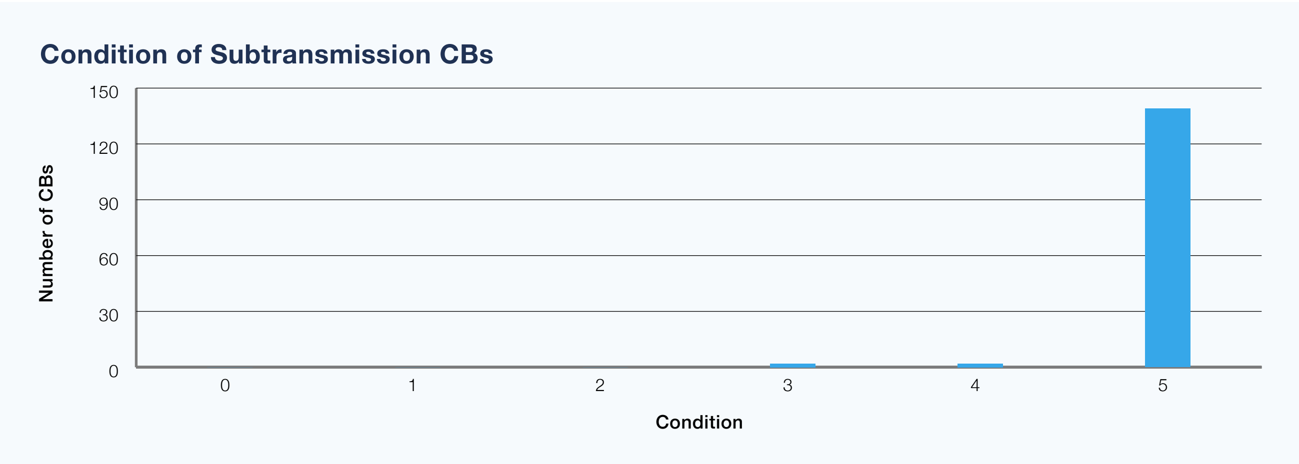


Figure 2.2.5.4: Condition of Subtransmission CBs

2.3 ZONE SUBSTATIONS

Zone substations transform power from the 33kV subtransmission to the 11kV distribution voltage. Switching stations provide the capability to switch load between different zone substation circuits, thereby providing security of supply during fault conditions or planned maintenance.

We operate 25 zone substations sites with construction dates ranging from the 1950s to 2016. Six of the 25 zone substations have outdoor switchyards which include 33kV CBs, outdoor instrument transformers, switches, insulators and busbars. Of the zone substations 16 have N-1 security and 8 have N security in accordance with the WEL security standard, which is discussed in further detail in Chapter 6.

Substations include buildings, outdoor structures, foundations, fences, oil interception equipment and auxiliary equipment such as low voltage AC and DC power supplies. The major plant items located at substations include power transformers and the associated switchgear.

Within the zone substation asset class there are three asset categories:

- Power transformers
- Indoor switchboards
- Substation buildings

2.3.1 Power Transformers

Power transformers reduce the voltage from the subtransmission voltage (33kV) to distribution voltage (11kV).

Population

We own 49 power transformers including spares with installation dates ranging from 1960 to 2015. There are 46 "in-service" transformers. There are also two 10MVA, two 15MVA and one 23MVA spare power transformers strategically located in our zone substations that are readily available when needed.

Figure 2.3.1.1 shows the size distribution of our power transformers. The majority are rated at 15/23 MVA with forced air-cooling.

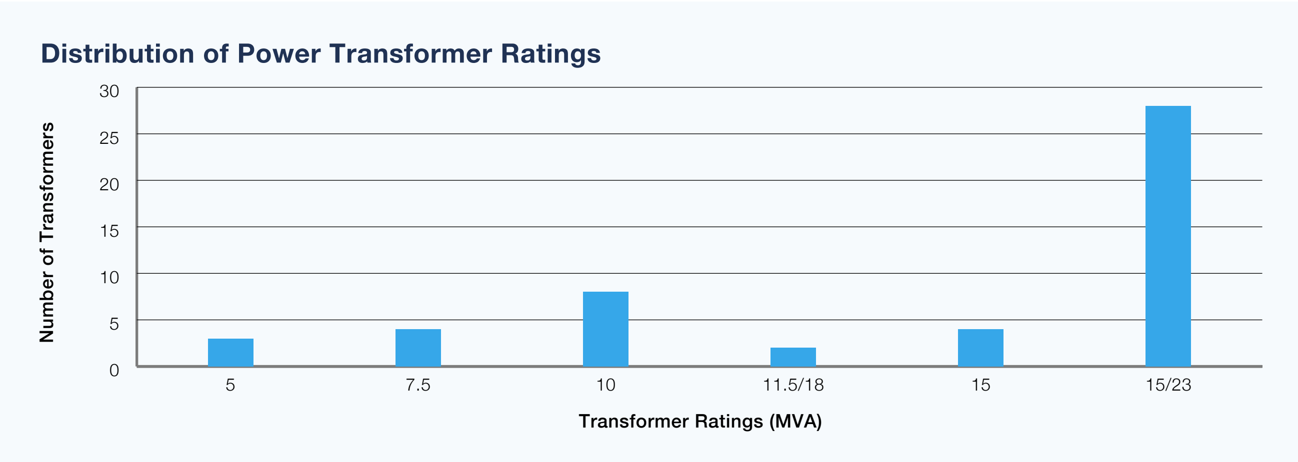


Figure 2.3.1.1: Distribution of Power Transformer by Ratings

Age Profile

The age profile of our power transformers is shown in Figure 2.3.1.2.

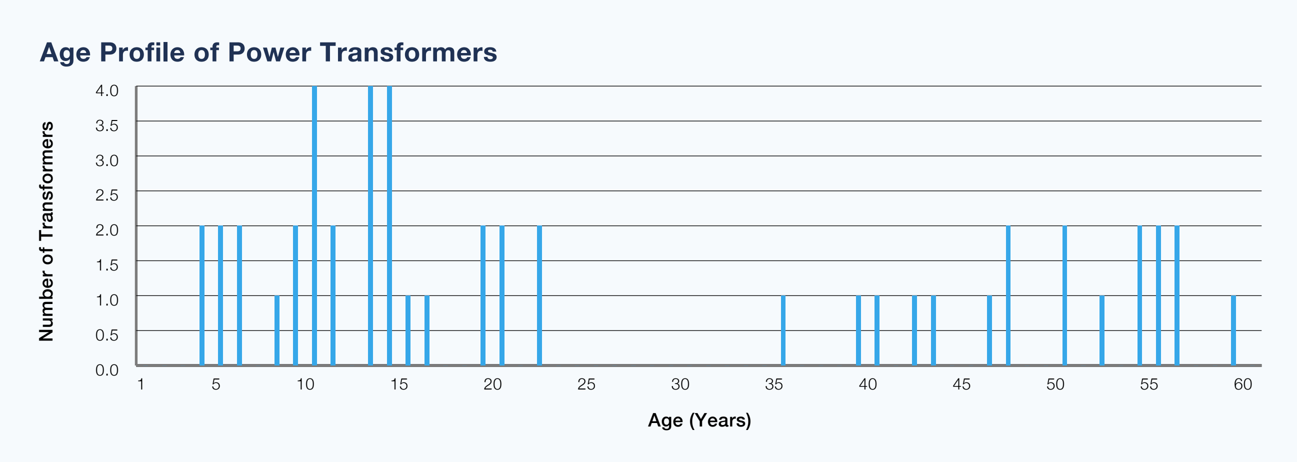


Figure 2.3.1.2: Age Profile of Power Transformers

The average age of the power transformer fleet is currently 26 years old. The life expectancy of power transformers is 60 years. Some transformers undergo a mid-life refurbishment to achieve this lifespan. Transformers often are upgraded, not because of old age, but because the load has exceeded their capacity. In such situations we rotate the transformers from one substation to another smaller one.

Condition

The internal condition of the transformers is monitored by utilising annual Dissolved Gas Analysis (DGA) and periodic furans analysis to give an indication of remaining life. Test results are then correlated with the results from other diagnostic testing such as Sweep Frequency Response Analysis (SFRA) and Dissipation Factor tests. The overall results of the testing shows that our power transformers are in a good condition. This is illustrated in Figure 2.3.1.3.

Figure 2.3.1.3: Condition of Power Transformers

2.3.2 Switchboards

Switchboards contain switchgear that provides control and protection for the network. There are two main types of switchgear; Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS). GIS is located indoors and installed in our newly constructed substations. Rural zone substations with outdoor switchyards are progressively being converted to indoor.

Population

We own 55 (33kV) and 11kV switchboards, with 44 being AIS and 11 GIS within our subtransmission network. Generally, the type of switchboards is a reflection of the age of the substations.

Age Profile

The age profile of the indoor switchboards is shown in Figure 2.3.2.1. The average age of switchboards is 20 years. The life expectancy of switchboards is 60 years.

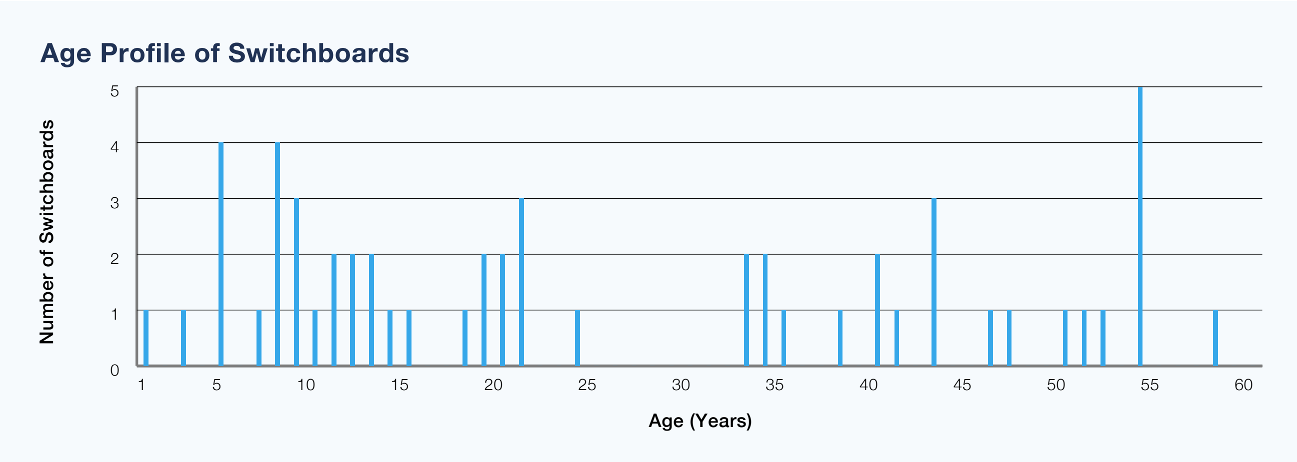


Figure 2.3.2.1: Age Profile of Switchboards

Condition

The condition of the majority of our switchboards is good. Partial discharge appears to be a problem for some of the older ones.

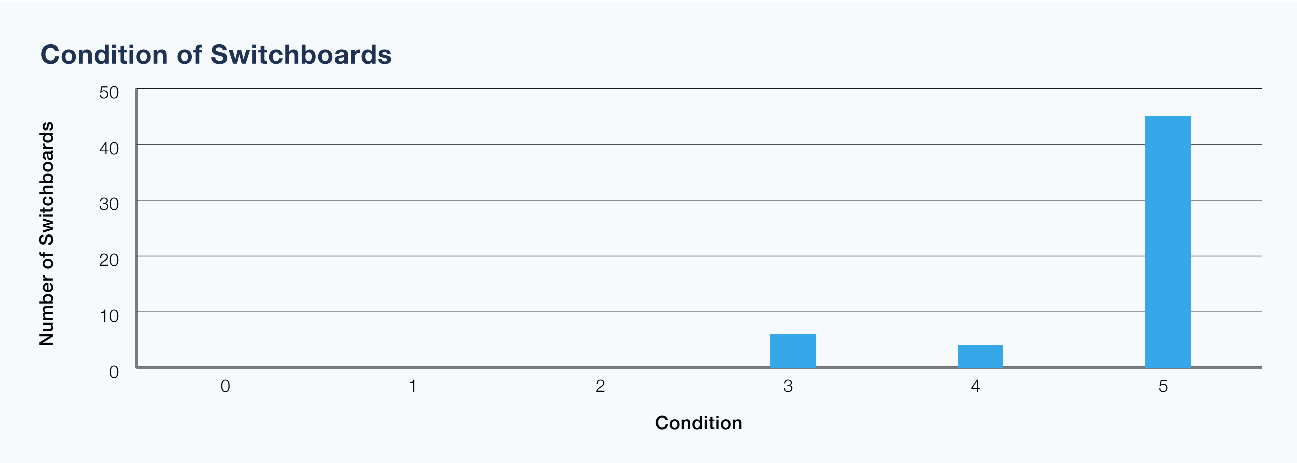


Figure 2.3.2.2: Condition of Switchboards

2.3.3 Substation Buildings

Substation buildings provide protection against environmental factors and prevent unauthorised entry reducing safety risk to members of the public.

Population

In total there are 31 zone substation buildings across the 25 zone substation sites that WEL operates. These were built to meet specific site and regulatory requirements at the time of construction. As the construction of our substations occurred over several decades they have differing designs.

Age Profile

The design working life of the substation buildings is 50 years. Figure 2.3.3.1 shows the age profile for substation buildings. The average age for the buildings is 18 years.

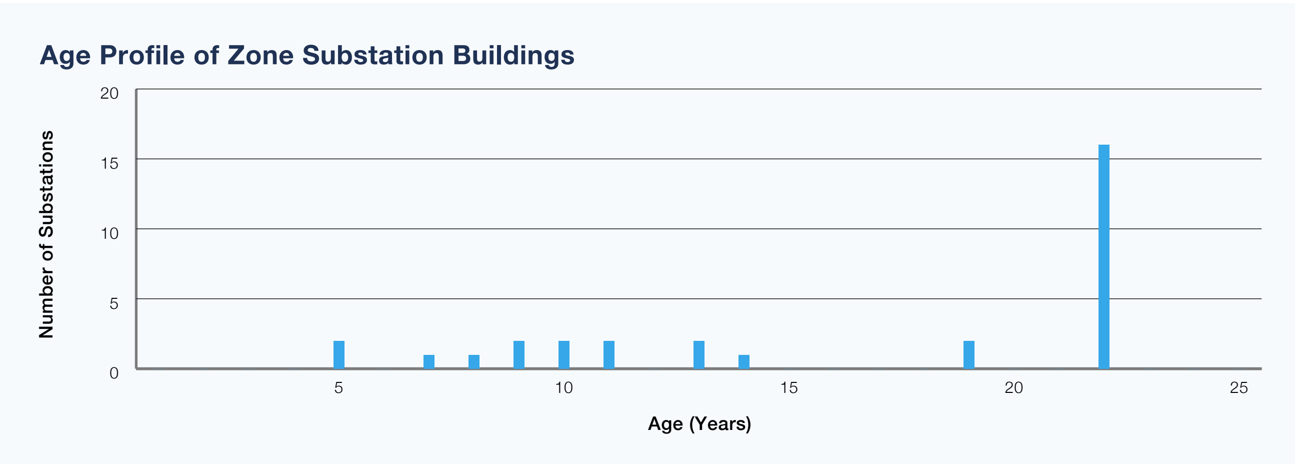


Figure 2.3.3.1: Age Profile of Substation Buildings

Condition

Our substation buildings were assessed by registered quantity surveyors as part of a financial valuation process. The assessment found that the majority of them are in good condition, as illustrated in Figure 2.3.3.2. When a substation is substantially refurbished the buildings are usually reinforced or completely rebuilt.

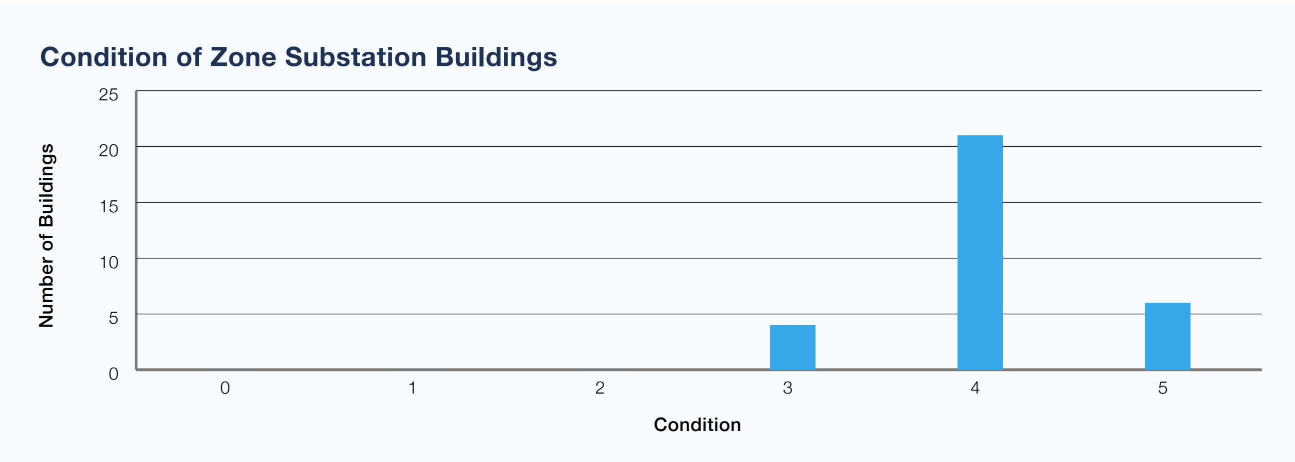


Figure 2.3.3.2: Condition of Zone Substation Buildings

All new WEL Zone Substation buildings will be designed and built to Building Importance Level 4 (IL4) standard. Seismic strengthening of existing zone substation buildings where practical, and as per recommendation in the assessment undertaken, shall be to IL4 and a minimum of 75% of New Building Standard (NBS). Where it is not practical to strengthen a building to the required level then a cost-risk assessment will be carried out to determine the most practical level.

WEL commenced a programme of specialised seismic assessment in 2007. Four were recommended to have seismic upgrades and planned as follows:

- Kent substation and Ruakura ripple plant are planned for FY22 and FY23 respectively.
- Weaver (11kV) and Glasgow substation are planned for strengthening starting from FY25 and FY28 respectively to coincide with switchgear replacement

The overall results of the seismic assessment to date are shown in Figure 2.3.3.3.

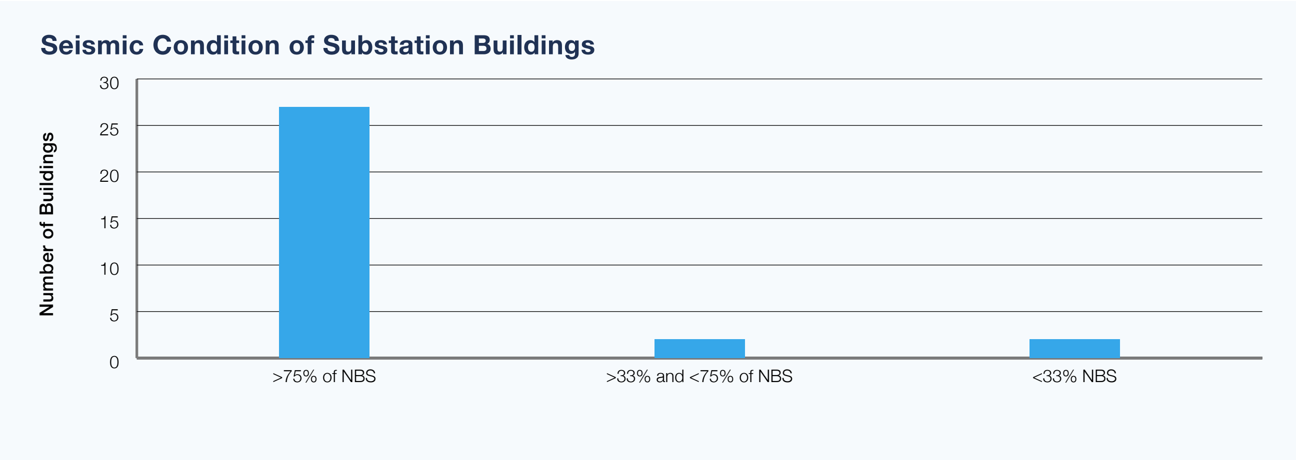


Figure 2.3.3.3: Distribution of Substation Building Seismic Conditions

2.4 DISTRIBUTION AND LV LINES

The distribution network conveys electricity from zone substations to the LV network. The LV network supplies the majority of our customers. The network includes overhead lines and underground cables. The total length is approximately 6,408km, of which 51% is overhead line.

This section describes the following asset categories which are included within Distribution and LV Lines:

- Poles;
- Crossarms; and
- Distribution and LV conductors

2.4.1 Poles

Poles support the overhead lines. They play a key role in isolating conductors and preventing contact with people and property.

Population

We own approximately 36,520 poles. Figure 2.4.1.1 shows the distribution by construction material. The majority are concrete poles, with a small number of softwood (1,665), hardwood (178) and steel poles (11) remaining.

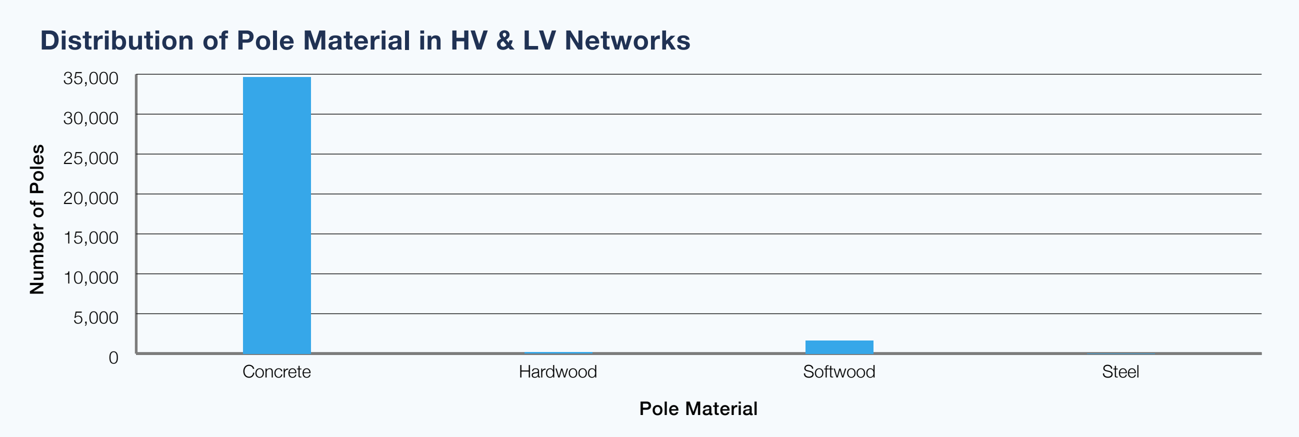


Figure 2.4.1.1: Distribution of Pole Material in HV and LV Networks

Age Profile

Figure 2.4.1.2 shows the age profiles of our poles. Both concrete poles and wooden poles have an average age of 34 years.

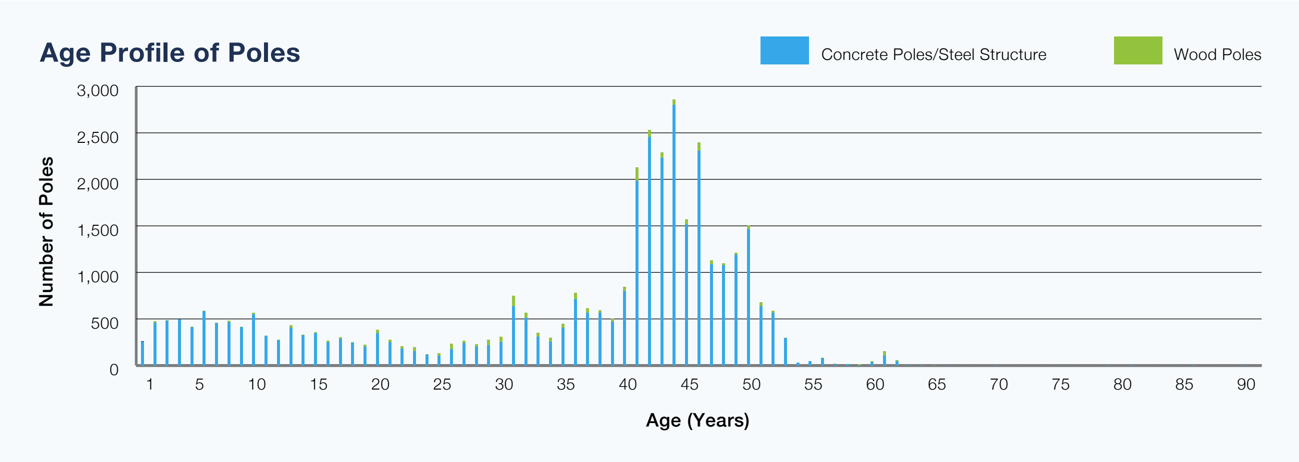


Figure 2.4.1.2: Age Profile of Poles

The life expectancy of concrete poles is 70 years and 45 years for wooden poles as illustrated in Table 2.4.1.3. The population of wooden poles is older and therefore closer to end of life compared to the concrete ones.

Asset	Life expectancy (Years)
Wooden Poles	45
Concrete Poles	70

Table 2.4.1.3 Life Expectancy of HV and LV Poles

Condition

The distribution of pole condition is shown in Figure 2.4.1.4.

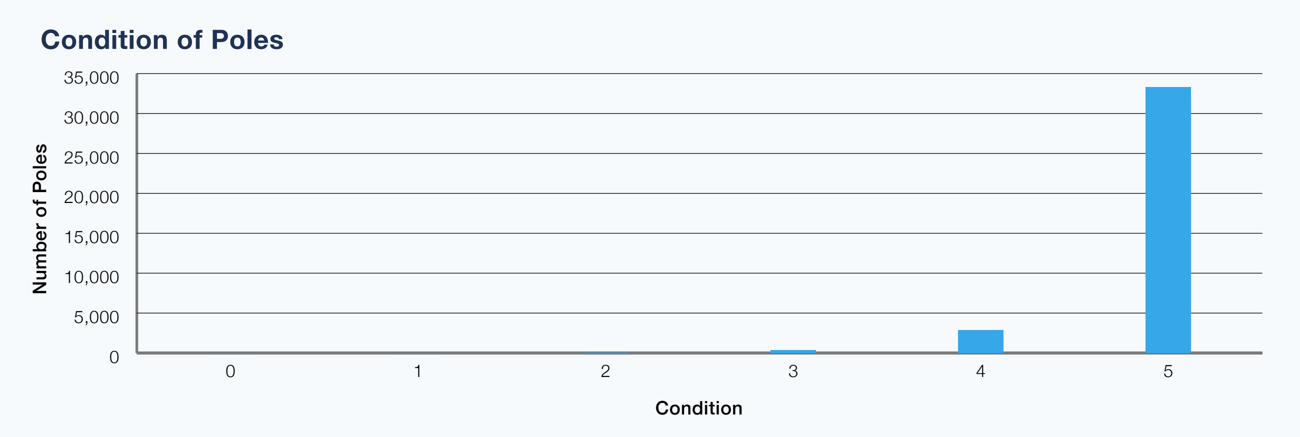


Figure 2.4.1.4: Condition of Poles

The majority of concrete poles are in good condition as the average age is young compared to their life expectancy.

There are approximately 178 hardwood poles remaining on our network that range in condition from good (HI 0-4) to poor (HI >7). WEL stopped installing hardwood poles on the network approximately 15 years ago and as such, it is expected that most wooden (hardwood) poles will need to be replaced in the AMP period. All hardwood poles have been tested and monitored for hidden rot at ground level and poles that were identified as needing replacement have been replaced with concrete ones. WEL will continue to track the condition through pole scanning techniques and these results will drive the replacement strategy.

Figure 2.4.1.5 shows the AHI profile of our poles.

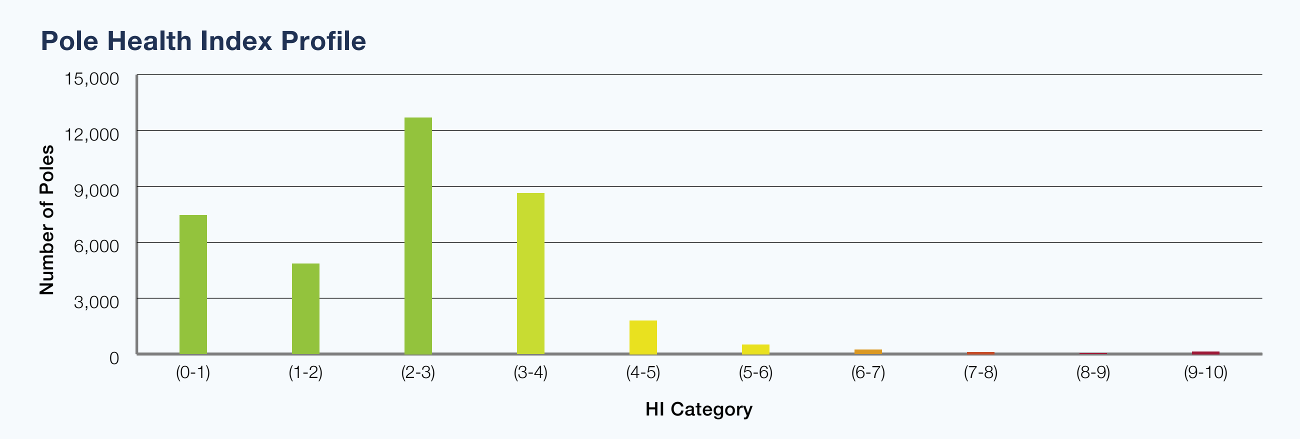


Figure 2.4.1.5: Poles Health Index Profile

2.4.2 Crossarms

Crossarms are found at the top of our poles. The crossarm assembly includes the support structure and the insulators that support and separate each of the three phase conductors. Until recently all of our crossarms were constructed from hardwood, however we have changed our design standard for new crossarms on HV circuits to steel. WEL has also installed a small number of virtual crossarms which are a type of insulator that attaches the line directly to the pole.

As the majority of the existing crossarms are wooden, which have half the life expectancy of the concrete poles, they generally require replacement halfway through the life of the pole.

Population

There are 70,670 crossarms installed on our network. The majority of crossarms are wooden as shown in Figure 2.4.2.1.

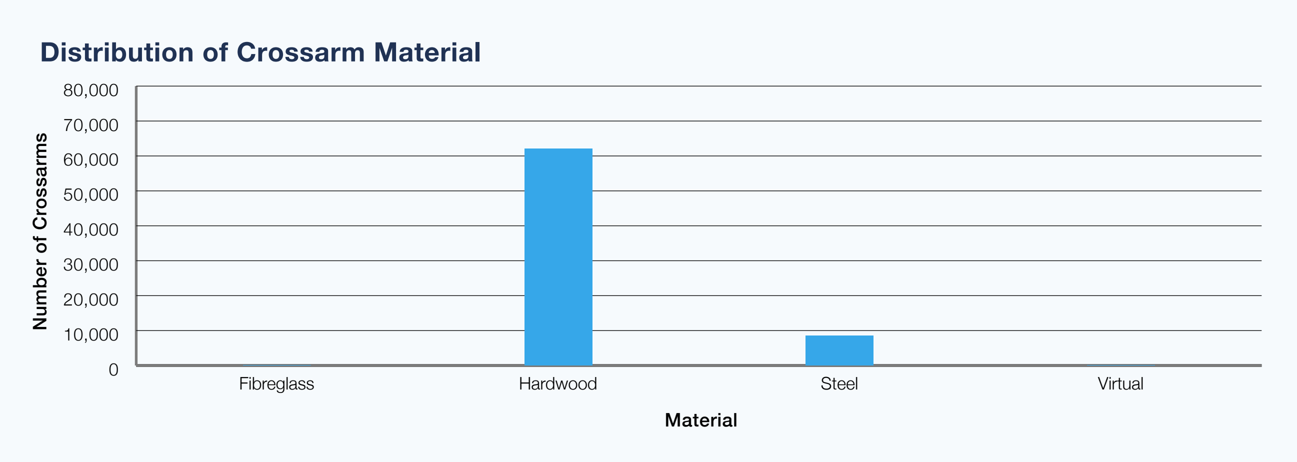


Figure 2.4.2.1: Distribution of Crossarm Material

Age Profile

Figure 2.4.2.2 shows the age profile of wooden and metal crossarms. The average age of the fleet is 30 years.

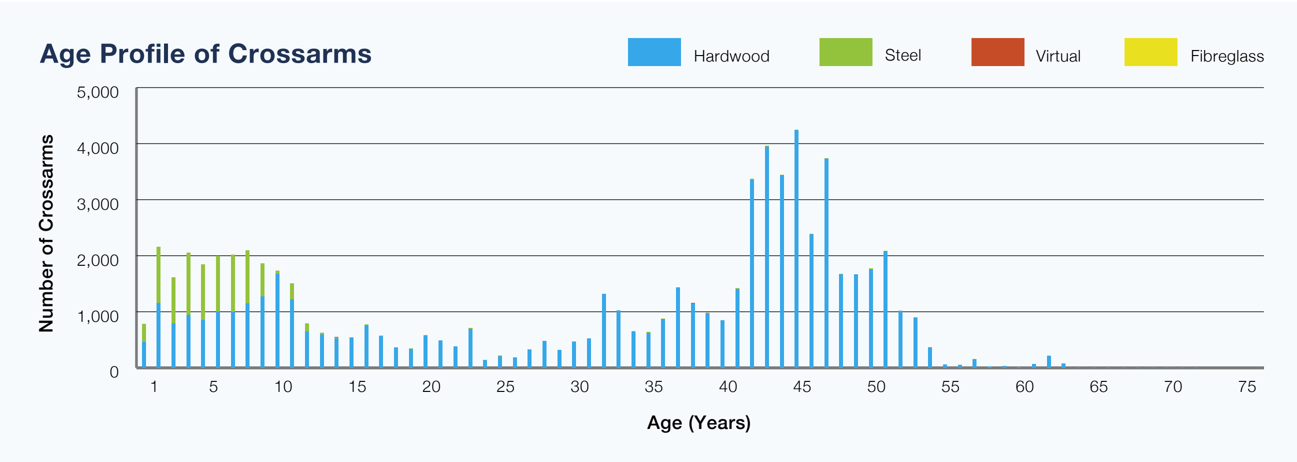


Figure 2.4.2.2: Age Profile of Crossarms

As shown in Table 2.4.2.3 the life expectancy of wooden crossarms is 35 years and metal crossarms is 70 years. Therefore, many of the wooden crossarms already exceed their expected lives. Consequently there is a higher failure rate, especially of the associated insulators. Chapter 8 details the maintenance strategies designed to address these issues.

Asset	Life expectancy (Years)
Wooden Crossarms	35
Metal Crossarms	70

Table 2.4.2.3: Life Expectancy of Crossarms

Condition

The condition distribution of our crossarms is shown in Figure 2.4.2.4.

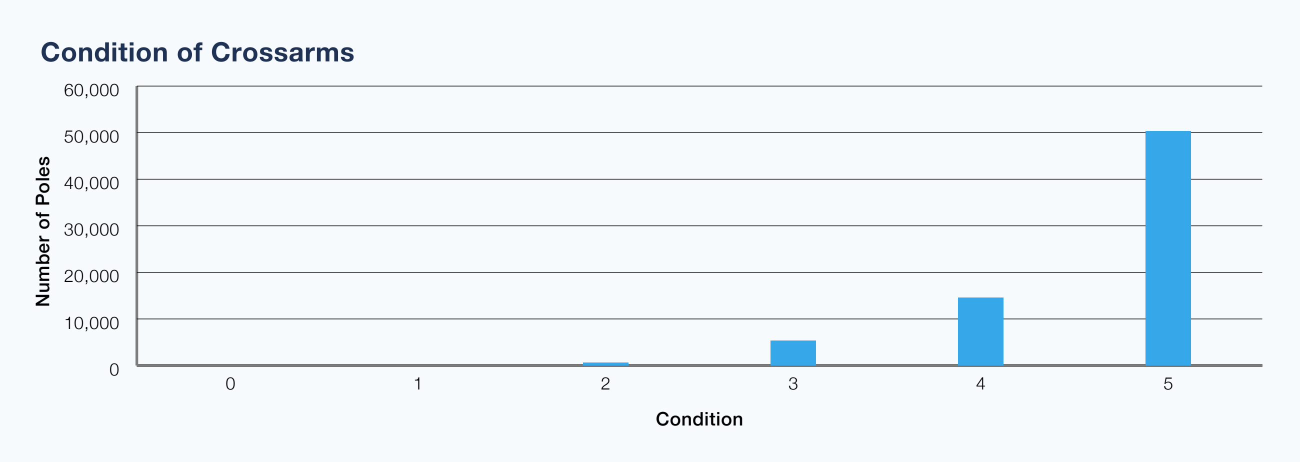


Figure 2.4.2.4: Condition of Distribution Crossarms

The AHI profile for our crossarms is shown in Figure 2.4.2.5. The graph indicates that a significant number are approaching the stage where they will need to be replaced. The AHI and the factors used to assess an asset are explained in section 2.1.

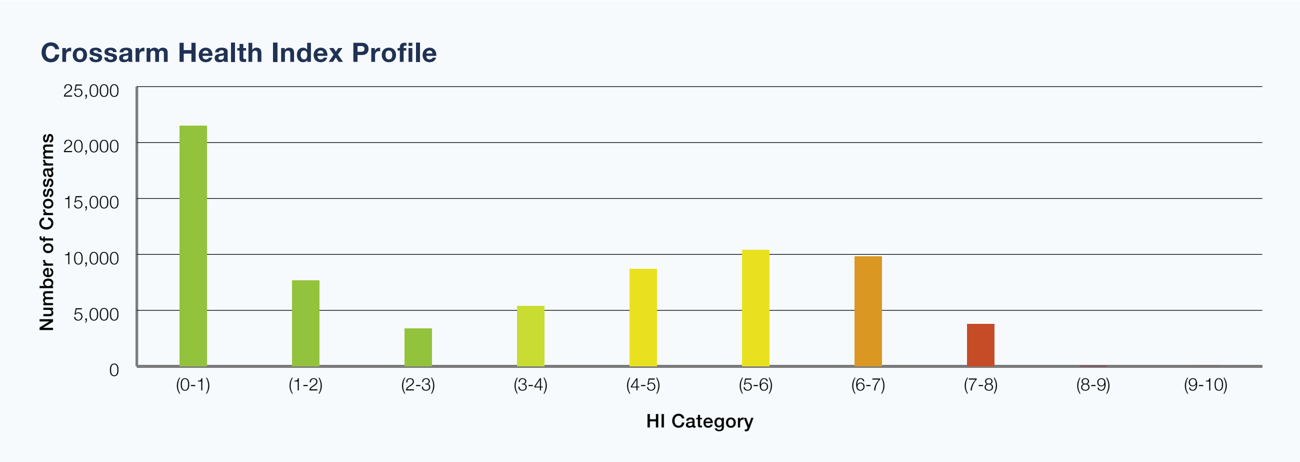


Figure 2.4.2.5: Crossarm Health Index Profile

2.4.3 Distribution and Low Voltage Conductors

Distribution and Low Voltage (LV) lines transport electricity from zone substations to our customers on the LV network.

Population

We own 3,248km of overhead distribution and LV lines, of which 1,920km is 11kV distribution lines and 1,328km is LV. Figure 2.4.3.1 shows the distribution of overhead conductor types.

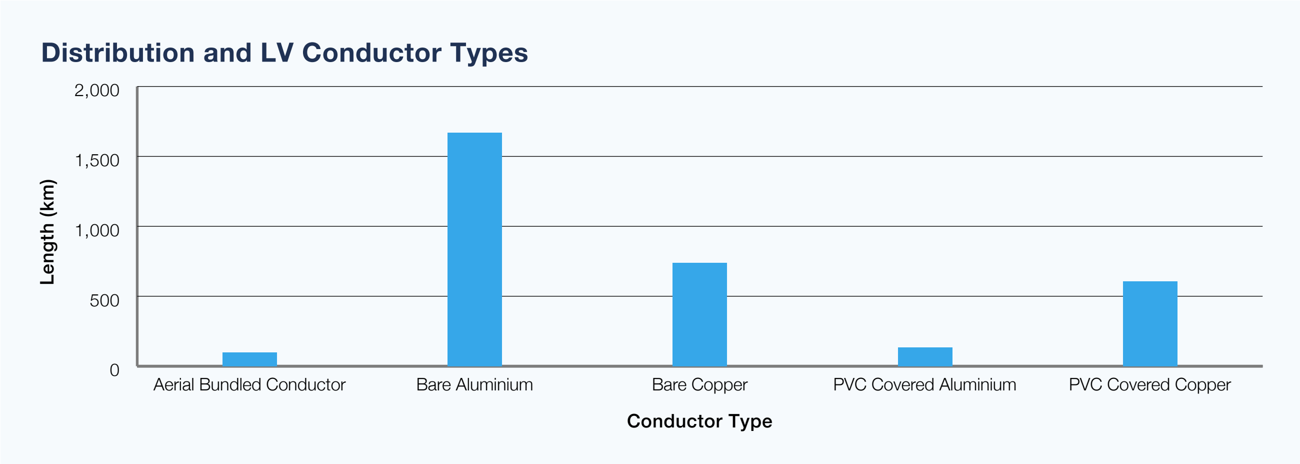


Figure 2.4.3.1: Distribution and LV Conductor Types

Figure 2.4.3.2 shows the location of the distribution and LV lines is primarily in the rural areas. Urban areas are typically reticulated with underground cables.

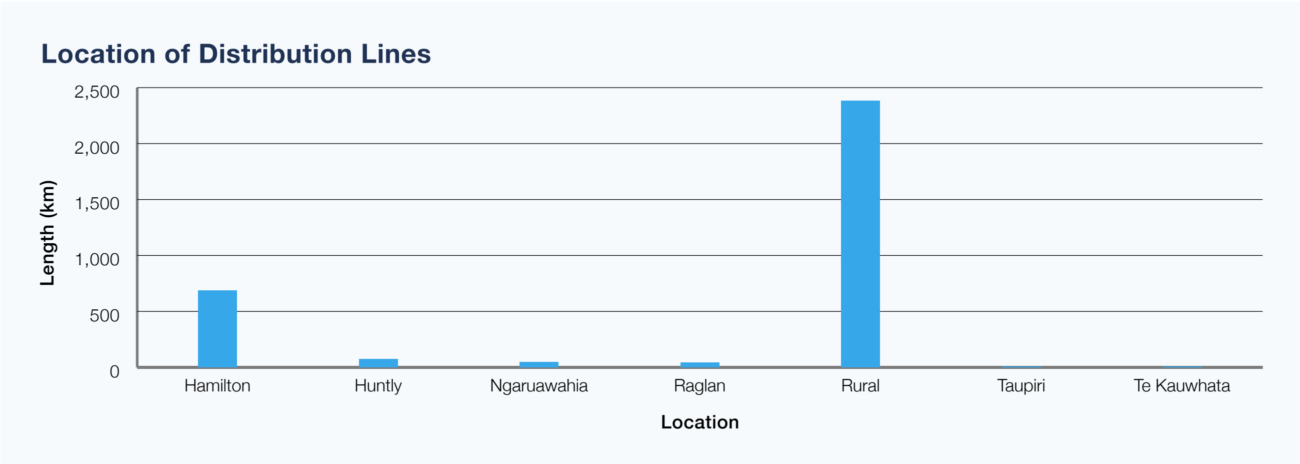


Figure 2.4.3.2: Location of Distribution of LV Lines

Age Profile

Figure 2.4.3.3 shows the age profile of all types of the distribution and LV conductors. The average age of our overhead conductors is 34 years.

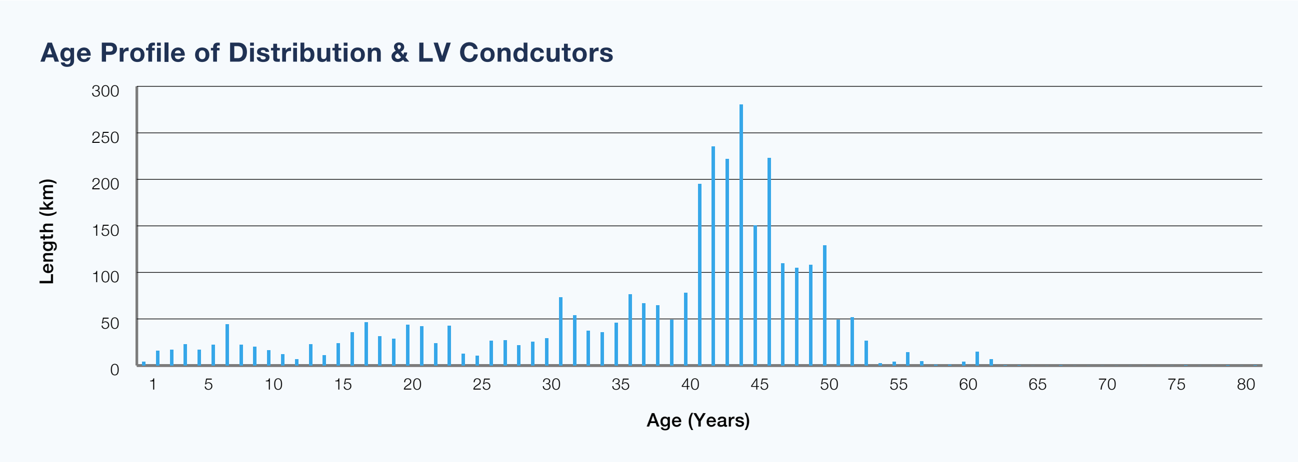


Figure 2.4.3.3: Age Profile of HV and LV Conductor

The spike in installing new conductors corresponds to the rapid expansion of the network during the 1970s. The life expectancy of conductors is 55 to 60 years depending on conductor type.

Condition

The condition distribution of overhead line conductors is shown in Figure 2.4.3.4.

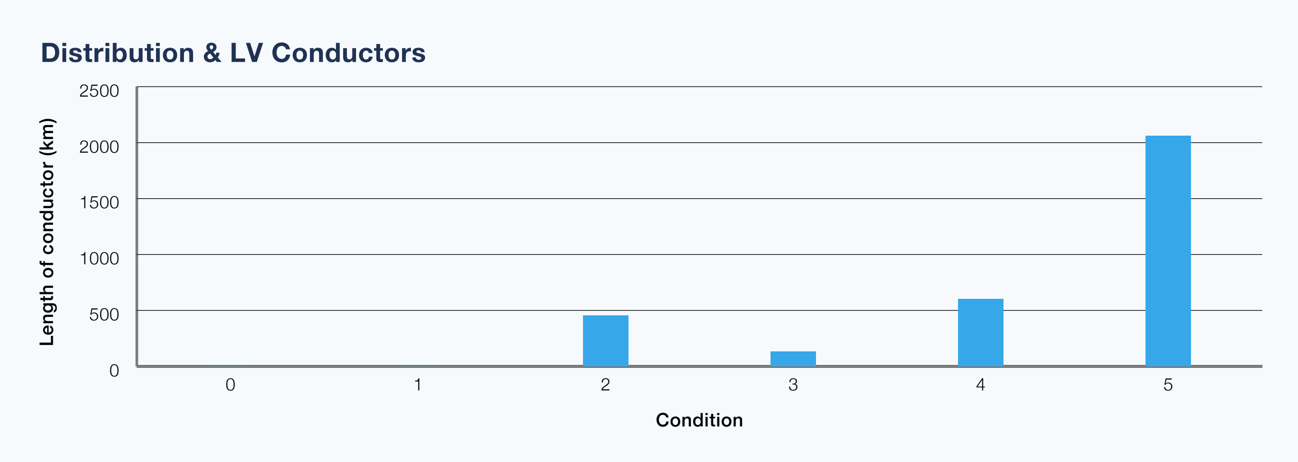


Figure 2.4.3.4: Condition of Distribution and LV Conductor

The condition is further supported by the AHI of our distribution conductors shown in Figure 2.4.3.5. Approximately 380km of distribution overhead line conductors are becoming poor in condition. These are predominantly 16mm^2 copper conductors which are being analysed for replacement through the CBRM model. Further conductor sampling and analysis is planned over the next two years to gain a better understanding of the condition of these assets.

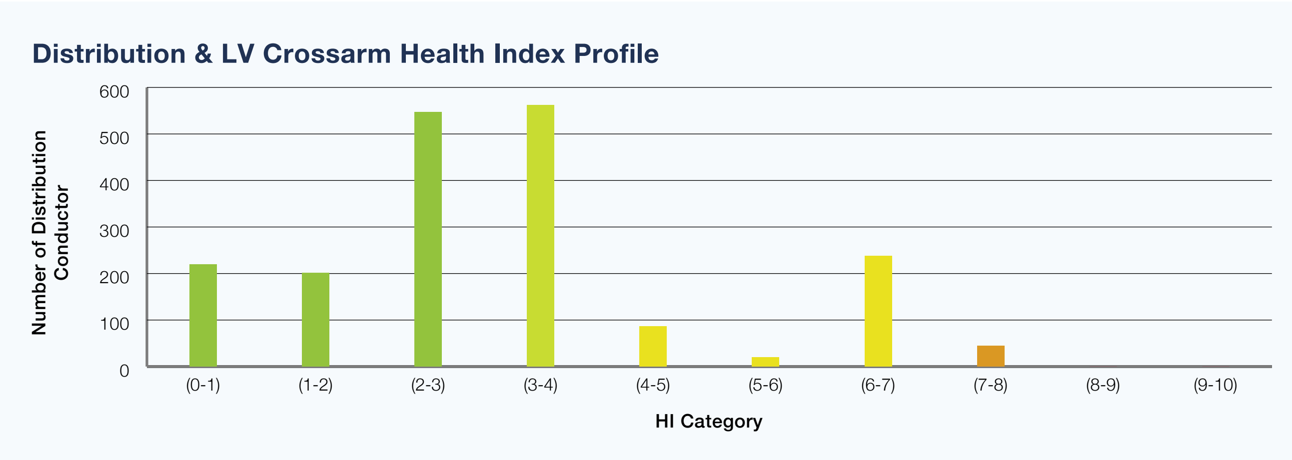


Figure 2.4.3.5: Distribution Conductor Health Index Profile

The majority of the conductors with an AHI of 7 or greater are the 16mm^2 copper type. This issue and remedial actions are discussed further in Chapter 8.

2.5 DISTRIBUTION AND LV CABLES

This section describes our Distribution cables and LV cables. These account for 49% (3,160km) of our distribution network.

2.5.1 Distribution Cables

Distribution cables form part of the 11kV distribution network.

Population

We own 726km of 11kV underground cables. All of the 11kV cable installed prior to 1976 was PILC. Between 1976 and 1990 XLPE cable was installed in the Hamilton CBD area with predominantly PILC installed in other areas. Since 1990 most cable installations have been XLPE. Most of the 11kV underground network is now aluminium conductor (21%), the remainder is copper.

Age Profile

Figure 2.5.1.1 shows the age profile of the distribution cable. The average age of PILC cable is 39 years and the average age of XLPE cable is 15 years.

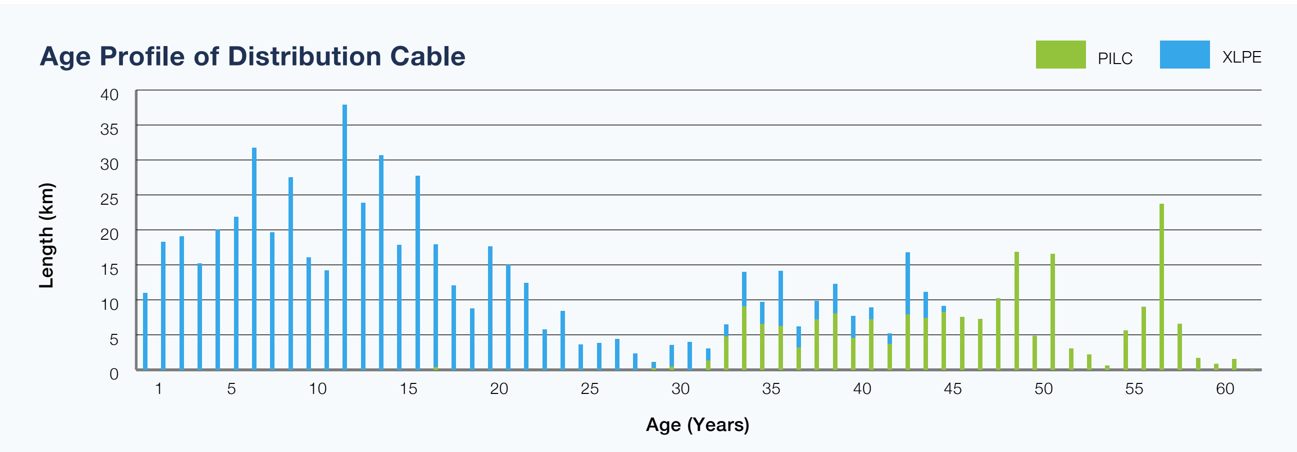


Figure 2.5.1.1: Age Profile of Distribution Cable

The life expectancy of cables is shown in Table 2.5.1.2 below.

Asset	Life expectancy (Years)
XLPE Cables	45
PILC Cables	70

Table 2.5.1.2: Life Expectancy of Distribution Cables

While some of the XLPE cables may be reaching the end of their design life expectancy, experience has shown that XLPE cables can usually be safely operated for much longer than 45 years. The average of all cables is 34 years.

Condition

The condition of underground cable is difficult to assess. The main indication of underground cable health is the number of faults that occur on it, however with new partial discharge (PD) technology available, WEL has started a program of cable testing in order to better understand the condition of these assets. A key determining factor of cable health is the quality of its installation. The cables are generally in good condition (Figure 2.5.1.3). The 11kV ring around the CBD was built around 1945 and still supplies customers with a high degree of serviceability. This is not shown in Figure 2.5.1.1 as the records regarding the installation dates for the older cables are less reliable.

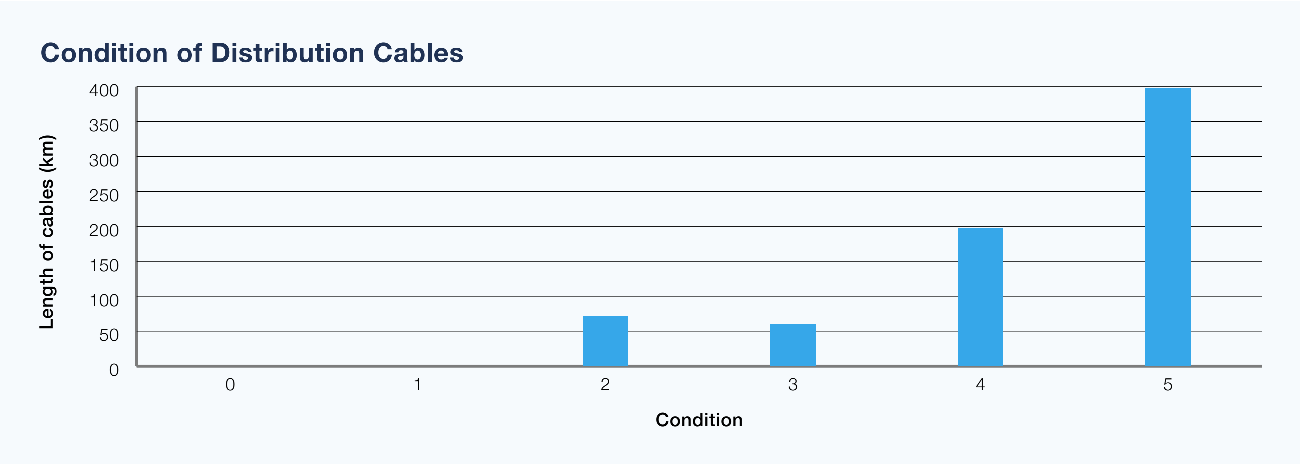


Figure 2.5.1.3: Condition of Distribution Cables

2.5.2 LV Cables

The LV cables convey electricity from distribution transformers to customers at a domestic voltage level.

Population

We have 2,434km of installed LV underground cable, of which 7km is PILC and the rest is XLPE. Figure 2.5.2.1 shows that the majority of LV XLPE cable is in the Hamilton area. Figure 2.5.2.2 shows virtually all the LV PILC cable is in Hamilton, with a small amount in Huntly.

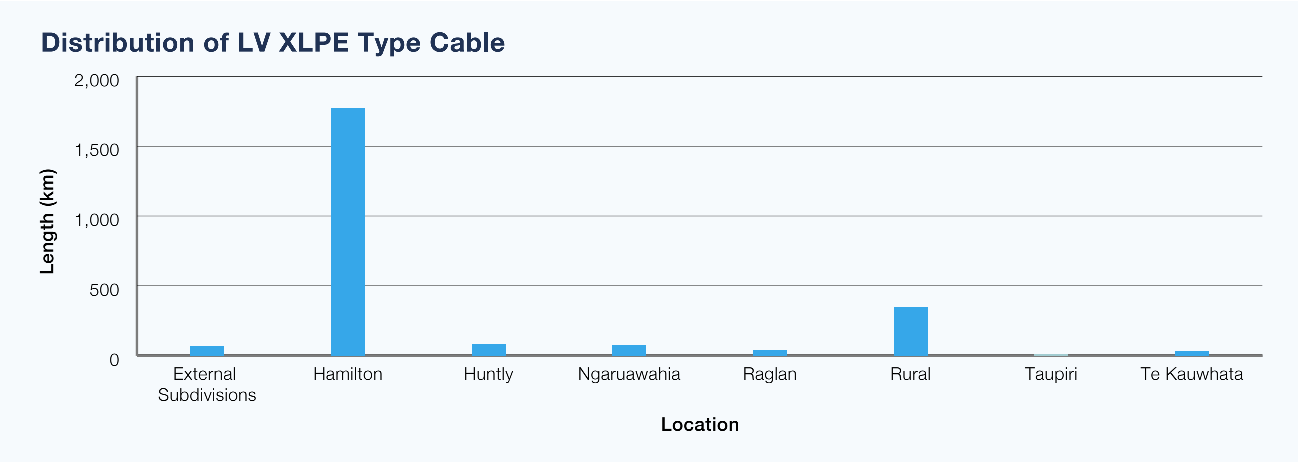


Figure 2.5.2.1: Location of LV XLPE Cable

This situation is similar for PILC Cable as shown in Figure 2.5.2.2.

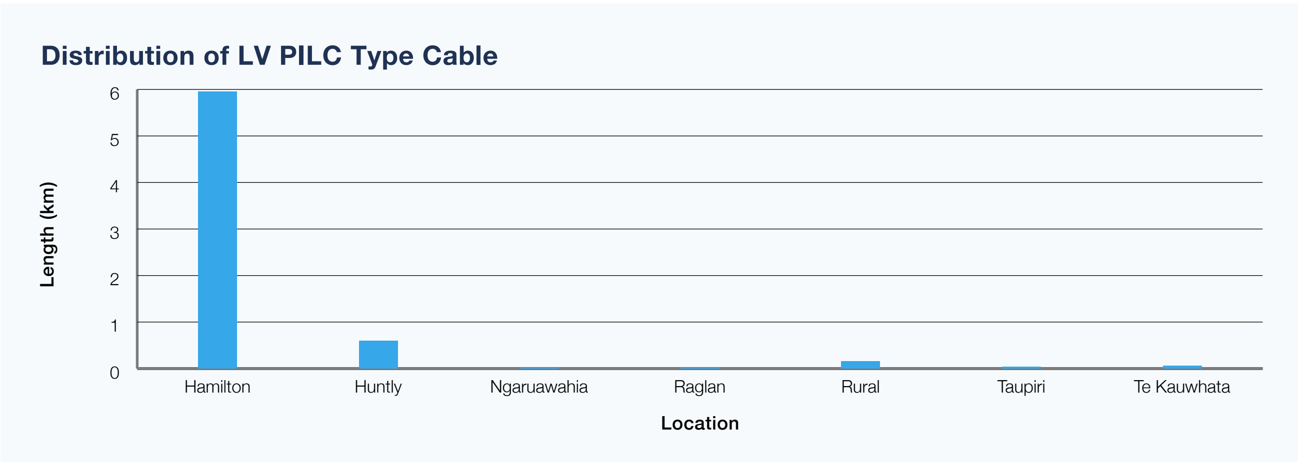


Figure 2.5.2.2: Location of LV PILC Cable

Age Profile

Figure 2.5.2.3 shows the age profile of the underground LV cables in the network. The average age of PILC cable is 68 years, because small amounts have been installed over the years, and the average age of XLPE cable is 21 years.

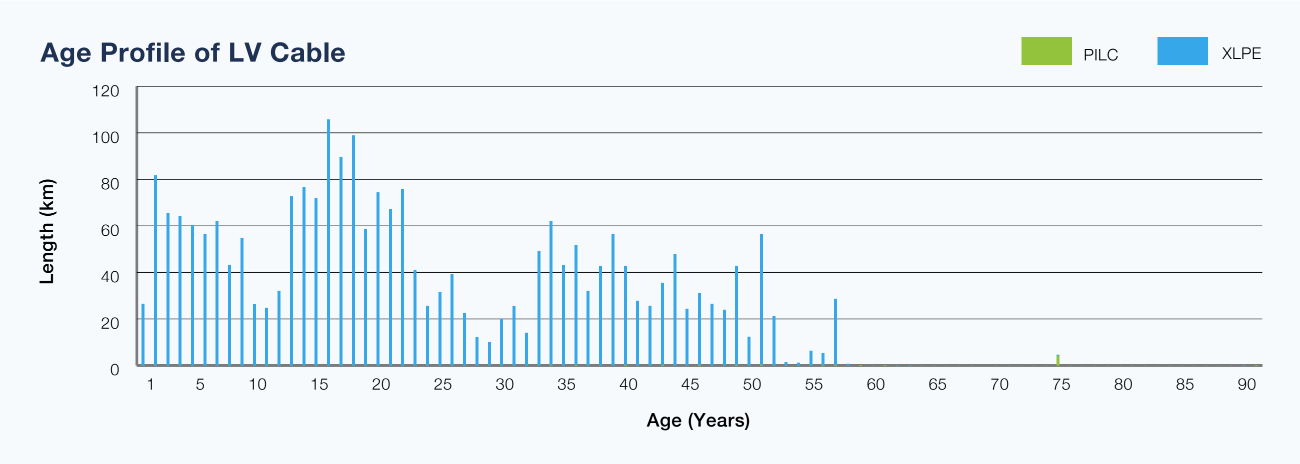


Figure 2.5.2.3: Age Profile of LV Cable

PILC cables have a life expectancy of 70 years and XLPE cables have a design life expectancy of 45 years as shown in Table 2.5.2.4. Some of the cables are reaching the end of their life expectancy. However, operational experience shows that XLPE can be safely operated for much longer than 45 years.

Asset	Life expectancy (Years)
XLPE Cables	45
PILC Cables	70

Table 2.5.2.4: Life Expectancy of LV Cable

Condition

The condition of underground LV cables is difficult to access. However to date the number of failures experienced has been small. The majority of faults have been caused by damage from external factors such as the works associated with the installation of ultra-fast fibre around Hamilton.

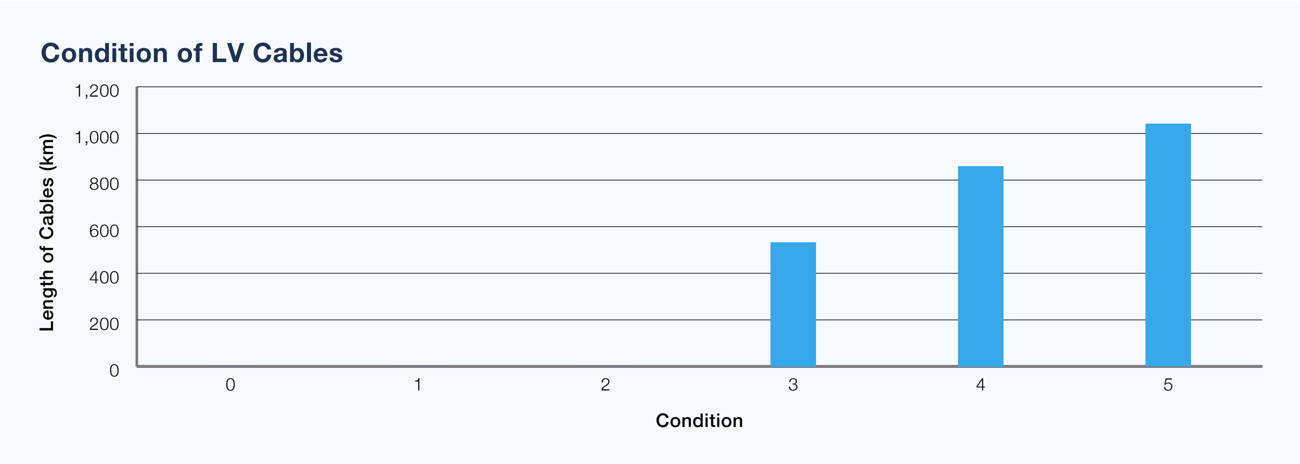


Figure 2.5.2.5: Condition of LV Cables

2.6 DISTRIBUTION SUBSTATIONS AND TRANSFORMERS

There are two asset categories within the distribution substations and transformers asset class:

- Distribution switching stations; and
- Distribution transformers.

2.6.1 Distribution switching stations

Distribution switching stations provide the capability to switch between interconnected 11kV circuits providing security of supply during fault conditions or planned maintenance.

Population

WEL operates 17 distribution (11kV) switching stations that were installed between 1967 and 2018.

Age profile

The age profile of switching stations is shown in Figure 2.6.1.1. The average age of switching stations is 21 years.

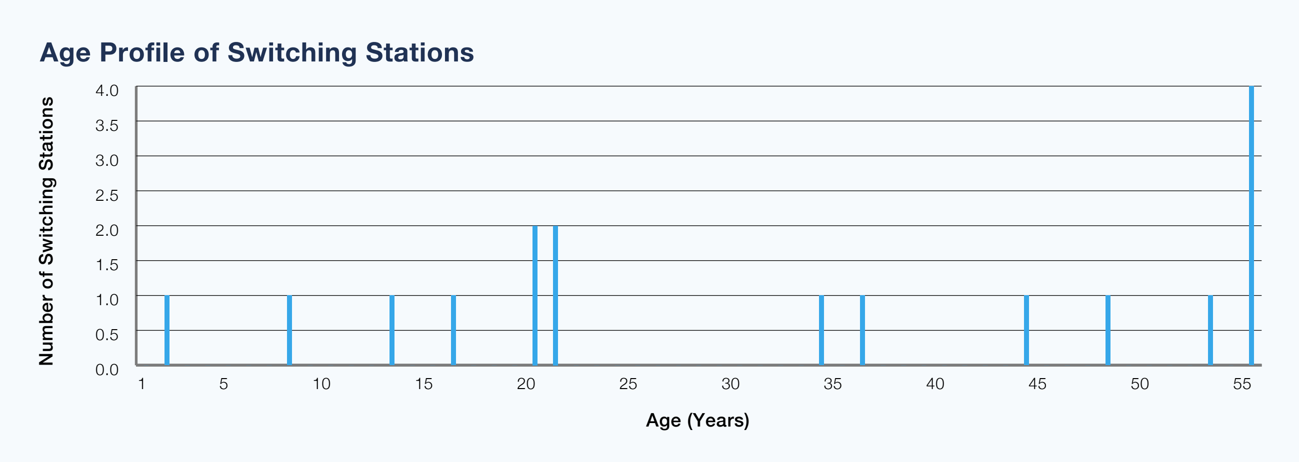


Figure 2.6.1.1: Age Profile of Switching Stations

Condition

The condition profile of switching stations is shown in Figure 2.6.1.2.

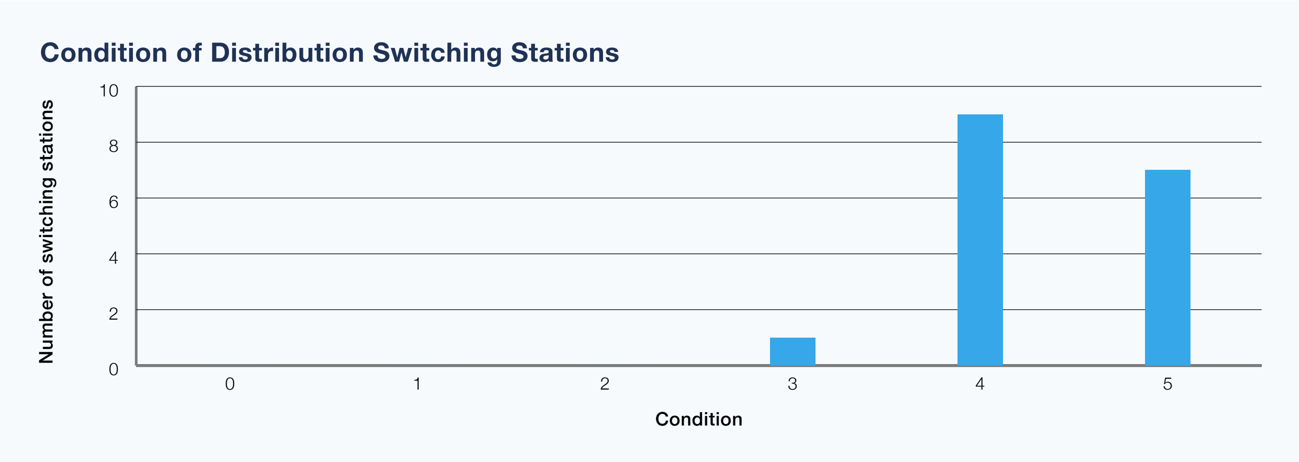


Figure 2.6.1.2: Condition of Switching Stations

The seismic ratings of most of the buildings have also been assessed. WEL commenced a programme of specialised seismic assessment in 2007. The results of the seismic assessment to date are shown in Figure 2.6.1.3.

Seven sites were assessed to have seismic mitigation work planned.

- The Garden Place switching station will be bypassed and decommissioned in FY22. Anglesea switching station is located at the ground floor of a multi-story complex, and WEL is coordinating with the building owner for any specific requirements as part of the overall building strengthening work.
- Barton, Civic, Whitiora, Steele Park and MAF buildings are programmed to be strengthened between FY23-25.

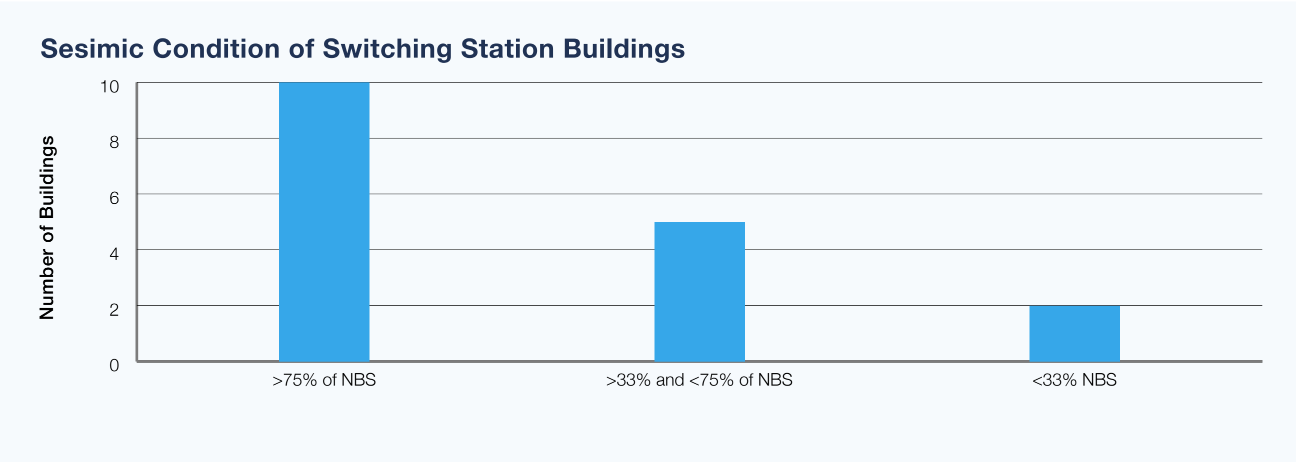


Figure 2.6.1.3: Seismic Condition of Switching Stations

All new WEL switching station buildings will be designed and built to IL4 standard. Seismic strengthening of existing switching station buildings, where practical, shall be to IL3 and a minimum of 75% of NBS. Where it is not practical to strengthen a building to the required level a cost-risk analysis will be carried out to determine the most practical outcome.

Distribution transformers

Distribution transformers step down electricity supply from the 11kV distribution voltage to LV. Transformers allow adjustments so the supply voltage remains within statutory limits.

Distribution transformers are either mounted on poles or to the ground. As a result of the Christchurch earthquakes, industry practice has changed and now requires large transformers to always be ground mounted.

Population

We own 4,190 pole mounted transformers and 2,045 ground mounted transformers.

Due to economies of scale we purchase transformers in a limited number of predefined sizes. The standard pole mounted transformer sizes we utilise are 1, 30, 50 and 100kVA. Standard ground mounted transformer sizes are 100, 200, 300, 500, 750 and 1,000kVA.

The population of transformers in each size is shown in Figure 2.6.2.1.

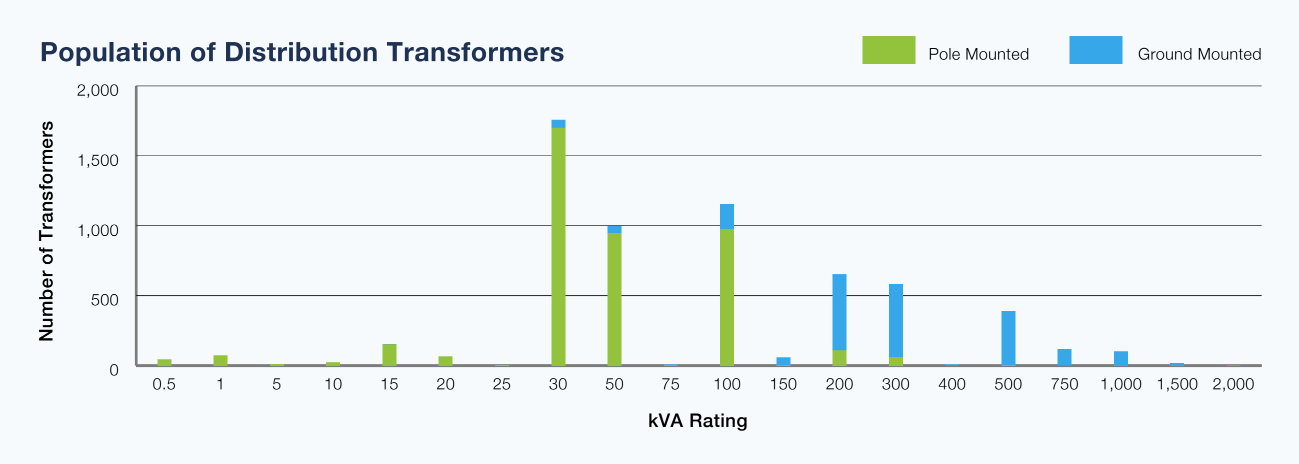


Figure 2.6.2.1: Population of Distribution Transformers

Age Profile

Figure 2.6.2.2 shows the age profile of our distribution transformers. The average age is 20 years. The significant investment made over the last 20 years was driven by an active replacement programme of older transformers in poor condition (often pole mounted) and the growth in load necessitating capacity upgrades. Consequently, the overall population of distribution transformers is young compared to other asset fleets. There are a small number of transformers that have exceeded their life expectancy, but they are still operating effectively.

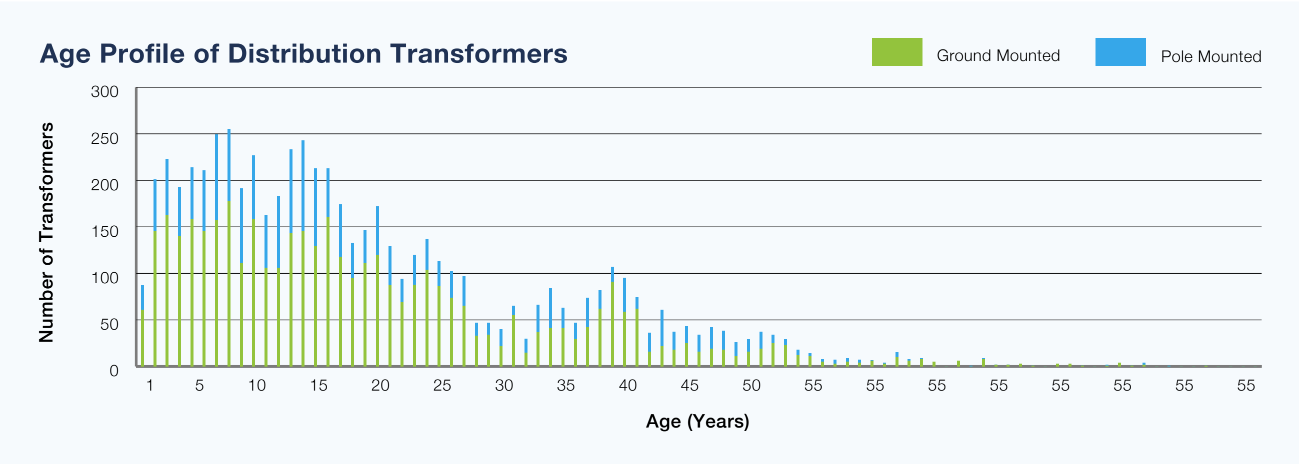


Figure 2.6.2.2: Age Profile of Distribution Transformers

Condition

Figure 2.6.2.3 shows the condition profile of our distribution transformers.

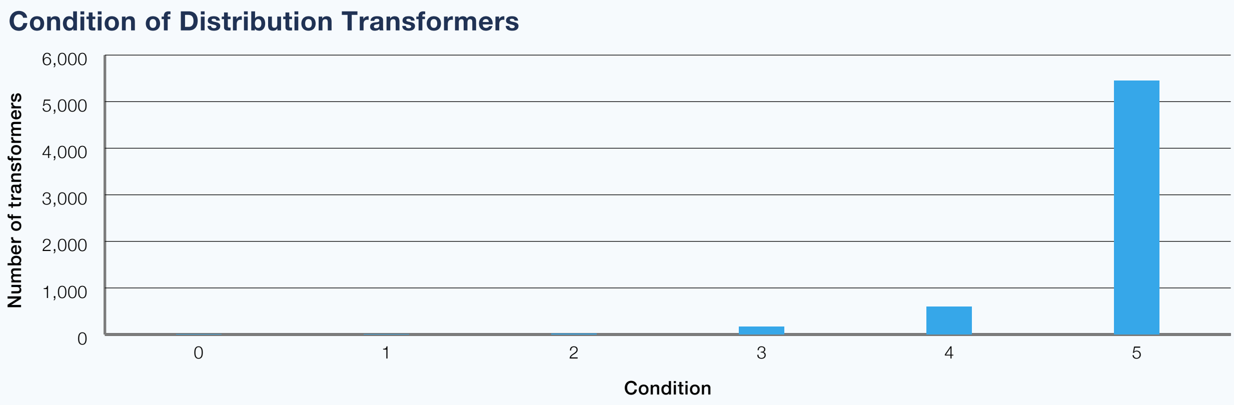


Figure 2.6.2.3: Condition of Distribution Transformers

The AHI for distribution transformers is shown in Figure 2.6.2.4. The AHI and the factors used to assess an asset are explained in Section 2.1.

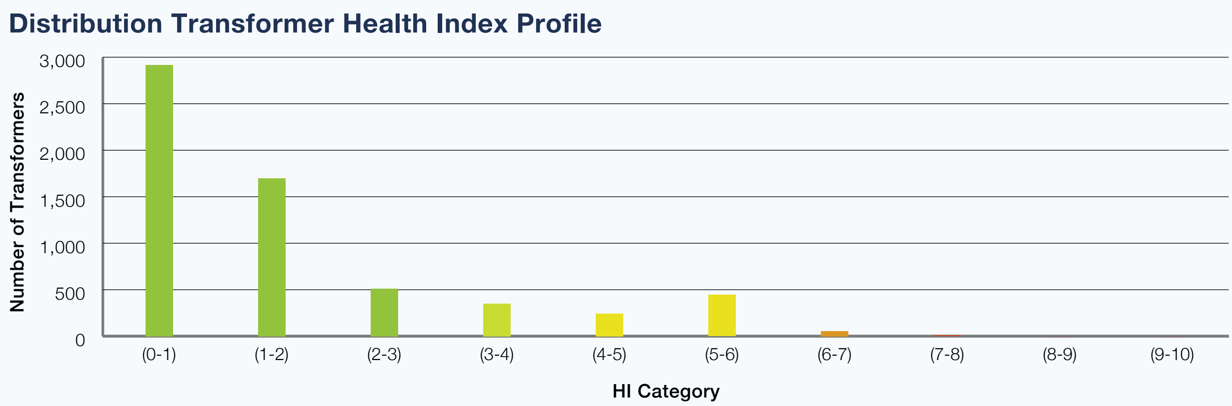


Figure 2.6.2.4: Distribution Transformers Health Index Profile

The condition profile and the health indices show that the fleet is in good health.

2.7 DISTRIBUTION SWITCHGEAR

Four switch types exist within our network. These are

- Ring Main Units (RMUs);
- Circuit Breakers;
- Air Break Switches (includes the modern SF_6 and Vacuum types); and
- Reclosers and Sectionalisers.

Each switch type is discussed in the following sections.

2.7.1 Ring Main Units (RMU)

RMUs are ground mounted switchgear that connects to 11kV cables. There are 1,125 RMUs in operation on the network ranging from new to approximately 60 years old. Older RMUs are typically oil insulated with all new RMUs being SF_6 gas-insulated switchgear. For sustainability reasons WEL has started using hybrid RMUs with vacuum bottles as the quenching medium. This is expected to reduce the increasing amount of SF_6 insulated equipment being installed in WEL's network.

Population

The RMU are a mixture of oil-filled and gas filled types, as shown in Figure 2.7.1.1.

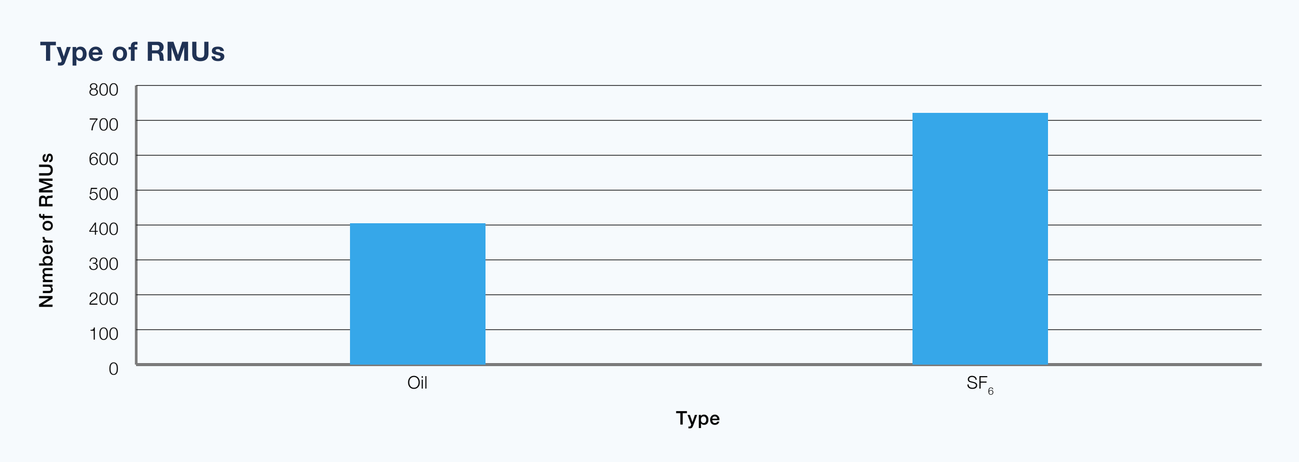


Figure 2.7.1.1: RMU Types

Age Profile

The age profile of RMUs is shown in Figure 2.7.1.2. The average age is 17 years.

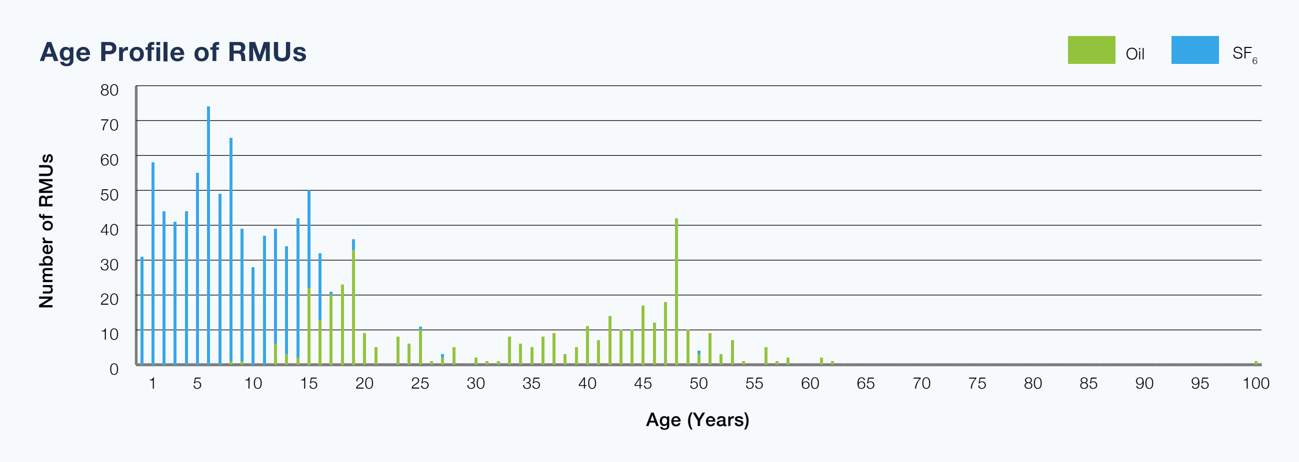


Figure 2.7.1.2: Age Profile of RMUs

The life expectancy of RMUs is detailed in Table 2.7.1.3.

Asset	Life expectancy (Years)
Oil-filled RMU	40
Gas Filled RMU	55

Table 2.7.1.3: Life Expectancy of RMUs

Condition

The distribution of RMU conditions is shown in Figure 2.7.1.4.

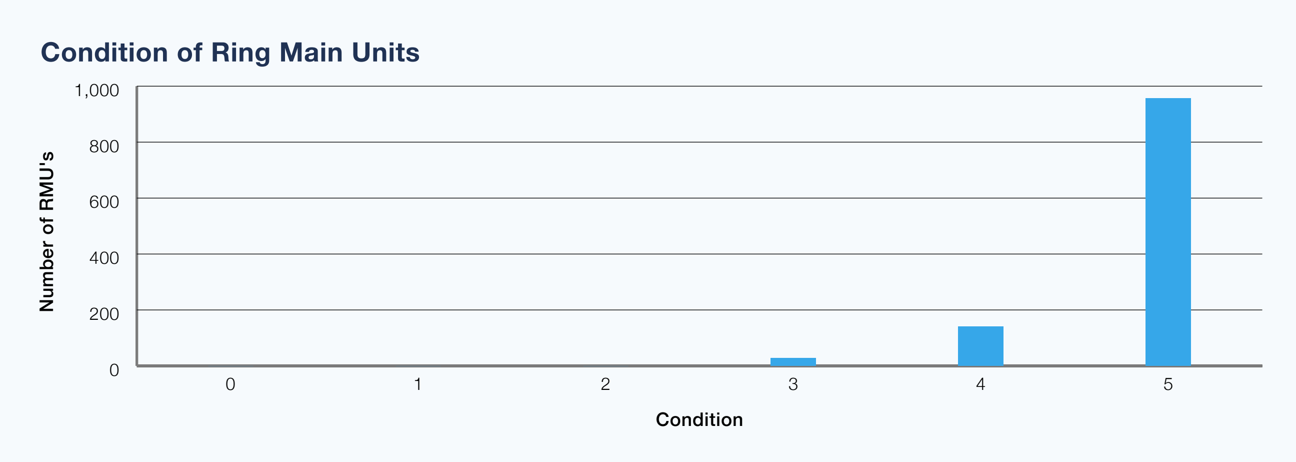


Figure 2.7.1.4: Condition of RMUs

A few oil-filled RMUs failed from an incorrect set up of the internal contacts. Consequently a targeted inspection programme was carried out. Where appropriate the RMUs were replaced with consideration of the new vacuum type. As a result of this programme the overall condition and health profile for RMUs is good. The AHI profile for RMUs is shown in Figure 2.7.1.5. The AHI and the factors used to assess an asset are explained in Section 2.1.

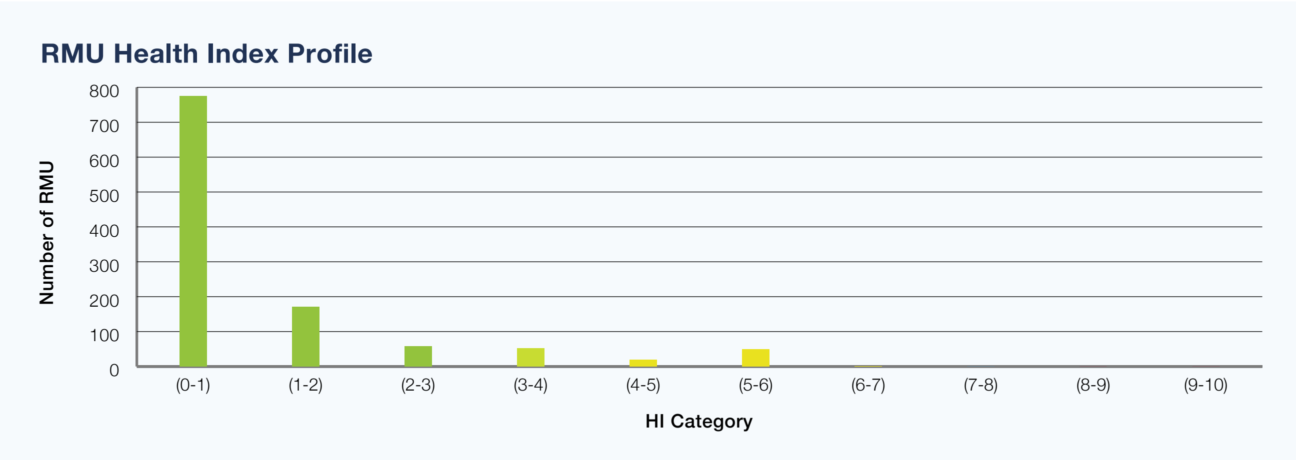


Figure 2.7.1.5: RMU Health Index Profile

2.7.2 Distribution Circuit Breakers (CBs)

Distribution CBs are used to control and protect the distribution network. The CB is a switching device that can be either operated manually or automatically. When operating automatically they interrupt the flow of electricity if the current exceeds predetermined limits.

Population

We have 440 distribution CBs on our network which range in age from new to over 45 years old. The CBs deployed are a mix of technologies which include oil-filled, SF_6 and vacuum as shown in Figure 2.7.2.1. The oil-filled CBs are the oldest followed by SF_6 and vacuum types.

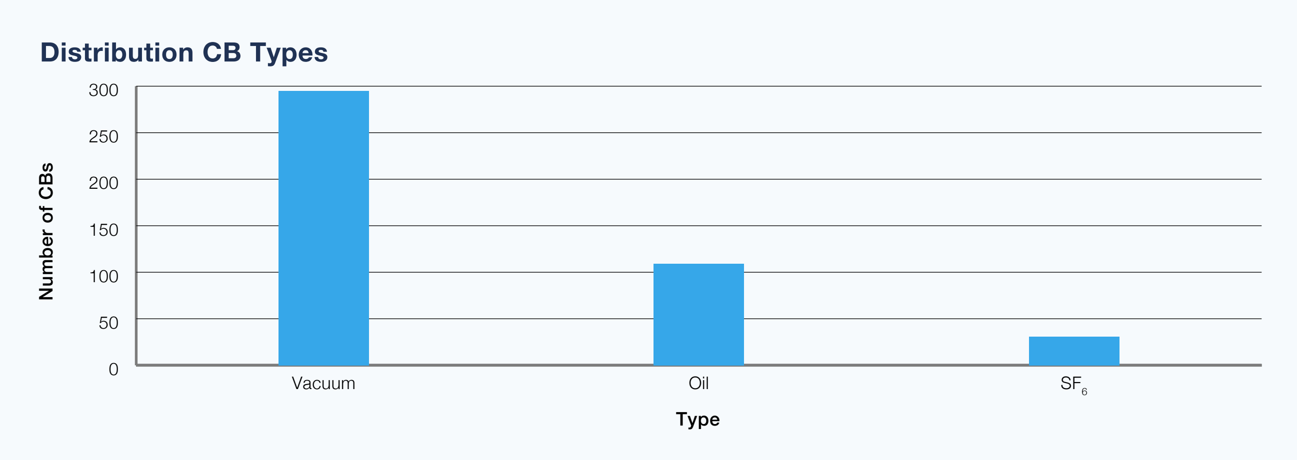


Figure 2.7.2.1: Distribution CB Types

Age Profile

The age profile is shown in Figure 2.7.2.2. The average age of the fleet is 21 years.

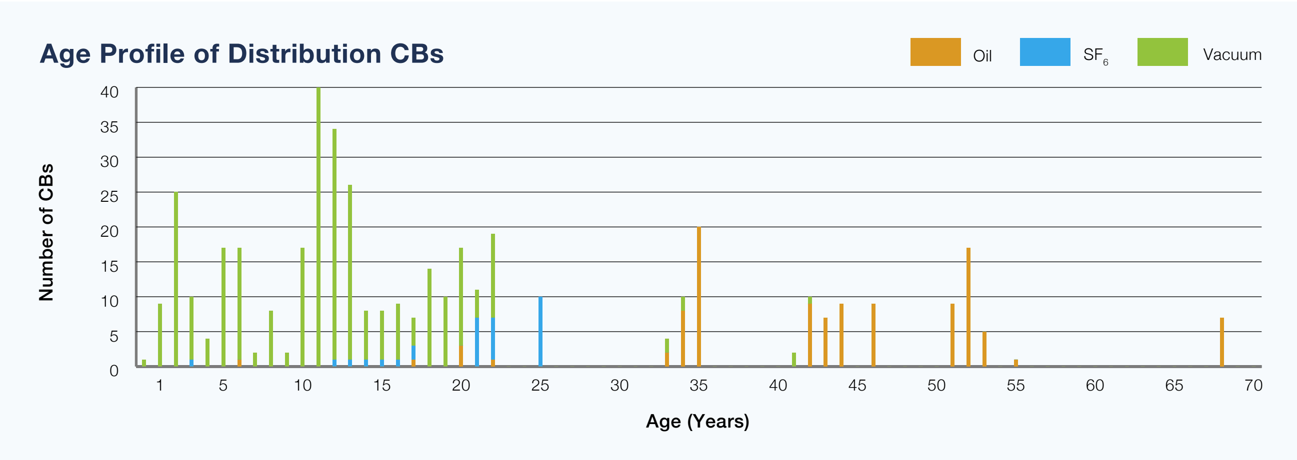


Figure 2.7.2.2: Age Profile of Distribution CBs

The life expectancy of CBs by type is shown in Table 2.7.2.3.

Asset	Life expectancy (Years)
Oil	45
SF_6	55
Vacuum	55

Table 2.7.2.3: Life Expectancy of Distribution CBs

Condition

The condition of CBs is summarised in Figure 2.7.2.4.

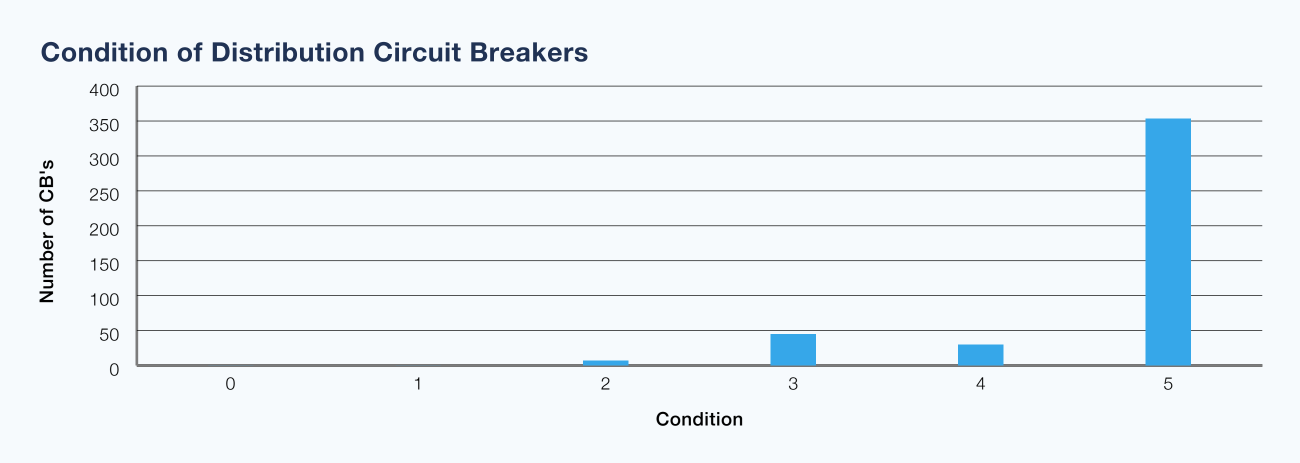


Figure 2.7.2.4: Condition of CBs

Routine condition monitoring indicates there are no significant maintenance problems. Since the number of operations of the circuit breakers is well below operational limits, life expectancy is likely to exceed the standard life for each type of CB. Vacuum and SF_6 CBs are now used for all new installations, as they have low maintenance requirements.

2.7.3 Distribution Air Break Switches (ABS)

ABS are installed on the network and used for isolation and switching. ABS are categorised as load break or non-load break. Operators are able to open a load break switch when current is flowing through it. A non-load break switch is designed to only open when no current is flowing.

Population

We own 869 ABS. We can remotely operate 121 from our centralised control room. This has the dual advantage of reducing customer outage impact (SAIDI) and improving safety. The location of our ABS is shown in Figure 2.7.3.1 below. Large proportions are in the rural areas as remote control capability in rural areas provides greater benefit than in urban areas.

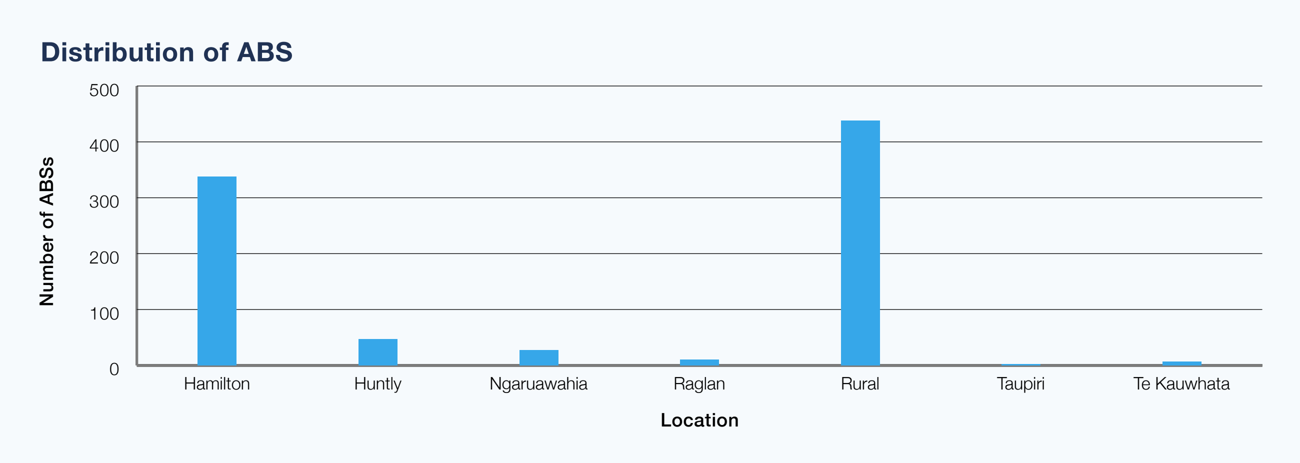


Figure 2.7.3.1: Distribution of ABS

Age Profile

The age profile of ABS is shown in Figure 2.7.3.2. The average age is 24 years.

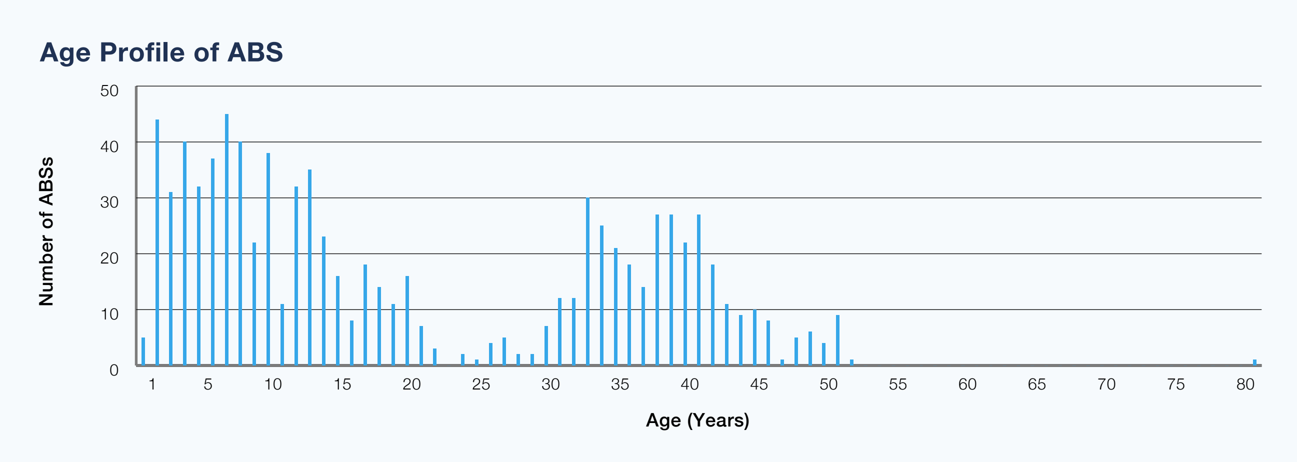


Figure 2.7.3.2: Age Profile of ABS

The life expectancy of ABS is 35 years. The replacement programme for our ABS is discussed further in Chapter 8.

Condition

The condition of ABS is generally good, as reflected in Figure 2.7.3.3. The AHI profile of ABS is shown in Figure 2.7.3.4 and indicates a substantial number of ABS have a medium AHI value, which signifies an increasing rate of asset degradation over the AMP period. The renewal strategy to address this is discussed in Chapter 8.

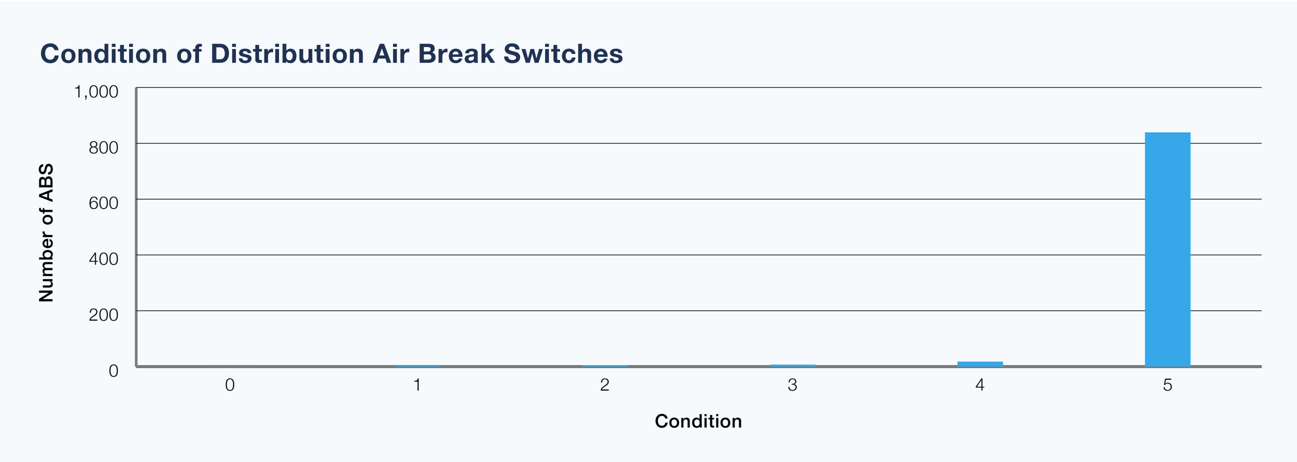


Figure 2.7.3.3: Condition Profile of ABS

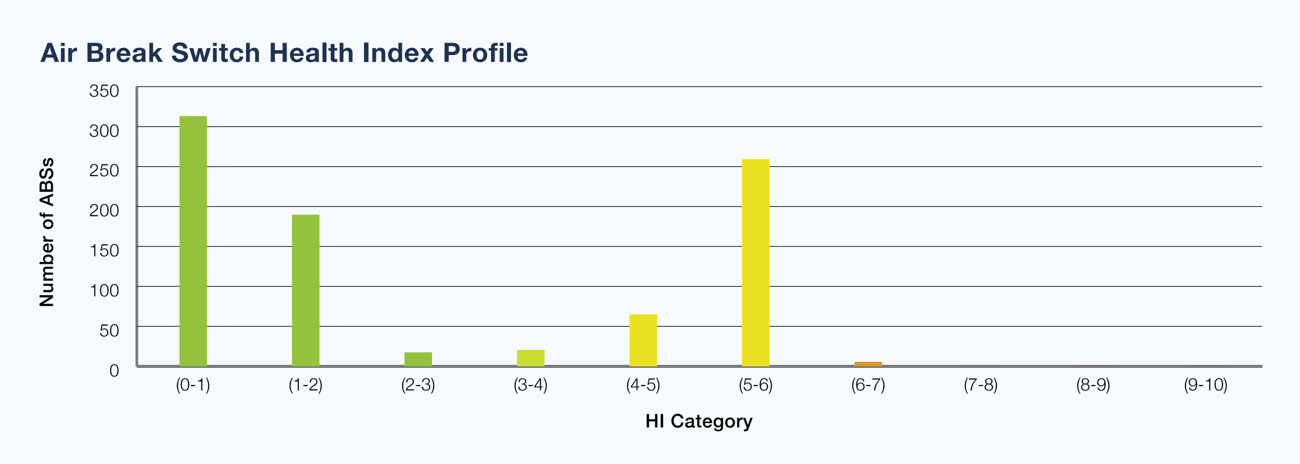


Figure 2.7.3.4: ABS Health Index Profile

The condition of the ABS fleet is good, but the health index shows about a third of the fleet is in fair condition. The reason for the difference lies in the nature of the condition assessment and the extra factors included in the assessment of the health index. The condition assessment is based on a visual inspection, so the information provided does not include weaknesses such as impending insulator failure. The AHI accounts for the relatively old age of the fleet and environmental factors such as proximity to waterways and the sea. The age in particular has a strong influence on the above AHI.

2.7.4 Distribution Reclosers and Sectionalisers

Sectionalisers are self-contained, circuit-opening devices used in conjunction with reclosers to automatically isolate faulted sections of the network. Sectionalisers also allow operators to locate a fault more accurately and quickly, as well as minimising the number of customers affected by any one fault.

A recloser is a circuit breaker equipped with a mechanism that can automatically close the breaker after it has been opened due to a fault. Reclosers are used to detect and interrupt momentary faults and have the ability to automatically restore power to the line subject to the fault.

Population

We own a total of 88 sectionalisers, which consists of 83 enclosed and 5 open. We also own 87 reclosers on our network as shown in Figure 2.7.4.1.

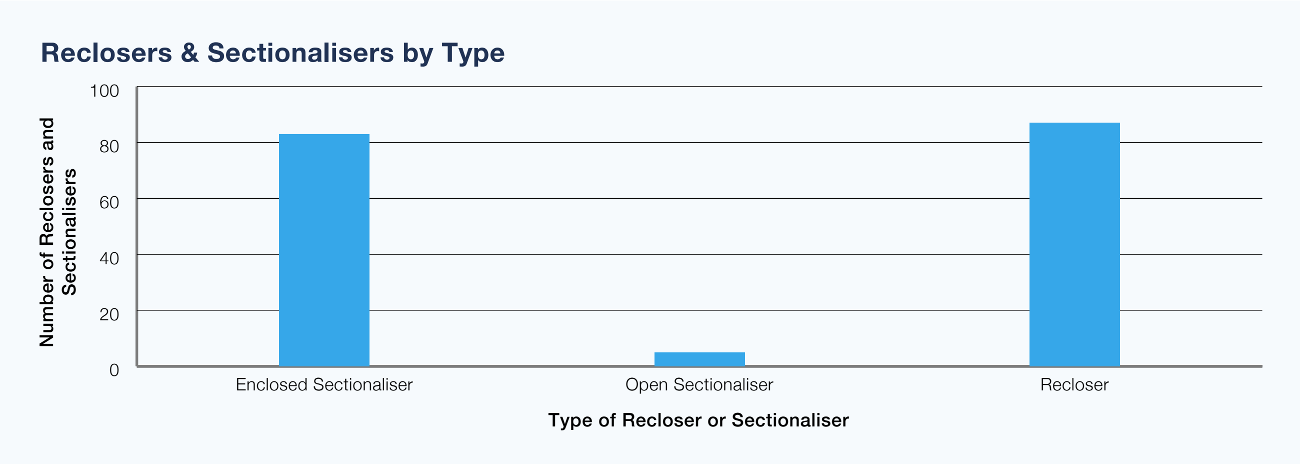


Figure 2.7.4.1: Distribution of Recloser and Sectionaliser Types

Age Profile

Figure 2.7.4.2 shows age profile of the reclosers and sectionalisers. All sectionalisers have been replaced with a vacuum enclosed type to address the reliability issues with dropout types that WEL had in the past. The age profile for enclosed sectionaliser shows that these equipment were primarily installed in the last six years.

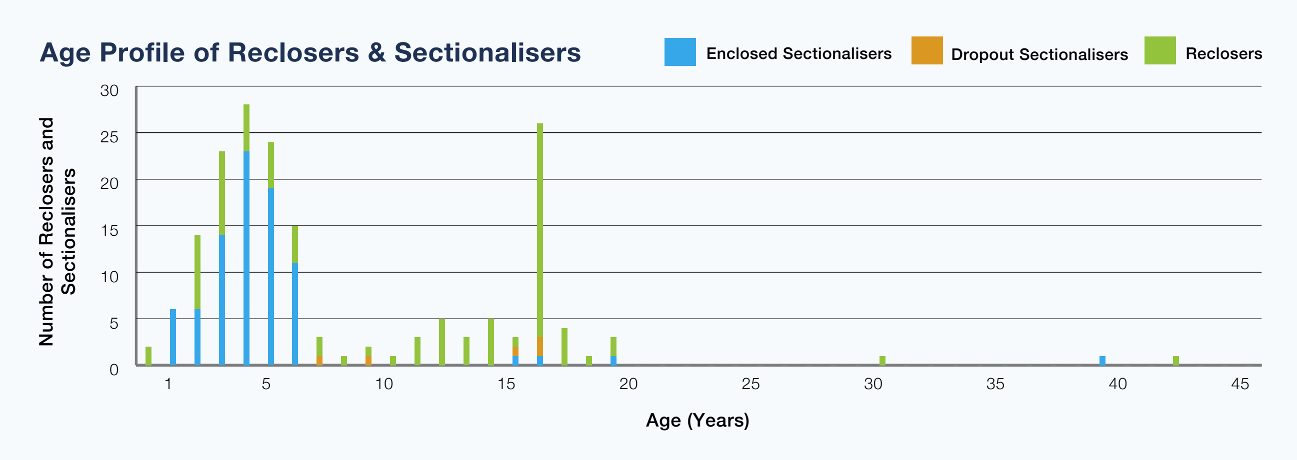


Figure 2.7.4.2: Age Profile of Reclosers and Sectionalisers

The life expectancy of sectionalisers and reclosers is 40 years. The average age of the fleet is 6 years.

Condition

All reclosers and sectionalisers are generally in good condition. Ancillary devices such as communication systems, protection and battery systems are maintained periodically. The condition profile is shown in Figure 2.7.4.3.

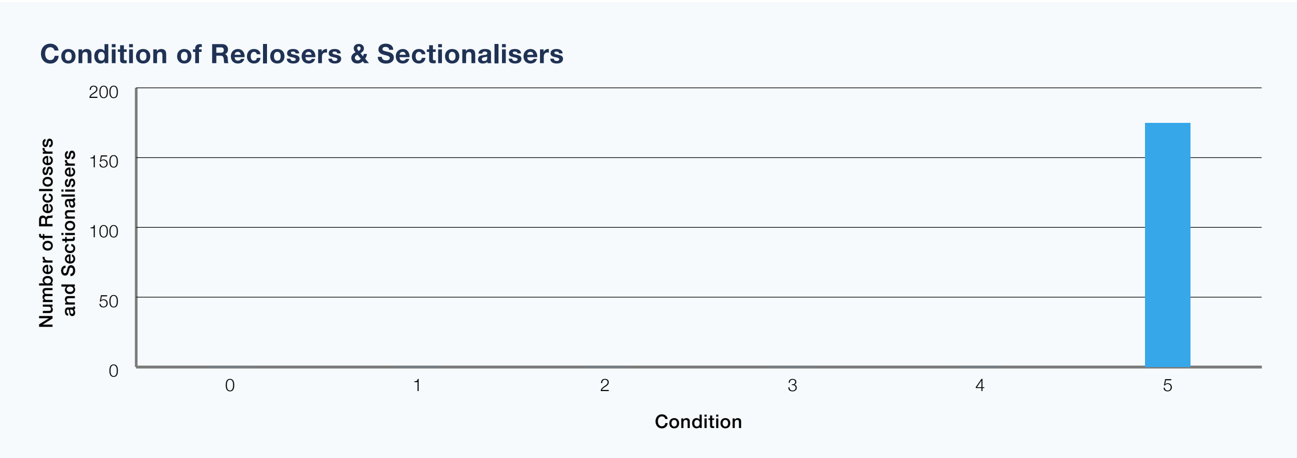


Figure 2.7.4.3: Condition of Reclosers and Sectionalisers

Figure 2.7.4.4 shows the AHI of the sectionalisers and reclosers. The AHI is further explained in Section 2.1.

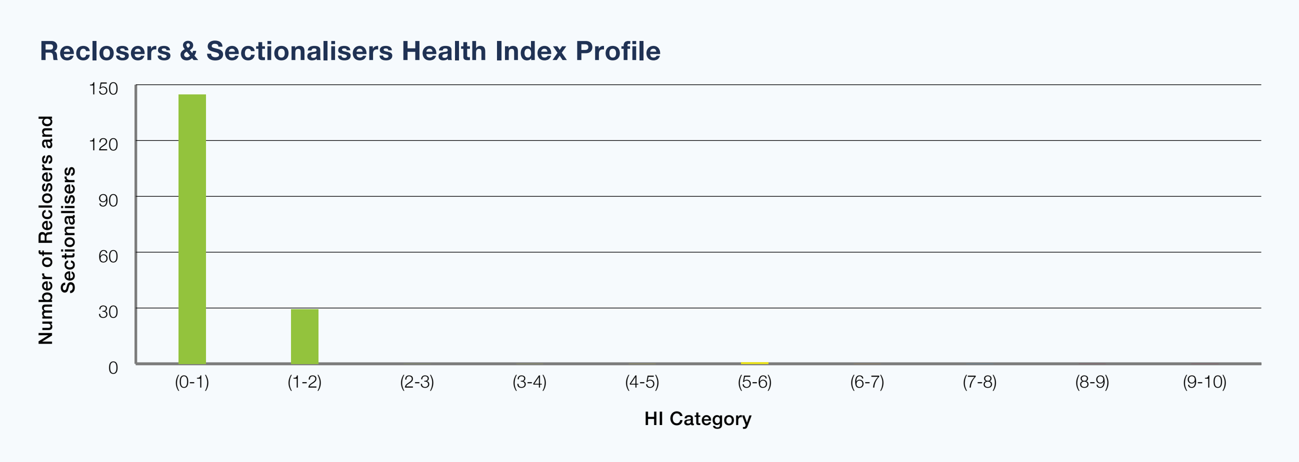


Figure 2.7.4.4: Reclosers and Sectionalisers Health Index Profile

Since a majority of the fleet is comparatively young the fleet is in good condition overall.

2.8 OTHER NETWORK ASSETS

This section covers the electrical protection, load control equipment and other system fixed assets and is structured by asset class:

- LV Pillars;
- Protection Relays;
- NMS;
- Load Control Equipment; and
- Meters

2.8.1 LV Pillars

The LV pillars provide termination points for LV cables, as well as fusing and isolation points.

Population

There are two types of LV pillars; distribution pillars and service pillars. Distribution pillars are the connection points for larger LV supplies, and allow for easy backfeeding. They are usually located close to town centres. Service pillars are the point of connection between the main LV feeder and a service main to the customer. There are 28,461 LV pillars on the network, which is an increase of 1,044 in the last year due to network growth.

Age Profile

The age profile of LV pillars is shown in Figure 2.8.1.1. The average age of LV pillars is 20 years.

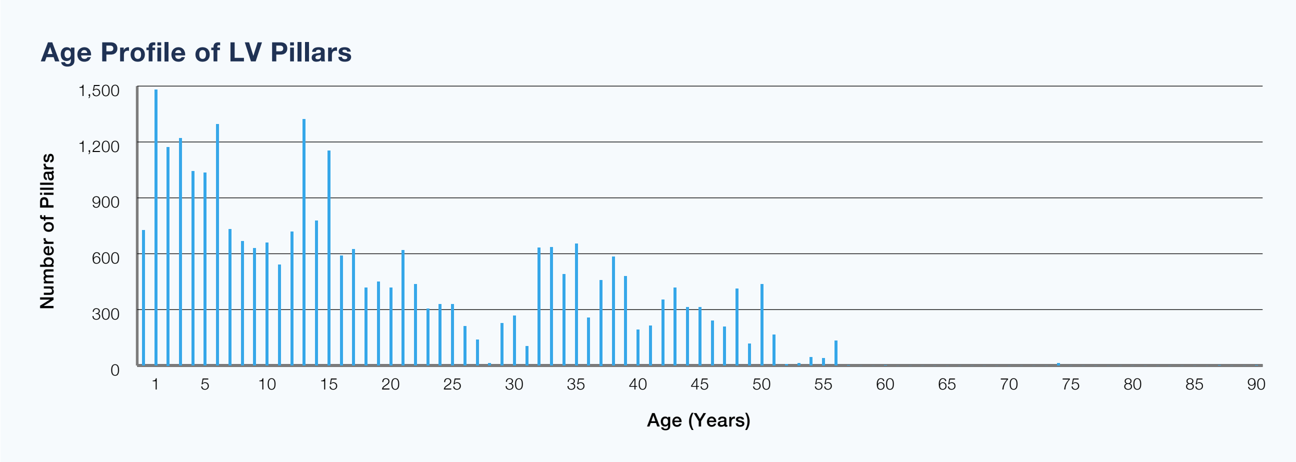


Figure 2.8.1.1: Age Profile of LV Pillars

Condition

The condition of LV pillars is shown in Figure 2.8.1.2. They are in good condition and are patrolled regularly as if the lid is open they can be a public health and safety risk. WEL has undertaken a targeted inspection on the entire LV pillars fleet in 2017 to check that these pillars are adequately secured and remedial works are undertaken as required.

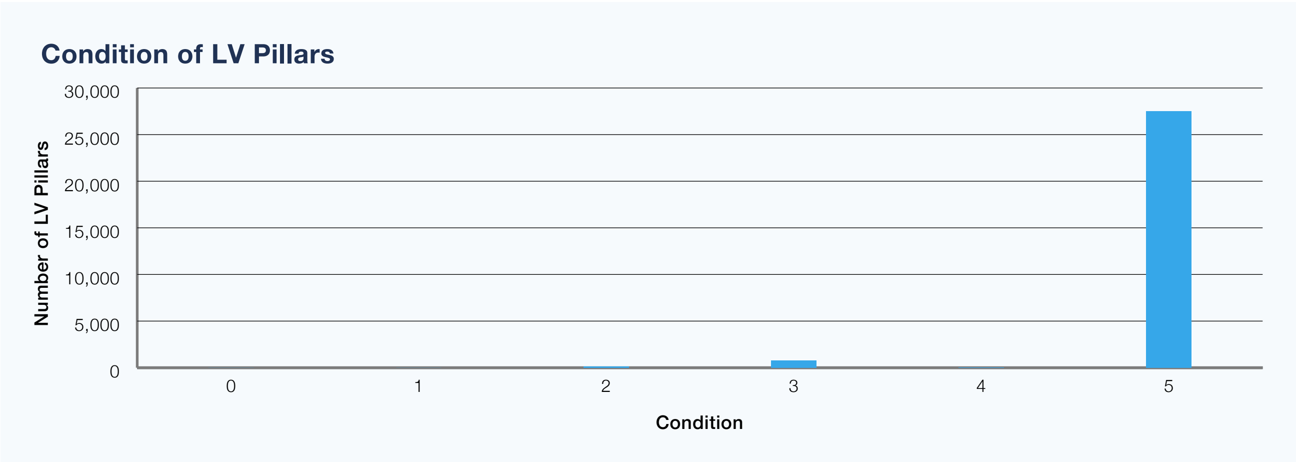


Figure 2.8.1.2: Condition of LV Pillars

2.8.2 Protection Relays

Electrical protection is the primary safety system within the electricity network. Protection relays are required to act quickly and trip a CB within a few thousandths of a second.

Population

We own 678 relays in total, with a mixture of electromechanical and numeric protection relays, with electromechanical representing the older relays. The distribution of relays is shown in Figure 2.8.2.1 below.

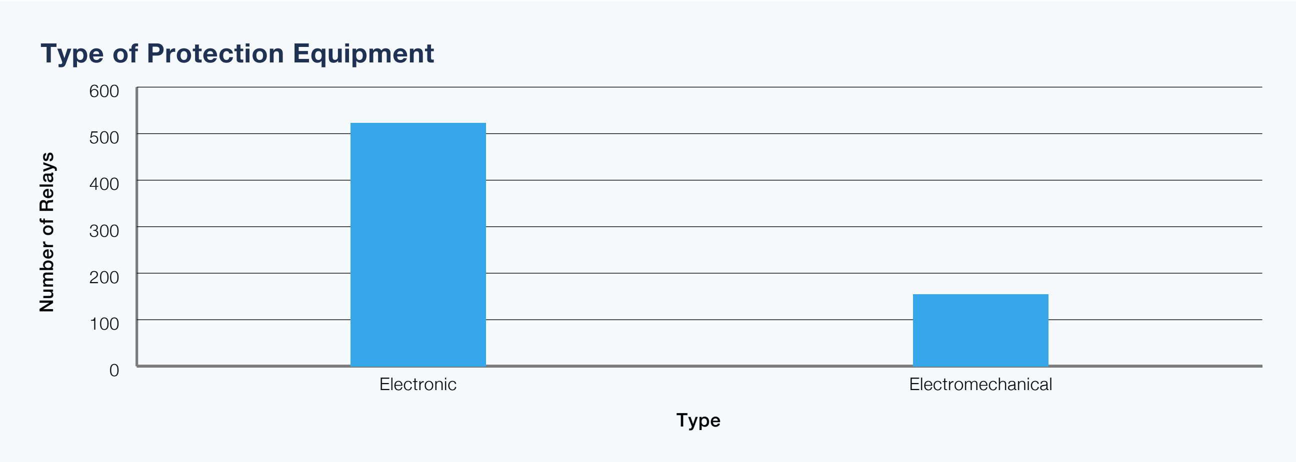


Figure 2.8.2.1: Type of Protection Equipment

Age Profile

Figure 2.8.2.2 illustrates the age profile of the protection equipment.

Figure 2.8.2.2: Age Profile of Protection Equipment

The average age of the protection relays on our network is 17 years. The life expectancy for all types of protection relays is 30 years.

Condition

The condition of the newer relays is good, but the older relays need replacing. This is discussed further in Chapter 8. The distribution of their condition is shown in Figure 2.8.2.3.

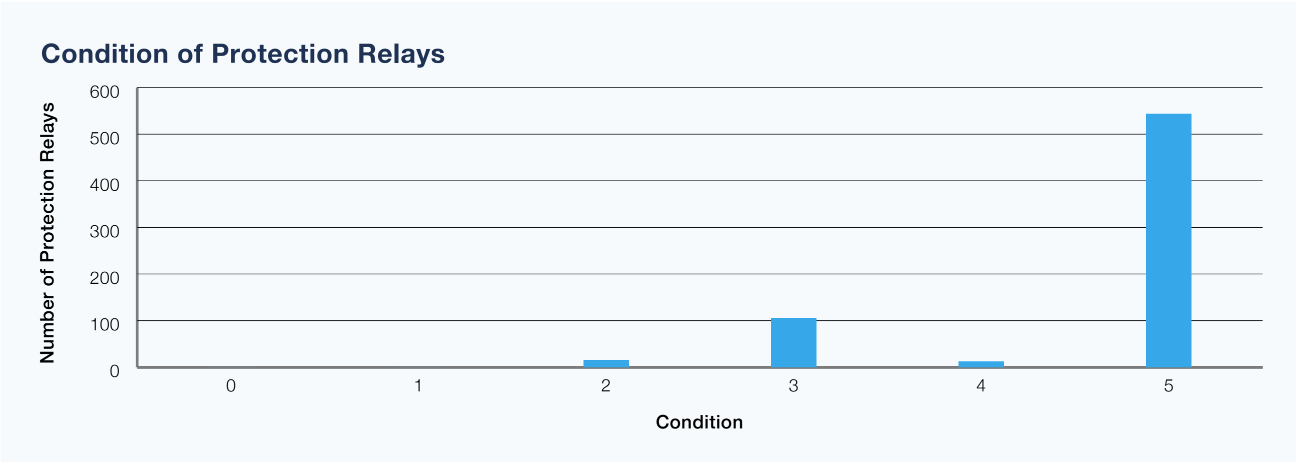


Figure 2.8.2.3: Condition of Protection Relays

In managing numerical relays the configuration data is critical to the correct operation of the relays in the field. In order to ensure the integrity of this data WEL uses a protection database.

2.8.3 SCADA and Communications

SCADA and communications are the foundation of the network automation and monitoring that is controlled by the Network Management System (NMS). Section 7.2.1 provides details on our NMS. The primary component of this supporting infrastructure are the RTUs.

Population

We own 502 RTUs, which is an increase of 36 over the last year. The older fleet are progressively being upgraded or replaced to provide improved functionality and communications capability. Figure 2.8.3.1 shows the location of our RTUs.

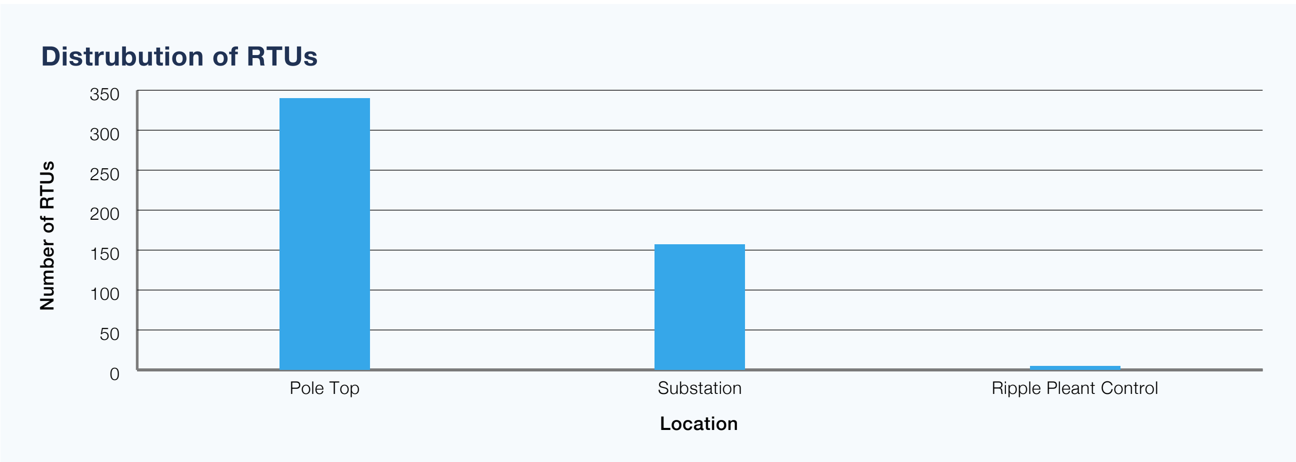


Figure 2.8.3.1: Location of Remote Terminal Units

Age Profile

The life expectancy of the supporting infrastructure, including the RTUs, is 15 years. The average age is 8 years. The age profile of NMS related equipment (RTUs) is shown in Figure 2.8.3.2.

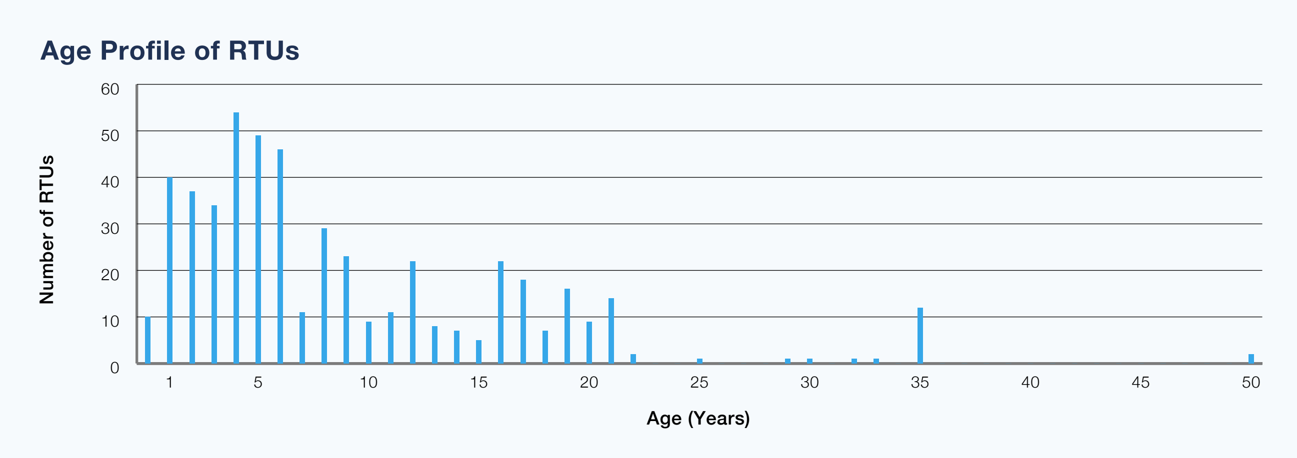


Figure 2.8.3.2: Age Profile of NMS Infrastructure

Condition

The condition of the control room NMS equipment is good with all computer hardware replaced in 2020. The software upgrade was completed in the same year.

The condition of NMS RTUs is shown in Figure 2.8.3.3 below.

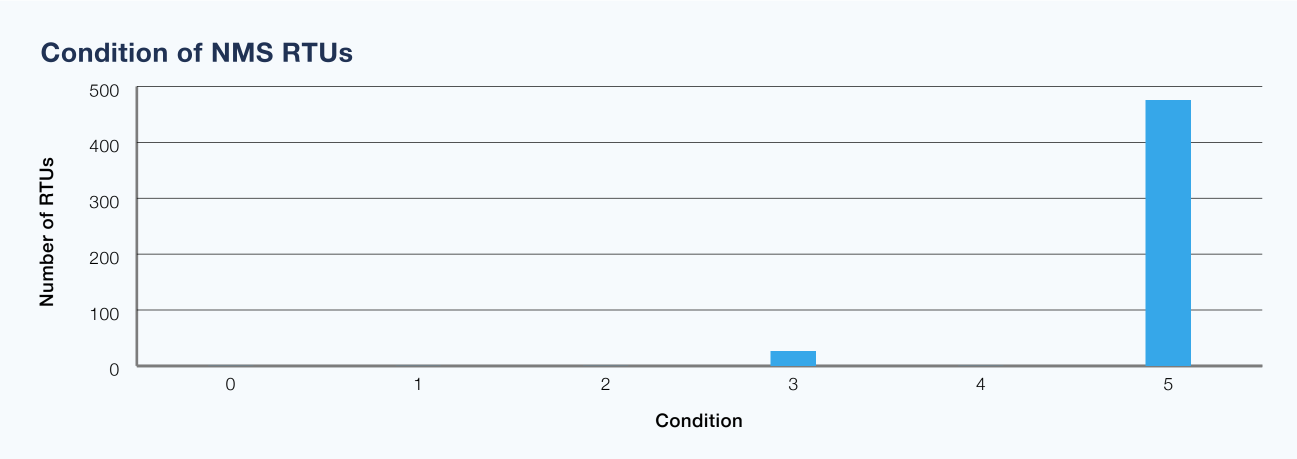


Figure 2.8.3.3: Condition of NMS RTUs

2.8.4 Load Control Equipment

Load control is an important part of managing peak loads on the network. It is initiated from the NMS which provides control signals to the ripple injection plants which in turn signal the ripple relays located at each customer's site. Load control equipment consists of the ripple injection plants and ripple relays.

The load management system within the NMS provides centralised intelligence to monitor network peak demand, forecast expected demand and control interruptible load within service levels to ensure demand does not exceed targets. Furthermore load management functionality is used to manage the total Regional Coincident Peak Demand (RCPD). Other controls provided by the load management system include street lighting and meter tariff rate control.

Our smart meter system has the ability to send signals to meters via mesh radio to perform load control functions in a similar way as ripple. This has been tested as a proof of concept and has been utilised in some instances as a backup for streetlight control.

Population

We own four 33kV static ripple injection sets and two 11kV static sets which operate at 283Hz.

Load Control Equipment is generally located at GXPs and where other signal propagation issues exist. Specifically the 33kV injection plants are located at the Hamilton GXP, Te Kowhai GXP and Weavers substation for the Northern area. The 11kV static sets are located at Pukete and Hamilton 11kV zone substations.

Ripple receivers consist of a mixture of discrete ripple relays and smart meters with the same ripple functionality in built.

Age Profile

The life expectancy of a load control plant is 20 years. The age profile of our load control equipment is shown in Figure 2.8.4.1. The average age of our load control equipment is 21 years.

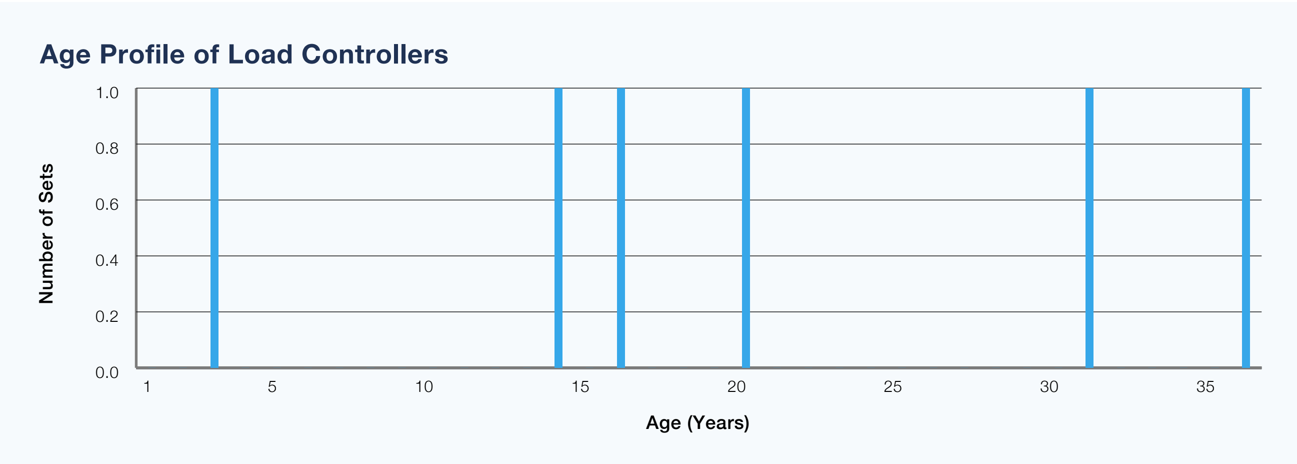


Figure 2.8.4.1: Age Profile of Load Controllers

Condition

The load control plants are within their life expectancy and are generally in good condition.

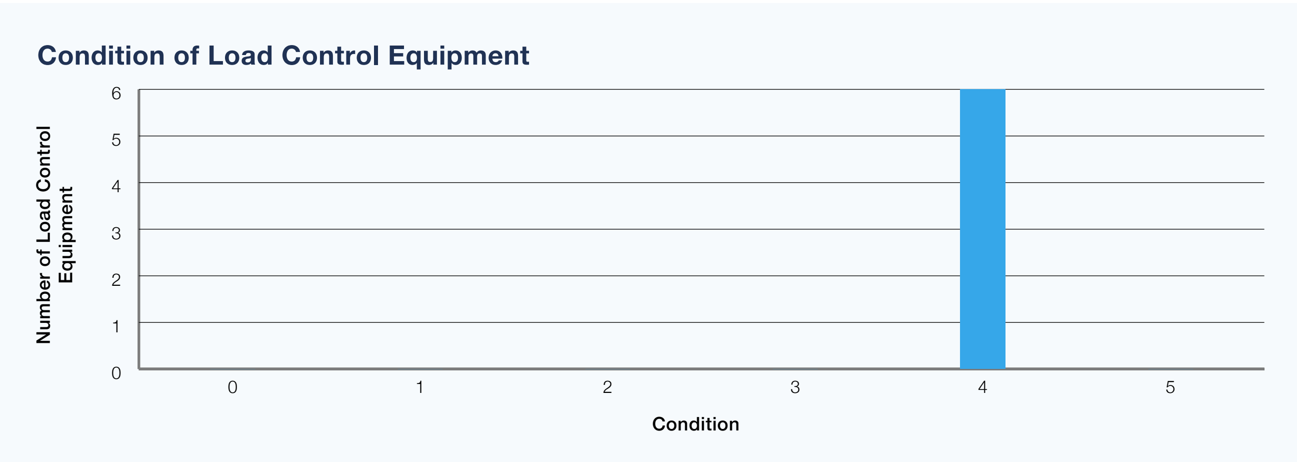


Figure 2.8.4.2: Condition of Load Controllers

2.8.5 Meters

WEL has a range of meters from 33kV meters down to LV smart meters. Further information about the Smart Meter System is contained within Section 7.

Population

The subtransmission and distribution meters are used for revenue protection, load control, operation, fault management and network protection. WEL has approximately 68,000 LV smart meters installed. The vast majority of these meters are installed as check meters in series with revenue meters. WEL has also installed a small number of data loggers at locations of special interest, which can be relocated as required for investigative work. All smart meters can also act as data loggers returning data quality information.

Age Profile

The average age of the subtransmission and distribution meters is 7 years. The low voltage smart meters are installed as compliant meters under the Electricity Industry Participation Code 2010 (Code), requiring strict auditing of procedures and a controlled maintenance and inspection management over their total life span of 15 years. The number of smart meters installed over recent years is shown in Figure 2.8.5.1.

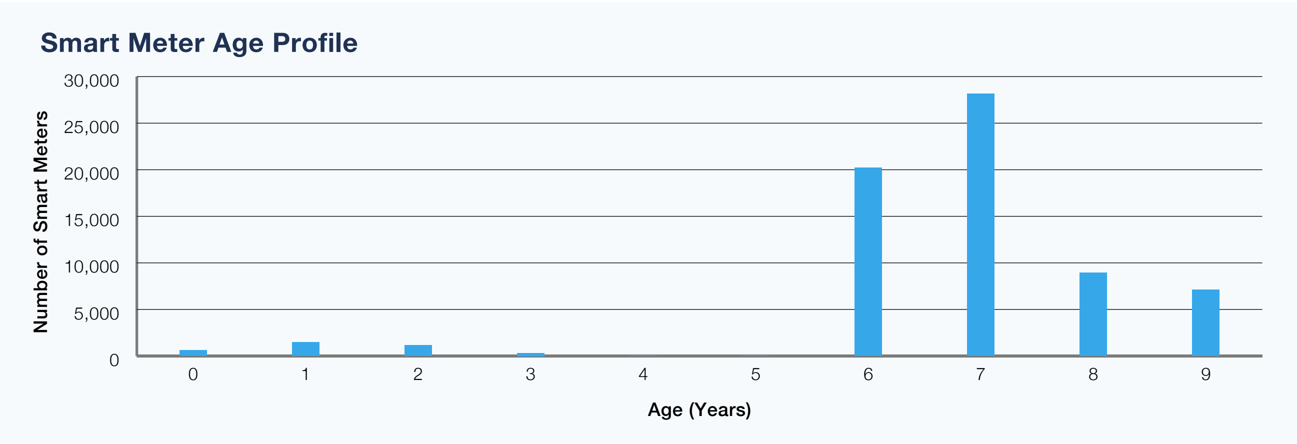


Figure 2.8.5.1: Smart Meter Age Profile

Condition

The condition of all these assets is good; all low voltage meters are maintained under the Electricity Industry Participation Code and the subtransmission meters are housed indoors.

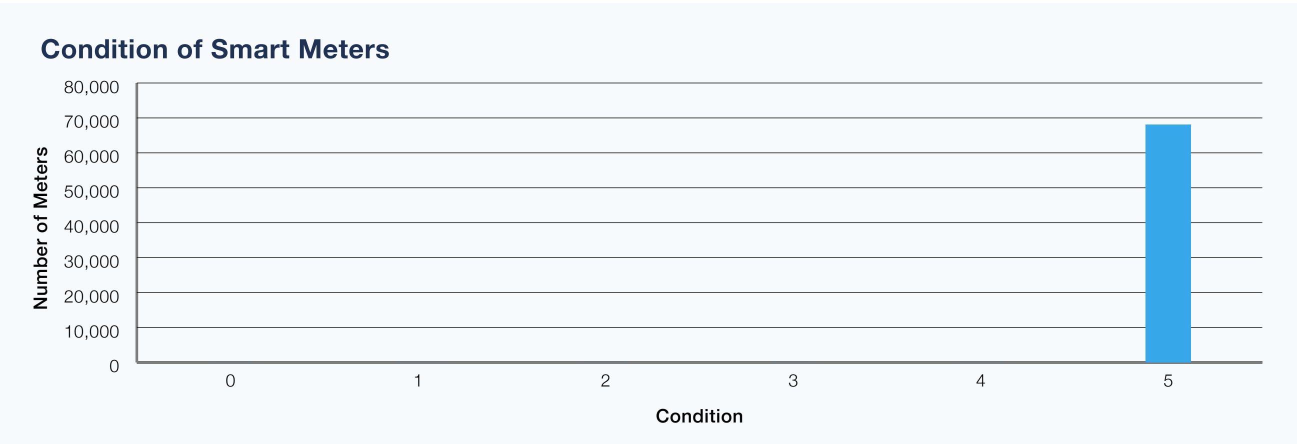


Figure 2.8.5.2: Condition of Smart Meters

2.9 OTHER ASSETS

This section describes the asset classes that are not directly part of the normal operation of the network.

2.9.1 Backup Generators

We have two emergency generators, one in the new Disaster Recovery Centre (DRC) and one for the corporate office and depot. The new 150kVA generator at the depot is in excellent condition and is only a year old. The BESS also provides black start capability and back-up power for short durations.

2.9.2 Emergency Critical Spares

We hold the following critical spares reserved for emergency conditions:

- 4km of overhead 33kV line;
- Substation battery bank;
- Protection relays;
- Substation communication equipment;
- Five zone transformers, 2x 10MVA,2x 15MVA and 1x 23MVA transformers;
- One 33kV circuit breaker;
- 33kV and 11kV sectionalisers and reclosers; and
- 33kV and 11kV air break switches.

RMUs are always in stock so not included in the critical spares list explicitly. The zone transformers will be distributed geographically across the network and on opposite sides of the Waikato River should bridges be destroyed in a disaster.

2.9.3 Head Office and Depot Buildings

We own our Head Office building and the depot for our field staff. These buildings are 12 and 13 years old respectively. Our Head Office has a four star energy efficiency rating. Both buildings are in very good condition.

2.9.4 Computer Hardware, Software and Data

The core software packages within WEL are Network Management System (NMS), Geographic Information System (GIS), Enterprise Resource Planning (ERP), Network Billing System, Electronic Content Management and Mobility Systems. These are further discussed in Chapter 7 – Non-network Solutions and Support Systems.

2.9.5 Other Operational Assets

We have a number of miscellaneous assets including safety equipment, test equipment and vehicles. The safety and test equipment is replaced as needed.

2.10 ASSETS OWNED BY WEL AT GXPs

The WEL-owned assets located at GXPs are covered in the above sections. However, for clarity they are summarised below. They generally include switchgear, metering and load control equipment.

Hamilton GXP

Hamilton GXP has the following assets:

- Communications equipment;
- Ripple Plant (load control equipment);
- Metering equipment;
- RTUs; and
- Protection relays.

Te Kowhai GXP

Te Kowhai GXP has the following assets:

- Communications equipment;
- Ripple Plant (load control equipment);
- Metering equipment;
- RTUs; and
- Protection relays.

Huntly GXP

Huntly GXP has the following assets:

- Communications equipment;
- Metering equipment;
- RTUs;
- Protection relays; and
- 33kV Switchgear.

WEL
NETWORKS
SAFE JOB START
Signatures
For personnel who arrive on site after work has commenced

3

APPROACH TO ASSET MANAGEMENT

3 APPROACH TO ASSET MANAGEMENT

This chapter describes our approach to asset management. Asset management is the core of what we do and as such our approach is fundamental to achieving the service level outcomes sought by our customers and stakeholders.

3.1 STAKEHOLDER REQUIREMENTS

In this section we describe our understanding of our stakeholders and our sustainability management requirements. Our primary stakeholders are:

- Customers
- Community
- Regulators
- Transpower (including in their role as System Operator)
- Electricity retailers
- Service providers
- Staff
- Board of Directors
- WEL Energy Trust

Stakeholder requirements are incorporated into our asset management practices through the metrics we use to measure our performance and in our network design and security standards. The metrics used to measure our performance against these requirements are described in Chapter 5 and our security standards are discussed in Chapter 6.

Our Customers

We identify our customers' needs through surveys, feedback and direct interaction. While there is diversity in the level of service sought by the different groups, all customers are concerned with four key service areas; public safety, quality of supply, price of the service they receive, and the level of customer service we provide. Their interests are accommodated within our asset management practices through delivering acceptable asset management, technical and performance standards.

As a part of our new connections process we conduct surveys (questionnaire by phone) on all Customer Initiated Works completed each month through an external service provider which then generates a quarterly report for analysis and action. The survey covers:

- Value
- Communication
- Efficiency
- Outcome
- Performance

Through our Operational Excellence programme of work, WEL is targeting a lift in overall performance and efficiency satisfaction ratings through addressing any shortcomings in delivery. The introduction of the Small Works Delivery (discussed further in Section 4.2.1) is one initiative to drive this satisfaction lift and is continually monitored for delivery and customer satisfaction. The delivery of the Works Management end-to-end process (see section 3.4.3) is another example of how Operational Excellence will enhance performance, delivery and ultimately customer satisfaction.

Retailers

There are 22 retailer brands under 17 parent companies which sell electricity and ancillary services to our customers. In most situations, retailers are responsible for collecting revenue on our behalf and maintaining the direct contractual relationship with customers.

We maintain frequent communication with retailers through our operational, billing and payment interactions and consultations. We understand retailers' requirements of us as an electricity distributor. These requirements include: the delivery of effective business to business services; use of transparent, simple and appropriate network price structures and fair contractual arrangements. Retailers are viewed as customers in their own right in addition to their role as representatives of our customers.

Community

We have a responsibility to the wider community in which we operate. Our owner is a community trust and as such the wider community needs are an important focus for us. We have developed our understanding of the community's needs through a number of channels including the Trust. These needs include the delivery of an essential service, public safety and the impact our assets have on the environment. These needs are paramount to us and are accommodated in our asset management practices. Our objectives and approach to public safety and environmental issues are described in Chapter 6.

Our assets form part of the landscape in which our communities live and work. Accordingly public safety is a key concern and consideration in our asset management planning, equipment design and network operations. These requirements are reflected in our safety objectives and performance measures and implementation of a certified Public Safety Management System (PSMS). WEL contributes to the community's prosperity on many levels but primarily through the safe and efficient delivery of our services.

Regulators' Requirements

As an electricity distribution business our operations are subject to regulations established under various Acts including the Commerce Act and the Electricity Industry Act. The regulations are primarily administered by the Commerce Commission and the Electricity Authority. The Commerce Commission is our economic regulator. It regulates price-quality requirements and public disclosure of important information (Information Disclosure) that applies to WEL. The Electricity Authority is responsible for establishing and regulating an efficient electricity market and other related aspects of an electricity distribution business, such as pricing structure, interactions with the System Operator and commercial agreements with retailers that also apply to WEL.

Compliance with regulation is a key requirement of the regulatory bodies and is consequently a key focus for us. The publication of this AMP is an example of a regulatory requirement being met. Our regulators require our compliance, constructive input and collaboration to assist them in fulfilling their duties.

Transpower (including in their role as System Operator)

We receive our electricity supply via transmission lines owned and operated by Transpower, the New Zealand transmission company. Transpower also holds the role of System Operator (SO) that is primarily responsible for maintaining the integrity of the electricity system including the coordination of electricity generation. Transpower and WEL consult extensively with each other regarding our respective asset management plans, commercial relationship and other industry issues. We have established systems and protocols with the SO for immediate communications regarding operational matters should circumstances require it.

In their role as SO they require that we maintain instantaneous communications and are able to respond to their instructions. They, in turn, must take into account our requirements.

We maintain communications through our regular planning discussions and through our Network Operation Control Centre. Electricity Industry Participation Code requirements are met through our established procedures and practices, and monitored through our risk and compliance framework.

Service Providers

We rely on service providers to carry out a number of functions. These include providing critical components of equipment and services. The requirements of service providers vary depending on the nature of the services they are required to deliver. However, to be effective they require appropriate payment for services and good working relationships. Accordingly we put significant effort into ensuring sustainable working relationships are fostered with all service providers.

People

Our people are the driving force behind our business. We have a workforce from diverse backgrounds who contribute to the success of the business by bringing diversity of thought and experience. Our people value job satisfaction, a safe, enjoyable and inclusive working environment and to be fairly remunerated for the work they perform. We strive to be a good employer and have incorporated health, safety and wellbeing, and diversity and inclusivity policies and initiatives, performance reviews and forward work planning so staff can maintain a positive work/life balance. These interests are identified though staff forums, surveys, performance reviews and other direct engagement.

They enable us to deliver on customer and stakeholder expectations. As such, staff safety and wellbeing is critical to our success.

WEL's Board of Directors

The Board of Directors are the shareholder's representatives in setting direction for the business. They are concerned, amongst other things, with:

- Providing a safe environment for staff, service providers and the public
- Enterprise value and the long-term sustainability of the business
- Ensuring a good reputation with the community
- Customer engagement
- The long-term management of our assets
- Managing business risk
- Seeking opportunities for growth
- Efficient operation
- Developing organisational capability
- Ensuring we are positioned to embrace and benefit from the evolving energy environment
- Sustainable community
- Diversity and inclusion

Their interests are identified and incorporated into asset management practices through our governance processes.

The WEL Energy Trust

The WEL Energy Trust manage the shareholding of WEL Networks on behalf of the local community. The core purpose of the trust is to maximise the benefit to the community by the long term growth and sustainability of WEL Networks. The trust distribute the dividends from WEL Networks to the community through initiative support and grants.

3.1.1 Sustainability

The management and Board of WEL Networks are committed to running the business in a way that is sustainable and embraces the principles of corporate social responsibility. We have chosen to align our activity to four of the United Nations' (UN) Sustainability Development Goals (SDGs) where we can make the most impact and generate the most synergy with our strategic direction. In this way we believe we will add the most value and have the largest impact on business performance.

The following sustainable activity areas support our Company values and are directly related to the activities encompassed in our strategic plan.

Area	UN Sustainable Development Goal - SDG
Employee Relations, Welfare, Diversity and Inclusion	Aligned to Good Health and Wellbeing (SDG 3)
To promote a positive workplace for WEL staff through a commitment to best practice employment processes ▪ Implementation of a diverse workforce and inclusive work environment ▪ Monitor and deliver gender equality across the business ▪ Deliver ongoing wellbeing initiatives for staff and implement an overarching wellbeing framework	
Sustainable Community	Aligned to Affordable and Clean Energy (SDG 7)
Invest in the future of the local community and address energy hardship through the provision of an affordable, reliable and safe supply of electricity ▪ Operate a retail platform to provide cheaper retail electricity to the wider Waikato community ▪ Reduce the risk of harm in the community through the ongoing effective implementation of a public safety management system across the network assets ▪ Support the expansion of EV charging infrastructure throughout the network to encourage the uptake of electric vehicles	
Resilient Infrastructure	Aligned to Industry Innovation and Infrastructure (SDG 9)
Build resilient infrastructure and promote sustainable and innovative development of network assets ▪ Monitor and reduce SAIDI (customer outage times) through a resilient network ▪ Develop nano-grid technical infrastructure to better understand how to optimise sources of generation attached to the network ▪ Install solar panels and a grid battery at the WEL depot in support of the nano-grid ▪ Investigate options for grid scale renewable energy generation	
Greenhouse Gas Emissions	Aligned to Climate Action (SDG 13)
WEL will undertake an assessment of its greenhouse gas (GHG) emissions with a view to reducing the relative impact of its emissions over time. All measurements will be validated by Toitū Envirocare. ▪ Measure GHG emissions and verify using Toitū carbon reduce certification ▪ Convert the WEL pool vehicle fleet to electric vehicles (EV) or hybrid ▪ Operate and evaluate the fully electric powered EV elevated work platform truck and the hybrid technology battery powered hydraulics/diesel truck	

3.1.2 Diversity and Inclusivity

Diversity and inclusivity are essential components of being a successful business. We value the diversity of thought and experience that comes from people of different backgrounds. Our Diversity and Inclusivity Policy speaks of our commitment to fostering a workplace in which everyone is treated fairly and is provided the opportunity to reach their full potential. In achieving this we believe will be a stronger, more creative and more resilient organisation.

3.1.3 Balancing Stakeholder Requirements

With a wide range of stakeholders, striking the appropriate balance between their requirements is necessary where the outcomes sought are mutually exclusive. In a majority of cases our stakeholder requirements align and can therefore be met without conflicting outcomes. However, when they don't align we always prioritise safety requirements ahead of all other needs, followed by other legal and regulatory requirements. Any remaining unserved stakeholder requirements are prioritised on a case by case basis depending on the particular circumstances.

3.2 ASSET MANAGEMENT FRAMEWORK

Effective asset management is critical to achieving our objectives. We have developed an asset management framework that links our corporate objectives and day-to-day activities (Figure 3.2.1). It comprises the following:

Asset Management Policy: aligns our asset management approach with our corporate objectives (Vision, Values and Strategic Plan). Our asset management objectives reflect these by focusing on risk management and the skills and competencies of our workforce;

Asset Management Strategy: translates the Asset Management Policy into drivers and high level objectives. The strategies employed currently sit within our network development, renewal and maintenance and non-network development plans;

AMP: (this document) reflects our asset lifecycle model, aligns our high level objectives to relevant processes and activities, and details our 10 year investment plans; and

Annual Work Plan: applies our strategies to individual assets and sets out intervention plans. Our work plans consider each element of the asset lifecycle.

Together these components align with the performance objectives established for the network.

In April 2019 WEL Networks commenced a two year programme of work called Operational Excellence. This will support an asset management system which is aligned with the recognised ISO Standard, ISO 55001:2014 Asset Management – Management Systems - Requirements. This includes the development of a Strategic Asset Management Plan (SAMP) to the guidance specified in ISO 55002:2018 Annex C – Strategic Asset Management Plan.

The SAMP sits beneath the Asset Management Policy and translates the goals of the WEL Networks Strategic Plan into asset management objectives. It also sets out the top-level strategic plans for how these objectives will be achieved, covering both plans for the assets and how asset management is delivered. Following the implementation of the Operational Excellence programme of work, the Asset Management Framework will change to include the SAMP as discussed above.

Further information on our journey to Operational Excellence and ISO 55001 alignment is described in section 3.4.3 and 4.1 of this document.

The current asset management framework is depicted below.

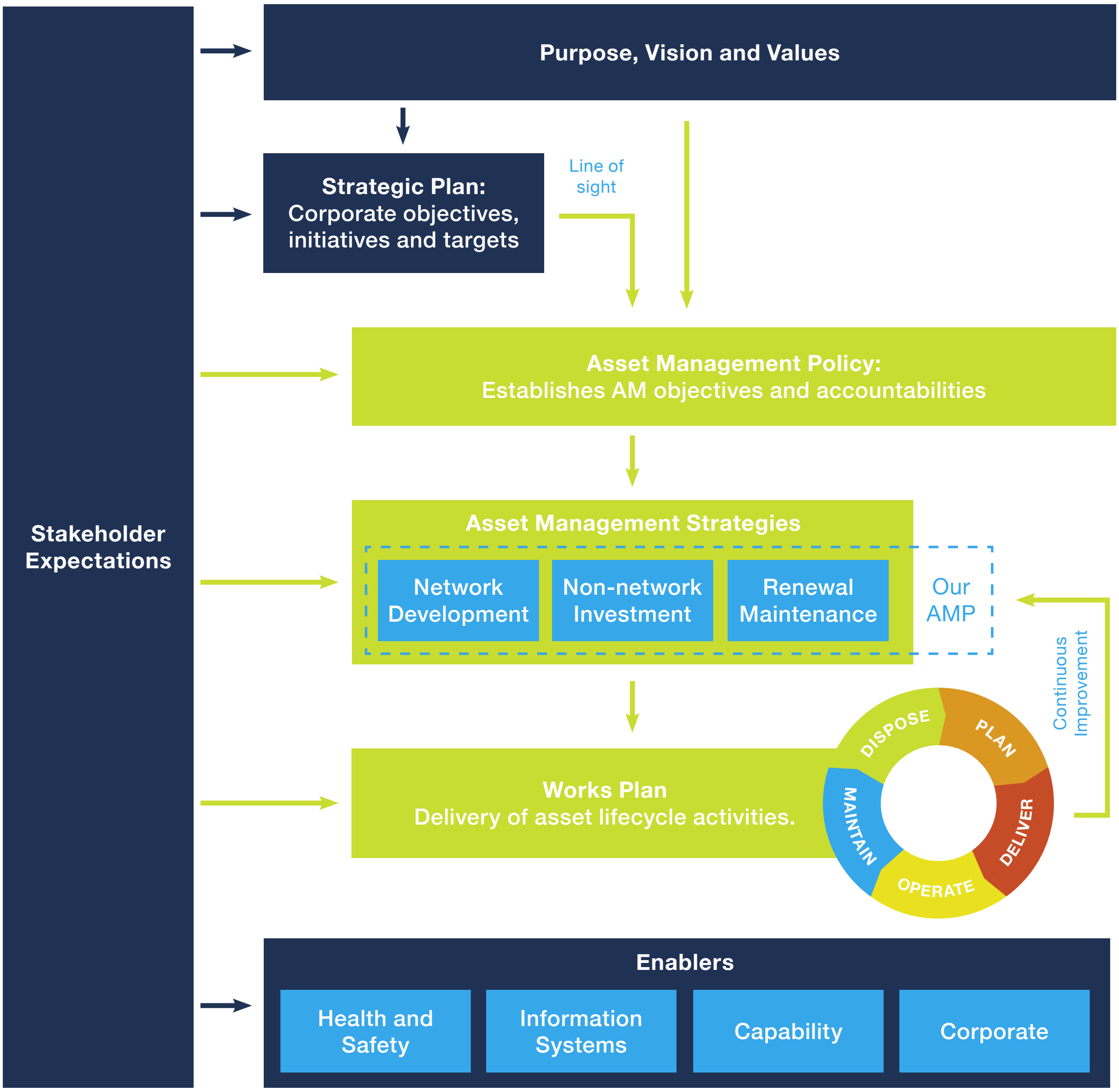


Figure 3.3.1: Asset Management Framework

3.2.1 Asset Management Policy

The WEL Asset Management Policy is central to the operations and management of WEL's distribution network and its business. The key policy principles are:

- Provide an enduring and reliable distribution network, targeting best practice levels of resiliency and safety and the efficient long-term utilisation of assets
- Development of the network structure to meet current and future customer performance
- Create an annual Asset Management Plan outlining the nature and characteristics of our assets and investment requirements and to provide an overview of our asset management planning, systems, procedures, and practices
- Make asset management decisions based on complete, accurate and timely information through the delivery and capture of quality asset data
- The network model will allow for the generation of sufficient asset based revenue to support the long-term operation of the business

The overall objective is that WEL network assets should be planned, designed, constructed, operated, maintained, renewed, and disposed of in an efficient manner including the following parameters:

- Minimise hazards and risks for people, plant and environment, striving to be "Best in Safety" through embedded safety culture and application of safety in design principles
- Comply with industry, regulatory and statutory requirements
- Adopt methodologies to achieve the optimal balance of longevity, utilisation and cost across the asset base. Support regional economic growth while still maintaining WEL security standards
- Base asset management decisions on the full evaluation of all alternatives taking into safety, reliability, environmental, sustainability, social whole of life cycle costs and economic benefits and risks.

3.2.2 Asset Management Strategy

The Asset Management Strategy links our policy objectives to three distinct components:

1. **Network Development**

   We invest to meet the capacity required to supply localised areas of growth in consideration of network security against the established security criteria. To achieve our customers' requirements in a cost effective manner, we will seek projects with high cost benefit ratios.

2. **Non-network Investments**

   We invest in non-network assets to increase operational flexibility and to improve the information that supports our asset management decision making. We are investigating new non-network solutions such as solar generation and battery installation. We have already gained substantial expertise on tools and data analytics using smart meter data. We continue to develop new systems from smart meter data to improve services to our customers.

3. **Maintenance and Renewal**

   Our strategic approach to maintenance and asset renewal is to maintain a consistent and sustainable level of risk over the long-term. The principal methodology employed for this is CBRM. Outcomes from asset and network reliability analysis are utilised and overlay onto CBRM to assist in the prioritisation of the renewal plan. This strategic approach and the resultant renewal and maintenance expenditure over the AMP period are discussed further in Chapter 8.

Document Control and Review

WEL uses Promapp for the control and review of its asset management process. Promapp is process management software that allows us to clearly define our processes and set review periods. Each process describes the actions that are required and links to all controlled documents. Each process is assigned an owner and it is the owner's responsibility to ensure that a review of the process and supporting documentation is undertaken within the interval set. We also undertake internal and external audits (including certification to ISO 9001:2015 Quality Management Systems - Requirements) of our asset management strategies and policy which ensures their alignment and accuracy.

Annual Works Plan

WEL Networks is currently 12 months into an improvement initiative to enhance our ability to deliver safe, effective and efficient maintenance and capital works across our network. As part of this ongoing improvement we have set a benchmark of aligning ourselves with selected leading practice asset management guidelines set out in ISO 55000:2014. We recently undertook a maturity assessment of our asset management function utilising the ISO 55000 framework as a benchmark and found several improvement areas to enhance the forward planning and delivery of our work. The improvement program is focused on the enabling functions of managing assets that not only deliver a safe and reliable service but also use key metrics to improve. The key areas of improvement include:

- SAP functional location reporting
- Work Management
- Performance Reporting
- Maintenance Strategy
- Asset Planning

The integration of outcomes across these improvement components are implemented through our annual works planning process. Annual works planning is integral to meeting the needs of our stakeholders. The focus of annual works planning is to safely and efficiently deliver both planned and unplanned works. It also includes operational services required to meet customer requirements. It involves three key steps:

1. Integration and optimisation of network development, renewal, and maintenance works.
2. Works and resource scheduling and programme management.
3. Management of delivery through WEL Services and external contractors.

The governance arrangements for works planning are discussed further in Chapter 4, and the associated performance metrics and targets are described in Chapter 5.

The Annual Works Plan is the delivery of approved work extracted from the Asset Management Plan and intended to be completed within the regulatory period. There are three drivers of work: network development to meet both localised and overall load growth, renewal of assets deteriorated to the point they will soon become not fit for purpose, and support of customer works such as new connections.

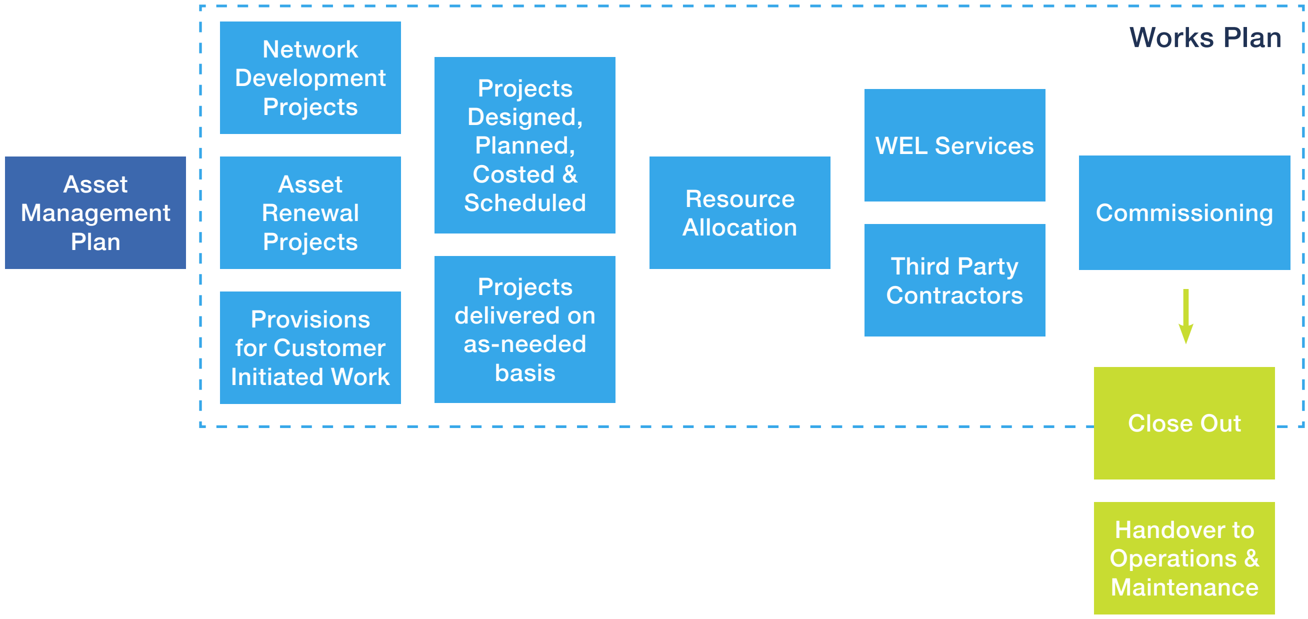


Figure 3.2.2.1: Works Plan

As set out in the AMP, WEL has a reasonable understanding of the volumes of anticipated future work in each category and makes provision for the resources and infrastructure necessary to deliver this work in accordance with agreed schedules. Short term fluctuations in the rate of work are managed with the use of external contractors. WEL utilises its history of project costs and performance to inform its capacity planning for future workloads.

The specification of each job complies with WEL engineering standards so that the network is developed and renewed to be safe, reliable and resilient in the future. Meeting these standards relies on consistent processes for defining projects, developing their scope of works and committing to detailed plans. These ensure that the works delivery in the field is safe, minimises the negative impact on network customers, and is delivered on time and on budget.

The Annual Works Plan allows WEL to balance resources and investment to meet the demand for work in the different job categories on a risk-prioritised basis, utilising the technical labour available both internally and through external labour contracts. Allowing sufficient lead time before each job commences enables planning and resource scheduling to ensure quality work is coordinated and undertaken safely. WEL recently updated our work planning processes and augmented our SAP capabilities to improve coordination of network projects.

As part of its asset management approach, WEL practices continual improvement whereby jobs are reviewed both when in progress and on completion. Assets delivered by the projects are registered in information systems so that they can be maintained in the future.

3.3 RISK MANAGEMENT FRAMEWORK

This section describes our approach to risk management. Risk management is a fundamental asset management discipline that supports the management of our assets. It requires that robust processes are in place for assessing and managing asset-related risk. It is a key principle in support of our ultimate aim of keeping people safe.

3.3.1 Risk Management Policy

Our Risk Management Policy identifies risk management as a key requirement when managing both day-to-day operations and longer-term network planning and design. It ensures that risk management is an integral part of our management and operating processes. It seeks to improve decision making, so that the business can maximise improvement opportunities while effectively managing risk.

We have developed and maintain a 'risk aware' culture across the business, where staff are empowered and enabled to identify and evaluate relevant risks. We have in place processes to evaluate, prioritise and mitigate these identified risks. Other than safety related decisions, we seek to balance the costs of mitigation and treatment with the residual risk.

Risk Accountabilities

Ultimate responsibility for risk management resides with the Board of Directors. The Board of Directors have issued a Risk Appetite statement and Risk Tolerance statement. The Board of Directors have delegated management of this responsibility to the Audit and Risk sub-committee. The sub-committee meets at least four times per year to review risk, audit and assurance activity. The full Board is updated about critical risks on a monthly basis by the Chief Executive as part of the regular management reporting functions.

The Risk and Internal Audit Manager provides management oversight of our risk management and audit processes. This includes reviewing all new risks entered in the risk database to validate the data, determine the classification of the risks and approve the treatments.

Each staff member is supported by the Risk and Internal Audit Manager to ensure they understand the risk management process and how it applies to them. This includes being actively engaged in the identification of new risks and ensuring these are captured and appropriately escalated for evaluation.

3.3.2 Risk Management Framework

Our Risk Management Framework is aligned to the AS/NZS ISO 31000:2018 Risk Management Standard. It consists of five process steps for systematically managing risk, as illustrated in Figure 3.3.2.1 below.

Figure 3.3.2.1: Risk Management Framework

The following describes our approach to each process step in the framework.

Establish the Context

The risk context is established from many factors including; accessibility by the public, location in the community e.g. rural or urban, asset age and condition, inspection programmes and data quality.

Risk Identification

Our asset management risks are identified through several mechanisms including the hazard identification process and asset inspection and condition monitoring programs, regular risk meetings, audit results or event analysis. Any new risk will then be assessed and ratified by the Asset Management team.

Managers from our Asset Management team meet on a regular basis to review a selection of risks. This provides a formal mechanism for risk assessment, risk monitoring and the identification of new or emerging risks.

Risk Analysis

When a potential new risk is raised a process of analysis is completed to understand the nature and extent of the risk. This includes discussion with relevant staff.

Risk Evaluation

Each risk is evaluated against established criteria to determine the degree of acceptability. At times risks may be accepted by the business. Where this occurs, decisions and reasoning will be documented.

Risk Treatments

Options to mitigate risks are identified. The costs (both initial and on-going) of the proposed treatment options are estimated. WEL notes that under the Health and Safety at Work Act 2015 cost is not considered to be a reason to not proceed with any particular treatment, but practicability is. The treated risk is then evaluated against the ‘inherent’ risk to provide a residual risk classification. The ‘gap’ indicates the effectiveness of the treatment option.

Once agreed, treatment actions are included in business plans and budgets where necessary, priorities are set and timeframes for actions are agreed with the risk owner and relevant managers.

Monitoring and Review

An active programme of risk monitoring and review is in place. Our internal audit programme also assesses key risks and the effectiveness of controls. The results of these audits are reported to the Audit and Risk Committee (ARC) with improvement opportunities discussed and additional actions approved. The internal audit programme utilises both our internal auditors and independent third party auditors to conduct a range of internal audits to verify performance.

Risk Management Database

To support our risk management framework, we use the Quantate Risk Management application. This software-based process supports AS/NZS ISO 31000:2018. It helps to ensure we have a structured approach to the risk management processes, and has assisted with the efficient administration of risk management reporting.

Risk Classification

Figure 3.3.2.2 below illustrates our risk management classifications. Risk classification bands (indicated by different colours) have been set to reflect our tolerance for risk. These settings were determined by establishing the potential impact and degree of acceptability.

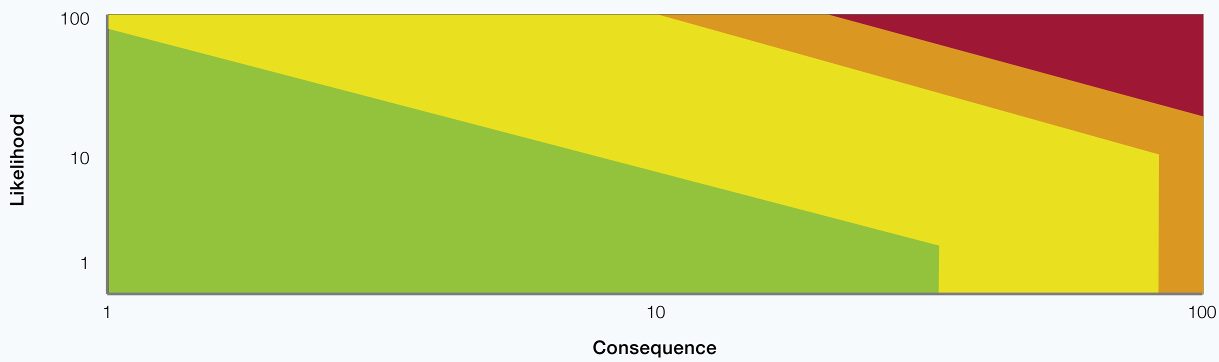


Figure 3.3.2.2: Risk Classification

There are two aspects to the classification of risk: likelihood and consequence.

Likelihood is determined from:

- **Historical data** – from our company and other similar companies
- **Empirical data** – externally sourced data e.g. equipment manufacturer information

Consequences are considered and rolled up into three broad categories of:

- **Health and safety** – the risk of a health and safety impact e.g. is there a risk of single or multiple fatalities, serious harm or minor injury.
- **Financial impact** – includes the service, environment and reliability factors estimated as cost impacts from $0 to > $100,000,000.
- **Reputation** – this looks at the impacts on various groups of internal and external stakeholders including our customer and community and is categorised in five bands from 1 (very serious impact) to 5 (very minor impact).

Each combination of consequence and likelihood has been given a value according to the potential impact on the business.

The classification of risks, shown by the colour bands in Figure 3.3.2 above, and description are:

- **Class 4 (Extreme)** risks are considered intolerable. Risk reduction actions must be applied to reduce the likelihood or consequences of the risk.
- **Class 3 (High)** risks are unacceptable without further controls unless the cost or practicability of such controls outweighs the benefits.
- **Class 2 (Medium)** risks are tolerable but undesirable. Higher consequences (those further over to the right hand side of the chart) are less desirable. Low cost mitigation may be justified unless the cost or practicability of such controls outweighs the benefits.
- **Class 1 (Low)** risks are acceptable.

3.3.3 Identified Top 10 Risks

We have identified the following asset risks as being the top 10 inherent.

Risk	Inherent Classification	Residual Classification	Key Mitigations
Major storm or natural disaster	Extreme	High	Contingency planning Network design
Sub-optimal investment in assets due to changing patterns in consumer energy efficiency practices and the impacts of emerging technologies	Extreme	Medium	Strategic Asset Management approach Project Prioritisation Tool
Asset class failure prior to scheduled replacement e.g. S&C link failure	Extreme	Medium	Asset Management condition-based assessment
Staff or contractors injured while working on the network	Extreme	Medium	Training and Competency Processes and Standards
Harm to member of the public through equipment failure	Extreme	Medium	Asset Management Maintenance Works
Harm to member of the public through deliberate contact with the network	Extreme	Medium	Asset Security Maintenance Works Public Safety Management System
Harm to staff or member of the public through defective work	Extreme	Medium	Training and Competency Processes and Standards
Harm to staff or member of the public due to inadequate earthing	Extreme	Medium	Maintenance Design and Construction Standards
Harm through failure of safety equipment	Extreme	Medium	Test and Inspection Purchasing Standards
Harm and/or reliability impact from inaccuracy or failure of critical production network systems	Extreme	Medium	Commissioning Process As built Process Routine equipment testing and calibrations

Table 3.3.3.1: Top 10 Inherent Risks

3.3.4 Managing Asset-related Safety Risk

Safety management is a critical component of the overall risk management framework and due to the inherent nature of our electricity network, many network risks have a significant safety consequence weighting. Minimising both the likelihood of safety events occurring, and the ability to minimise the consequences when events do occur are therefore of paramount importance to us.

Our Public Safety Management System reflects our approach to managing asset based safety risk. The key principle in managing asset and infrastructure risk is to reduce the residual risk to being as low as reasonably practicable as outlined in NZS 7901:2014 Safety Management Systems for Public Safety.

Asset Failure Risk Management

Safety risk due to asset failure is a key concern for WEL. The Asset Management team is responsible for managing risk associated with our assets, the delivery of our works programmes and the operation of the assets. WEL Services and our contractors also have a responsibility for managing any operational or delivery risks.

WEL has employed the technique of exposure rate analysis to assess the likelihood (frequency) of asset failure and related impacts. Risk assessments have been conducted for the various classes of network assets. This approach is inherently built into our Condition Based Risk Management (CBRM) asset management tool, discussed further in Chapter 8.

3.3.5 Resilience and High Impact Low Probability (HILP) Events

Although natural disasters and emergency situations are unlikely, they would have a significant impact on our assets and operations. Reflecting this, our planning in this area is extensive and includes the following aspects: while natural events can have a significant impact on the network, we actively identify areas and sections of the network that may be subject to HILP events and have response plans in place. In line with good industry practice WEL operates an N-1 design philosophy on its major plant and in particular its sub transmission network. All substations and major network building have been assessed for seismic strength and those that failed to reach required standards have been strengthened to Importance Level (IL) 4 or IL3 depending on risk and importance. All new buildings are designed to meet IL4.

Lifeline Utility

As a critical infrastructure provider within New Zealand, WEL is a Lifelines Utility and has a significant Civil Defence Emergency Management (CDEM) role to play. Section 60 of the CDEM Act 2002 requires WEL to:

- Function at the fullest possible extent during and after an emergency;
- Have plans for such functioning;
- Participate in CDEM planning at national and regional levels; and
- Provide technical advice on CDEM issues where required.

We are a participating member of Waikato Lifelines Utility Group (WLUG) which has overall goals to:

- Assist members to meet their obligations under the CDEM Act;
- Coordinate and work to progress the completion of projects which benefit lifeline organisations in their region;
- Strive to ensure that member organisations get value for money through their participation; and
- Endeavour to meet ever increasing customer expectations that Lifeline Utilities will deliver secure services.

Lifeline utilities are responsible for strengthening relationships within and across sectors, and individually committing to actions that ensure continuity of operation and delivery of service. Through our membership in WLUG, we have access to regional and national studies carried out on natural, technological and biological hazards. From these we have identified the top hazards and developed a comprehensive vulnerability assessment which identifies the risks in terms of importance, vulnerability, resilience, and impact of each major asset on the network. WEL Networks recently sponsored a study on effects of a possible Tsunami on the West Coast of the North Island and participated in the National Civil Defence Exercise Tangaroa.

Major Event Procedures

A major event procedure has been established and is applied when events e.g. weather, flood or earthquake have a major impact on our ability to supply electricity across our network, or when a Civil Defence Emergency is declared. The procedure is designed to prepare resource levels beyond those normally available or on call. The procedure requires the following actions to be taken:

- Prepare for impending weather that has been forecast. Teams are required to make preparations and resources are put on stand-by;
- Manage increased or increasing numbers of faults due to weather conditions. Resources are increased accordingly;
- Liaise with Civil Defence in the event of a Civil Defence Emergency being declared; and
- Respond to Civil Defence requirements to prioritise the restoration of supply to critical sites.

WEL Networks has adopted the CIMs (Coordinated Incident Management Structure) for dealing with major incidents. There are specific procedures and designated people to deal with and support each of the following areas:

- Incident Controller
- Operations
- Public Information and Communications
- Logistics
- Wellbeing
- Technology
- Administration Support Services
- Lifelines Liaison

There is also a dedicated Disaster Recovery Facility which allows for all of the above functions to continue if the main Maui Street office is not available for any reason.

Contingency Planning

We have developed contingency plans for loss of significant assets or groups of assets, including total loss of supply from the grid. Further development of specific plans for zone substations and critical subtransmission (33kV) circuits is ongoing. Our contingency plans include switching processes to ensure essential services, as much as is practicable, are able to continue to receive power supply in the event of a major outage. We have also entered into arrangements to gain priority access to emergency generation should the need arise. WEL also stores all of the components required to build a 4 km 33kV line to enable an emergency river crossing to be built as part of a disaster recovery effort.

Emergency Exercises

We undertake regular emergency response exercises. These alternate between desktop and full scale emergency scenario simulations. Typically these have involved full scale alarms being initiated without prior warning. A range of scenarios have been staged including major rolling storms, significant failure of both the electricity and the communications network (affecting SCADA), major accidents affecting staff and customers and failure of a Transpower point of supply. Following every exercise we debrief and discuss any potential improvements to be made and record lessons learnt.

Disaster Recovery Site

We operate our system control centre under normal circumstances from our Maui Street premises. When this is not available for any reason, our Disaster Recovery (DR) site provides for business continuity facilities or the resources required to manage a major event including full hot back-up of the Network Management, SCADA and major corporate systems. The DR site allows full monitoring and control of the network to continue. In addition to the main DR site WEL has a further site (Substation offices as a third relief SCADA operations hub for social distancing during Government enforced restrictions) and operators are able to conduct some SCADA functions from home.

COVID-19

COVID-19 presented a real life test of our resilience and contingency planning. As word began to spread of a new strain of Coronavirus taking hold around the world, WEL moved quickly to review and then implement its Business Continuity Plan. A number of measures were put in place to prioritise the health and safety of staff and communities, and to ensure essential electricity services were maintained across the Waikato region.

As part of our early activation of our response to the global pandemic, a taskforce team was set up to monitor developments and coordinate WEL activities, including:

- The system control centre being isolated to reduce unnecessary interactions, along with essential network operators and faults staff being dispersed across the network – working from substations and the Disaster Recovery site.
- Field crews adhering to strict COVID-19 safety procedures including social distancing, heightened hygiene protocols and working in dedicated bubbles.
- Office staff working remotely.

WEL was able to successfully pivot to remote operation as the country rose through the alert levels in 48 hours. A COVID-19 health and safety protocol framework was produced, providing essential guidelines for keeping staff, contractors, customers and communities safe. In addition, an approach to work scheduling was developed for each alert level of COVID-19 based on ENA guidelines.

Following nationwide lockdown, additional measures were also implemented to ensure the safe re-engagement of crews after several weeks away from field work, while contact tracing procedures were strengthened across the organisation.

3.3.6 Asset Related Climate Change Risk

Climate change has been identified one of the most significant business risks that we face today. As a community owned organisation, we are committed to take the necessary actions to manage and mitigate our business risks over the long term, in order to continue to provide a sustainable, resilient, safe, reliable and secure supply of electricity across our network area. In alignment with the framework proposed by the Task Force on Climate Related Financial Disclosures (TCFD), WEL is currently assessing climate related risk in two phases.

1. Transition impacts, which are risks and opportunities resulting from policy, legal, technology and market changes occurring in the transition to a low carbon economy; and
2. Physical climate impacts arising from extreme weather events or from longer term shifts in climate patterns caused by climate change. This includes sea level rise, storms, flood, drought, changing temperatures and any consequence of these.

3.4 ASSESSMENT OF ASSET MANAGEMENT PERFORMANCE

In this section we describe the assessment tool we and all other electricity distributors are required to use to assess our respective asset management capability.

3.4.1 AMMAT

AMMAT is a prescribed set of questions identified by the Commerce Commission for the self-assessment of electricity distribution businesses (EDBs) asset management performance and maturity. The Commerce Commission developed the tool to help all EDBs and stakeholders to assess and understand their performance and to encourage continuous improvement.

The tool uses a selection of 31 questions, which are grouped into six key areas. The questions relate to the key components of the internationally recognised ISO 55000 framework for asset management.

3.4.2 The Purpose of AMMAT

The purpose of the assessment is to gauge our performance against the selected components of the ISO 55001 Standard. The self-assessment informs us and stakeholders about the level of competency we have reached at the time of assessment. This also highlights areas for improvement so we can continue our journey towards full ISO 55001 alignment.

3.4.3 Improvements

In April 2019 WEL Networks commenced a two year programme of work called Operational Excellence. The purpose of the Programme is to unlock greater capability within the business to manage down cost and improve risk management through better alignment of WEL teams to core business requirements and utilisation of WEL systems. The programme aims to:

- **Reduce** waste in team processes
- **Improve** the use of technologies and data to optimise decision making
- **Lift** capability and focus of WEL teams
- **Improve** WEL's reputation

This approach will support an asset management system which is aligned with the ISO 55001 standard. This includes the alignment of our current AMP to the guidance specified in ISO 55002:2018 Annex C – Strategic Asset Management Plan.

The Operational Excellence programme identified seven capability projects of which most are now complete. The projects are summarised below:

1. Measurement

This project delivered performance reporting on the effectiveness and efficiency of all aspects of asset management and supports a broad range of stakeholders from executive leadership to personnel working directly on our assets. Power BI Dashboards were created to track all stages of the Asset Lifecycle and improve decision making.

2. Asset Management Planning

This project, which is still underway, will enable WEL to improve the asset replacement planning processes in relation to cost, reliability and risk for WEL's investment. The following outputs have been delivered to-date:

- Identified opportunities for an end-to-end process and data flow of the Asset Renewal process including CBRM.
- Creating an electronic work scoping tool accessed through tablets.
- Grouping replacements into outage envelopes.
- Prioritising projects by risk mitigated per dollar spent.
- Providing data to enable better planning such as procurement needs, craft requirements, landowner details and site specific risks.
- Adjustments to the data format that feeds into the FY22 Annual Works Plan.

3. Works Management

This project, through the design and implementation of an end-to-end works management process, assigned competent people to the right job at the right time with all the information and resources needed to complete the job safely and efficiently. The following have been implemented to facilitate this:

- An end-to-end works management work flow with appropriate controls, clear roles and responsibilities and reporting to assure work progress.
- Improved planning quality.
- Optimised scheduling including appropriate handover between Works Programme and WEL Services to clarify scope of works and ensures inspections and construction of assets are properly resourced.
- Improved materials management to ensure parts and materials are available and issued on time.
- New and improved tools and systems to aid staff throughout the works management process.

4. Customer Initiated Works

This project improved processes associated with servicing major network customers, delivering small projects and residential customers. It focused specifically on improving network design, large and small works delivery, and the customer initiated works schedule. This has resulted in improved planning, alignment and delivery of work and customer satisfaction.

5. Maintenance Inspections and Data Configuration

This project, currently nearing completion, has updated WEL's asset inspection and maintenance strategies, asset health tracking and maintenance interventions. This includes the creation of Maintenance Engineering Standards, Standard Maintenance Procedures, measurement points, guiding documentation and training material. In essence the project updated 'how our assets degrade and/or fail', how we will inspect and address this degradation and how often we will need to inspect our assets. The result is an Asset Maintenance Strategy for each of our 14 major asset classes. Chapter 8 provides further details on our asset maintenance strategies.

6. **SAP Data Quality Management**

   This project implemented a SAP governance framework to manage SAP data and established a governance group who will control areas such as data principles and policies, data stewardship and data management. Ultimately the project will improve the quality and governance of our data held in SAP. Specific deliverables included:

   - Identification of Asset Management SAP data owners and maintainers.
   - A SAP data quality framework to improve the monitoring and maintenance of data quality.
   - The recruitment of a Data Quality Specialist to address asset related data issues.

7. **ISO 55001 Certification and SAMP**

   This project aimed to align our asset management systems to the ISO 55001:2014 standard with the end goal of certification. The following steps were completed:

   - Provision of a framework SAMP.
   - A gap analysis carried out by an external party to inform the cost/benefit analysis for becoming certified.
   - Provision of a roadmap to certification depending on compliance model selected, with specific actions to achieve compliance with examples.

3.4.4 2021 AMMAT Assessment

Our 2021 assessment is summarised below.

The results shown below indicate an improvement in the scores over our last full assessment undertaken in 2018. This indicates we are obtaining a better alignment to the ISO 55001:2014 Standard.

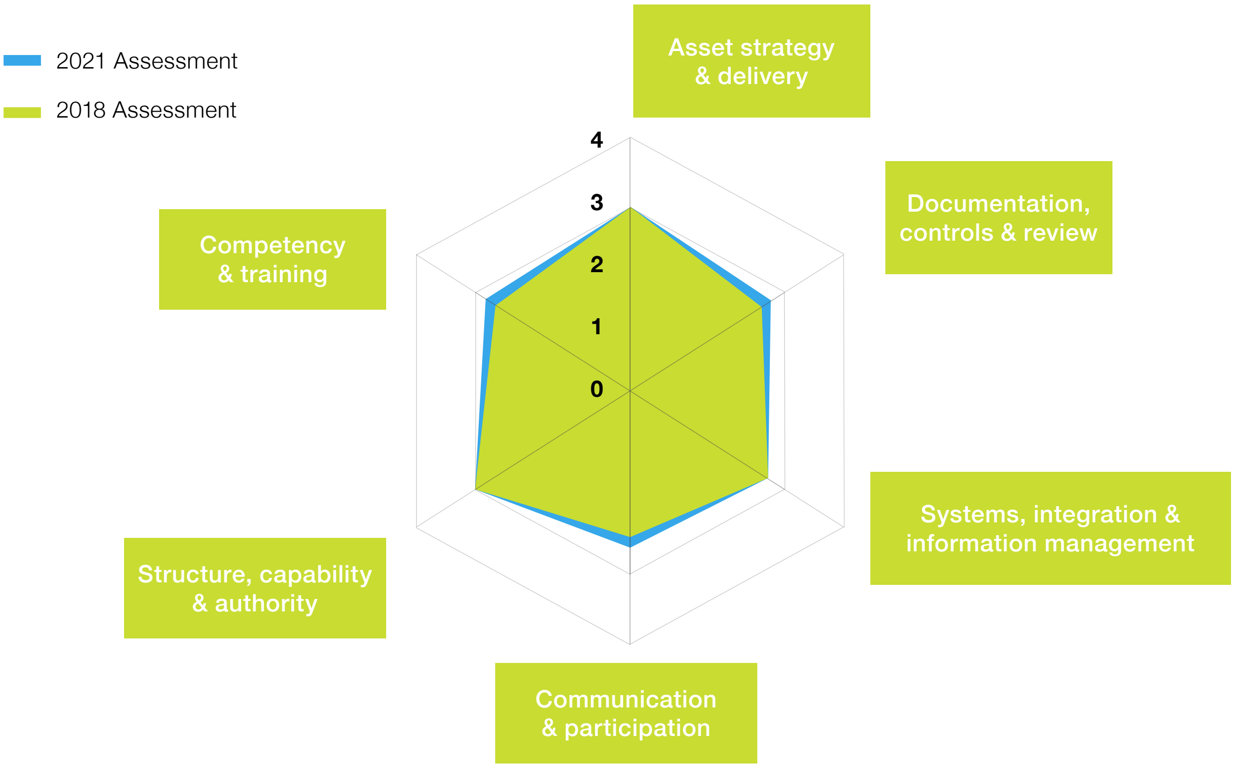


Figure 3.4.4.1: AMMAT Result

This assessment shows we have improved in three of these areas. In particular a significant uplift in the assessment area of communication and participation as a result of the business wide involvement in the Operational Excellence programme as we continue our journey to ISO 55001 certification.

4

ASSET MANAGEMENT GOVERNANCE

4 ASSET MANAGEMENT GOVERNANCE

This chapter sets out WEL's asset management governance framework, in which established processes support investment planning decisions with clear accountability and expenditure approvals. The later sections of the chapter describe our approach to works delivery.

4.1 ISO 55001 CERTIFICATION

WEL has been on an ongoing journey of alignment to the international standard for asset management, ISO 55001:2014. We have recently decided to accelerate our journey and gain certification. In November 2020 a gap analysis was carried out by an external consultant to inform the cost/benefit analysis for becoming certified. The decision on certification timeframes will be made after this AMP is finalised for publishing.

As part of our journey to ISO 55001 certification we have created a framework for our Strategic Asset Management Plan (SAMP). This document translates the wants/needs of our stakeholders into the Asset Strategies that are captured in this AMP. The updated Asset Management System is shown in the infographic below (Figure 4.1.1).

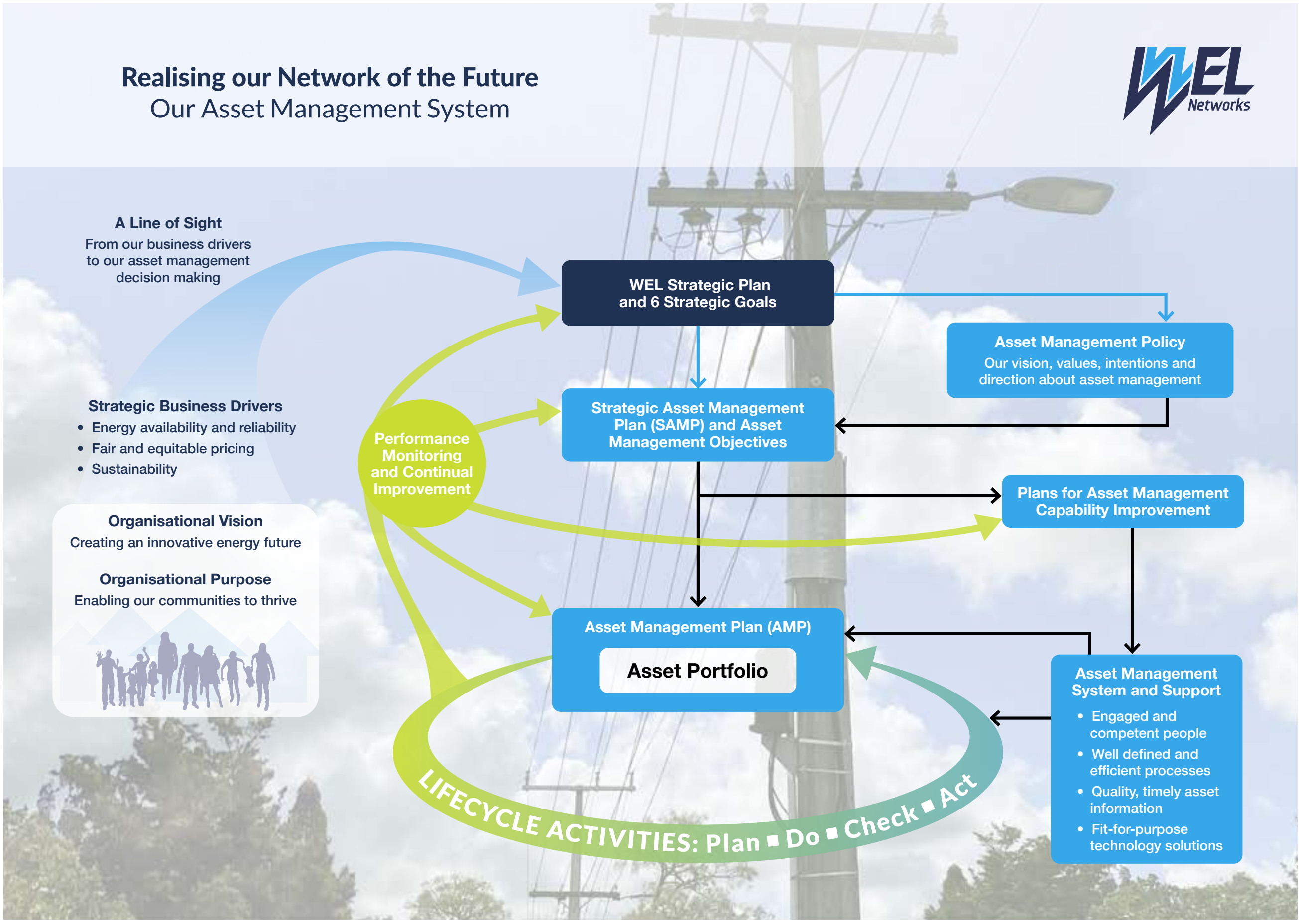


Figure 4.1.1: WEL Networks Asset Management System

The success of our Asset Management Planning relies on our ability to capture and align our business objectives with our stakeholder needs and requirements. Our approach begins with the stakeholder internal and external needs and requirements analysis. This forms the backbone to develop and align the strategic direction of the business with the stakeholder needs. Our Strategic Asset Management Plan (SAMP) defines clear and measurable objectives for delivery to meet our stakeholders' requirements, as discussed in the following sections. Our AMP details how we deliver on the objectives, achieve the required standards and outputs, such as regulatory disclosures, and ensure communications are maintained. Network Expenditure requirements are understood, assessed, and optimised to form Project Definition Documents (PDD) for each Project before being approved to form the Annual Works Plan.

The six strategic goals of WEL that flow to Asset Management are:

1. Optimise WEL's financial position and improve community benefits through a period of decreased regulatory returns
2. Establish our people strategy to attract and retain capable and innovative people engaged in our culture of growth, inclusion and flexibility
3. Adopt an operational excellence model and ISO 55001 principles to optimise the core business
4. Become a data driven organisation through technology, advanced analytical models, people, culture and processes enabling greater agility and enhanced efficiency
5. Operate a sustainable business that supports our vision and values to do the "right thing"
6. Explore commercial opportunities that align with WEL's core capabilities and improve outcomes for our community

The overall flow from our stakeholders through the SAMP and AMP to the Annual Works Plan is illustrated in Figure 4.1.2.

Stakeholder Requirements	▪ Identify and understand External Stakeholder requirements ▪ Identify and understand Internal Stakeholder requirements
SAMP	▪ Assess the Strategic Direction of WEL Networks, ▪ Clear and measurable objectives to deliver stakeholder requirements in the following areas: ▫ Health and Safety. Environment and Sustainability, Legislative and Regulatory ▫ System Growth ▫ System Reliability ▫ Quality of Supply
AMP	▪ How we deliver on the objectives set in the SAMP for regulatory assets ▪ How we achieve the standards and outputs ▪ Regulatory Disclosures ▪ Key communication to stakeholders, our staff, contractors and other interested parties
Network Expenditure Process	▪ Customer initiated Works ▪ Asset Renewal / Replacement ▪ Network Development ▪ Networks and Non-network Operational Expenditure
PDD	▪ Verification against strategic objectives, stakeholder needs and requirements ▪ Defines project scope budget, timing and specific health and safety requirements ▪ Forms part of the organisational governance requirements
Annual Works Plan	▪ Operational and Capital Maintenance works ▪ Reactive Maintenance provision ▪ Customer Initiated Works ▪ Networks Developments ▪ Resourcing schedule

Figure 4.1.2: WEL Strategic Asset Planning Objective Alignment

4.2 ASSET ANNUAL INVESTMENT PLANNING AND DELIVERY

Investment planning is fundamental to many of our activities. Our planning capability is also central to efficiently delivering on customer price and quality requirements.

The process for identifying and prioritising network expenditure is provided below in Figure 4.2.1. Customer Initiated Works requirements, Asset Renewal requirements and Network Development inputs all lead into the Capital Plan Optimisation, prior to the formation of the Annual Works Plan. A detailed description of the key elements of these processes are given in the following sections.

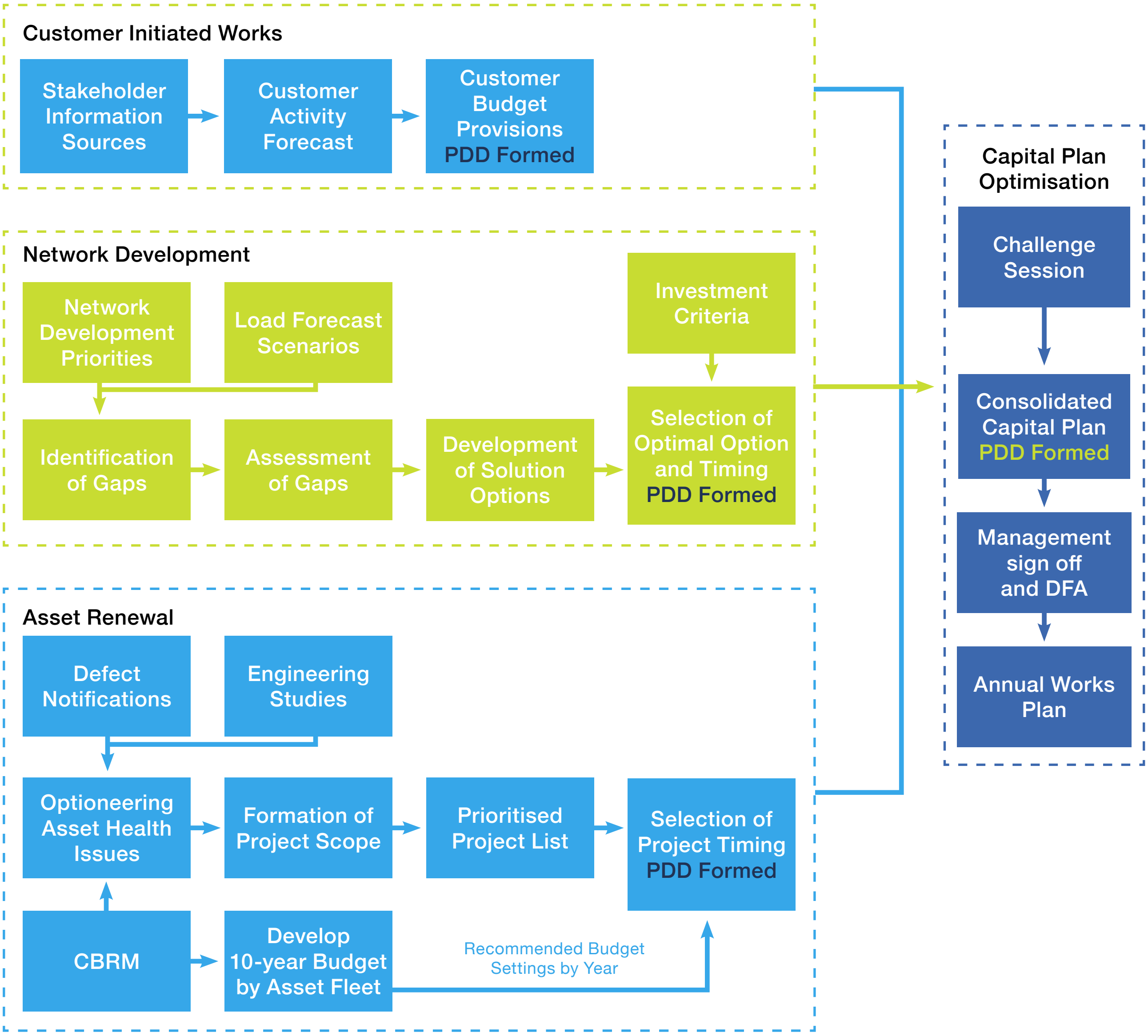


Figure 4.2.1: Network Capital Expenditure Process

Customer Initiated Works is defined as all work in response to a customer request such as developing a new subdivision, relocation to allow a customer to develop their land or large industrial development. Larger projects are designed and planned across several years and therefore the scope and spend for each project can be clearly defined. Every year we deliver hundreds of smaller projects within the current planning year. These projects are not known during the AMP planning cycle but can be estimated in aggregate by combining a number of external information sources such as:

- Hamilton City Council Annual Plans and growth forecasts
- Waikato District Council Residential and Agricultural growth forecasts
- Discussions with large industrials
- Customer Working Groups
- Other EDB experiences and technical working groups focused on developing technologies
- Waikato University NIDEA Low data
- Annual developer/surveyor meetings

Network Development responds to the aggregate of load growth to provide a resilient Network backbone. This section is responsible for the resilience of the Network topology i.e. providing backfeeds and sectioning the Network. Network Development also drives projects designed to meet our regulatory requirements and continuously improve our Environmental and Health and Safety performance.

The maintenance capital budget is allocated to help maintain or improve the reliability of Network assets. This is primarily driven from the Asset Replacement budget which addresses assets beyond their economic life that display a high probability of failure. The Notification budget addresses assets in distress that must be replaced within the current financial year and the Faults budget is a provision for the replacement of assets that have failed and must be replaced as soon as safely practicable.

4.2.1 Customer Initiated Works

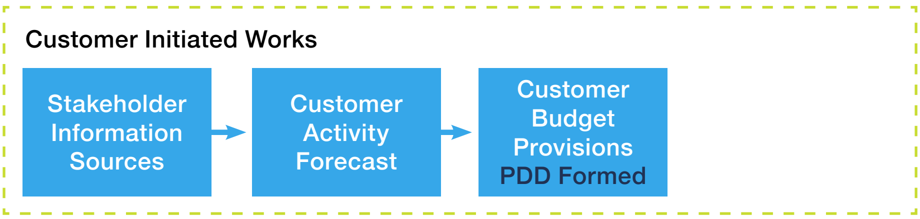


Figure 4.2.1.1: Customer Initiated Works Process

Forecasting of Customer Initiated Works is achieved through analysis of external information provided along with historical WEL data from previous years. It must be noted that this is highly assumptive and is based on perceived future growth within the Waikato region. Connections, both residential and commercial are determined from council and historical WEL data. Subdivisions are also determined from the same information along with forward works plans provided by developers and surveyors. Relocation forecasting is based on historical data and includes council and roading forward works plans.

All forecasted numbers for Customer Initiated Works are outlined in a Project Definition Document (PDD) and circulated to the appropriate stakeholders for approval.

Customer Activity Forecast

Customers often seek new connections or an upgrade to their existing connection. Network changes are also frequently required to meet the electrical needs of new connections or can be requested due to road layout changes e.g. widening or safety improvements, or new roads being built e.g. the Waikato Expressway.

Customers are directed in the first instance to the WEL Networks website where they can complete their application for the required scope of work. Our Customer Initiated Works team will process the request in a timely manner and keep the customer informed of the status of the request.

Customer Budget Provisions

The Customer Initiated Works team is part of the Works Programme team and will assess the works required, advise of any costs to be paid by the customer and initiate the works required to fulfil the customer request.

Any capital contribution required from the customer is calculated in accordance with our Capital Contribution Policy. The main purpose of the Capital Contribution Policy is to further ensure that the best option selected is also financially viable. A copy of the policy can be found on our website **www.wel.co.nz.**

Customer Initiated Works budget provisions are formed into the PDD and approved via the capital plan optimisation and governance process. The budget provisioned flows through into the Annual Works Plan where it is resourced and scheduled in conjunction with other capital works priorities.

4.2.2 Network Development

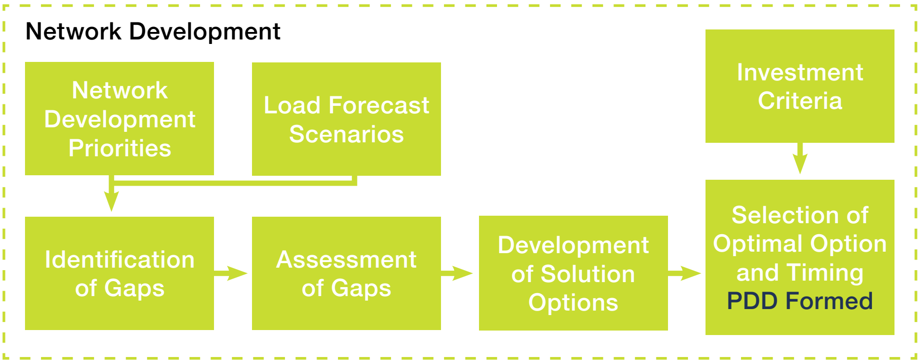


Figure 4.2.2.1: Network Development Process

WEL's asset management goal is to maintain a cost effective, resilient and reliable network that enables our community to thrive. We achieve this through best practice network design which includes outage segregation, backfeeds and reliable equipment that is both fit for purpose and optimally maintained. Where possible, technological advances are utilised to enhance our resilience and restoration response.

Network Development Priorities

Our investment options are prioritised through criteria defined via consultation with our stakeholders. The areas and drivers that we have collectively identified as being key focus areas are shown in Table 4.2.2.2 below and detailed in the following subsections.

Area	Driver
Health and Safety	Confined space
	Substation egress
System Growth	Network growth
	Security of supply
Reliability Performance	Communication network reinforcement
	Network visibility improvements
	Zone substation refurbishments
Technology Change	Obsolescence
	Software and hardware enhancements
Legislative and Regulatory	Seismic
Quality of Supply	Voltage regulation
Environmental and Sustainability	Zone substation oil management

Distribution System Operator Drivers

Table 4.2.2.2: Network Development Priority Focus Areas and Drivers

Health and Safety

Investment to address safety concerns and safety related asset issues is a high priority for us. The majority of safety related risks can be addressed in the design and selection of equipment on the network, through our "Safety in Design" process. In addition, there will be specific safety drivers within our expenditure on reliability, asset condition and health, and growth and security. There are instances where specific safety related investments emerge from incident investigations and risk review meetings and these instances are assessed on their individual merits.

System Growth

As peak demand grows, new capacity from additional investment is generally required to reconfigure the network. The process starts with an assessment of expected future demand on the network followed by identification of areas where current network capacity is insufficient to meet expected demand and current and future security requirements. The level of security required in the network has been established as part of our network design security criteria. Assessing the need for growth and security investment is the responsibility of the Asset Planning and Engineering team.

Reliability Performance

As assets age and/or demand grows, the reliability and performance of sections of the network can degrade. In these instances investment to maintain reliability performance is required. Typically this will result in additional network automation, further sectionalising of circuits, backfeed options or the addition of new feeders.

Asset reliability and performance issues are identified as part of our network planning process and are the responsibility of the Asset Planning and Engineering team to propose and manage these as described in Chapter 6.

Technology Change

Obsolescence, technology changes, software and hardware enhancements can drive the need for investment expenditure. This is particularly true where critical operational equipment is required for continued electricity supply. Critical operational equipment includes network management software and communications, network monitoring, and corporate support technologies.

Responsibility for proposing technology investment lies with individual business units. For example, the Technology Group is accountable for all corporate systems, hardware and software investments, while the Asset Planning and Engineering team is accountable for SCADA and network automation investments.

Legislative and Regulatory

Our formal Regulatory Compliance Policy requires that we endeavour to comply with all relevant legal, regulatory, and environmental obligations. Where non-compliances are found, we will take all reasonable steps to address and remediate them in a timely manner. It is therefore a key consideration in our needs identification that we are either maintaining compliance or are taking all reasonable steps to achieve compliance through the AMP period.

Quality of Supply

Under the Electricity Safety Regulations 2010 we are required to supply connected customers within ±6% of standard low voltage (230V). Where non-compliances are found, we will take all reasonable steps to address and remediate. Through the use of smart meters we can proactively identify sites where there is non-compliance.

Sustainability

Sustainability is a broad area that is driven by the collective requirements of multiple stakeholders. WEL acknowledges that sustainable asset management practices are fundamental to our future. We strive to minimise the environmental impact of our operations and embrace initiatives to protect our consumers and reduce energy hardship within our community. WEL operates a diverse and inclusive workplace and actively supports the wellbeing of its employees, using the following principles:

- WEL recognises that protecting the environment today is essential to the creation of a sustainable business future
- We seek to reduce our impact on the environment over time through the investigation, and where appropriate, the delivery of sustainability initiatives
- Greenhouse gas emissions will be measured, verified and managed through 'Toitū carbon reduce' certification by Toitū Envirocare
- WEL is committed to reducing its relative greenhouse gas footprint
- We ensure our staff go home safely every day and that our network assets are operated and maintained with public safety as the top priority
- We strive to be an employer of choice offering a great place to work where employees are valued and supported

Environment

A key driver is to minimise the impact of our assets on the environment and community. Our view is that we should be exceeding legislative requirements and leading the way for the community and wider industry. This is why we have taken steps to reduce our greenhouse gas emissions by introducing a 100% electric EWP truck, a hybrid technology EWP truck and a fleet of 100% electric survey vehicles fuelled by a solar array.

Load Forecast Scenarios

Our forecasting methodology is discussed in section 6.1.4.

Identification and Assessment of Gaps

Levels of service or performance and security criteria are agreed with our stakeholders. A gap analysis is performed between the agreed criteria and our existing network with today's conditions and the conditions we predict at the end of the AMP 10 year spend plan period. For example, our GXPs require N-1 security levels (refer to Section 6, Network Development, Table 6.1.1.2), and our Hamilton GXP currently does not meet this criteria for approximately four hours every year. However, we expect this gap to widen to 120 hours by the end of the planning period due to strong load growth. This gap drives a number of network development projects (see Section 6.3.1).

Development of Solutions

Optioneering with cost/benefit analysis is used to determine the optimal solution. Risk, funding and resource constraints are considered when programming the delivery of our selected option. Our options review includes both traditional network solutions as well as non-network and emerging technologies such as network scale batteries or customer load profiling systems. The combination of all selected project options forms our spend profile. The spend profile and the individual projects are approved through the PDD Process and then disclosed in our AMP.

Network Development budget provisions are formed into the PDD and approved via the capital plan optimisation and governance process. The budget provisioned flows through into the annual work plan where it is resourced and scheduled in conjunction with other capital works priorities.

4.2.3 Asset Renewal

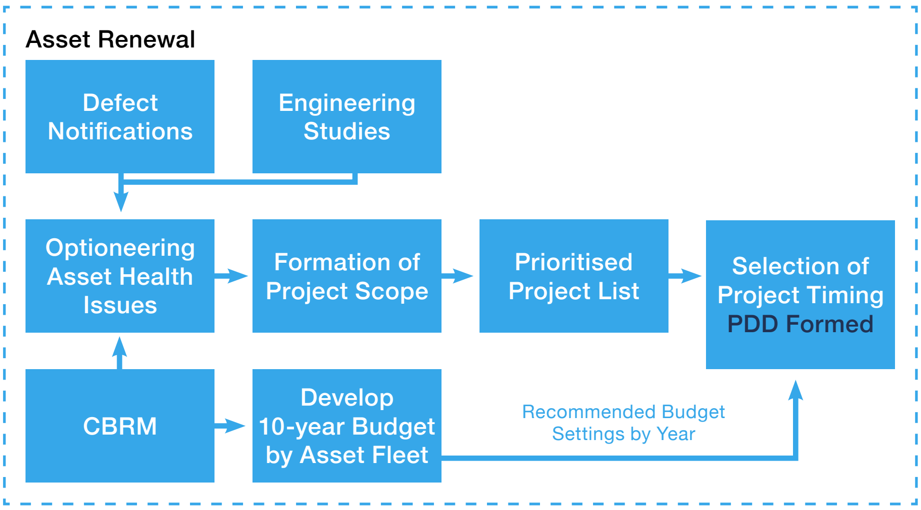


Figure 4.2.3.1: Asset Renewal Process

The goal of WEL Maintenance is to optimise the balance between planned and unplanned maintenance costs and the network reliability experienced by our customers. For capital maintenance, we strive to plan asset replacements for the lowest cost across all planned and unplanned work. This is to minimise both WEL and our customers' expenditure and the impact on the environment.

Defect Notifications

Assets exhibiting defects are generally identified by our field staff during routine inspections as defined in our maintenance strategy. Assets displaying defects that are urgent are dealt with immediately through Fault Notifications. Assets displaying defects that are low urgency and can be remedied within a five year timeframe, are identified as Defect Notifications. Defect Notifications form the backbone of the Asset Renewal Process.

Engineering Studies

This considers assets that are not performing to design specification and abnormalities from condition monitoring information captured during routine inspections. It includes localised areas of study such as line inspections by Unmanned Aerial Vehicle (UAV) to identify and correct poor performance from sections of line and routine and non-routine inspections performed by field staff. Issues arriving from trend analysis of asset information drawn from systems across the business are assessed to give a picture of overall asset health.

Engineering Studies also assess the impact from changes in technology, asset or component obsolescence, the ability to procure critical spares and make recommendations on the best solution moving forward for the assets life cycle.

Engineering studies, combined with defect notifications, identify issues with our assets. We assess the impact of these issues using our CBRM process.

Condition Based Risk Model (CBRM)

The lowest cost is determined through Whole of Life Cost Analysis using our CBRM. The CBRM aggregates the following risk types:

- Network Outage
- Environmental
- Safety
- Financial
- Legal and Regulatory

Budget and scope of capital maintenance is defined via two processes. The first process uses CBRM to determine our long term asset replacement strategy. This creates the overall spend plan for each asset class for the next 1-10 years and beyond. This process also estimates the quantum of asset failures anticipated annually for the chosen replacement strategy and informs the long term notifications and faults budget.

The second process prioritises the actual assets that should be targeted for replacement based on the mitigated risk per dollar spent. The Network assets that are most likely to require replacement within the next five years are identified and put forward for scoping. Notifications with low urgency form the backbone of this process as these assets have been identified by field staff as definitely requiring remediation but with timeframes that allow a coordinated and planned response.

Our CBRM model also identifies assets with low health scores that have a high probability of requiring replacement. All overhead line equipment is then put forward for scoping. For assets such as transformers and ring main units, replacements are identified through engineering studies that focus on reviewing previous test results and inspection data.

Optioneering

The Optioneering phase in the process considers, in depth, all inputs from CBRM, engineering studies and Defects Notifications and identifies the best solution for the asset. Optioneering is a balance between the optimal time for replacement, asset condition and health, network needs, risk and return on investment.

Formation of Scope

If optioneering determines that an asset should be replaced then it is advanced through to field scoping. Scoping also includes assessing other assets that will be isolated during any required outage. Scoping determines the assets within each outage group that require replacement within the next five years. For each replacement, risks and constraints that may add cost, complexity or long lead times for the project are identified. The database system updates the estimated cost for each project using the scoped information and historical cost information from SAP. Outage times and SAIDI are also estimated so that they can be considered during the Capital Plan Optimisation process.

Prioritised Project List

Once we have identified a list of assets that may potentially require replacement and their scope of works, they are grouped into outage envelopes. These are ranked by how much risk would be mitigated by the replacement for each dollar spent and the highest ranking projects are then field scoped to assess for delivery risks and special considerations such as traffic management, rail corridor requirements, schools, access and landowners. The scoping improves our view of risk and cost.

Once the scoping is completed, the outage groups are reprioritised with the new risk and cost information. The projects that provide the highest risk mitigation per dollar are selected to feed into the Capital Plan Optimisation process and will ultimately form part of the Annual Works Plan.

The overall responsibility for asset health and condition related investment sits with the Maintenance Strategy team. A detailed explanation of our asset condition, asset health assessments and how we manage identified issues is set out in Chapter 8.

Asset Renewal budget provisions are formed into the PDD and approved via the capital plan optimisation and governance process. The budget provisioned flows through into the annual work plan where it is resourced and scheduled in conjunction with other capital works priorities.

4.2.4 Project Definition Document

The Asset Renewal, Network Development and Customer Initiated Works programs all require Project Definition Documents (PDDs) to move through to the Annual Works List. The PDD provides the project description and outcomes, scope of work, cost and resource estimations, outage and commissioning requirements. The PDD is signed off by all impacted parties throughout the project planning lifecycle e.g. scoping and estimators, designers, planners and project managers. The PDD also gains the required Delegated Financial Authority to secure budget for the project.

The PDD author and reviewers take a safety in design approach throughout the planning, engineering and design process to any issues which may affect the safety of WEL personnel, contractors, the public and the assets over the project duration as well as the full asset lifecycle.

Optimisation of individual projects is key during the development of the PDD. This is to ensure we are minimising network outages, whilst maximising our resources with an overall goal of increasing the efficiency of project delivery.

Following expenditure approval of the PDD (see Section 4.2.5) and associated budgets, resource planning for detailed design and project construction is used to produce a high level project delivery timeline.

4.2.5 Capital Plan Optimisation

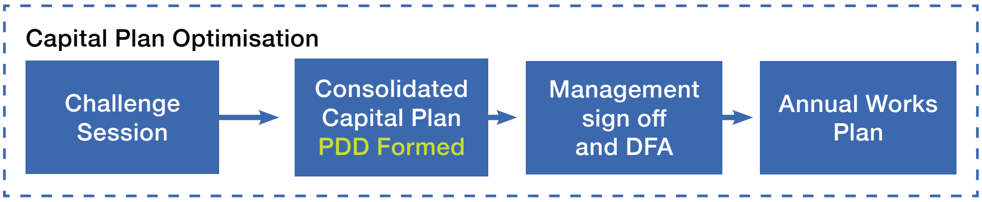


Figure 4.2.5.1: Capital Plan Optimisation Process

The Capital Plan Optimisation phase focuses on consolidating the inputs (PDD) from the Network Development, Asset Renewal and Customer Initiated Works phases and subjecting the PDD's to an appropriate level of internal challenge. The Consolidated Capital Plan undergoes management signoff, ensuring the correct level of financial accountability within the organisation, before entry in to the Annual Works Plan (covered in Section 4.3).

Challenge Session

All PDDs go through a robust challenge session where all aspects of the project are scrutinised accordingly to ensure it is delivering value to our stakeholders and aligns with our strategic direction. Key areas challenged are project risk, return on investment, size of spend and type of spend.

Consolidated Capital Plan

The consolidated Capital Plan combines all workflows and programs delivery with design requirements and construction resources. It is the integrated schedule that includes all network projects, maintenance, provision for notifications and faults as well as non-network projects.

Management sign off and DFA (Governance)

Our Board has established a Delegated Financial Authority structure for the business. The structure sets the expenditure approval level of the Chief Executive, the Executive Management team and Senior Managers.

Expenditure approval limits have been established to commensurate with our organisational structure, meaning higher limits are set corresponding to a person's position and role within the organisation.

The expenditure limits are further differentiated between budgeted and unforeseen expenditure. Unforeseen expenditure limits are set significantly lower than budgeted expenditure given that budgeted expenditure has already undergone the preliminary approval process incorporated in our strategic, business planning and asset management planning processes.

The Chief Executive's budgeted expenditure limit has been set at $2 million excluding any Board pre-authorised regular payments above this amount e.g. Transpower's monthly charges. The Chief Executive's unbudgeted expenditure limit has been set at $500,000. Board approval is required for greater amounts.

4.3 ANNUAL WORKS PLAN

This section describes how WEL manages planned projects, incorporating the capacity to respond to unplanned events. The focus of works delivery is assuring safety as the top priority and then delivering quality work on time and to budget. This ensures that network assets are commissioned and then maintained to be reliable and deliver their intended function over their expected service life.

The challenges which WEL manages in order to deliver an on-time and on-budget Works Plan include:

- Localised areas of higher than expected network growth
- External events (e.g. storms)
- Third party damage

The following five points detail our delivery optimisations and improvements:

1. Works Delivery Plan

The Works Delivery Plan is made up of Project, Capital and Operational Maintenance work which is delivered by both WEL Services and external contractors. We have enhanced our ability to plan and schedule these work types and maximise the forward planning to ensure minimal disruption to our customers, maximum resource availability and completion of our Annual Works Plan. The Annual Works Plan can therefore be delivered without impacting our day-to-day maintenance program and fault response.

Our works management process in (Figure 4.3.1) aims to manage the safe and efficient delivery of the Annual Works Plan. It links the asset management planning of WEL through to delivery of work and then to continual improvement, with prudent control of scheduled work and financial outlay.

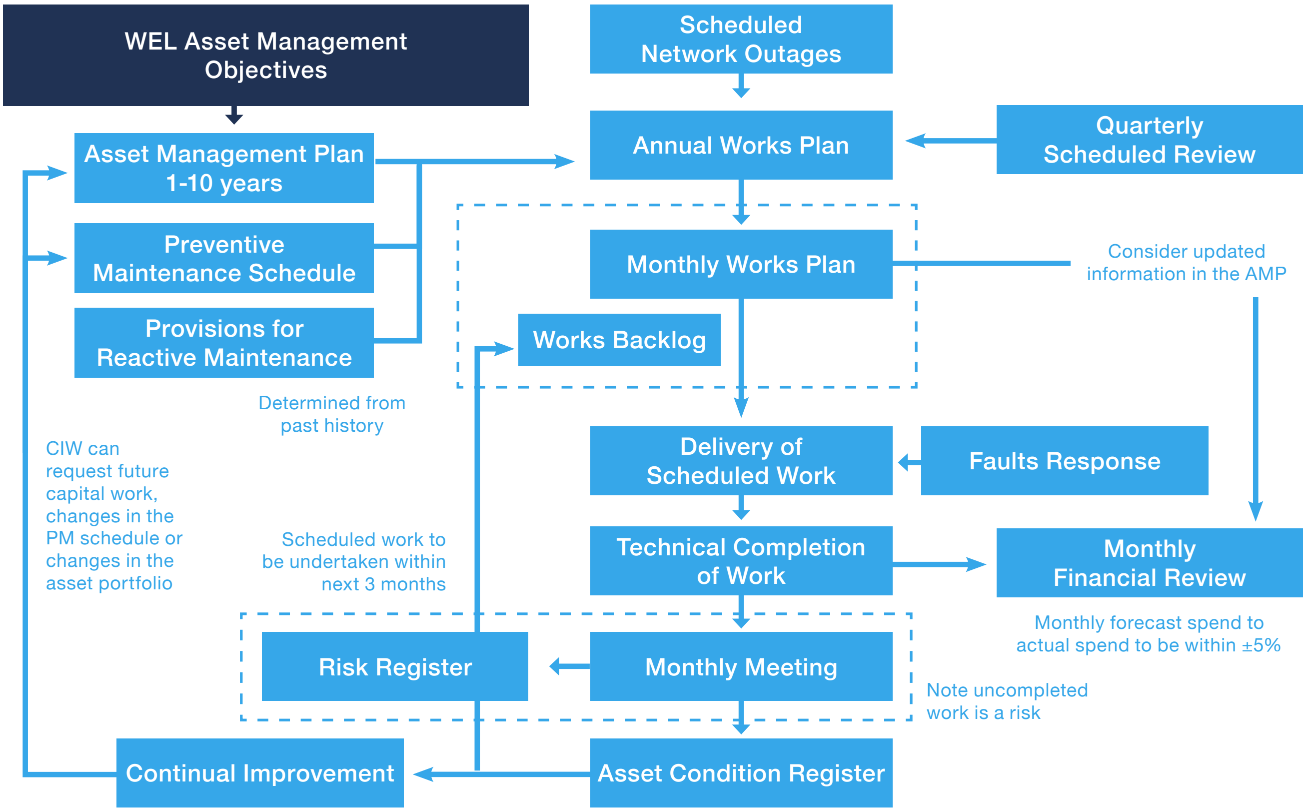


Figure 4.3.1: Works Management Process

At the commencement of the year, the Annual Works Plan is used to determine the resource capacity required in specific competencies and craft types expected to deliver the program of work. The capacities are re-assessed on a quarterly basis to ensure WEL can deliver the work throughout the year. This informs both resource planning for internal teams and establishment of third party contracts.

The monthly work schedule then refines the capacity planning to confirm available resources are on hand and not tied up with other work to deliver the schedule each month. This ensures resources are available for customer work as well as the longer term scheduled work for network development and asset renewal.

2. SAP functional location reporting

Functional location reporting enhances our ability to package work in a geographic area by reporting on regions and localities (suburbs). This visibility allows us to maximise the resource effort in a particular vicinity i.e. group jobs that are in the same general location.

3. Work Management Governance

A consolidated and consistent approach to delivering maintenance and capital projects. This includes:

- Clear roles and responsibilities – We work as a team and know what to do
- Identifying work – Skilled eyes in the field and analytics to predict asset health
- Planning work – Making the job efficient
- Scheduling work – Maximising our people's time in the area and on the job
- Executing work – Doing the work safely and effectively with our skilled teams
- Follow-up work – Find and schedule asset issues during our inspections

4. Performance Reporting

We report on lagging and leading indicators to determine what can be improved to ensure our network remains safe and reliable. We act on performance trends that fall below benchmarks which are set out by our regulators and business objectives.

At the commencement of each month, the anticipated budget to deliver the schedule of work is confirmed. This is based on estimates of work from the Annual Works Plan as well as provisions for customer work and reactive maintenance. Estimation is refined by detailed planning so that cost estimates are based on precise scope of works, current market labour rates and where necessary, quotations from third parties.

The costs for the month are consolidated at the end of each period and compared to the original budget estimates. WEL targets are estimated to within ±5% each month for actual total expenditure. This can be further broken down into detailed types of work to understand any issues with over or under expenditure.

Within the monthly schedules of work, customer driven works and reactive maintenance are combined with scheduled work that is listed in the Annual Works Plan. Monthly schedule compliance is tracked to ensure that all intended work is completed on time. Faults responses and other reactive work, which breaks into the monthly schedule, are assessed to ensure that resources are not unnecessarily tied up, to the detriment of achieving the monthly schedule.

5. Continuous Improvement

Our continuous improvement process starts with registering improvement opportunities and prioritising them based on a range of criteria. This criteria includes effects on health and safety, effort to implement and the impact it will have to the organisation or customers. We identify improvement opportunities through:

- Consultation with our teams
- Asset performance measurement
- Asset health measurement
- Incidents reporting and feedback
- Public feedback

On the completion of each month a formal review of completed work is undertaken to ensure quality work has been delivered, all requisite information has been handed over and projects may be closed out. Financial assessments review that the work has been delivered to budget.

Technical information consolidated at the end of each month compiles data regarding the health of the network assets. When combined with fault Root Cause Analysis, our maintenance strategy may be adjusted to improve preventative maintenance (through Standard Maintenance Procedures) or change the rate at which we are replacing assets at the end of their useful life. This feedback and tracking is used to calibrate our CBRM system.

4.3.1 Works Delivery Model

This section describes our Works Delivery Model. The aim of the Works Delivery Model is to manage the safe and efficient delivery of maintenance, renewals and development works. The delivery process involves the following stages:

- **Resource and expenditure forecasting:** The Annual Works Plan is a high level plan based on PDD information for growth and security, renewal and scheduled maintenance activities. For customer driven and reactive maintenance work, historical resource utilisation and expenditure are used for forecasting and to establish delivery timelines across design, planning and scheduling then construction.
- **Detailed Design:** We utilise standard designs and construction techniques as documented in our design and construction manual to drive quality, standardisation and cost efficiency. Asset categories, for which standardised designs have been developed, include subtransmission lines, zone substation equipment and switchgear. All designs incorporate safety in design concepts assisting assets to be safely accessed, operated and maintained. Opportunities to develop standardised designs are typically identified as part of the asset renewal process and development of maintenance strategies. Specialist independent design support is sought to help manage work flows and cover capability gaps.
- **Scheduling Plan:** A detailed monthly schedule for the delivery of all work types, monitoring delivery against the plan to improve coordination of resources.
- **Construction Handover:** Applies to internal resources and external service providers. Capital projects have a handover meeting between the design team and the project manager to effectively manage any safety, delivery risks or complexity.
- **Project Closeout:** All capital projects and any other project with a budget that exceeds a defined financial threshold require a close out report to be completed, circulated and a meeting held to capture and discuss lessons learned.

Design and Construction Resourcing

The Annual Works Plan establishes our resourcing requirements across available design and construction resources. The plan determines the projects for internal and external service partner delivery prior to the start of the financial year to ensure appropriate resource availability for full delivery of the Annual Works Plan. WEL Networks has entered into a Partnership Agreement with an external service partner for the mutual benefit of each company. This ensures performance criteria are established early and secures both design and construction resources to meet the forecast workload through the year. Additional sub-contractors supplement both the internal and external service partners.

4.3.2 Materials Procurement

This section describes our materials procurement activities. The objective of the materials procurement process is to efficiently acquire the materials specified by asset management and WEL Services (WSL) following a core set of principles, being:

- **Lawfulness** – WEL will act within the law and meet its legal obligations.
- **Fairness** – WEL will act fairly and reasonably in its administration of procurement activities and will apply ethical principles and equitable opportunities to its procurement.
- **Value** – WEL will consider the total cost of ownership and whole of life cost when sourcing goods and services to ensure value for money.
- **Transparency** – WEL will act in an open and transparent manner, free from unmanaged conflicts of interest to ensure the quality and integrity of the decision making process.
- **Sustainability** – WEL will consider environmental, social and economic factors when sourcing goods and services for the network.
- **Safety** – Procurement for the network will be considerate of all aspects of the safety of our staff, contractors and community.

The stages of the procurement process are:

- Requirements identification;
- Tender or Request for Proposal or Quotation (RFP, RFQ);
- Approval to proceed;
- Preferred Supplier Agreement established;
- Purchase order raised
- Evaluate and monitor ongoing supply, costs and quality.

This has proven to be a highly effective means of procuring items e.g. inventory, equipment and vehicles as the procurement model for these items is centralised. The centralised model works well because the business processes are adhered to, the benefits and results are measurable and responsibilities are clearly defined and are supported by senior management. The processes and business rules for procurement activities have been recorded in our process management systems.

Tendering

We tender all major equipment requirements, generally over the value of $250,000. The tender process encompasses the assessment of business requirements, establishing timeframes, compiling specifications, selecting suitable suppliers, tender or RFP/RFQ preparation and evaluation, and then submitting a formal written recommendation.

For purchases or categories up to $2M, a written recommendation approval is sought from the WEL Tenders Committee. Approvals for values over $2M are approved by the Board.

Preferred Suppliers

Through the process of category management and the use of RFP, we have established a number of preferred suppliers. The benefits of a preferred supplier arrangement are consistency and certainty of supply, optimal and stable pricing structures which reflect current market conditions, quality assurance and volume rebate options.

Monitoring Cost Performance

We use various techniques for monitoring suppliers to ensure required specifications, quality and cost requirements are being achieved. These include market analysis and product cost benchmarking, monitoring raw material and foreign exchange trends and new technology evaluation.

5

ASSET MANAGEMENT PERFORMANCE

5 ASSET MANAGEMENT PERFORMANCE

This chapter describes our performance objectives, initiatives, measures, and targets for the AMP safety, customer experience, cost efficiency and asset performance.

5.1 OVERVIEW OF PERFORMANCE OBJECTIVES

We have established performance objectives in four key areas: safety, customer experience, cost efficiency and asset performance. The objectives reflect outcomes sought by our stakeholders as described in Chapter 3. They are also directly linked to our business plan, strategic plan and ultimately support our corporate vision.

The Asset Management Objectives are set out below:

1. Optimise WEL's financial position and improve community benefits through a period of decreased regulatory returns
2. Establish our people strategy to attract and retain capable and innovative people engaged in our culture of growth, inclusion and flexibility
3. Adopt an operational excellence model and ISO 55001 principles to optimise the core business
4. Become a data driven organisation through technology, advanced analytical models, people, culture and processes enabling greater agility and enhanced efficiency
5. Operate a sustainable business that supports our vision and values to "do the right thing"
6. Explore commercial opportunities that align with WEL's core capabilities and improve outcomes for our community

The areas of focus for our objectives can be summarised as follows:

- **Safety:** Safety remains WEL's highest priority. We continue to strive for a strong safety culture with a focus on continuous improvement. We are looking at the next steps in our maturity journey and the evolution from having a mature safety culture to having a resilient safety culture where strong safety practices are firmly embedded as part of what we do. We recognise that having staff who are well trained and skilled in making good safety decisions is critical to ensuring their safety and that of our service providers and the public. This focus will flow into the development of new safety objectives and will inform our action plans for continuous improvement activities. Our Board and Executive Management Team are committed to ensuring company-wide engagement in continuing to improve our safety performance.
- **Customer Experience:** Our customer experience objectives cover both reliability (quality of supply) and the quality of service we deliver through our interactions with customers e.g. the time taken to resolve a complaint.
- **Cost Efficiency:** Cost efficiency is driven by making the right investment choices at the right time, and delivering our works programme for the lowest total ownership cost possible while achieving our quality and safety targets.
- **Asset Performance:** The performance of our assets directly determines the quality and cost of services provided to our customers. This, in turn, is a direct consequence of the asset management decisions we make on a daily basis. We will improve our asset performance by further developing our asset management capability and decisions.

5.2 SAFETY

WEL aspires to being 'Best in Safety'. This underpins our commitment to ensuring the health and safety of our staff, service providers and the communities we operate in.

5.2.1 Safety Objectives

Our safety objectives are summarised as:

- **Bring 'Best in Safety' to life** – Our people will be fully engaged in health and safety and understand our health and safety strategy, objectives and accountabilities.
- **Build Capability** – We will have strong and sustainable leadership in health and safety. We will have the competence to identify hazards, ensure that risks are appropriately controlled and make sound safety-based decisions.
- **Risk Management** – We will focus on our Critical Risks, ensuring we have effective controls in place across the organisation. We will measure and monitor our controls through our Risk Management Framework.
- **Systems and Structure** – We will raise the standard and continually improve our health and safety performance, systems and structure. We will effectively communicate health and safety issues and performance.
- **Contractor Management** – We will ensure our strategic service partners are engaged, competent and capable in supporting WEL Networks in achieving our desired objectives.

5.2.2 Safety Initiatives

Health and Safety Roadmap 2019 – 2021

In line with our commitment to ongoing health and safety improvement, WEL established a range of improvement projects and actions which are agreed across the business and monitored to completion. The current two year Health and Safety Roadmap was developed in early 2019 based on the results of a GSI Safety Culture Survey and an exercise within WEL Services to identify improvements in the safety arena that was named 'the Safety Reset'. The resulting 44 actions within the roadmap are targeted for completion by March 2021. A new roadmap will then be developed with a focus on continuous improvement and continuing to develop our safety maturity.

Injury Prevention Measures

We have a strong focus on the prevention of the types of injuries common to our industry. We continue to provide Move@Work workshops to teach workers about correct body posture and movement in order to reduce manual handling injuries which have always represented the biggest cause of injury to our people. We have also introduced targeted strengthening programmes where we have experienced an increasing trend in injuries, this has included a shoulder strengthening programme for our arborists. To date we have seen a small reduction in the numbers of injuries associated with manual handling and we have seen a decline in the severity of musculoskeletal injuries.

Public Safety

To increase public understanding of the potential safety risks associated with our assets WEL has run a number of public safety campaigns. The most recent public safety campaign highlighted the potentially deadly outcome of not treating all fallen power lines as live. We continue to educate the public about the correct action to take when encountering fallen power lines – particularly as a result of a car accident e.g. car vs pole.

Our latest public safety campaign is targeted at creating awareness about the risks of working near roadsides. This will be approached from the aspects of looking out for the workers as well as reminding the public about working on roadsides themselves.

An education programme aimed at emergency services personnel has also been developed and is being rolled out to increase people's understanding of electrical safety risks when attending motor vehicle and other incidents where live lines or assets are present.

Free Staff Mole-Mapping

Our people can be exposed to the sun for long periods of time. While front line protection measures are taken, regular mole-map checks are now offered to staff free of charge. Staff uptake has been strong with many people having moles identified as potentially problematic and being removed as a precaution.

5.2.3 Safety Measures and Targets

Our primary measure for safety performance has changed from Total Recordable Injury Frequency Rate (TRIFR) to a broader range of lead and lag indicators including; injury severity rate, the number of public safety incidents causing harm, the average time to address safety issues raised by the public and the number of site safety visits completed by team leaders and management. TRIFR focuses on the number of injuries and while this has driven many improvements and is still a useful internal measure, the focus has shifted to lead indicators for health and safety performance to target even greater improvement. The following tables show our safety performance against targets.

Lag indicators	Targets	Actual Performance – FY 2020
Injury Severity Rate (Rolling monthly average of the average number of recovery days following a workplace injury/illness)	< 7	4.7
Public Safety Incidents Causing Harm	0	1

Table 5.2.3.1: Safety Lag Indicators and Targets

Lead indicators	
Near Misses Reported	Measure – Investigation type decided and launched within three working days of receiving the report. Report complete and actions assigned within four weeks.
Leadership Site Visits	All members of the Board, Executive Management, a selected group of Supervisors and Business Managers are required to visit WEL sites to observe works and engage in safety conversations. The frequency of these visits is determined and recorded against individuals as KPIs.
Health and Safety Meetings	Staff Health and Safety Committee: monthly. Service Partners (Contractors): bi-monthly. Senior Leadership Health and Safety Committee: quarterly

Table 5.2.3.2: Safety Lead Indicator Measures

Other Measures		
Category	**Target**	**Number – FY2020**
Lag Indicators		
Notifiable Incidents	0	0
Lost Time Injuries	0	7
Medical Treatment Injuries	0	6
Restricted Work Injuries	0	1
First Aid Injuries	0	11
Motor Vehicle Incidents	0	25
Environmental Release	0	1
Number of incidents of faulty neutral causing harm where WEL Smart Meter was installed	0	0
Lead Indicators		
Near Misses Reported	-	193
Director Site Visits	1 per year	5
Executive Site Visits	1 per month	72
Management and other site visits	Varies by role	593
Health and Safety Meetings (Three committees)	N/A	17

Table 5.2.3.3: Other Safety Measures and Targets

5.3 CUSTOMER EXPERIENCE

WEL aspires to being ‘Best in Service’. This epitomises our objective to provide excellent customer service and network performance. We also believe that relationships in our community, with businesses, councils and community groups are vital to our future success.

5.3.1 Customer Experience Objectives

Customer experience is a measure of how customers feel about the service and the value they receive. For WEL, customer experience includes the level of network reliability each customer receives, how we interact with them, the value derived from the services we provide and the information we supply on what is happening on our network.

Our objectives for providing ‘Best in Service’ customer experience are:

- Delivery of electricity at the service level sought by our customers
- Customers know who we are and can contact us across multiple mediums
- Providing meaningful feedback that customers understand and know we will act on
- Customers value the services we offer and can rely on us to meet their needs
- WEL is considered to be a ‘partner of choice’ within the community and within the industry.

5.3.2 Customer Experience Initiatives

Our Customer Experience Initiatives have been categorised into two keys aspects: network performance and customer service.

Network Performance Initiatives

The following network reliability initiatives will be pursued during the AMP period:

- Using information gathered from Failure Modes, Effects Criticality Analysis (FMECA), Root Cause Analysis (RCA) outcomes and notifications to initiate improvement strategies. This includes network reconfiguration and the installation of automated devices that provide thorough fault information. This reduces both the number of customers affected by an outage and also allows remote fault diagnosis and restoration of some customers within a shorter time frame.
- As a result of this analysis initiatives to target our most common equipment failure modes have commenced. The first targets early identification of cracked insulators though acoustic and corona based inspections. This allows the failing insulators to be identified and replaced before failure. The second is the strengthening or replacement of twist sleeve joins on copper overhead lines. The failure of these joints is the most common cause of lines down. The strengthening of these joints facilitates the deferral of major reconductoring projects.
- Inclusion of predictive technology and enhanced diagnostic testing in maintenance plans and work processes for early detection of incipient failures e.g. cable PD testing, UAV inspection of pole top equipment, thermal hotspot detection and ultrasonic/acoustic detection on overhead line insulators.
- The inclusion of automation as appropriate when replacing distribution switches or ring main units.
- Investment in network capacity and security. The investment will address localised areas of forecast growth and is described further in Chapter 6.
- Introduction of new Monitoring Technology. The Energy Services team will actively monitor, assess and trial new technology to maximise the opportunities available from emerging technologies like PV, battery systems and EV.
- We continue to leverage the use of data from our Smart Meters in support of our investment decision making processes and improve customer service by proactively identifying and correcting poor power quality and unsafe situations. The use of smart meter data analytics is further discussed in Chapter 7.
- Light Detection and Ranging (LiDAR) network surveys to accurately identify the position of all overhead line assets and identify any issues like:
    - Conductor clearance to the ground, structures and other circuits
    - Vegetation encroachment
    - Sites where conductor clashing is probable

Customer Service Initiatives

Our Customer Service Initiatives include:

- Establishment of a Small Works Delivery team whereby work scope that requires less business involvement is 'fast tracked' and solely managed via the Small Works Delivery Team. These projects have no long lead materials, minimal network upgrade requirements and targets a 35 working day delivery from enquiry to quote plus payment to construction completion.
- Introduction of Customer Initiated Works satisfaction surveys to enable customer feedback on works completed and utilising this data to improve our service offerings.
- Continuous improvement in our internal processes, so that customer interactions and broader relationship management are centrally supported and co-ordinated.
- Measure and benchmark delivery times for services and set key targets for improvement.
- Ensure that customer needs are understood and fully integrated into our asset management decision making processes. This includes proactive stakeholder engagement in the development of the AMP.
- Develop and implement a customer relationship improvement plan. Ensure that key stakeholders, and their business needs are central to this plan.
- Reinforce our vision and values with our staff, particularly the 'Best in Service' objective by providing additional training.
- Review our customer feedback process to ensure that the customers' concerns and opinions are clearly identified.

5.3.3 Customer Experience Measures and Targets

Similar to our initiatives above, our customer experience measures have been categorised into network performance and customer service.

Network Performance Measures

Our Network Performance Measures reflect the average reliability a customer is expected to receive. These measures account for outages on the high voltage (HV) network and do not include outages that are only on the low voltage (LV) network. System measurement and control improvements that will enable accurate recording of all LV outages will be rolled out as a part of our transition to a Distribution System Operator. The primary measures of reliability are:

- **SAIDI** – System Average Interruption Duration Index. SAIDI is the most frequently used reliability indicator. It signifies the average interruption duration for a customer, over the course of a year. It is measured in units of time, usually minutes. For example, a SAIDI of 60 minutes indicates that on average a consumer on the network experienced 60 minutes without power in that year.
- **SAIFI** – System Average Interruption Frequency Index. SAIFI measures the number of times on average a customer will have a power interruption per year. For example a SAIFI of two indicates that the average customer on the network experienced two interruptions in a year.

Network Performance Targets

Our planned and unplanned reliability targets for the next 10 years are outlined in the following tables. These align with our 2020 AMP targets. With the introduction of a new reliability engineer position these targets are planned to have a rigorous update in 2021. The outcomes of this review are to closely align the targets with stakeholder expectations, regulatory guidelines and asset strategies.

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Planned SAIDI	64.0	65.5	67.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0
Unplanned SAIDI	59.4	58.4	57.5	56.6	56.5	56.5	56.5	56.4	56.4	56.4

Table 5.3.3.1: Planned and Unplanned SAIDI Targets

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Planned SAIFI	0.41	0.42	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Unplanned SAIFI	0.99	0.97	0.96	0.94	0.94	0.94	0.94	0.94	0.94	0.94

Table 5.3.3.2: Planned and Unplanned SAIFI Targets

These build into our overall reliability targets shown in Table 5.3.3.3 that are aligned with the Commerce Commission's Electricity Distribution Services Default Price-Quality Path Determination 2020. The primary impact of this alignment is a 50% weighting to planned outages. This means only half of the duration of planned outages are included in the following targets.

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Total Regulatory SAIDI	91.4	91.2	91.0	90.6	90.5	90.5	90.5	90.4	90.4	90.4
Total Regulatory SAIFI	1.19	1.18	1.17	1.16	1.16	1.16	1.16	1.16	1.16	1.16

Table 5.3.3.3: Overall Reliability Targets

Network Performance Results

Table 5.3.3.4 compares our SAIDI and SAIFI performance against our targets for FY2020 and forecast FY2021. FY2020 saw a significant increase in our unplanned SAIDI and SAIFI over our forecasted target. This was primarily due to an abnormal 72% increase in the number of car vs pole faults. Due to the nature of these faults they have a much higher repair time, are generally in urban areas and affect a higher number of customers.

	FY2020			FY2021		
	Target	Actual	Variance	Target	Forecast	Variance
Planned SAIDI	60.0	42.5	29%	62.0	53.1	14%
Unplanned SAIDI	61.2	80.1	-31%	60.2	49.6	18%
Planned SAIFI	0.30	0.31	-3%	0.31	0.38	-23%
Unplanned SAIFI	1.00	1.34	-34%	0.99	0.82	17%

Table 5.3.3.4: SAIDI and SAIFI Performance against Targets

Worst Performing Feeders

We use PowerBI dashboards showing our faults per feeder and faults per 100km of line length to monitor the performance of our feeders. Our focus is the feeders with the highest rate of outages per 100km and the highest SAIDI. The five worst performing feeders within each metric for the five years ending 31 March 2020 are:

Based on outages/ 100km /year			
Feeder	Total Outages	Total SAIDI	Outages /100km /year
WEACB4	103	4.69	35.88
TEKCB5	132	3.96	31.54
HPTCB3	12	0.16	21.70
RAGCB3	17	0.63	21.70
GLACB1	60	1.35	20.27

Based on SAIDI			
Feeder	Total Outages	Total SAIDI	Outages /100km /year
WEACB6	176	17.38	14.90
TEUCB1	143	12.34	4.64
WEACB2	124	10.80	14.55
CLACB16	22	9.71	4.92
WEACB3	121	9.55	10.82

Table 5.3.3.5: Worst Performing Feeders

For those feeders the most common fault causes are shown in Figure 5.3.3.6 below. We also show how those failure modes relate to our asset replacement strategies.

Most Common Outage Causes	
RAGCB3	Lightning damage
WEACB6	Lightning damage
	Car in contact with pole
	Insulator split
	Line break at twist joint
	Tree blown over on line
TEUCB1	High wind line break
	Insulator split
	Lightning damage
	Pole blown over
TEKCB5	Birds
	Animal contact
	Lightning damage
	Line break at twist joint
GLACB1	Fuse blown on overload
	Birds
	Animal contact
WEACB4	Animal contact
	Bird contact
	Fuse blown on overload
WEACB2	Birds
	Car in contact with pole
	Lightning damage
	Line break at twist joint
WEACB3	Car in contact with pole
	Jumper falls on through fault
	Wind blown debris
HPTCB3	Fuse blown on overload
	Line dashing high wind
	Tree blown over on line
CLACB16	Cable fails unknown
	Cable joint fails
	Cable termination fails

Common Improvement		Strategy
Transformer	Lightning damage	Lightning arrestors are fitted to the new pole mounted transformers
Crossarm / insulator	Asset health	Crossarm replacement programme
Crossarm / insulator	Conductor spacing	Crossarm replacement program and crossarm length vs conductor span study
Conductor	Conductor size / strength improvement	16mm copper replacement
Customers per outage	Network configuration	Traditional network solutions or new technology to reduce customers per outage
Cable	Health testing	New cable test equipment and cable test program

Figure 5.3.3.6: Most Common Failure Causes and Aligning Strategy

Note that feeders that have high SAIDI, but low failures per 100km, indicate that the line equipment is relatively reliable but due to the line length we have a large number of outages. To reduce SAIDI on these lines our best approach is to reduce the number of customers for each outage and/or the duration of each outage. This can be achieved through a range of network configuration upgrades, backfeeds and ties to other networks. We are also investigating the use of new technologies such as batteries and distributed generation.

Customer Service Measures

Our customer service performance measures are:

- **Customer Satisfaction** – we regularly survey a sample of customers to gauge their performance expectations, the price they're prepared to pay, and their satisfaction with our service.
- **Customer Satisfaction (Customer Initiated Works)** – we survey all customers who have had a new connection or similar customer work type completed in the previous month. The survey is carried out by an external research service provider and measures customer satisfaction across Value, Efficiency, Communication, Performance and Outcome. A quarterly report is provided to WEL for analysis and action generation to support a lift in customer satisfaction. Current targets are a 10% lift across Performance and Efficiency satisfaction ratings, the desired target is reviewed annually to ensure we retain a customer focus.
- **Standard New Connection Quote Time** – measures the average number of working days it takes us to provide a quote for upgrades and new connections to our network.
- **Complaint Response Time** – the average number of work days to provide a resolution to any complaint we receive.

Table 5.3.3.7 shows the targets for each measure over the AMP period.

Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Customer Satisfaction	87%	88%	88%	89%	90%	90%	90%	90%	90%	90%
CIW Satisfaction Performance (Annual weighted average)	7.2	7.3	7.4	7.5	7.6	7.7	7.7	7.7	7.7	7.7
CIW Satisfaction Efficiency (Annual weighted average)	6.2	6.3	6.4	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Standard Connection Quote Time (workdays)	5	5	5	5	5	5	5	5	5	5
Non-standard Connection Quote Time (workdays)	21	20	20	20	20	20	20	20	20	20
Complaint Response Time (workdays)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5.3.3.7: Customer Experience Performance Targets 2022 – 2031

Customer Service

With the continuing high level of new connections one of the main areas where we directly interact with our customers is through Customer Initiated Works. Our customer satisfaction when delivering these works is shown against our target in Table 5.3.3.8.

Measure	Target	2020	2021 YTD
CIW Satisfaction Performance (Annual weighted average)	7.0	6.5	6.6
CIW Satisfaction Efficiency (Annual weighted average)	6.0	6.0	6.2

Table 5.3.3.8: CIW Customer Service Measures

5.4 COST EFFICIENCY

Our overarching cost efficiency objective is to implement our Works Plan (see Section 4.4), which has been optimised for risk and impact, without compromise to safety, at the least feasible cost to customers. Our cost efficiency objectives are primarily concerned with the efficiency of our works delivery function.

5.4.1 Cost Efficiency Objectives

Our objectives for cost efficiency are:

- Delivery of works in a safe manner, on time and to the required standard.
- Essential core skills and knowledge are developed and retained.
- The systems we use enable and support efficient delivery.
- Investment and repairs are prioritised and optimised using robust methodology to achieve our operational targets in a cost effective way.
- We continuously measure and monitor our delivery performance (safety, quality, time, and cost) and always seek ways to improve.

Collectively our objectives reflect the cost position we wish to achieve and provide the right incentives for capability development and the safe delivery of projects and maintenance services.

5.4.2 Cost Efficiency Initiatives

The Operational Excellence programme discussed in Section 3.4.3 sets out a number of initiatives that impact our cost efficiency. This includes the automation of processes, data improvement and monitored performance measures.

5.4.3 Cost Efficiency Measures and Targets

The measures we have established for cost efficiency are:

- **Cost Per Customer** – operating costs that are allocated to electricity distribution service (in accordance with Information Disclosure requirements), divided by the number of connections. These exclude Capex, depreciation, tax subvention payments, revaluation, interest expenses, pass-through, and recoverable costs.
- **Capital Expenditure Performance** – project delivery performance for capital works (excluding customer initiated work, which is variable and reactive in nature) will be measured by comparing the delivered cost of projects with the budget. The performance is subject to the following conditions being met:
    - Full scope of the project delivered
    - Safety performance is maintained or improved
    - Design and construction standards are met
    - Timeframes are met
    - As built information and drawings are captured accurately and in a timely manner
    - Project lessons learnt are captured for the establishment of future project scope inclusive of financials.

The targets are based on achieving the expenditure levels forecast. Table 5.4.3.1 shows the targets for each measure over the AMP period.

Cost Efficiency	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Cost per customer ($)	274	273	272	271	270	269	268	267	266	265
Capital Expenditure performance %	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%

Table 5.4.3.1: Cost Efficiency Performance Targets

5.4.4 Cost Efficiency Performance Evaluation

Our performance measures for cost efficiency performance are shown in Table 5.4.4.1 below.

Cost Efficiency	Target	Actual	Variance %
Cost per Customer ($)	287[1]	272	-5.4%
Capital Work Delivery ($M)	22.0	21.4	-2.7%

Table 5.4.4.1: Cost Efficiency Performance

We met both cost efficiency targets for 2020.

5.5 ASSET PERFORMANCE

Asset performance directly reflects our asset management decisions and processes over the past decade and beyond. Changes to our strategy will take many years before we see measurable changes in the outcome. Therefore, we also look for leading indicators to predict future fault performance and track the number of asset condition notifications.

5.5.1 Asset Performance Objectives

Our asset performance objectives are to ensure:

- Our Asset Management investment decisions are optimised and are based on appropriate trade-offs between capital and operational expenditure, risk and reliability.
- Preventive and corrective maintenance decisions are made using quantitative analytical techniques such as FMECA and Whole of Life Cycle Cost (WLCC) analysis. These techniques support quantifiable trade-offs between operational expenditure, asset condition and reliability.
- How, when and who we use to deliver our works plan, as these are key inputs in our investment decisions.
- We continue to develop new tools and systems for data analytics using smart meter data to improve our services to our customers (discussed further in Chapter 7).

5.5.2 Asset Performance Initiatives

The initiatives we are undertaking in the next year to achieve our asset performance objectives include:

- A full review of the asset renewal and works prioritisation programme to manage the work throughput that will support the works planning and delivery, while maintaining acceptable level of risks.
- A revamp of the maintenance planning ‘end-to-end’ process to achieve cost effective maintenance plans. This is achieved by targeting the equipment with common modes of failure and improving the quality of condition data obtained from maintenance activities.
- Assessing opportunities to integrate emerging technologies e.g. PV and battery to improve the performance of existing and future network assets.

[1] inflation adjusted from 2018 AMP.

5.5.3 Asset Performance Measures and Targets

We are currently reviewing our asset performance measures. The measures are the ISO 55001 feedback loop from our WLCC Maintenance Planning. Failure rates, notification rates and preventative maintenance to corrective maintenance ratios will be tracked for each asset class in PowerBI dashboards. Changes in these parameters will drive changes in our asset replacement and preventative maintenance strategies. These parameters will be reported in our 2022 AMP.

In the short term our asset performance measures focus on network utilisation. Transformer utilisation was measured in the past but this has little value and improving this KPI would result in poor asset management decisions. We will continue to track and improve our GXP load factor. Load Factor at GXPs measure the efficiency of assets we contract from Transpower at GXPs. Low values indicate the provision of excess capacity and cost while higher values can also cause concern due to not having sufficient capacity available.

The basis of the targets is maintaining our historical performance. Table 5.5.3.1 shows the targets for each measure over the AMP period.

Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Load Factor at GXPs	>60%	>60%	>60%	>60%	>60%	>60%	>60%	>60%	>60%	>60%

Table 5.5.3.1: Asset Performance Targets 2022 – 2031

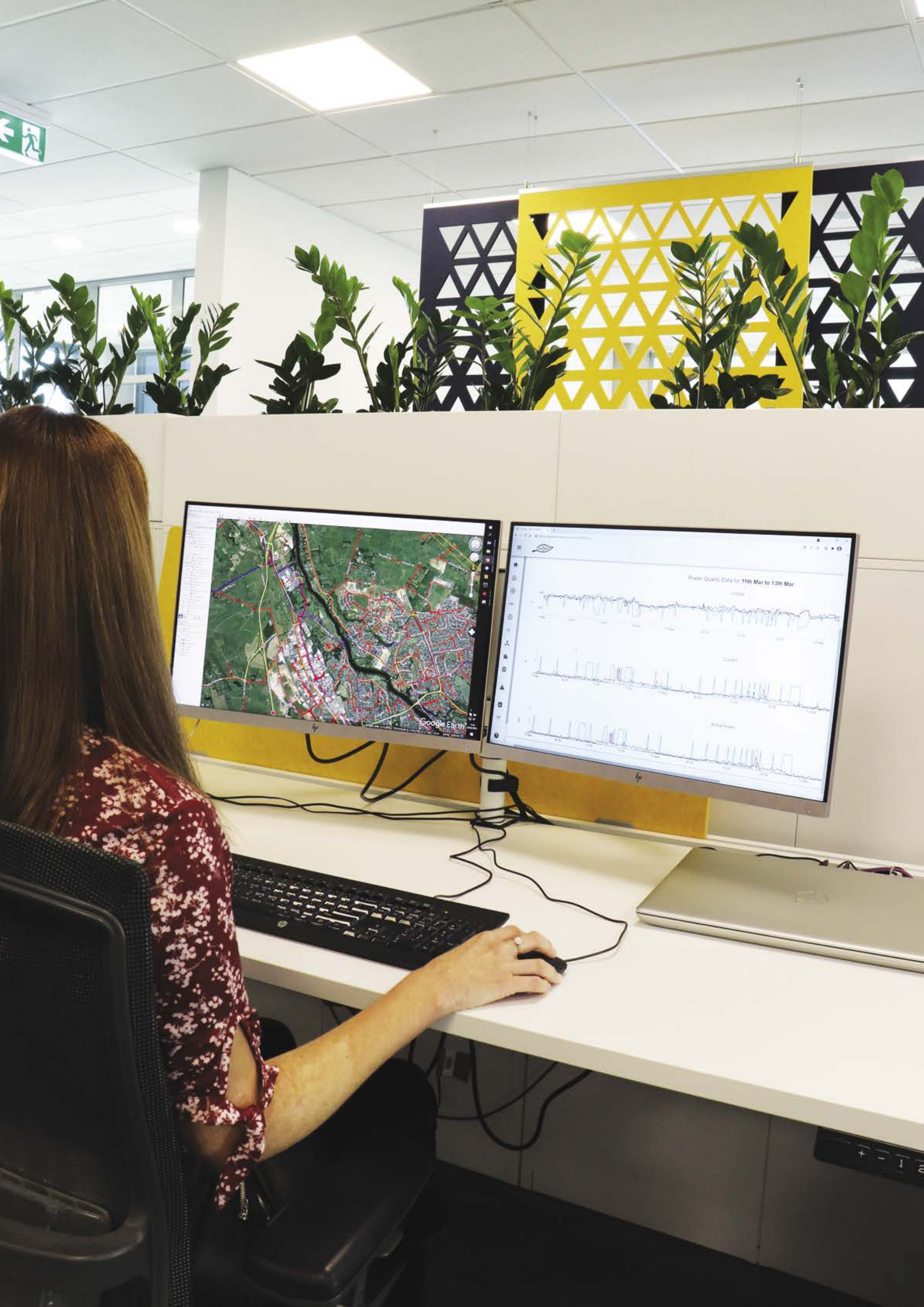
5.5.4 Asset Performance Evaluation

Our asset performance for 2020 is shown below.

Asset Performance Measures - FY2020			
	Target	Actual	Variance %
GXP Load Factor (%)	60%	56.2%	-3.8%

Table 5.5.4.1: Asset Performance 2020

Since 2017 we have reduced our peak demand by 2MW to 271MW. Over the same period the energy consumed throughout our network has increased by 4.7%. The result is a 2.8% improvement in GXP load factor. We will continue our stringent control of peak loads and we'll continue to connect customers to our network so that GXP Load Factor can increase. However, with a greater proliferation of PV reducing energy consumption, and an upwards pressure on peak load due to EV charging, greater measures will be required to continue our improvement.


Google Earth
Power Quality Data for 11th Mar to 13th Mar

6

NETWORK DEVELOPMENT

6 NETWORK DEVELOPMENT

This chapter sets out our approach to network development and describes the plans we have in place for the AMP period.

6.1 OVERVIEW

Our plans have been reviewed and aligned with the requirements of our customers and the overall performance objectives described in Chapter 5. This approach leads to targeted investment based on needs in each area of the network.

The two fundamental performance needs addressed by our network development investments are:

1. Capacity constraints forecasted to arise due to peak demand growth in specific areas within the network; and
2. Security issues arising from reduced back-up capacity due to growth in peak demand.

The projects identified in this chapter are our view of what is appropriate. It is possible that as the operating environment changes the investments forecast for the mid to latter part of the AMP period may need to be refined.

6.1.1 Our Approach

Chapter 4 describes our process and approach to all investment projects, including network development and non-network investment. In summary, our approach consists of two stages.

1. **Need identification**

   An investment need or primary driver for an investment is identified. The needs considered fall under the categories: safety, reliability performance, asset condition and health, growth and security, customer requests, technology change, or legal, regulatory and environmental requirements. Network development projects can fall under all the need categories with the exception of asset condition and health, which is covered by asset replacement and renewals as discussed in Chapter 8.

2. **Options analysis**

   Following need identification, potential options that meet the need are formulated and considered. The number of options will vary depending on the type and complexity of need(s). Non-network options and demand management solutions are considered as a potential option and undertaken if practical and cost effective.

The investment option selected is the one that ensures safety, and best meets identified need(s) for the lowest whole of life cost. There are occasions where a specific externality will result in a decision to adopt an alternative investment path e.g. regulation. All investments are subject to the governance framework and processes described in Chapter 4.

Key Planning Assumptions and Inputs

The key assumptions informing our network development planning are:

- Future peak demand growth based on Customer Initiated Works and forecast in Section 6.2;
- The large embedded generation plants operated at Te Uku and Te Rapa will not be available to meet demand following a major power outage.

There are many inputs utilised in the planning process, the key inputs are:

- The reliability performance sought by our customers and stakeholders as detailed in Chapter 3 and the corresponding performance objectives discussed in Chapter 5;
- Specific individual customer and stakeholder requirements;
- The inputs required to forecast electricity consumption and demand, as set out in Section 6.1.4;
- Voltage requirements and other regulated limits; and
- Equipment ratings based on the manufacturer nameplate ratings.

Overview

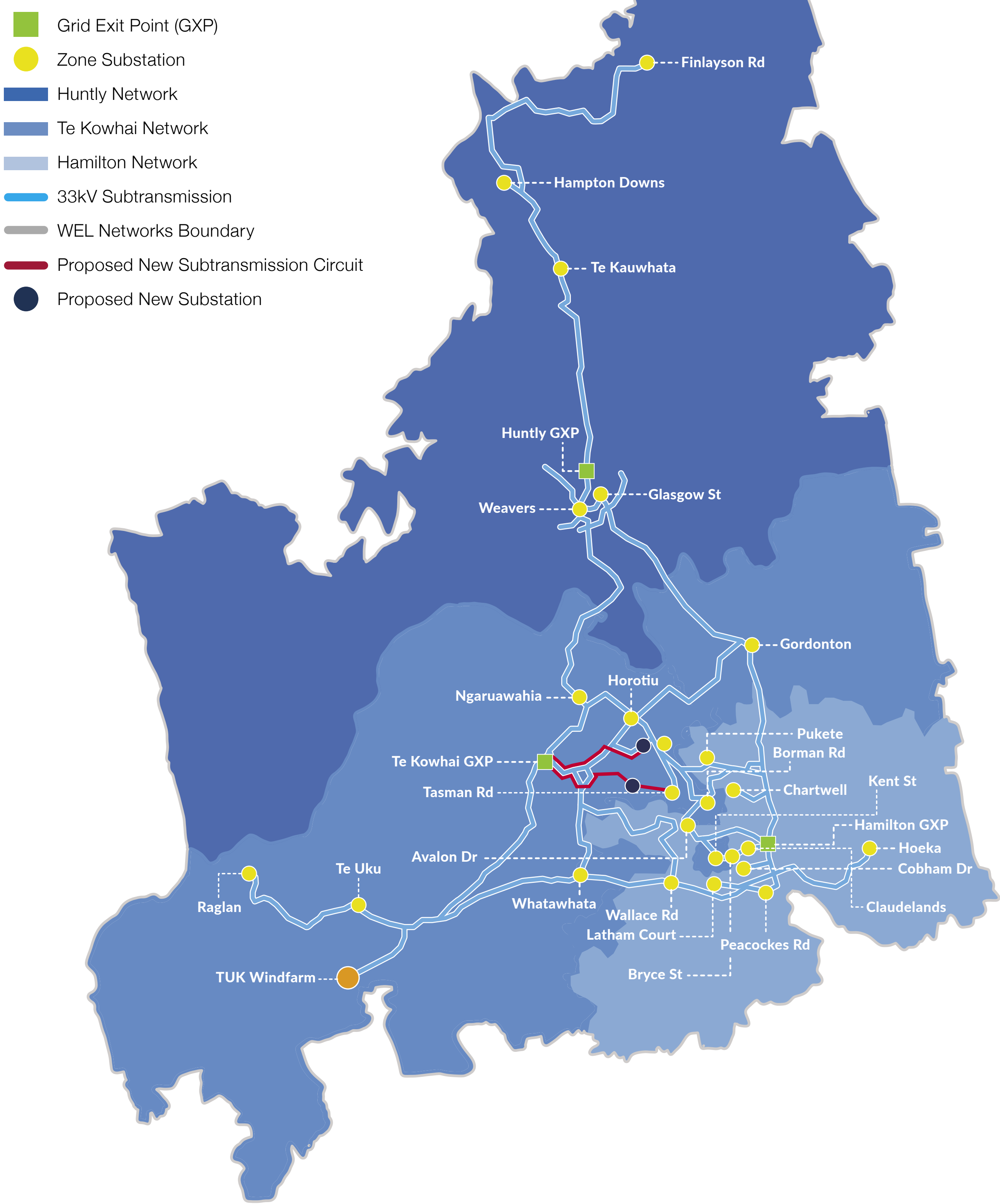


Figure 6.1.1.1: Overview of WEL Network System

Security of Supply

The security of supply standard sets the high level guidelines for facilitating a reliable and resilient network. The security level determines the ability of the network to maintain supply following the failure of an asset. Our security standards are specified to achieve our performance objectives and the reliability performance sought by our customers and stakeholders.

The security criteria used by us are set out in Table 6.1.1.2 below.

Range of Post Contingent Demand (PCD) MVA	Customer Impact	Security Level	Time to Restore after 1st interruption	Time to Restore after 2nd interruption
30MVA+ Grid Exit Point	>5,000	N-1	Maintain 100% of PCD[1]	100% restored within one hour
10 to 25 MVA CBD zone and switching substations	>2,000	N-1	Maintain 100% of PCD	Majority restored within two hours, 100% in repair time
10 to 25 MVA Large urban zone substations	>5,000	N-1	Maintain 100% of PCD	Within three hours Restore 90%, repair time 100%
5 to 10 MVA Medium urban zone substations	>2,000	N	Within 15 minutes restore 75%, within three hours 90%, repair time 100%	Within three hours restore 90%, repair time 100%
2.5 to 5 MVA Rural zone subs and urban interconnected feeders	>1,000	N	Within one hour restore 75%, within three hours 90%, repair time 100%	Restore 100% in repair time
1 to 2.5 MVA Urban and rural interconnected feeders	>300	N	Within one hour restore 50%, within three hours 75%, repair time 100%	Restore 100% in repair time
Under 1 MVA Rural feeder, urban spur, distribution transformers	<300	N	Restore 100% in repair time	Restore 100% in repair time

Table 6.1.1.2: WEL's Security of Supply Standards

Twins Model

The Twins Model is an innovative network configuration that moves us towards the architecture of a Distribution System Operator (DSO). This model is based on the concept of moving the N-1 security level closer to the customer's point of connection. This provides benefits such as optimal power quality, increased security and better reliability. For network development, the model lessens project cost by reducing assets required compared to existing configuration. For asset utilisation, existing and new assets are optimised.

The concept involves two or more substations acting as one so that as a unit they provide an N-1 supply. The substations and its network will be linked from 33kV to 400V voltage levels with control (switching) and data collection capabilities.

As the substations are linked, this provides the same security level (N-1 or N-2 by switching) as a traditional configuration but requires less assets. Security level of N-1 is achieved for two substations having one transformer each. Further security is provided at the 33kV or 11kV level with strong ties between the Twins.

The model reduces the number of assets compared to the existing substation arrangement and optimises existing network assets. As described above, a substation with N-1 security level does not need to have two transformers but only one. This would lead to a reduction of substation assets including those associated with the transformer – incomer circuit breaker and protection relays among others. These benefits are even more apparent when a third transformer is required to meet load growth where a green field's site avoids the complexity of integrating a third transformer into an established site.

For zone substations an additional advantage is that the length of each distribution feeder will be shorter providing improved power quality, increased distribution security and better reliability. The adjacent Twins and adjoining substations of the Twins will also benefit from an increase in transferrable load thereby increasing each security down to the 400V level.

[1] Post Contingent Demand (PCD) is the peak demand after demand reduction through contracted load control services.

This concept will be introduced in Te Rapa North and Exelby Zone Substations. Te Rapa North Zone Substation will be the twin of both Pukete and Horotiu Zone Substations. Exelby Zone Substation will be the twin of Tasman.

At a more macro level this concept is also being applied to manage the security constraint at the Hamilton 33kV GXP. This involves reconfiguring and reinforcing the subtransmission network to allow zone substations to be easily transferred between GXP's to manage constraints. This is currently an extremely cost effective solution when compared to the traditional option of upgrading the capacity of the GXP.

6.1.2 Planning Risk Mitigation and Network Energy Efficient Operation Strategies

Planning Risk Mitigation

All equipment, with the exception of power and distribution transformers, are factored into our planning based on the capacity rating stated on the nameplate.

The ability to overload transformers for short durations helps to mitigate the residual planning risk, particularly when the load increases faster than expected. The overloading of the transformers is in line with the international standards that the transformers were designed to. If applied within the guidelines of the standards it will accelerate the aging of the transformer but does not greatly increase the risk of failure.

WEL Networks puts considerable effort into ensuring our loading forecasts are accurate and up-to-date. The process used is detailed in Section 6.2. It is rare for the load to increase at a rate which exceeds equipment normal operation conditions.

Many sections of WEL's Network have the ability to be offloaded to neighbouring zone substations and feeders. While the prime reason for this is to provide alternate supply in a fault scenario, it can also be used to mitigate planning risk by providing capacity in the short to medium term planning periods. If the neighbouring zone substation or feeder is lightly loaded it will be used as a solution to reduce capital investment.

Network Energy Efficient Operation

WEL applies a number of strategies around network energy efficient operation. This includes utilising the benefits of smart meters for our planning purposes such as proactive power quality and abnormal condition detection, load profiling, identification of distributed generation and revenue assurance. The benefits are described further in Chapter 7 for Non-network Solutions and Support Systems.

6.1.3 Influence of Emerging Technology, Demand Management Initiatives and Residential Load Patterns

Emerging Technology

Solar generation, electrification, electric vehicle (EV) and battery storage systems are the main examples of emerging technologies with the potential to significantly impact the design and operation of our network. At this stage WEL is experiencing a minor impact from solar and EVs which is accounted for in our planning. Ongoing analysis and review of industry trends will be used to manage the risk of emerging technologies. Chapter 7 describes our initial plans for these technologies.

Demand Initiatives

We assume that the current level of load control will continue through the AMP period. We would expect that the impact of demand initiatives is likely to increase over the AMP period, however this is difficult to quantify at this time.

Residential Load Patterns

The residential load patterns have significantly changed over the last three years because of appliance efficiency and number, lighting technology (LED lights), adoption of heat pump technology, shift of hot water heating to gas and use of electrical technology. With the use of smart meters we can achieve load profiling in the distribution transformers.

6.1.4 Peak Demand Forecast

Our network delivered 1,284 GWh of electricity for the 2020 financial year with coincident peak demand of 271MW. This peak demand is the primary driver of our network development investment. Our forecast of peak demand is a key input and informs the expected timing for growth driven investment during the AMP period.

Our approach to developing demand forecasts is discussed in this section, including our assumptions and the level of uncertainty involved. All demand forecasts take into account any load transfers and network growth projects presented in this plan.

Forecasting Methodology

Our forecasting methodology involves a number of components. Each component is assessed and combined to produce our best estimate of peak demands during the AMP period.

Establishing Base Demand

The most recent peaks were measured at zone substations, GXPs and in total across our network. The peaks between zone substations and their respective GXP are generally not coincident, due to diversification in customer energy use. One-off events not likely to repeat are eliminated from these actual peaks. This establishes a baseline demand level for our forecasts.

The Compass tool allows for aggregation of smart meter data and the estimation of the load profile of monthly meter data. This allows for accurate loading estimates for distribution transformers and then aggregated up to 11kV distribution network. This enables loading estimates to be established for sections of the distribution network that are fitted with no telemetric devices. The effect of planned network reconfigurations can then be accurately forecast.

Drivers of Peak Demand

The second component of the methodology assesses the drivers of peak demand growth during the AMP planning period. The drivers are:

- **Hamilton City residential** – residential growth is expected based on the Hamilton City Council Structure Plans that outline the proposed layout of a future development area. The Rototuna Structure Plan area is supplied from Borman substation. The northern part of the Ruakura Structure Plan is supplied from Chartwell substation. Rotokauri Structure Plan area will be supplied from Tasman, Avalon and the planned Exelby substation. The Peacockes Structure Plan area will be supplied from Peacockes substation.
- **Waikato District residential and agricultural** – growth in these areas is expected to be modest and we have assumed a continuation of the historical trend. Te Kauwhata substation demand is adjusted as a result of the Te Kauwhata Structure Plan.
- **Industrial and commercial** – our growth forecast is based on applications received and our discussions with developers. Expected growth is also based on the Hamilton City Council Structure Plan which indicates Horotiu, Pukete, Rotokauri and Ruakura as industrial areas. The CBD will also see growth in commercial establishments.
- **Distributed generation** – no adjustment has been made for small scale distributed generation due to its limited ability to impact peak demand. The increasing availability of battery storage systems paired with PV generation has the potential to have a material impact on peaks at the distribution level at the end of the planning period.
- **Load control** – is assumed at current levels throughout the planning period;
- **Temperature** – temperature can impact peak demand. Colder winters can increase demand by as much as 10% compared to average winters. This variation is allowed for in our contingency planning;

Forecasting Uncertainty

All forecasts involve a degree of uncertainty particularly over longer periods. As a result our demand forecast is expected to be less accurate in the later years of the AMP period. The uncertainty will be greater where there are changing circumstances or the potential for new activities. In the medium term emerging technologies and drive for decarbonisation increases the uncertainty of our demand forecasts. There is also uncertainty in the short term driven by the ongoing economic impact of the COVID-19 pandemic and the resulting change in the working environment with more individuals working remotely.

Our development plans and corresponding investments may be amended in subsequent revisions of our AMP reflecting the emerging needs of our customers and stakeholders and changing circumstances on our network.

6.2 CONSUMER CONNECTION

In the last financial year, WEL produced over 1,000 quotes for potential new load on our network.

The following table summarises CIW projects across a number of different connection types.

Project / Programme	Investment Need	Estimated cost (in Nominal Price $000)
New Connections, Subdivisions and Upgrades	Network existing capacity is compromised with the additional demand	153,316

Table 6.2.1: CIW Total Expenditure (excluding relocations)

Customer Initiated Works Schedule

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Non Std Connections	1,746	1,806	1,902	1,893	1,827	1,815	1,926	1,932	1,851	1,854
New Connections<110kVA	2,146	2,219	2,337	2,326	2,245	2,230	2,366	2,373	2,274	2,278
New Connections >110kVA	2,209	2,284	2,405	2,394	2,311	2,296	2,436	2,443	2,341	2,345
Upgrade Existing Sml	246	271	281	295	294	284	282	299	300	288
Upgrade Existing Lge	649	716	741	780	776	749	744	790	792	759
Subdivisions	6,750	7,450	7,704	8,111	8,073	7,793	7,742	8,213	8,238	7,895
Network Upgrade due to DG	20	20	20	20	20	20	20	20	20	20
Total	13,766	14,767	15,389	15,819	15,546	15,187	15,516	16,070	15,817	15,438

Table 6.2.2: Customer Initiated Works Projected Capital Expenditure (excluding relocations).

6.3 SYSTEM GROWTH

We expect system peak demand to modestly increase over the AMP period. Table 6.3.1 shows the individual GXP capacity, forecast, and the demand forecast for the AMP period.

GXP	Security	Firm Capacity	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Hamilton 11kV	N-1	44	29	30	30	31	32	33	34	35	36	37
Hamilton 33kV	N-1	132	133	127	129	132	134	136	122	124	126	113
Huntly 33kV	N-1	82	23	25	30	31	31	32	36	37	53	54
Te Kowhai 33kV	N-1	136	98	110	107	109	113	115	129	131	118	135
System Peak			274	283	288	293	301	306	311	317	322	328

Table 6.3.1: GXP Demand Forecast (MVA)

Our system peak demand forecast shows a need to augment the supply capacity at the Hamilton GXP. To manage this constraint we plan to reinforce and reconfigure our subtransmission network to transfer load across to Te Kowhai and Huntly GXP's.

The system growth is further detailed in the following sections by the network area that each GXP supplies.

6.3.1 Hamilton Network Development Plan

Hamilton network is supplied by Hamilton 33kV and Hamilton 11kV. However, they are separated by a phase shift of 30˚ or 90˚ depending on the adjacent Hamilton 33kV Zone Substations. This means that we cannot easily and automatically connect the Hamilton 11kV network to the Hamilton 33kV network. This network supplies the Council's Structured Plan areas in Rototuna, Ruakura and Peacockes as well as CBD developments.

There are ongoing residential subdivision developments in the Rototuna and Borman areas, and in the northern part of the Ruakura Structure Plan area.

Customer distribution as at end of Financial Year 2020:

Customer Group	Number of Active ICP	Electricity Delivered (GWh)
Domestic	52,049	337
Non-Domestic	5,368	106
Small Scale Distributed Generation	686	6
Streetlights and Unmetered	222	5
Large Commercial	405	269

Table 6.3.1.1: Hamilton Network Customer Breakdown

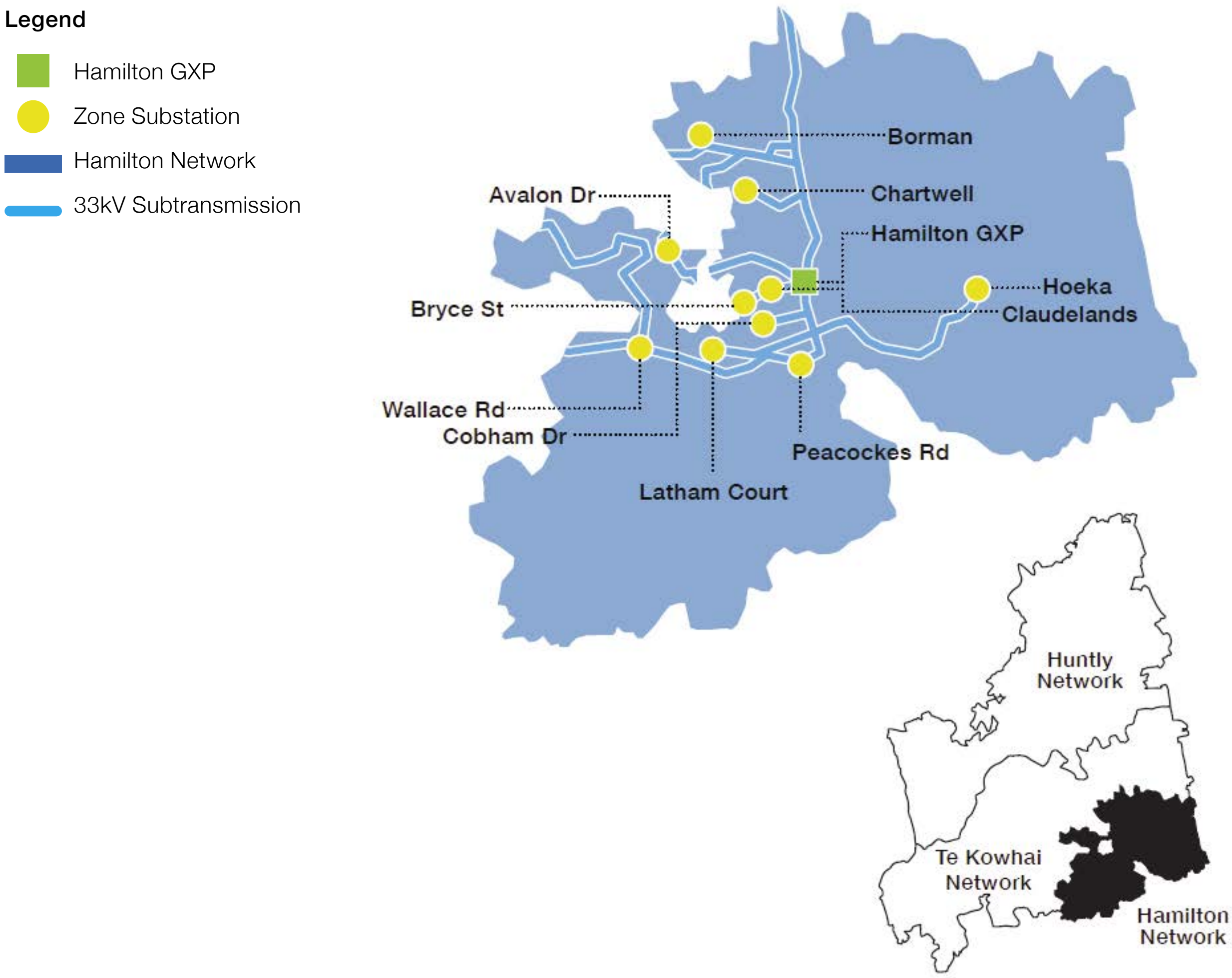


Figure 6.3.1.2: Hamilton Network

Zone Substation	Security	Firm Capacity	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Avalon Dr	N-1	23.8	18.1	18.3	18.5	18.8	19	19.2	19.4	19.7	19.9	20.1
Borman	N-1	20.6	18.2	19	19.2	19.4	19.6	19.8	20	17.7	17.8	17.8
Bryce St	N-1	22.9	16.5	16.9	17.2	17.6	18	18.4	18.8	19.1	19.5	19.9
Chartwell	N-1	25.9	15.8	16	16.2	16.4	16.6	16.8	17	14.7	14.7	14.7
Claudelands	N-1	22.9	19.8	20	20.2	20.4	20.5	20.7	20.9	21	21.2	21.4
Cobham	N-1	25.9	12	12.4	12.7	13	13.4	13.7	14.1	14.4	14.7	15.1
Hoeka Rd	N	25.9	7.6	7.8	8	8.1	8.3	8.4	8.6	8.8	8.9	9.1
Latham Court	N-1	22.9	17.7	17.7	17.8	17.8	17.8	17.9	17.9	18	18	18
Peacockes Rd	N-1	25.9	17.1	18	19.1	20.2	21.3	22.1	22.9	23.7	24.5	19.3
Wallace Rd	N-1	15.4	10.5	10.7	10.8	10.9	11	11.1	11.1	11.2	11.3	11.4
Airport[1]	N-1	23	-	-	-	-	-	-	-	-	-	6
Crosby[2]	N-1	23	-	-	-	-	-	-	-	5	5.4	5.7

Table 6.3.1.3: Hamilton Network Zone Substation Demand Forecasts (MVA)

The following table summarises the Hamilton network system growth projected investment:

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($000's)
Crosby Substation Twin	Load growth in the northern part of Ruakura Structure Plan. Security of Supply.	New Zone substation twin (✔) Install 3rd transformer at Borman or Chartwell Do Nothing	4,079
Crosby Distribution Network	Load growth in the northern part of the Ruakura Structure Plan.	Upgrade feeders (✔) Install new 11kV cables (✔) Install automated switchgear (✔) Network Reconfiguration (✔) Do Nothing	765
Distribution Network Reinforcement	Feeders identified with loading and/or security issues. Driven by ongoing urban growth and densification.	Upgrade feeder (✔) Install new 11kV cables (✔) Install automated switchgear (✔) Network Reconfiguration (✔)	11,138
Peacocke Bridge spare cable ducts	Industrial growth around Hamilton airport and development of the Peacockes Structure Plan area. Cost effective to allow for future capacity during initial construction.	Include ducts in new bridge (✔) Do nothing	180

[1] Airport zone substation will be operated as a 'twin' of Peacockes Rd
[2] Crosby zone substation will be operated as a 'twin' to Borman and Chartwell

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($000's)
Peacockes Growth	Industrial growth around Hamilton airport and development of the Peacockes Structure Plan area. Load growth and security of supply.	New Airport zone substation twin (✓) Install 3rd transformer at Peacockes Install new 11kV feeders	2,237
GXP Transfer: Avalon zone substation to Te Kowhai GXP	Hamilton 33kV GXP security of supply constraint. Driven by ongoing network growth.	Reinforce and reconfigure sub transmission network to transfer load (✓) Upgrade Hamilton 33kV GXP Install Grid Scale Battery Do Nothing	500
GXP Transfer: Borman zone substation to Te Kowhai GXP	Hamilton 33kV GXP security of supply constraint. Driven by ongoing network growth.	Reinforce and reconfigure sub transmission network to transfer load (✓) Upgrade Hamilton 33kV GXP Install Grid Scale Battery Do Nothing	500
GXP Transfer: Wallace zone substation to Te Kowhai GXP	Hamilton 33kV GXP security of supply constraint. Driven by ongoing network growth.	Reinforce and reconfigure sub transmission network to transfer load (✓) Upgrade Hamilton 33kV GXP Install Grid Scale Battery Do Nothing	344

Table 6.3.1.4: Hamilton Network System Growth Projects

Hamilton Network Development Schedule

Hamilton Network System Growth ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Crosby Substation Twin	-	-	-	-	-	2,305	1,524	250	-	-
Crosby Distribution Network	-	-	-	-	-	255	255	255	-	-
Distribution Network Reinforcement	600	1,430	510	1,634	1,612	1,222	1,320	1,310	750	750
Peacocke Bridge spare cable ducts	180	-	-	-	-	-	-	-	-	-
Peacockes Growth	-	337	-	-	-	-	-	-	1,200	700
Smart Meters	1,087	377	377	377	377	377	510	765	800	800
GXP Transfer: Avalon to Te Kowhai	-	-	-	-	-	-	500	-	-	-
GXP Transfer: Borman to Te Kowhai	-	-	-	-	-	-	-	-	-	500
GXP Transfer: Walace to Te Kowhai	344	-	-	-	-	-	-	-	-	-
Total	1,124	1,430	510	1,971	1,612	3,782	3,599	1,815	1,950	1,950

Table 6.3.1.5: Hamilton Network System Growth Projected Capital Expenditure

6.3.2 Te Kowhai Network Development Plan

Te Kowhai network is supplied by Te Kowhai GXP. There are two large embedded generators in this network: the 50MW Te Rapa cogeneration and 64MW Te Uku Wind Farm plus one small generation unit at Hamilton City Council's Waste Water Plant 1MW cogeneration. With the exception of a spur line to Raglan, the Te Kowhai 33kV subtransmission is meshed where all the 33kV subtransmission network is interconnected and ringed back to the Te Kowhai GXP.

Customer Group	Number of Active ICP	Electricity Delivered (GWh)
Domestic	19,203	129
Non-Domestic	4,599	81
Small Scale Distributed Generation	374	4
Streetlights and Unmetered	64	0
Large Commercial	358	216

Table 6.3.2.1: Te Kowhai Network Customer Breakdown

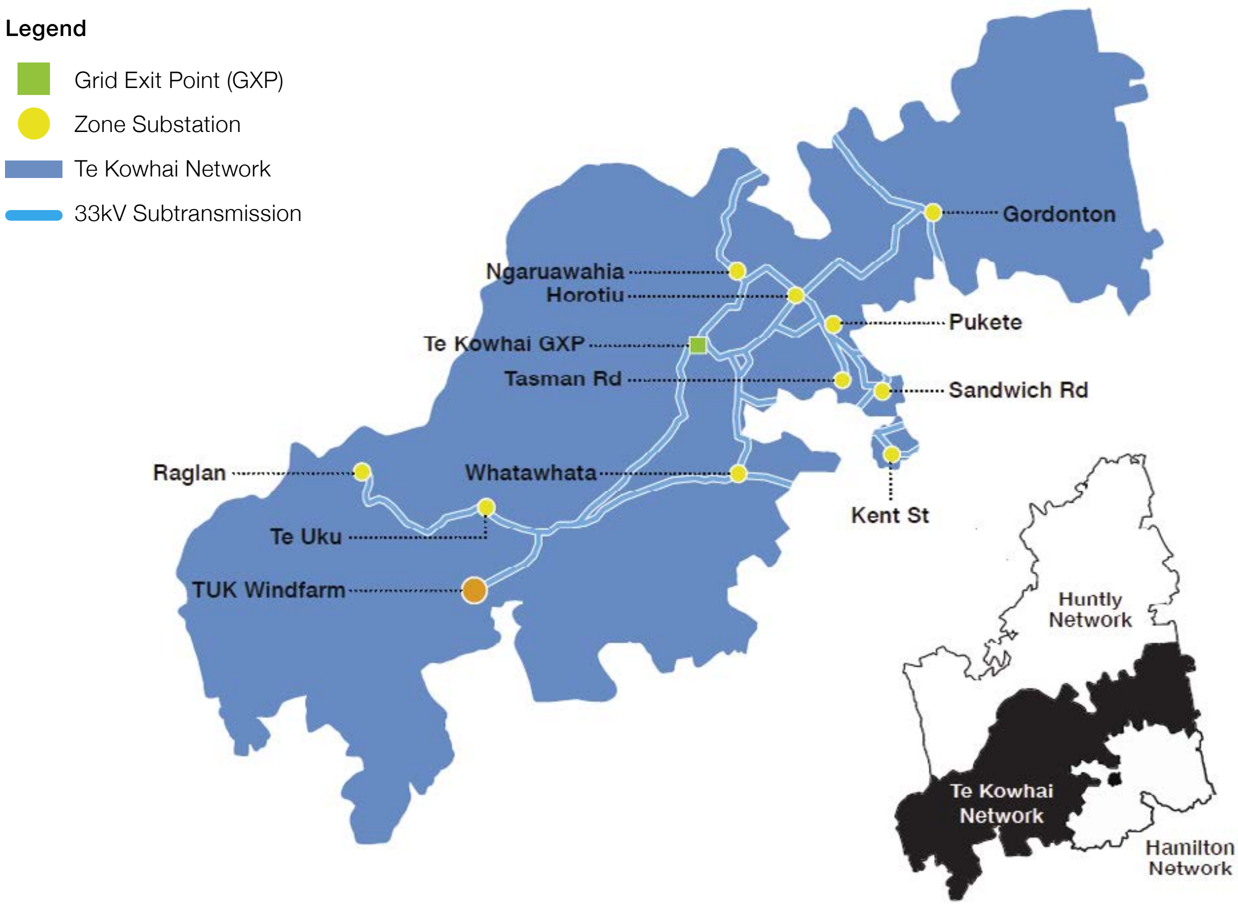


Figure 6.3.2.2: Te Kowhai Network

Zone Substation	Security	Firm Capacity	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Gordonton	N	10	7.1	7.2	7.2	7.3	7.3	7.4	7.4	7.5	7.5	7.6
Horotiu	N-1	18	13.8	15.8	12.7	12.6	14.3	14.3	14.3	14.4	14.6	14.7
Kent St	N-1	22.9	16.2	16.3	16.3	16.4	16.5	16.5	16.6	16.6	16.7	16.7
Ngaruawahia	N-1	9	6.6	6.7	6.8	6.8	6.9	7	7.1	7.2	7.3	7.3
Pukete - Anchor	N-1	30	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
Pukete - 11kV	N-1	12.6	10.5	10.9	9.6	9.8	9.7	9.9	10.2	10.4	10.6	10.9
Raglan	N	11.4	5.2	5.2	5.2	5.3	5.3	5.4	5.4	5.4	5.4	5.5
Sandwich Rd	N-1	28.2	20.6	20.7	20.8	20.9	21	21.1	21.3	21.4	21.5	21.6
Tasman	N-1	25.9	21.1	22	23.3	24.5	21.8	21	21.7	21.4	22.9	23.4
Te Uku	N-1	10	2	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.5	2.6
Whatawhata	N	22.9	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	4.9	4.9
Exelby[1]	N-1	23	-	-	-	-	4	6	6.6	7.3	8	8.8
Te Rapa North[2]	N-1	23	-	-	5	5.1	5.9	6	6.1	6.3	6.5	6.6

Table 6.3.2.3: Te Kowhai Network Zone Substation Demand Forecasts (MVA)

The following table summarises the Te Kowhai network system growth projected investment:

Project / Programme	Investment Need	Options Considered / Selected (✔)	Estimated cost ($000's)
Exelby Substation Twin	Demand growth of Rotokauri Structure Plan development. Security of Supply.	New Zone substation twin (✔) Install 3rd transformer at Tasman Do Nothing	2,530
Exelby Distribution Network	Demand growth of Rotokauri Structure Plan development.	Upgrade feeders (✔) Install new 11kV cables (✔) Install automated switchgear (✔) Network Reconfiguration (✔) Do Nothing	1,785
Te Kowhai to Tasman subtransmission cabling	Security of supply. Driven by ongoing network growth at the northern end of Hamilton.	Install new subtransmission circuit (✔) Do nothing.	55
Te Rapa North Substation Twin and Subtransmission Cabling from Te Kowhai	Demand growth of Rotokauri structure development. Security of Supply.	New Zone substation twin (✔) Install 3rd transformer at Tasman Do Nothing	4,315

1 Exelby zone substation will be operated as a 'twin' to Tasman.
2 Te Rapa North zone substation will be operated as a 'twin' to Horotiu and Pukete – 11KV

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($000's)
Te Rapa North Distribution Network	Demand growth due to the Te Rapa north industrial development.	Upgrade feeders (✔) Install new 11kV cables (✔) Install automated switchgear (✔) Network Reconfiguration (✔) Do Nothing	2,040
Te Rapa North, Horotiu-Pukete connection	Security of supply. Demand growth due to the Te Rapa north industrial development.	Tie into existing Horotiu-Pukete circuit (✔) Install new circuit to Horotiu Do Nothing	778
GXP Transfer: Gordonton to Huntly	Te Kowhai 33kV GXP security of supply constraint. Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Reinforce and reconfigure sub transmission network to transfer load (✔) Upgrade Hamilton 33kV GXP Install Grid Scale Battery Do Nothing	408
GXP Transfer: Horotiu to Huntly	Te Kowhai 33kV GXP security of supply constraint. Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Reinforce and reconfigure sub transmission network to transfer load (✔) Upgrade Hamilton 33kV GXP Install Grid Scale Battery Do Nothing	4,488
GXP Transfer: Ngaruawahia to Huntly	Te Kowhai 33kV GXP security of supply constraint. Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Reinforce and reconfigure sub transmission network to transfer load (✔) Upgrade Hamilton 33kV GXP Install Grid Scale Battery Do Nothing	153
RMZ900-SAN circuit uprating	Security of supply. Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Reconfigure to increase thermal rating (✔) Install new sub transmission circuit Reconductor circuit Do Nothing	215
TWH-RMZ903 circuit uprating	Security of supply. Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Reconfigure to increase thermal rating (✔) Install new sub transmission circuit Reconductor circuit Do Nothing	160

Table 6.3.2.4: Te Kowhai Network System Growth Projects

Te Kowhai Network Development Schedule

Te Kowhai Network System Growth ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Exelby Distribution Network	-	255	510	510	255	255	-	-	-	-
Exelby Substation Twin	-	-	1,530	900	100	-	-	-	-	-
RMZ900-SAN Circuit Uprating	-	215	-	-	-	-	-	-	-	-
GXP Transfer: Gordonton to Huntly	-	-	-	-	-	-	408	-	-	-
GXP Transfer: Horotiu to Huntly	-	-	-	-	-	-	-	1,632	1,436	1,420
GXP Transfer: Ngaruawahia to Huntly	-	-	153	-	-	-	-	-	-	-
TRN Distribution Network	-	-	510	510	510	255	255	-	-	-
TRN Substation HOR-PUK cut in	-	-	-	-	778	-	-	-	-	-
TWH GXP to TAS 33kV cabling and TWH GXP to TRN 33kV cabling Stage 1	55	-	-	-	-	-	-	-	-	-
TWH GXP to TRN 33kV cabling Stage 2 and Development of TRN substation	1,310	1,593	1,412	-	-	-	-	-	-	-
TWH-RMZ903 Circuit Uprating	-	-	160	-	-	-	-	-	-	-
Total	1,365	2,063	4,275	1,920	1,643	510	663	1,632	1,436	1,420

Table 6.3.2.5: Hamilton Network System Growth Projected Capital Expenditure

6.3.3 Huntly Network Development Plan

Huntly network is supplied by Huntly GXP. The major load centre is Huntly township which is supplied from the Weavers and Glasgow St Zone Substations. After Huntly, Te Kauwhata is a rapidly growing township supplied from the Te Kauwhata Zone Substation.

Customer distribution as at end of Financial Year 2020 is shown in the table below:

Customer Group	Number of Active ICP	Electricity Delivered GWh
Domestic	6,535	48
Non-Domestic	2,267	33
Small Scale Distributed Generation	123	1
Streetlights and Unmetered	48	2
Large Commercial	83	32

Table 6.3.3.1: Huntly Network Customer Breakdown

Huntly Network

Legend

- Grid Exit Point (GXP)
- Zone Substation
- Huntly Network
- 33kV Subtransmission

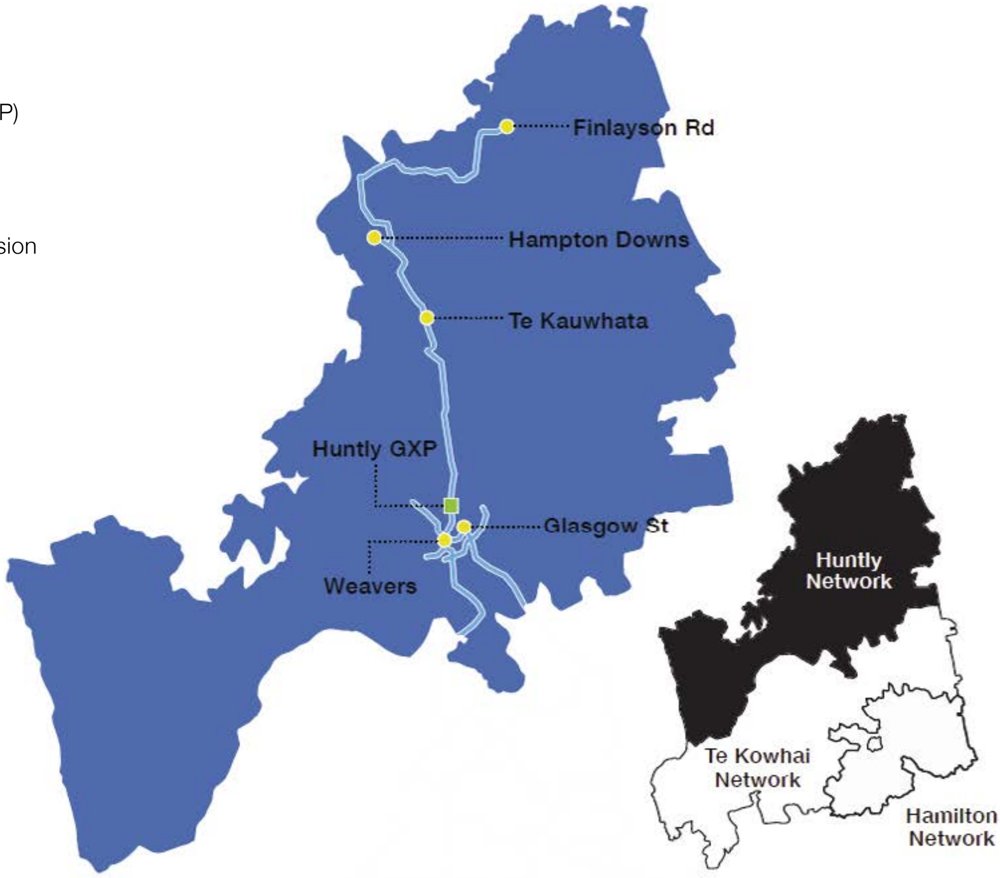


Figure 6.3.3.2: Huntly Network

Zone Substation	Security	Firm Capacity	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Finlayson Rd	N	7.5	3.2	3.6	3.6	3.6	3.7	3.7	3.7	3.7	3.7	3.7
Glasgow St	N	10.0	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.9
Hampton Downs	N	9.1	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8
Te Kauwhata	N-1	10.0	5.4	5.5	5.7	5.8	5.9	6.1	6.2	6.3	6.5	6.6
Weavers	N-1 Switched	9.0	9	10.6	10.7	10.9	11	11.2	11.3	11.4	11.6	11.7

Table 6.3.3.3: Huntly Zone Substation Demand Forecast (MVA)

6.3.4 Summary of System Growth Capital Expenditure

The 10 year System Growth Investment forecast is shown in Table 6.3.4.1. Work has been undertaken to spread the required capital over the AMP period.

System Growth ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Hamilton Network System Growth	1,124	1,430	510	1,971	1,612	3,782	3,599	1,815	1,950	1,950
Te Kowhai Network System Growth	1,365	2,063	4,275	1,920	1,643	510	663	1,632	1,436	1,420
Huntly Network System Growth	-	-	-	-	-	-	-	-	-	-
Total	2,489	3,493	4,785	3,891	3,255	4,292	4,262	3,447	3,386	3,370

Table 6.3.4.1: System Growth Capex by Region

6.4 SAFETY, RELIABILITY AND ENVIRONMENT

This section is composed of subsections covering quality of supply, legislative and regulatory, and other reliability, safety and environment.

6.4.1 Quality of Supply

The following table summarises the quality of supply projected investment:

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($000's)
Distribution Transformer and LV Feeder Upgrade for power quality projects	Upgrade distribution transformer and LV feeders to improve power quality. This is driven through analysis of our smart meter data.	Upgrade distribution transformer and LV feeders identified by smart meters to improve power quality (✔) Do nothing	7,200

Table 6.4.1.1: Quality of Supply Projects

Quality of Supply ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Distribution Transformer and LV Feeder Upgrade for power quality projects	500	500	550	650	750	800	800	850	900	900
Total	500	500	550	650	750	800	800	850	900	900

Table 6.4.1.2: Reliability, Safety and Environment Projected Capital Expenditure

6.4.2 Legislative and Regulatory

The following table summarises the legislative and regulatory projected investment:

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost (in Nominal Price $000)
AUFLS scheme change	Compliance to new AUFLS regime	Comply with regulatory requirement (✔) Do nothing	137
Te Kowhai 33kV Neutral Earthing Resistor and protection enhancement	Voltage regulation Protection coordination	Install Neutral earthing resistor and upgrade protection (✔)	584
Seismic strengthening of substations and switching stations	Safety and compliance	Strengthen buildings to comply (✔) Replace buildings	2,676

Table 6.4.2.1: Legislative and Regulatory Projects

Legislative and Regulatory Project Schedule

Legislative and Regulatory ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
AUFLS scheme changes	-	-	-	137	-	-	-	-	-	-
NER protection changes through TWH Network	130	454	-	-	-	-	-	-	-	-
Seismic upgrades of substations	616	-	-	610	850	600	-	-	-	-
Total	746	454	-	747	850	600	-	-	-	-

Table 6.4.2.2: Legislative and Regulatory Projected Capital Expenditure

6.4.3 Other Reliability, Safety and Environment

The following table summarises the other reliability, safety and environment projected investment:

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($000's)
Air-conditioning for Substations	Substation humidity and condensation.	Install air conditioning and ventilation (✔) Do nothing	311
CBD IOT Fault Indication	Reliability. Improved fault response to critical customers in the Hamilton CBD.	Install IOT fault indicators (✔) Install automated switchgear Do nothing	173
Confined spaces	Substation confined spaces access restrictions.	Remove or mitigate confined space risks (✔) Ongoing access restrictions	1,234
Opportunistic Fibre Install	Opportunity to install new fibre cable or duct when there is Council and third party road or footpath works.	Install new fibre cable or duct when there is Council and third party road or footpath works or new cable installations (✔) Do nothing	558

Project / Programme	Investment Need	Options Considered / Selected (✔)	Estimated cost ($000's)
Gordonton Zone Substation Upgrade	Substation has only one 33kV circuit breaker, with a bypass switch all on one pole, for two transformers. No clearance for maintenance without a complete site outage. Protection and 11kV asset replacement.	Upgrade substation to modern standards (✔) Transfer demand Do nothing	2,183
Te Uku Substation Upgrade	Improve security of 33kV supply, protection upgrade and asset replacement and safety improvements.	Upgrade substation to modern standards (✔) Do nothing	2,090
Distribution System Operator enabling	SCADA, communications and control enhancements to facilitate the transition to a distribution system operator.	Enhance SCADA, communications and control systems (✔) Do Nothing	2,475
Fibre Routes	Install new fibre to provide redundancy and high bandwidth to key sites.	Install new fibre (✔) Install new radio links Do Nothing	3,401
Garden Place Switching Station Bypass	Confined space, seismic strengthening and asset condition.	Bypass and install distributed automated switchgear (✔) Upgrade existing switching station Establish a new switching station Do Nothing	864
LV Visibility	Provide measuring devices in LV network.	Provide measuring devices in LV network (✔) Do nothing	1,875
Massey	Aged equipment with high arc flash risk.	Replace switchgear (✔)	1,386
Multi Circuit Rationalisation	Reliability and maintainability of high criticality overhead lines that carry multiple circuits.	Replace with cable circuits (✔) Rebuild on different routes (✔) Network reconfiguration (✔) Do nothing	750
Substation Door Upgrade	Safety improvement for emergency egress.	Upgrade substation doors (✔) Do nothing	102
Zone Substation Oil Containment	Environmental and fire risk.	Improve transformer bunding (✔) Do nothing	500
Network Reliability Project	Reliability. Minimise fault duration and the number of customers impacted by outages.	Install new isolation equipment (✔) Reconfigure circuit (✔) Install feeder ties (✔) Do nothing	5,741

Table 6.4.3.1: Other Reliability, Safety and Environment Projects

Other Reliability, Safety and Environment Project Schedule

Other reliability, safety and environment ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Air-conditioning for substations	-	-	101	110	100	-	-	-	-	-
CBD IOT Fault Indication	47	63	63	-	-	-	-	-	-	-
Confined spaces	68	126	210	-	210	-	220	200	-	200
Opportunistic Fibre Install	51	51	51	55	55	55	60	60	60	60
Gordonton Zone Substation Upgrade	1,556	627	-	-	-	-	-	-	-	-
Te Uku Zone Substation Upgrade	-	1,420	620	50	-	-	-	-	-	-
Distribution System Operator enabling	-	175	250	250	300	300	300	300	300	300
Fibre routes	252	149	350	250	300	300	300	500	500	500
Garden Place Switching Station Bypass	864	-	-	-	-	-	-	-	-	-
LV Visibility	-	-	175	200	250	250	250	250	250	250
Massey	700	686	-	-	-	-	-	-	-	-
Multi Circuit Rationalisation	-	-	-	-	-	-	-	250	250	250
Substation Door Upgrade	-	-	51	51	-	-	-	-	-	-
Zone Substation Oil Containment	-	-	-	-	-	-	-	-	250	250
Network Reliability Project	61	400	530	650	650	650	650	650	750	750
Total	3,599	3,697	2,401	1,616	1,865	1,555	1,780	2,210	2,360	2,560

Table 6.4.3.2: Other Reliability, Safety, and Environment Projected Capital Expenditure

6.4.4 Summary Of Reliability, Safety And Environment (Rse) Capital Expenditure Forecast

Reliability, safety and Environment ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Legislative and regulatory	746	454	-	747	850	600	-	-	-	-
Other reliability, safety and environment	3,599	3,697	2,401	1,616	1,865	1,555	1,780	2,210	2,360	2,560
Quality of supply	500	500	550	650	750	800	800	850	900	900
Total	4,845	4,651	2,951	3,014	3,465	2,955	2,580	3,060	3,260	3,460

Table 6.4.4.1: Summary of Reliability, Safety, and Environment Projected Capital Expenditure

6.5 ASSET RELOCATION

Relocations

These are predominantly relocations of our assets associated with the continuing development of the Waikato Expressway, other NZTA road works and for works associated with subdivision or land development.

Undergrounding

In some circumstances and upon request, WEL will convert overhead lines to underground cables and will fund up to 50% of the total project cost where there is a community focus. A maximum annual spend inclusive of WEL contribution is $500k, beyond which will be 100% cost to the customer.

The following table summarises the asset relocation projected investment:

Project / Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost (in Nominal Price $000)
Relocations	Relocation of assets to support the expressway development	Relocate assets (✔)	39,634
Undergrounding	Undergrounding of overhead lines	Underground overhead lines (✔) Maintain overhead lines	5,000

Table 6.5.1: Asset Relocation Projects

6.5.1 Summary Of Asset Relocation And Expenditure Forecast

The 10 year capital expenditure forecast is shown in table 6.5.1.1.

Asset Relocation ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Undergrounding	500	500	500	500	500	500	500	500	500	500
Other Relocations	-	2,401	3,901	3,901	3,901	3,901	3,901	3,901	3,901	3,901
Peacockes Development	2,000	1,500	-	-	-	-	-	-	-	-
Hamilton City Council	1,023	-	-	-	-	-	-	-	-	-
Chedworth Properties (Spine Road)	1,500	-	-	-	-	-	-	-	-	-
Total	5,023	4,401	4,401	4,401	4,401	4,401	4,401	4,401	4,401	4,401

Table 6.5.1.1: Asset Relocation Capital Expenditure

6.6 SUMMARY OF NETWORK DEVELOPMENT CAPITAL EXPENDITURE

The 10 year Network Capital Investment forecast is shown in table 6.6.1.

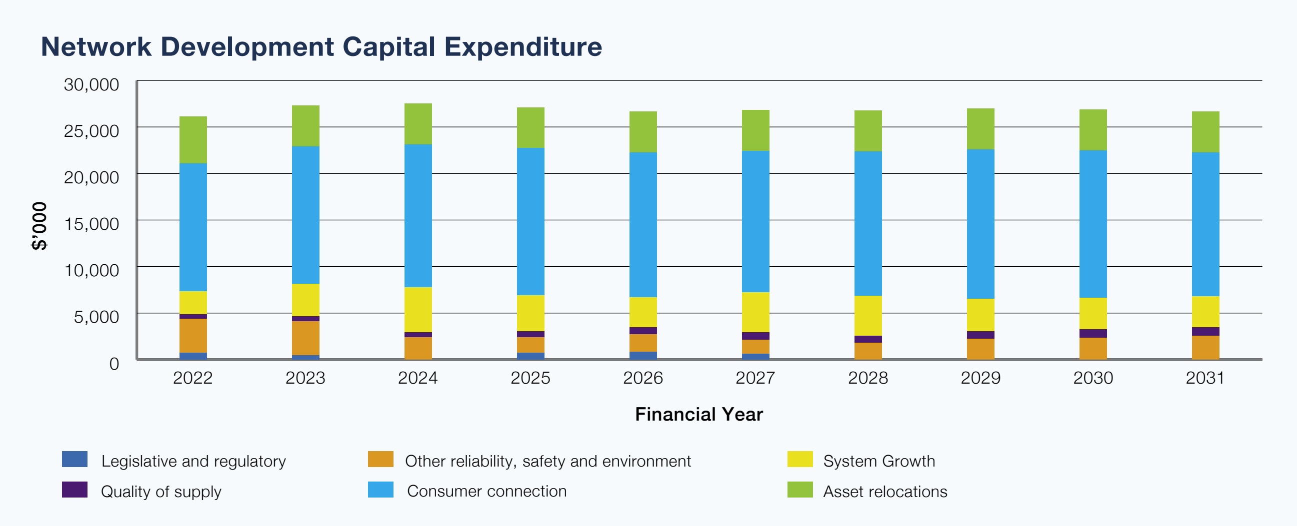


Figure 6.6.1: Network Development 10 year Capital Expenditure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NON-NETWORK SOLUTIONS AND SUPPORT SYSTEMS

7 NON-NETWORK SOLUTIONS AND SUPPORT SYSTEMS

This chapter sets out our approach to non-network solutions and support systems. The chapter provides an overview of the plans we have in place for emerging technologies such as solar generation and battery storage systems. The chapter also outlines the benefits we have gained from installing our own smart meters.

7.1 NON-NETWORK SOLUTIONS

WEL Networks is investigating and testing solar generation and battery storage to have a robust understanding of their capabilities, impacts and influence to the network. Further, WEL have installed six standalone electric vehicle (EV) fast charging stations to support the NZ government initiative in promoting the use of electric vehicles. In conjunction with this WEL have partnered with local businesses to install EV charging stations at seven other sites across the region. WEL is continuing to develop new systems for smart meter analytics as well as providing these services to other companies.

7.1.1 Solar Generation

As of 1 April 2020, WEL has over 1,200 customers who have mounted photovoltaic panels with panels totalling over 5MW of installed capacity. The graph below illustrates the historical growth of solar connection and capacity.

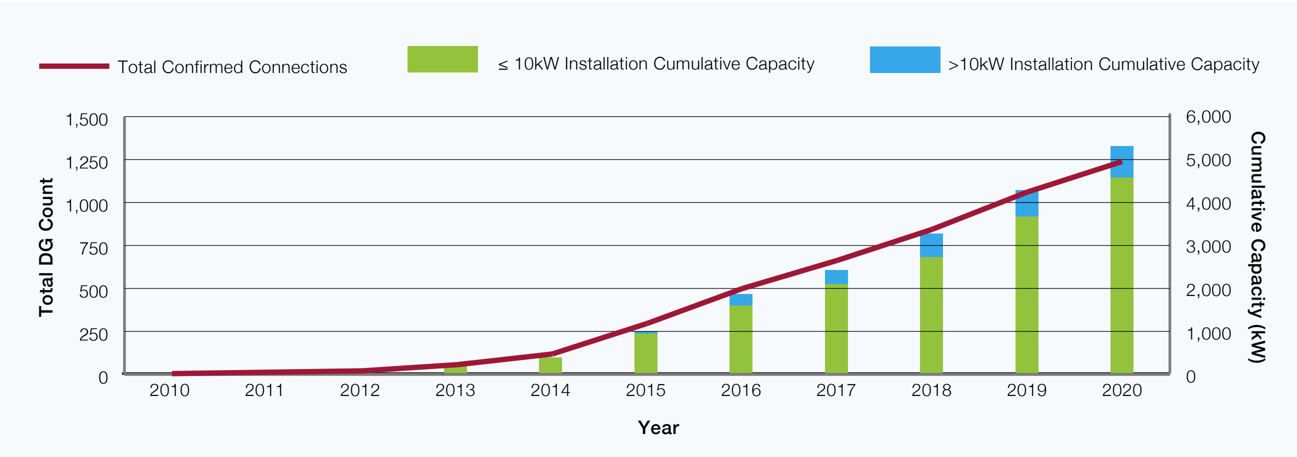

Figure 7.1.1.1: Total Distributed Generation Connections over the last 10 years

To study and understand the future impact and opportunity of solar generation, WEL Networks has undertaken a range of Distributed Energy Resource (DER) trial projects with Solar Generation being one of the energy sources.

7.1.2 Distributed Energy Resource (DER) Investigations

WEL has taken a proactive approach to distributed energy resource management by carrying out a number of practical trials. A grid-tied microgrid has been developed and built, including solar PV generation, battery energy storage, diesel generation and integrated control system.

This project is providing WEL Networks with data and information on operating a number of DER's together and the impact they have on the network. These findings will provide insights for future capital investment into the traditional network to provide customers sustainable and low cost options to meet their energy requirements.

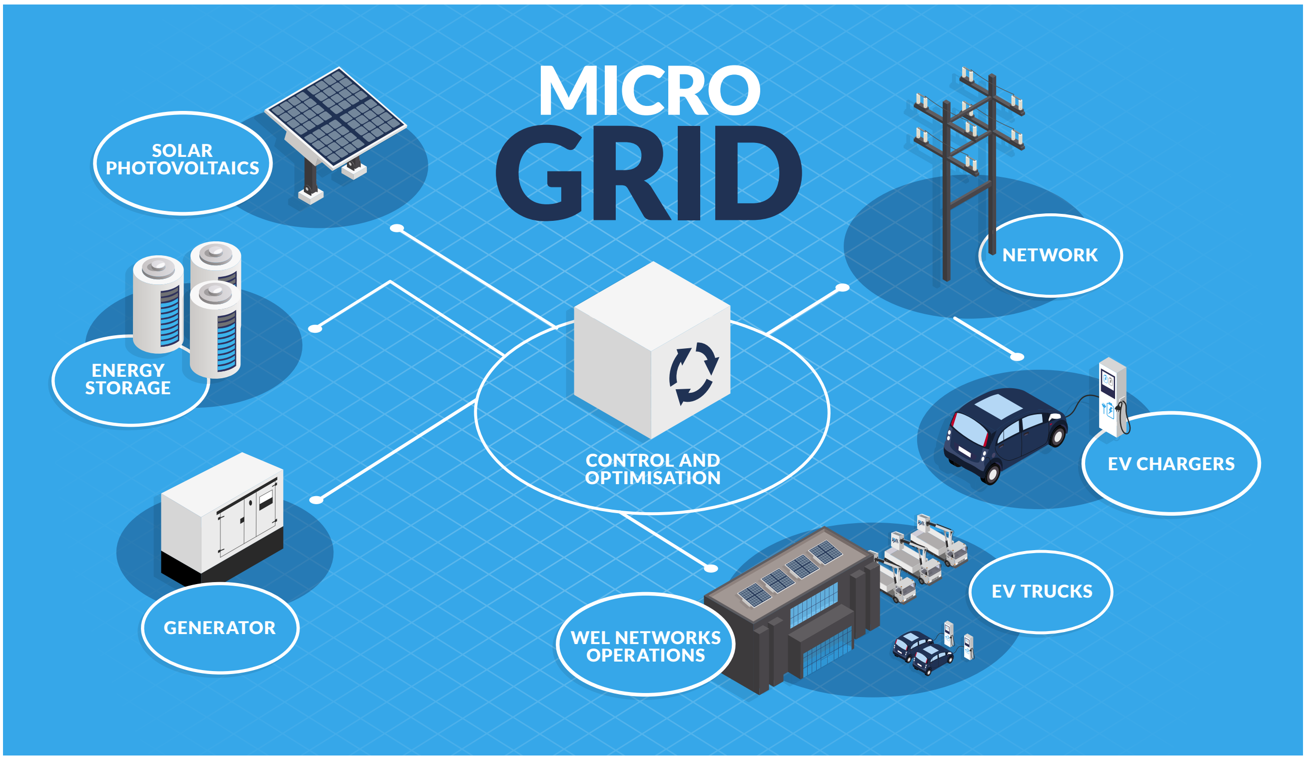

Figure 7.1.2.1: Distributed Energy Resource Micro Grid

7.1.3 Smart Meter

WEL has installed over 68,000 smart meters in its distribution area since 2011 and is continuing to install smart meters on new connections. WEL has gained significant expertise in developing tools and analytics for meter data and continues to develop new systems with the aim of becoming the centre of excellence for smart meter data analytics in New Zealand.

WEL has realised benefits of the tools and data analytics across the network and these can best be categorised as near real time operational and planning benefits. These are discussed further below.

A system is currently under development for receiving and processing 5 minute interval measurement data (including voltage, current and power) from meters and using this data to support a number of advanced use cases.

Smart Metering Systems

The smart metering systems consist of the core communications and meter management modules supplied by Itron and other data systems built by WEL, to manage meter readings and meter device information in order to meet MEP (Metering Equipment Provider) process and compliance requirements.

Mesh Communications Network and Advanced Meter Management

The Itron head end hosts a suite of applications that support the WEL smart meter implementation. The head end itself is hosted in the United States and the contractual arrangement is a “Software as a Service” agreement. The application is accessed in the WEL office via a web interface. Data traffic from devices and other application traffic flows from the WEL office to the head end via an Internet Virtual Private Network.

The Advanced Meter Management module within the Itron head end is the main application used for managing devices (meters, relays, access points) and for setting up schedules, reports and exports. The number of devices in various life cycle states can be monitored along with events and alarms from devices. On demand interrogation and control of devices at selectable frequencies can be performed using web services. Meter readings and events are obtained at scheduled intervals.

Smart Meter Database and Data Warehouse

WEL is a Metering Equipment Provider (MEP) currently providing metering services to eight retailers. To support this function WEL maintains a Metering Equipment database containing all metering equipment details and associated compliance information. Tablet devices are used to field capture meter installation activity and update the database automatically.

All smart meter readings and event data are downloaded from SSN and stored in a Meter Data Warehouse. This provides meter data feeds to traders for sites where WEL is the MEP, updates to the Registry, and also serves as a data source for reports and analytic tools that use the data for distribution network purposes. This database is linked to the previously mentioned Metering Equipment database and the Network Billing database.

Smart Meter Operational Benefits

Proactive Low Voltage Correction

WEL is able to poll and log (voltage, current, power and power factor) data from the meters remotely at a customer's premises. This allows Voltage Complaints and other issues which require investigations to be carried out from the office, without having to install data loggers at the site. Five minute logging of voltage and current is being incorporated into Compass to allow for a review of the general power quality at the time the customer is reporting the issues.

Control Room Operations

The control room has the ability to monitor meter voltages in real time. This results in:

- **Improved fault detection and management:** By using smart meter voltage data it is possible to confirm if and where a single HV fuse is suspected of having blown. When power is restored by a fuse or switch being closed it is possible for the operator to check voltages and confirm power is back and at normal levels on all phases. It is no longer necessary to direct fault staff to climb a pole or open a transformer cabinet to measure voltages and confirm power has been restored.
- **Improved Network Flexibility:** Having the ability to obtain an instantaneous measurement of voltage has improved the flexibility of our network. This can be used to increase the proportion of the network that is backfed during both planned and unplanned outages.
- **Reduction in Response Time:** When power is lost to a smart meter it sends out a communication to inform WEL that power has been lost, this is referred to as "last gasp". This signal is fed into our NMS (Network Management System) and simulated as a customer call creating a 'no power' incident. This provides the operator with immediate notification of an outage. This can then be actioned and fault staff dispatched directly to the correct fault site, prior to any fault notifications being received from the public.

Reduction in Fault Call Outs

As we are able to connect to a smart meter and obtain instantaneous measurement data; Customer Service Representatives use this when we receive a call of part power or no power from a customer to determine if the fault is on the network side of the meter or within the customer's installation. This has reduced the number of faults that our staff need to attend.

Streetlight Control

The failure of a ripple injection plant on a GXP resulted in a loss of control of automatic streetlight control. Smart meters have been installed on all streetlight control points and mesh commands used to switch the control contacts were sent through the smart meter communications mesh. This successfully allowed centralised control of the streetlights while repairs to the ripple plant were undertaken. Use of smart meters also provides the ability to remotely confirm the state of a device's switch in real time and also measure the ripple plant signal strength at that device.

Smart Meter Network Planning Benefits

The detailed information provided by the smart meters provide a range of network planning benefits including:

- **Proactive Power Quality and Abnormal Condition Detection:** The voltage excursion events generated by meters are stored in a data warehouse. These events are analysed and reported on in various ways with the intention of identifying various conditions such as overloaded transformers, overloaded or undersized conductors, incorrectly tapped transformers, loose connections and deteriorating or broken neutrals. A significant number of unsafe conditions have been detected and proactively repaired as a result of this ongoing analysis.
- **Load profiling:** The meter load profile information can be aggregated to distribution transformer level and by supplementing this with feeder profiles to account for legacy meters, an accurate approximation can be derived of the distribution transformer load profile. This can indicate overloaded transformers and an assessment can be made of the severity of that overloading (in terms of quantity, timing and duration) and appropriate upgrades planned and prioritised.
- **Identification of DG and Unauthorised Energy Export:** The smart meters can detect energy export and sites reporting this can be compared with known and approved DG sites to identify sites for investigation.

- **Revenue Assurance**
    - Load control not operating – confirming that load control is operational at a site and is being correctly measured.
    - Tamper – altering of a meter generates tamper events.
    - Confirming site capacity – identifying overloaded sites
    - Meter bypass detection – with the meter in the disconnected state, potential on the load side can be detected.
- **Reduction in Capital Expenditure:** By using smart meter analytics WEL has been able to improve our asset management decision making by using real world measurements instead of relying on often more conservative modelling that often results in a reduction in network upgrades required.

7.1.4 Electric Vehicles

WEL Networks has established a network of public chargers throughout the Waikato to support the movement of EVs.

- Maui Street, Te Rapa
- Wayside Road, Te Kauwhata
- Bow Street, Raglan
- Innovation Park, Ruakura
- Caro Street, Hamilton CBD
- Hampton Downs Raceway
- Mystery Creek, Waitomo Fuelstop
- Six Countdown supermarkets

WEL has partnered with EECA through the Low Emissions Vehicle Contestable Fund (LEVCF) on two projects. The first to assist in providing some of the chargers, mentioned above. The second project was to develop and build a fully electric elevated work platform (EWP) truck, or 'bucket truck'.

WEL Networks is using smart chargers to manage the time of charging the electric truck and electric pool vehicles at the depot.

In 2021 we plan to run a trial of a home charger engagement management program that involves interfacing customer chargers to an automated device management platform. It allows us to understand customer needs on EV charging, and provides the ability to accommodate more charging flexibility without triggering upstream asset replacement. This trial aims to establish the benefits to both the customer and the network of managing how and when EV's charge.

7.2 NON-NETWORK SUPPORT SYSTEMS

WEL Networks has a variety of non-network support systems that enable the business to conduct its day-to-day activities in an efficient manner. The key systems are Network Management System (NMS), Geographical Information System (GIS), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Network Billing, Electronic Content Manager (ECM), Vegetation Management System (VMS), mobility services, Compass, and the new Customer Self Service (CSS) web portal.

In the majority of cases, the non-network support systems are "off the shelf" products configured to accommodate internal business processes. These are supported by internal staff and 3rd party vendors to ensure that the systems remain up-to-date, secure, and fit for purpose. The legacy mobility solution has been developed specifically to WEL's needs by a third party vendor who works closely with the business to maintain and enhance this system. This mobility solution is being supplemented with the deployment of new mobility apps to collect inspection data from the field. A strategic mobility programme will be established to consolidate the mobility solutions and build out more capability in future. The Network Billing System is a bespoke system specifically for use within WEL Networks as third party products were either not available in the market place at the time of implementation or were priced well beyond internal costs relating to system development. The smart meter data system, Data Warehouse, and Device Database have been developed in-house. The Advanced Meter Management module is a third party product and externally hosted. The current GIS system is being phased out and will be replaced with a new off the shelf solution by the end of 2022.

These systems interface with one another to ensure a consistent dataset is available across the non-network support systems landscape in a format that is meaningful to the users of each system.

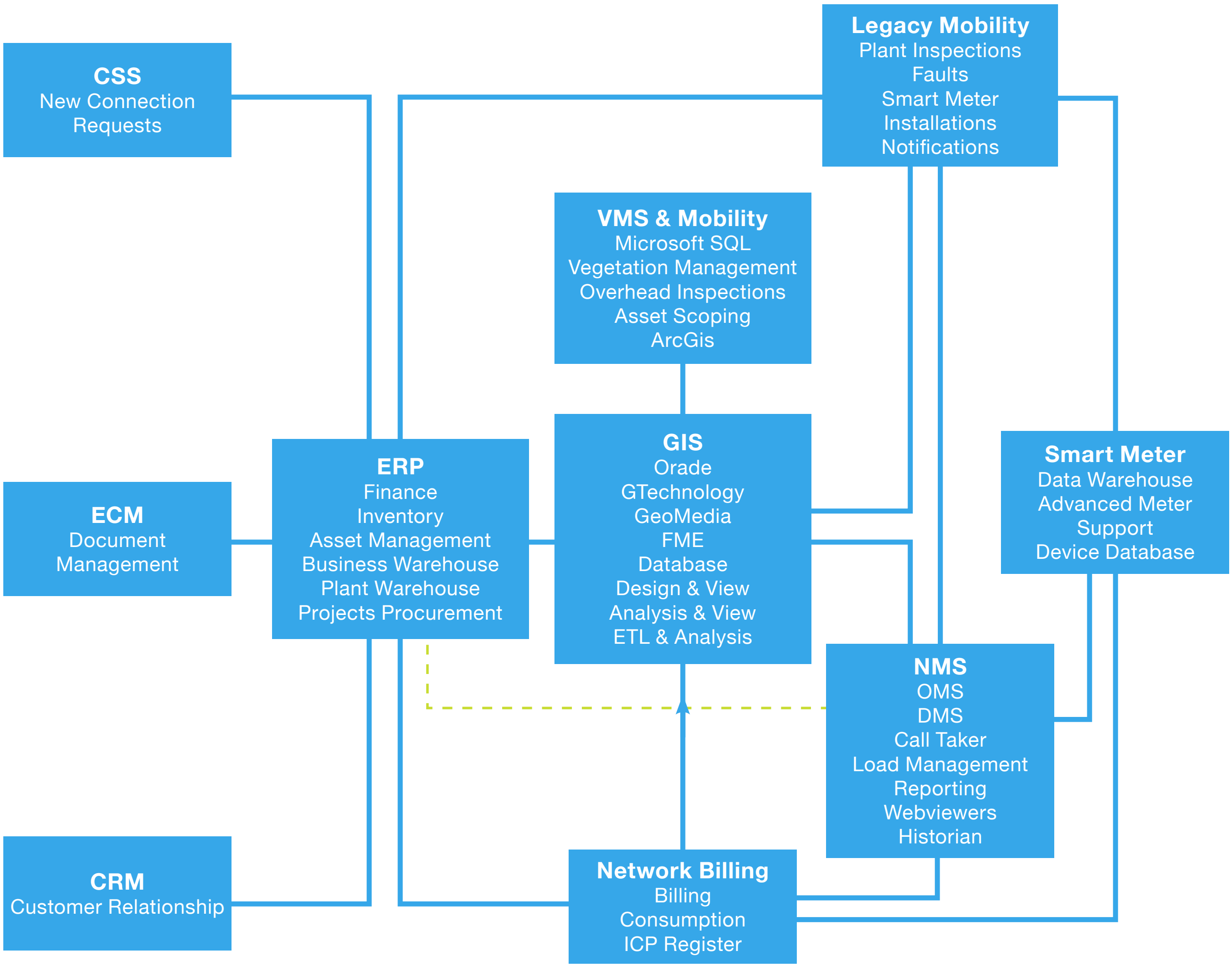

Figure 7.2.1: Non-network Support System

7.2.1 Network Management System (NMS)

The NMS enables the fast and efficient control of the electricity network for the operator. It consists of the General Electric PowerOn Advantage software package and data storage systems connecting with our SCADA Devices through an IP based wide area network. The Supervisory Control and Data Acquisition (SCADA) network includes Remote Terminal Units (RTUs) that communicate back to the control room equipment in real time. The key business benefit of the system is to enhance the safe, reliable and efficient management of the network, as well as providing effective customer service. The current system was first implemented in 2011 and has been updated regularly since then.

The NMS consists of the following subsystems:

- Distribution Management System (DMS) and Switching Management
- Outage Management System (OMS)
- Trouble Call Taker, with smart meter information integration
- Reporting
- Webviewers
- Historian

These subsystems are described as follows:

- **Distribution Management System (DMS) and Switching Management**

  The DMS is the core of the NMS. It collects the real time information and disseminates it to users and other subsystems. A key element of the DMS is the connectivity model that allows operators to easily see the effects of actual and planned switching through animation of the diagram with the current energisation state. It also controls all switching management steps (preparation, validation and execution) and can enforce built in safety logic throughout all stages. This is a particularly powerful aspect of the system, especially from a safety perspective and enforcement of operational procedures.

- **Outage Management System (OMS)**

  The OMS is an application designed to aid in the management, prioritisation, administration and reporting of outages on the network. The OMS automatically associates customer calls and clusters of calls to the one incident and to the respective devices supplying them. To do this OMS relies on the Installation Control Point (ICP) to transformer relationship and the connectivity of the DMS. 'Last gasp' data from the smart meters has been integrated with the OMS to improve fault location by simulating customer calls.

- **Trouble Call Taker, with smart meter information integration**

  The Trouble Call Taker records customer calls and provides vital information to the Dispatch Team. The information derived from the calls is integrated with the OMS to predict the location of faults or likely future faults. It can also be used for post event analysis. It is available to the internal WEL Dispatch Team as well as the external after-hours call centre.

- **Reporting**

  The reporting system performs queries over the NMS database using MS SQL Reporting Services and there a large number of system and in-house developed reports tailored for different parts of the business. All network reliability information (SAIDI, SAIFI etc.) is captured by the NMS and is presented in reports. The annual reliability disclosure reports are also automatically generated.

- **Webviewers**

  The PowerOn product provides a web based view of the operating single line diagram and a linked geographic view (based on GIS). This provides visibility of the system to a wider audience in the business. An alternative viewer based on more modern software is being trialled and is expected to be implemented in the 2020/21 year.

- **Historian**

  All analogue points with the NMS are recorded and stored within a product called TrendSCADA. This makes the data available as tables and trends to other users in the business.

The NMS system was upgraded to PowerOn Advantage V6.4.1 in 2019 and consists of multiple application servers distributed over the WEL main office and the disaster recovery site. There are communication gateways to the WAN (Wide Area Network) at each of these sites. Most of the core system is virtualised on recent high quality hardware. Such arrangements ensure high availability and resilience of the system. There are separate pre-production and development environments. An upgrade to V6.6.0 is currently underway. These system software upgrades are typically done on a two yearly basis. Third party software such as Linux, Windows and Oracle are also upgraded to the latest supported versions when these upgrades take place.

Some mobility functionality have been developed to allow the dispatch of fault jobs to field devices and the completion of fault reports from the field. A full mobile switching application is planned to be implemented in the 2020/21 year. This will replace earlier dispatch and fault reporting functions and provide a real-time view of the network diagram in the field and full integration with the control room for field switching operations.

Supporting IT infrastructure is continuously monitored for performance and typically refreshed on a four yearly basis. Improvements to cyber security are made as part of a wider ongoing IT program of works or in response to recommendations from external reviews.

7.2.2 Geographic Information System (GIS)

The network assets managed by WEL are distributed over a large geographical area, so WEL needs to know, visualise and analyse the geographical location of each asset. The WEL GIS enables this by storing the spatial data for each asset (that describes its geographic coordinates) and any associated contextual information which can be presented to users in a variety of targeted ways depending on their needs.

As well as the spatial data, the GIS contains a basic connectivity model enabling users to visualise connected assets spatially and trace the connectivity of the network spatially upstream and downstream to identify connected assets.

Each asset record in the GIS has a spatial attribution that describes the asset, its location, its relationship to other assets, the lifecycle state (e.g. In Service or not), the length of linear assets (e.g. conductors), and the asset's connectivity and electrical state (Open/Closed and which circuit it is connected to).

The asset data is updated in the GIS by means of physical and electronic 'As Builts' and GPS survey data received from within WEL and from external contractors. This data is uploaded or entered into the GIS to keep the asset data up-to-date. Structured and on-going quality assurance routines are in place to monitor data entered and identify priority legacy data to target for remediation.

The following contextual data is contained in the GIS. Its purpose is to allow core asset data to be viewed and analysed in relation to features that give context to the asset data;

- Landbase information from Land Information New Zealand (LINZ)
- Master Address data from CoreLogic
- Aerial Photography
- Political Boundaries from Statistics New Zealand

The GIS provides data by external interface to NMS (CAD files), SAP (aspatial data), Design (CAD files) and other systems so that there is consistent and unified geographic data used throughout the organisation. WEL GIS data is also automatically extracted for the beforeUdig organisation to provide detailed GIS plans of WEL's Network (alongside other utilities) to ensure the safety of those working near WEL's assets and to protect the assets from damage.

Currently WEL runs a hybrid GIS system with legacy components from Hexagon/Intergraph alongside an Esri Enterprise deployment with full collaboration to ArcGIS Online cloud platform to support mobility and external access. The GIS road map is to move all functionality to Esri solutions over the next few years (target October 2022) and that includes replacing the Hexagon GTechnology solution with Esri Utility Network Management Extension for ArcGIS Pro. WEL GIS uses safe Software's FME product for ETL and reporting needs.

For on premise GIS components (Hexagon and Esri) systems are hosted within a virtualised server environment on modern, high quality hardware. There are separate production, testing and development environments managed within structured system development life cycles. For external/mobile systems WEL collaborates data from on premise to the ArcGIS Online Cloud platform. Change management processes exist to protect the production systems and data and to ensure these key information systems are always available to users.

WEL is in year two of a three year site product licence contract with Hexagon and year one of a three year Enterprise Agreement with Esri. Esri Support is provided by Eagle Technology (NZ Distributor).

Recent system enhancements include; Deployment of Esri mobility solutions (online and offline) for Inspections, Scoping and operational field data collection; Deployment of Clearion/Esri Vegetation Management System; Deployment of bespoke internal Web Map Applications for Works Planning.

In early 2021 a full LiDAR assessment of the network is being carried out. This will enable a global update of our special information and will highlight missing assets.

7.2.3 Enterprise Resource Planning (ERP)

SAP consists of the ERP, Customer Relationship Management (CRM) and Business Warehouse (BW) reporting. The core ERP system supports the finance, works management and inventory management functionality for the business. The functionality that is enabled with SAP includes:

- Finance and Controlling
- Project Systems
- Plant Maintenance
- Materials Management and Inventory Management
- Quality Management

The Finance and Controlling module is the central accounting function within SAP and incorporates accounts payable, accounts receivable, asset accounting, banking, general ledger accounting and forecasting and budgeting. The reporting outputs form the company's financial statements from both a business and regulatory requirements perspective.

The Project Systems module is used for managing expenditure against capital projects (both network and non-network). The project managers forecast and monitor the expenditure against the work delivered via the work order process. The costs accumulated from the delivery of the project are capitalised into a number of assets in the financial asset register.

The Plant Maintenance module forms the works delivery component of SAP. Network assets are represented as equipment records where maintenance and repair work orders are raised against. Labour, materials and external service costs are recorded against the work orders as the work is completed. There is also a preventative maintenance function that contains the planned maintenance schedules. Work orders are automatically generated ready for the field teams to complete the planned maintenance.

The Materials Management and Inventory Management modules contain the spares inventory. The inventory is restocked based on requirements planning (via work order reservations and other requirements) so there is enough stock on hand for project work and fault breakdowns. Materials Management includes the procurement (purchase orders) functionality. Purchase orders are used to procure inventory, external services, business consumables etc.

The Quality Management module is used to record the site safety auditing tasks against the work performed. Here an evaluation of the performance of the internal field staff and external contractors are able to be measured and reported on.

The ERP solution is integrated with other systems to maintain consistency with the equipment data within the GIS system and to create necessary work orders from the NMS Trouble Call system (for faults/breakdowns). The mobility solution feeds these fault work orders to field staff to assist with information flow and data (repair/cause) collection.

The CRM system is used to manage customer feedback (complaints and compliments) relating to work completed in the field. The CRM system captures the initial feedback and the activities for the resolution of the issue.

The SAP Business Warehouse collates the SAP and non-SAP data and provides for the transactional reporting needs for the business. Using analysis tools (both SAP and Power BI) the data can be analysed accordingly by the business users to locate trends and manage any KPI measures to gauge how the business is performing.

Future enhancements to the SAP system include:

- Upgrade of SAP environments to the latest support packs so the system is kept secure and its components are kept in vendor support.
- Deployment of Fiori apps for better user experience on all devices including PC’s, laptops, tablets, and phones irrespective of the operating system installed.
- Upgrade of the existing SAP Business Warehouse solution
- Review of the current ERP solution to determine the upgrade path or replacement with an alternative ERP system.

7.2.4 Network Billing System

The billing system is an internally developed system to support the requirements of ICP management, and the retailer and direct billed consumers invoicing calculations.

The system controls different data aspects to meet the billing requirements of the Company which includes:

- **ICP Information:** This data has a two way synchronisation with the data held by the Electricity Registry. This synchronisation includes ICP details, network pricing category, status and retailer switches.
- **Consumption Data:** Receives retailer consumption data for processing the retailer invoices (invoices created in SAP). This includes both Mass Market and TOU billing.
- **Revenue Assurance:** Provides revenue assurance of the retailer data supplied. This may be via billing history, ICP statistics, retailer data interrogation or comparison with the metering data provided by the smart meters.
- **Customer Data:** Holds ICP customer data supplied by the retailers
- **System Interfaces:** Provides interfaces with the smart meter database, NMS Outage Management system, GIS and SAP.

This system centralises ICP related data obtained from the Registry, traders, GIS and smart meters. It is used to perform energy billing to traders and is a source of data to other systems such as NMS.

7.2.5 Electronic Content Management

Content Server using OpenText (known to WEL staff as Content Manager), is a repository for unstructured corporate data. It provides a controlled location within a defined taxonomy for accessing and sharing information such as agreements, policies, guides, emails, presentations, board books etc. It builds an understanding of the history of the business, its decisions and relationships, including financial, asset/equipment, human resources, board and community.

The compiled history within Content Server dates back to 2004 with specific archive folders for historical documents. Document management ensures that despite the large number of documents and emails in the system, important items are still discoverable to support good decision making and understanding. Version control applies to all content, providing a single controlled source of the truth and is leveraged by the intranet, SAP and any system that may reference business documents.

7.2.6 Mobility Systems

The mobility solution is a bespoke solution that provides functionality for electronic data collection from the field.

There are 4 main parts of mobility being used:

- **Inspections:** The preventative work orders are provided to facilitate the collection of maintenance condition data which is stored in SAP as measurement documents. This facilitates the collation of condition history for the network equipment for detailed planning and lifecycle analysis.
- **Faults:** The breakdown work is assigned to the respective field worker who is able to view important detail such as address, contact details etc. This helps to speed up the response by ensuring accurate information is communicated to the faults technician. At the completion of the repair, notes and repair information is sent back along with damage coding for long term maintenance and fault analysis.
- **Reporting of Defects:** Capturing information about the defect, including observations and any necessary photos which create a notification record in SAP. These notifications are submitted into a planning queue for rapid analysis and corrective work creation as required.
- **Smart Meters:** The certification details are captured electronically along with any job information. The data is interfaced directly into the metering database via a data validation portal.

A digital roadmap will be established to consolidate the various mobile platforms currently in use plus build out the mobile capability of the business. These changes will include an electronic workflow function to move work through the business without the need for paper. Digital job packs will be electronically dispatched to field crews and all paper currently being completed in the field will be replaced with digital forms and mobile applications.

7.2.7 Customer Self Service Portal (CSS)

The Customer Self Service Portal is a bespoke web application developed in 2020 and caters primarily for Customer Initiated Works, related billing tasks, and some customer service team functions. The system centralises all online requests and related data obtained from customers. It is used to manage these requests through the approval process and is a source for work processed internally prior to handover to Field Services via SAP.

Future enhancements to the CSS Portal include:

- Consolidate all online requests into the portal where appropriate:
  - Distributed Generation Applications
  - Cable Locate Requests
  - (New) Physical Connection Bookings
  - High Load Consents
  - Tree Trimming Consents
  - Temporary Disconnection Requests
  - Permanent Disconnection Requests

- New Connections Works Delivery
  - Schedule and dispatch
  - View work request schedule on a mobile device
  - Update and complete work requests on a mobile device
- Retailer dashboard (accept new connection)
- New Connections Team dashboard (mobile work request management/field delivery)
- Online quote and invoice
- Additional SAP integration (display WO number and status)

7.3 NON-NETWORK CAPITAL AND OPERATIONAL EXPENDITURE

7.3.1 Non-network Capital Expenditure

The non-network capital expenditure addressed in this section covers:

- **Computer Software Capital Expenditure.** This covers the periodic upgrades of existing software applications and the development of new business tools. Examples include:
  - Major version upgrades for our industry standard software applications including SAP, GTechnology Suite (GIS), Esri ArcGIS, Microsoft Office, desktop and server platforms, our document management system (Content Manager) and the NMS;
  - Implementation of the digital roadmap, which provides in-field connectivity to core systems, resulting in significant productivity gains;
- **Computer Hardware Capital Expenditure.** This covers the physical computing infrastructure including servers, storage, switches, firewalls and desktops. Our server systems have an expected lifespan of three to four years and will need to be updated in 2022. Desktop, laptop, and tablet computing devices are also on a three to four year replacement cycle. We will also continue to monitor and review the use of "on-premises" infrastructure, versus moving hosting into the 'cloud'. It is highly likely that relatively non-critical systems (e.g. Office, Skype for Business, Exchange, and even SAP) could migrate to Microsoft Office 365 and Microsoft Azure over the timeframe of this plan, with transfer of associated costs into operating expenditure.
- **Motor Vehicles.** The forecast reflects the revised policy for non-WEL Services vehicles, which is to replace vehicles at year 10 or 150,000 km, whichever is earliest. We have also moved to a wider pool car model, which has reduced the size of the fleet and resulted in better vehicle utilisation. The revised strategy results in fewer planned vehicle replacements without compromising safety, availability or vehicle suitability. The overall pool car fleet is now comprised of 8 vehicles, with 63% being EV or Hybrid. As more AWD EV vehicles come into the market, the aim is to replace fossil fuel vehicles with EV. This aligns with our sustainability strategy to change over 75% of the pool fleet to electric vehicles.
- **Sustainability Projects.** WEL is continuing to develop a strong sustainability stance and has embarked on a programme of activities in support of this. The programme will assist us in reducing our carbon footprint and promote activities that further enhance sustainability within WEL and in our community.

The table below summarises the expected non-network capital expenditure required over the AMP period.

Routine Non-network Capital Expenditure ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Computer Equipment	300	700	300	350	300	300	300	300	300	300
Computer Software	3,000	5,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Plant and Equipment	100	100	100	100	100	100	100	100	100	100
Motor Vehicles	120	45	-	100	270	107	107	107	107	107
Total	3,520	5,845	1,900	2,050	2,170	2,007	2,007	2,007	2,007	2,007

Table 7.3.1.1: Non-network Capital Expenditure

The table below summarises the expected strategic non-network capital expenditure required over the AMP period. These strategic projects target business improvements. Business improvement projects have been budgeted at $2M Capex per annum, which will be used on projects such as process improvements (including LV works management), mobility enabled tools and systems in the field, and a focus on data use.

Strategic Non-network Capital Expenditure ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Computer Equipment	500	500	500	500	500	500	500	500	500	500
Computer Software	2,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Total	2,500	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000

Table 7.3.1.2: Strategic Non-network Capital Expenditure

7.3.2 Non-network Operational Expenditure

The non-network operational expenditure addressed in this section covers:

- **Systems Operations and Network Support.** This covers areas of the business functions including:
  - Asset Management which includes Asset Information and Strategy, Network Planning, Maintenance Strategy, Network Design, Customer Projects, Development and Automation, System Control and Engineering.
  - Distribution Design, Capital Projects.
  - Customer Support and Procurement
- **Business support.** This covers areas of the business functions including:
  - Finance, Commercial and Technology which includes, Information Services, GIS, Procurement, Regulatory and Metering Services.
  - People and Performance which includes Health and Safety, Business Assurance, Organisational Development and Human Resources.

The table below summarises the expected non-network operational expenditure required over the AMP period.

Non-network Operational Expenditure (in Nominal Price $000)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
System operations and network support	8,371	8,371	8,371	8,371	8,371	8,371	8,371	8,371	8,371	8,371
Business support	12,674	12,674	12,674	12,674	12,674	12,674	12,674	12,674	12,674	12,674
Total	21,045	21,045	21,045	21,045	21,045	21,045	21,045	21,045	21,045	21,045

Table 7.3.2.1: Non-network Operational Expenditure

8

ASSET REPLACEMENT AND RENEWAL

8 ASSET REPLACEMENT AND RENEWAL

This chapter describes our renewal and maintenance approach for the AMP period. It details our planned renewals and maintenance work and how we have forecast the associated expenditure.

8.1 OVERVIEW OF ASSET REPLACEMENT AND RENEWAL

Delivering our performance objectives, as described in Chapter 5, requires the right balance between expenditure on maintenance and investment in renewals. In striking this balance, we have considered the whole of life cost of our assets, and required interventions during their lifecycle.

As part of our capability project initiatives, we have streamlined our end-to-end asset renewal process to improve the decision making when prioritising replacements and enabling work packaging, by introducing work scoping at the early stage of the planning process. An Annual Works List (AWL) is generated, and risk ranked, using the outcomes of Condition Based Risk Management (CBRM).

8.1.1 Key Asset Classes Assessed with CBRM Model

With the establishment of our asset management framework, described in Chapter 3, we have taken a risk-based approach to renewals with the implementation of CBRM. Key asset groups are now contained within the CBRM model, as shown in the list below:

1. Sectionalisers and Reclosers
2. Network Switches
3. Battery and Power Supply Systems
4. Circuit Breakers
5. Distribution Transformers
6. 11kV Overhead Line Conductors
7. LV Pillars
8. Poles
9. Protection Relays
10. Ring Main Units
11. Crossarms and Insulators
12. Zone Transformers

For assets, such as HV fuses (DDOs), that don't have a CBRM model, WEL uses information obtained from inspection and reliability tools, such as Failure Mode Effects and Criticality Analysis (FMECA) to assess risk of failure and to prioritise the renewal programme.

There has been a steady reduction in the SAIDI impact attributed to equipment related failures as described in Chapter 5. The most significant reduction is in 16mm^2 copper conductor failures. While the number of these failures is reducing we still have a high rate of jumper and twist joint failures. We are initiating a long-term response to identify and address these areas of weakness in a cost effective manner. Our reliability is also impacted by storm events and bird contact.

Although WEL is achieving positive results in SAIDI reductions in the equipment failure category, planned SAIDI has been increased to enable the asset replacement program to be completed. We have also seen an increase in planned SAIDI due to the introduction of the Electricity Engineers' Association proposal for HV Live Line safe work practice. This has increased the amount of work on HV lines to be undertaken whilst de-energised.

Optimised asset management also seeks to lower the cost of replacement for each asset class. We lower these costs through our Operational Excellence initiatives that scope, group and risk-rank replacements. The risk-ranking targets replacements to the assets with the highest risk and allows us to extend asset life with lower overall risk. The grouping and scoping allows more streamlined replacement planning and execution, while lowering the cost of each replacement. Our Computerised Maintenance Management System (CMMS) has now been updated to include asset risk scores and upstream isolation switches to allow grouping of notifications and planned work.

The resulting maintenance works and renewal plans are described in Section 8.2 below.

8.2 MAINTENANCE

Our maintenance activity is first and foremost safety focused. After which, it is structured to minimise the whole of life costs of our assets while managing optimum performance over time. This is achieved by selecting maintenance techniques and processes that:

- Ensure safety risks are identified and mitigated;
- Optimise the costs of maintenance together with renewal expenditure;
- Meet all applicable regulatory requirements;
- Improve work delivery efficiency through the work management process and
- Where possible improve network availability.

These techniques are described for each asset category in Section 8.4 below.

8.2.1 Assumptions and Inputs

A number of assumptions and inputs inform the level of maintenance undertaken on our assets. The key assumption and inputs are described below.

Industry Standards and Analysis Tools

Maintenance tasks are determined by the use of industry maintenance standards, supporting tools and analysis that assist maintenance engineers to optimise and rationalise the maintenance plan. From 2017, WEL began a programme of creating Standard Maintenance Procedure documents (SMPs). This started with key assets such as circuit breakers and protection relays. All asset classes will have SMPs developed by mid-2021.

SMPs will outline the maintenance requirements in the Maintenance Manual in a more detailed and procedural way. This is expected to assist in standardising plant maintenance processes and the capture of key asset information, including asset condition.

Asset Inspections

We regularly inspect our assets, the surrounding area and vegetation. The frequency at which an asset is inspected or monitored is determined by potential risk, manufacturer's recommendations and legislative requirements. During an asset inspection, the condition is assessed and recorded, along with any defects found, in the Computerised Maintenance Management System (CMMS).

Condition Assessment

Asset condition influences the extent of servicing, any necessary repairs required and provides vital data to inform our asset renewal decisions. Our condition assessment is based on a 0 to 5 rating system, as set out in Table 8.2.1.1 below.

Condition Score	Remaining Life Description	Definition
5	Early Life	As newly installed or equivalent
4	Mid Life	Normal ageing and use
3	Near End of Life	Likely to meet replacement criteria at the next inspection
2	End of Life	Meets replacement criteria. Schedule for replacement within 18 months
1	Unserviceable	Unserviceable but not hazardous. Replace within 14 days
0	Hazard	Immediate action is required to eliminate hazard

Table 8.2.1.1: Asset Condition Assessment Ratings

Defect Notifications

Defects are identified during inspections. If an asset has a defect, the asset inspector will assess the severity of the defect and assign a defect rating as specified in Table 8.2.1.2 below.

Defect Rating	Defect Classification	Delivery Period	Definition
1	Red	2 days	Faults / Urgent work required – immediate temporary repairs may be required to 'make safe'
2	Amber	4 weeks	No customer outages or door knock for low volume of customers.
3		3 months	Major customer consulted if outage required, typically Plant Maintenance will be priority 3.
4		18 months	Long lead material consideration
5	Green	3 years	Typically asset replacement works or jobs which could be undertaken as part of capital projects.

Table 8.2.1.2: Defect Classifications

8.2.2 Management of SF_6

Sulphur Hexafluoride (SF_6) is a gas used in modern switchgear as an insulating and arc quenching medium, however it has an adverse effect on the environment. As a prudent operator, WEL manages SF_6 closely in terms of exploring options in minimising the overall capacity of SF_6 in WEL's equipment i.e. using vacuum as an alternative arc quenching medium. We have initiated a review of equipment that could be used as an alternative to SF_6-filled switchgear. In the meantime we are required by law to disclose the quantity we have installed in our network. We record and monitor the volumes of SF_6 gas installed, disposed and emitted into the environment. As at 31 December 2019 the volume of SF_6 utilised by our switchgear is 1.43 tonnes. During the year, while we were able to reduce our stored spare SF_6, our overall SF_6 increased by 38kg due to network expansion and replacement of oil RMUs.

8.2.3 Vegetation Management

Vegetation Management is the process of managing vegetation in and around our assets that have the potential to interfere with the safe and reliable supply of electricity to our customers and network. We have increased our inspection frequency and also introduced a vegetation management system to record, predict and manage all vegetation works through mobility. This system has a vegetation growth model to help predict future vegetation management requirement per vegetation species. On top of efficiency improvements this is forecast to provide an improvement to our vegetation related SAIDI.

Vegetation operational expenditure is based on our vegetation management requirement to maintain safety compliance and ensure network reliability targets are met. Table 8.2.3.1 shows expected expenditure for the AMP period.

Vegetation Management Operational Expenditure ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Vegetation Management	1,632	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616
Total	1,632	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616

Table 8.2.3.1: Vegetation Management Expenditure

8.2.4 Service Interruption and Emergency Management

Service interruption and emergency management relates to required faults work.

The projected faults spend profile slightly increases over the next 10 years, as shown in Table 8.2.4.1. This is based on the last five years' historical data and our CBRM models' projections. The slight increase in faults is from our strategy to slow asset replacements and to extend the lifespan of assets. Modelling shows that for a marginally higher fault cost, we can defer a significantly higher value of asset replacements. Our history also shows that approximately 70% of faults are low voltage faults.

Service Interruption and Emergency Management Operational Expenditure ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Service Interruption and Emergency Management	3,231	3,248	3,264	3,280	3,313	3,346	3,379	3,413	3,447	3,482
Total	3,231	3,248	3,264	3,280	3,313	3,346	3,379	3,413	3,447	3,482

Table 8.2.4.1: Service Interruption and Emergency Management Expenditure

8.2.5 Maintenance Forecasting

Our maintenance activities and associated expenditure have been forecast by asset category. The basis of the forecast includes estimates of asset quantity, maintenance type (preventive, predictive and corrective) and relevant unit costs. Unit costs are based on historical maintenance task costs, adjusted for known changes e.g. increases in labour costs. These are validated annually with our maintenance team to ensure improvements are captured and updated in our plans.

The maintenance forecast for each asset category is shown at the end of each section below.

8.2.6 Innovations and Improvements in Maintenance Practices

Innovation and continuous improvements are necessary to meet our cost efficiency objectives. As part of WEL's Capability Projects, through the Operational Excellence initiatives, the Maintenance Strategy team has been working on improving the end-to-end Maintenance Process flow. This is intended to drive improved asset reliability, data quality, and works delivery efficiency. The maintenance related improvements and innovations we have recently implemented include:

- Development of Maintenance Strategy's maintenance planning end-to-end process, known as CP5. CP5 starts from failure mode first principles, using Failure Mode, Effects and Criticality Analysis (FMECA) to identify the available maintenance options for all possible failure modes. A gap analysis is then completed between the available maintenance options and existing maintenance program for the specific faults or defects WEL's equipment is experiencing. Whole Life Cycle Cost (WLCC) analysis is used to evaluate maintenance options to close any gaps identified. A Maintenance Engineering Strategy (MES) is developed to implement and record the revised maintenance plan;
- The effectiveness of the revised maintenance plan will be monitored by review of ongoing failure or defect data, and used to make further refinements in a continuous improvement cycle, refer figure 8.2.6.1;
- Initial trials of mobility solution tool to record asset information in the field;
- Improved inspection strategies that enhance risk identification, asset condition and population data;
- Implementation of 'targeted' inspection programmes for overhead line assets and PILC cable terminations;
- Updating of the master data specification to align with the asset condition monitoring requirements;

- Improvement of asset data quality and accuracy through the field verification and systems cross-checking programme;
- Introduction of diagnostic testing on primary assets, including online and offline cable Partial Discharge (PD) testing;
- Specification of strategic spare requirements for emergency preparedness;
- Development of Standard Maintenance Procedures (SMP) for plant maintenance and corrective works which will improve delivery of maintenance;
- Review of the maintenance work flow, including system architecture, processes and reporting; and
- Introduction of a dedicated network reliability function to review network performance and inform the asset management strategy, with a medium to long term aim of reducing customer outage impacts.

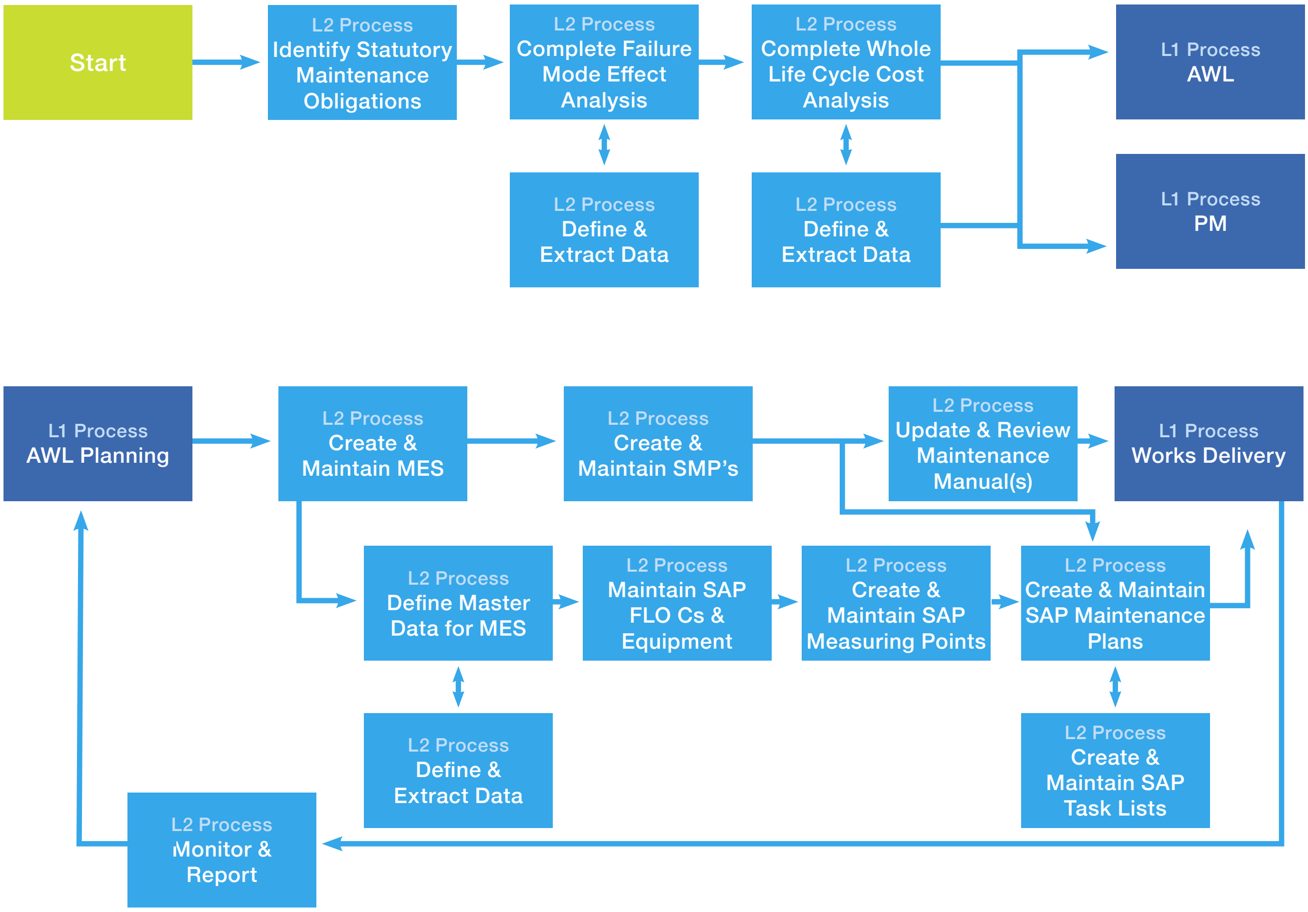

Figure 8.2.6.1: CP5 Process Overview

Engineering Analysis (FMECA)

Failure Mode, Effects and Criticality Analysis (FMECA) and asset Whole Life Cycle Cost analysis (WLCC) are two of the key engineering analysis techniques that WEL utilises in driving the maintenance strategy. FMECA undertaken on each asset class will highlight the common mode of failures. When combined with the actual historical data, the overall strategy will form a targeted maintenance programme that is expected to address asset reliability issues such as premature failures or condition related failures.

Whole Life Cycle Cost (WLCC)

WLCC is used to analyse available maintenance options, verify the maintenance programme is 'balanced' in terms of costs, and demonstrate the trade-offs between OPEX and Capex.

Maintenance Engineering Specification (MES)

The required maintenance program for an asset class is identified through one or more of the following:

- FMECA
- WLCC
- Regulatory Requirements
- Legacy maintenance task lists
- Original Equipment Manufacturer (OEM) requirements/recommendations
- Component-based plant maintenance database
- Local/industry knowledge

The Maintenance Engineering Standards (MES) in conjunction with the asset class' common failure modes, translates the above into the measurement points that are relevant to asset condition monitoring. MES also defines the engineering information required for establishing the maintenance plans for an asset class in WEL's Computerised Maintenance Management System (CMMS).

Measurement Points

Measurement points (MPs) are specified for each of the sub-categories of an asset class. MPs are outlined based on "what" needs to be measured and tracked on an item of equipment through inspections and testing regimes. MPs can be numerical, text or character values, depending on their application.

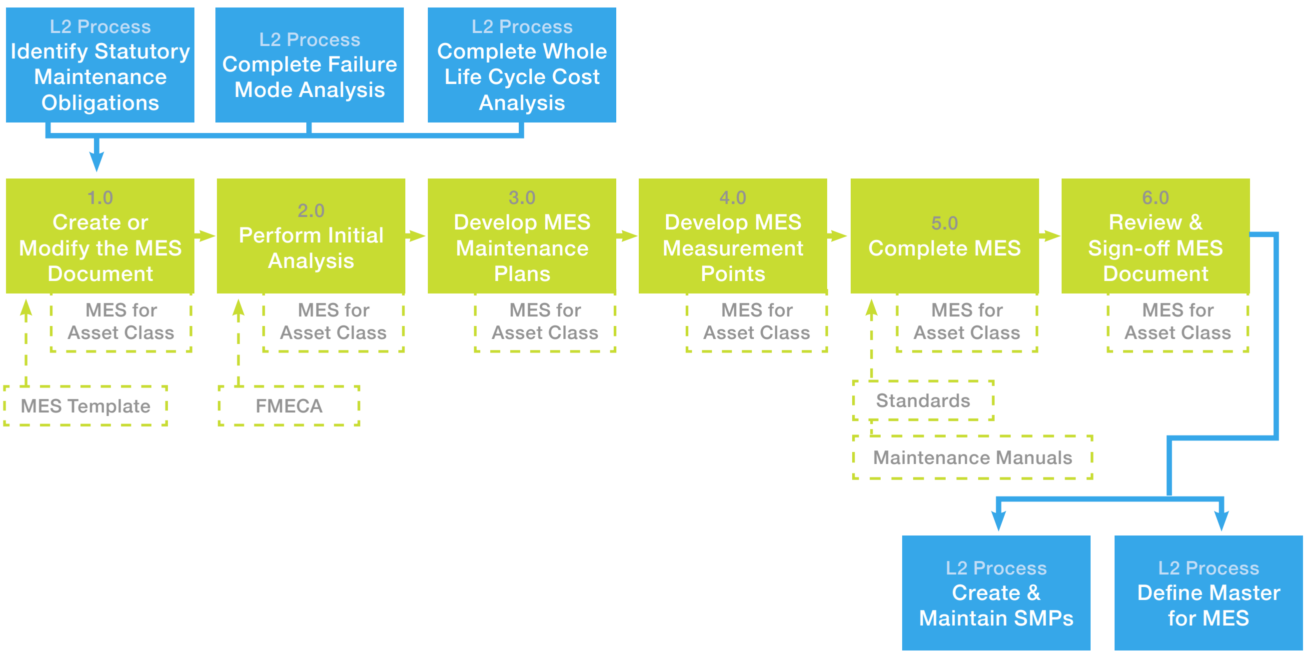

Figure 8.2.6.2: MES Process Overview

Standard Maintenance Procedures

WEL is currently rolling out improved Standard Maintenance Plans (SMP) to ensure they meet the requirements of the current asset technology and actual condition. The process covers all assets including poles, conductors, pillars, transformers, substations etc. The purpose of rolling out the SMP program is to define the required level of maintenance which will ensure equipment and systems deliver a safe and reliable service at their required duty, taking into account the environment in which they operate. This approach is a key driver of WEL's asset management strategy which is based on a preventive and predictive approach that takes into account the capacity of available resources, access to assets and the balance between safe operating assets and life cycle cost effectiveness.

Our Maintenance Strategy Team retains oversight and technical management of the standard maintenance plans and sets the guideline for both internal and external (contract) maintenance service providers. These teams are obliged to perform maintenance to the high standard set out in the SMPs and provide critical measurements and test results back to our maintenance strategy team for them to perform reliability analytics and ensure our network remains safe and reliable.

Our continuous improvement framework is based on the principle of "data supporting decision making". The data we use to improve our services includes:

- Work order history
- Notification process and defect prioritisation
- Work visualisation and optimisation tools
- Performance KPIs
- SCADA
- Fault register
- Incident register
- Call Centre logs

Ultimately, we seek to not only make improvements to our network, but also internally as a company by improving our processes that will lead to better service for our customers.

The application of these innovations and improvements is discussed in Section 8.4 below.

8.3 RENEWALS

We have used Condition Based Risk Management (CBRM) modelling to develop a risk based approach to planning our asset renewals. This approach prioritises the renewal of assets that present the highest risk to safety, network performance, environment and financial loss. The methodology is used by numerous electricity distribution companies internationally to deliver effective risk related asset management.

CBRM is a process that combines asset information (e.g. age, asset type, working environment, condition, other factors such as number of connected parties etc.), engineering knowledge and practical experience to estimate future condition and performance of network assets. Specific risks for each asset category are identified and quantified. We have developed CBRM models for all of our key assets.

Through the asset planning process, WEL manages scope and budget requirements of renewal work. This is outlined in the Project Definition Document (PDD).

Overall WEL's asset renewal philosophy remains aligned to its previous AMP displaying a relatively flat five year expenditure, with an increase to address ageing poles and crossarms through years 6 to 10. We have reduced the overall spend and the rate at which we ramp to address our ageing assets. The major reduction has been through reviewing our overhead line reliability strategy and the rate at which we replace conductors. Capitalised Faults and Notification work will increase slightly over the 10 year period in response to the significantly reduced asset replacement strategy.

8.3.1 Investment Scenarios

To determine the optimal level of renewal expenditure across our key asset categories, we considered four alternative investment scenarios and compared to a baseline of the 2020 AMP approach. Figure 8.3.1.1 below shows indicative 10-year risk profiles for each scenario. The scenarios are:

- **Scenario 1 – The Do Nothing scenario** models a hypothetical base case to understand the effects of not undertaking renewals. Under this scenario, by year 10 the number of failures is expected to increase rapidly;
- **Scenario 2 – $7M ASR [Proposed] scenario** is WEL's preferred option which requires a starting annual budget of $7M for asset renewals. Under this scenario the number of failures per year is expected to have a slight reduction of equipment failures compared to the 2020 AMP. This outcome can be achieved through optimisation and prioritisation of critical assets using CBRM overlaid with other engineering analysis. The overall cost of faults will increase slightly but the increase is much less than the savings made from deferring asset replacements;

- **Scenario 3 – $8M ASR [+$1M] scenario** indicates an additional $1M to WEL's proposed annual budget. There is a small improvement in the number and cost of equipment failures in comparison with Scenario 2, however, the overall cost is much greater. Compared to previous AMP strategies this strategy still represents a reduction in costs but with an improvement in both SAIDI and outage cost outcomes; and
- **Scenario 4 – $6M ASR [-$1M] scenario** indicates a reduction of $1M from WEL's proposed annual budget. This increases the number and the cost of equipment failures beyond the savings that are made from a lower asset replacement rate, i.e. overall this strategy will result in higher total costs and inferior performance.

In summary, our analysis has shown that an asset replacement spend of $7M results in the lowest overall cost. If we increase spend by $1M our SAIDI decreases slightly, but the overall cost increases. Conversely, if we decrease our asset replacement spend to $6M, our SAIDI increases significantly and our overall cost increases. Over the 10 year planning period our average asset age will increase and therefore the lowest cost asset replacement level will increase.

In the coming year we plan to move our CBRM models to the cloud where faster computing is possible. This will allow us to run CBRM with higher definition cost curves for each asset type. This information will allow further optimisation of our asset replacement strategies.

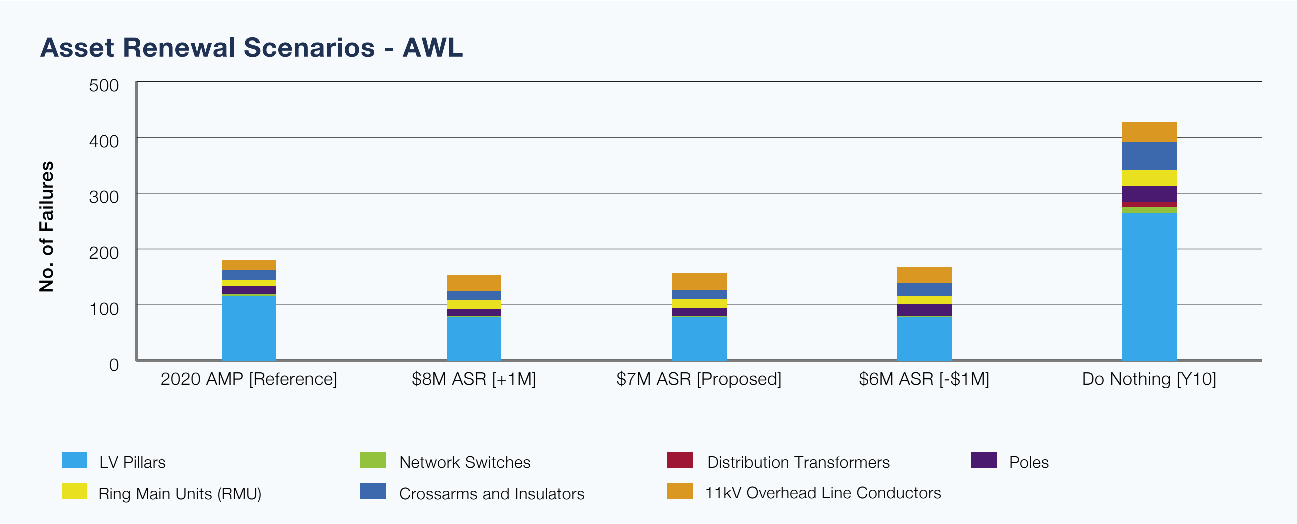

Figure 8.3.1.1: Estimated Asset Failures Based on Asset Renewal Scenarios

Our renewal programme is based on Scenario 2 as it maintains a stable level of risk over the AMP period. Our renewal expenditure will be optimised by prioritising the highest risk assets.

8.3.2 Assumptions and Inputs

There are a range of assumptions and inputs necessary for establishing our renewal plan and CBRM models. These are described below.

Asset Health and Condition Information

The accuracy of asset age and condition is critical to determining when an asset is due for renewal. For this reason improved specifications have been implemented in our inspection programs for condition assessment, field data verification and the mobility solution to improve data accuracy. This is in line with the Electrical Engineers Association (EEA) guidelines.

Asset Monitoring

Diagnostic measurement techniques such as ultrasonic and thermal surveys on overhead lines, PD acoustic surveys on switchgear, and Sweep Frequency Response Analysis on zone transformers are providing better asset condition information than simple visual inspections. Asset inspectors have started using unmanned aerial vehicles (UAV) for inspecting overhead line assets particularly on locations with difficult terrain.

WEL has procured state of the art PD measurement test gear for ground mounted equipment and underground cables. This equipment has lifted the quality of inspections and is being used to systematically test and record results on WEL assets.

Overhead conductor sampling to determine conductor condition has also been initiated.

A complete Network LiDAR survey (Light Detection and Ranging) will gain a laser accurate position of all WEL overhead line assets in relation to ground levels and GPS coordinates. This will be used to aid design, reduce site visit requirements and enable network-wide risk analysis of design elements with fault data. This analysis becomes even more powerful with the introduction of computer learning techniques and future LiDAR surveys.

These techniques help eliminate failures proactively through early intervention programmes and can be used to defer premature asset renewal. It also provides WEL with early warning on potential failures that would result in catastrophic consequences.

Design Life Assumptions

The expected design lives of assets are based on manufacturers' guidance and our own practical experience managing assets. WEL seeks to extend the working life of its assets, past original design life estimates, based on risk assessments, benchmarking asset reliability and the condition of older assets with similar configurations.

8.4 ASSET LIFE CYCLE MANAGEMENT

This section describes how we manage our assets over their full lifecycle. For each asset category we have:

- Developed FMECA, WLCC and MES analysis and documents;
- Identified routine and corrective maintenance tasks;
- Described the inspection policy and programme employed;
- Identified any systemic problems and described our approach to addressing these problems;
- Identified the replacement programme and drivers;
- Described the innovations we have made to defer asset replacements; and
- Listed the projects underway or planned.

The remainder of this section is structured by the following asset categories, with details of included assets and expenditure summaries:

- Subtransmission
- Zone Substations
- Distribution and LV Lines
- Distribution and LV Cables
- Distribution Substations and Transformers
- Distribution Switchgear
- Other Network Assets

8.4.1 Capitalised Faults and Notifications

Capitalised faults covers unplanned asset replacement due to network faults. The capital expenditure is detailed in Table 8.4.1.1 and shows a slight increase in line with our asset renewal strategy. Historical network data shows network faults occur regularly due to storms (2-3 per year), vegetation, car versus pole, vandalism, equipment failures and other miscellaneous causes. Capitalised Faults can impact the public and WEL personnel safety, customer supply and WEL's reputation. The annual quantity of faults is forecasted based on historical trends. The exact timing, location and magnitude of a fault is probabilistic in nature and therefore cannot be undertaken in a planned replacement.

Notifications are asset defects that are identified as requiring urgent replacement within the current financial year. Such notifications give sufficient time to plan the repair within the year however, due to their urgency insufficient time to plan and budget for the repair prior to the start of the next financial year. Historical network data shows defect notifications are raised regularly due to a number of different causes. WEL's strategy is to safely repair all notifications prior to them becoming capitalised faults, in the minimum outage time possible. The hierarchy of repair is; like for like, WEL standard design or specific design. The capital expenditure for notifications is outlined in Table 8.4.1.2.

Capitalised Faults ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Capitalised Faults	2,500	2,550	2,600	2,650	2,700	2,750	2,800	2,850	2,900	2,950
Total	2,500	2,550	2,600	2,650	2,700	2,750	2,800	2,850	2,900	2,950

Table 8.4.1.1: Capitalised Faults Expenditure

Notifications ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Notifications	2,000	2,025	2,050	2,075	2,100	2,125	2,150	2,175	2,200	2,225
Total	2,000	2,025	2,050	2,075	2,100	2,125	2,150	2,175	2,200	2,225

Table 8.4.1.2: Notification Capital Expenditure

8.4.2 Subtransmission

Subtransmission Lines including Poles, Crossarms and Insulators

Risks and Issues

The principal risks and issues associated with subtransmission lines are:

- Cars colliding with poles resulting in outages and public safety risks from falling poles or uncontrolled live conductors;
- Insulator failures or tree debris blown onto the lines during high wind or storm events; and
- External influences such as possums or birds causing flashovers.

Maintenance Undertaken

Inspections on subtransmission lines include:

- Detailed inspections on all line assets every five years;
- Six-monthly thermal and corona surveys on critical lines; and
- A complete network LiDAR survey is being carried out that will take an accurate snapshot of all overhead assets.

During detailed inspections, tests are carried out on all earth banks. Recently, ultrasonic surveys using a multi-functional PD instrument have also been undertaken. Thermographic surveys are carried out on selected critical subtransmission feeders. Other diagnostic measurement techniques, such as Corona surveys and multispectral imaging, are currently being evaluated.

Maintenance tasks are undertaken to correct any defects identified.

Asset Renewal Programme

No major line lengths are due for replacement within the AMP period as they are well within their life expectancy. Targeted replacements will be made based on condition.

Subtransmission Cables

Risks and Issues

The principal risks and issues associated with subtransmission cables arise from:

- Mechanical damage due to excavations or directional drilling by third party; and
- Cable joint failures.

Maintenance Undertaken

Our previous cable testing did not adequately inform our asset health model. This is why we have invested in a specialised cable testing device and have implemented a new strategy of regular cable testing, results tracking and end-of-life prediction. With three years of test results, we will be able to produce a cable Health Index (HI) profile and a replacement strategy based on quantitative data. Further refinements will be possible with five years of data, repetition of tests and tracking of results across the length of cables (PD mapping).

In the next three years, WEL is planning to complete the first round of scanning of all sub transmission cables and develop both health and risk profiles for this asset class. Corrective or remedial actions will be planned based on the test reports, asset health and risk profiles.

For critical and high-risk cable defects, WEL will undertake corrective actions proactively and will determine the failure mechanism of the suspected cable joints and terminations. Once the mechanism of failure is understood, this information is used to continuously improve our preventative and predictive maintenance routines for cables.

Asset Renewal Program

Under the new maintenance strategy, WEL Networks has started the development of sub transmission cable insulation and accessories condition and health profile. After completion of the first assessment cycle, the Maintenance Strategy Team will analyse and recommend a long-term plan for HV cable renewal. To date, no provision has been made in the budget for cable replacements.

Currently, most cable faults are caused through human activity or joint failures. These do not require large lengths of cable to be replaced. However, we have significant lengths of cable approaching nominal design life. Our new cable testing regime will allow us to understand its health, remaining life and expected replacement timeframe. This enables optimal replacement with lower impact on network reliability.

Subtransmission Circuit Breakers (CBs)

Risks and Issues

There have been no significant issues identified with our subtransmission CBs.

Maintenance Undertaken

CBs are inspected and tested every three years. Tests undertaken include PD tests and dynamic tests, such as the ‘first-trip’ test, using a CB profile analyser.

The level of servicing is increased where multiple trips have occurred. Major servicing is also undertaken every six years. Servicing includes changing the insulating oil (in oil-filled CBs), vacuum or SF_6 integrity checks, trip-timing tests, trip circuit integrity checks, close circuit integrity checks, SCADA alarm and control checks and testing of all functional parts (both electrical and mechanical). This is to ensure they meet the manufacturer’s minimum requirements and recommended industry minimum acceptance criteria.

Asset Renewal Programme

CBs scheduled for renewal within the AMP period are due to their age and condition and include those at Massey St, Gordonton and Te Uku. Renewing CBs involves considerable resource and outages on the network. Therefore, where possible, other co-located asset renewals are co-ordinated at the same time. This includes protection, battery and SCADA systems.

A CBRM model has been implemented to assist in renewal prioritisation and forecasting the required level of investment for subtransmission CBs.

Summary of Subtransmission Renewal Expenditure

Table 8.4.2.1 summarises Subtransmission Capital expenditure for the AMP period. The planned subtransmission CB renewals have been included under network development projects that address a wide range of network risks (see Section 6.4.3).

Subtransmission Capex ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
33kV Poles	59	58	58	58	58	58	58	60	63	68
33kV Crossarms and Insulators	122	119	119	119	119	119	124	133	143	155
Total	181	177	177	177	177	177	182	193	206	223

Table 8.4.2.1: Subtransmission Capital Expenditure

8.4.3 Zone Substations

Zone Substation Power Transformers

Risks and Issues

The principal risks and issues associated with power transformers are:

- Debris on external or exposed bushings increasing the flashover risk.
- Poor insulation or degradation of the paper windings resulting in operational failure of the transformer. The condition of the insulation drives the Health Index (HI) and accordingly the life expectancy of the transformer.
- Unbunded transformers may result in uncontained oil spills and therefore soil contamination or other environmental damage. Systematic upgrading of transformer bunding has been included in this AMP.
- Vibration from external factors such as trains. Vibration can cause mal-operation of the mercury switches within the Buchholz relays causing tripping of the incomer CBs. The mercury switches are being progressively replaced with magnetic reed as necessary.

Maintenance Undertaken

Testing and maintenance is specific to the subcomponent of the power transformer as detailed in Table 8.4.3.1

<table>
<tr><th>Frequency</th><th>Maintenance</th><th>OIL-OLTC[1]</th><th>Vacuum-OLTC</th></tr>
<tr><td>2 Months</td><td>Inspection</td><td>X</td><td>X</td></tr>
<tr><td>Yearly</td><td>Annual DGA</td><td>X</td><td>X</td></tr>
<tr><td>3 Yearly</td><td>Transformer Minor</td><td>X</td><td>X</td></tr>
<tr><td>6 Yearly</td><td>Transformer Major</td><td>X</td><td>X</td></tr>
<tr><td>3 Yearly</td><td rowspan="2">OLTC[1] Servicing</td><td>X</td><td></td></tr>
<tr><td>6 Yearly</td><td></td><td>X</td></tr>
</table>

Table 8.4.3.1: Summary of Power Transformer Maintenance

Minor refurbishment is also carried out on transformers that require them to be repainted or rust treated. Gaskets are also replaced as part of the minor refurbishment. The remaining life is assessed at this time. We expect that well maintained transformers, with mid-life refurbishment, will have a life exceeding 60 years.

Asset Renewal Programme

Zone transformers at Gordonton are reaching the end of their nominal lives. Renewal of the two transformers is planned just outside the AMP period. We will continue to track asset health indicators to refine our replacement date.

[1] **On-Load Tap Changer**

Zone Substation Switchboards

We have Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS) on our network.

Risks and Issues

The principal risks and issues for zone substation switchboards are:

- Fault flashover causing injury to staff and equipment damage. Fixed-pattern switchgear has been considered as replacement to traditional withdrawable CBs to mitigate this risk;
- Surface discharges on voltage transformer compartments and vacuum bottles on AIS switchboards. The cause is believed to be high humidity within the substations during winter. Expenditure to install suitable air-conditioning units in substations has been included in the AMP period;
- Mechanical misalignment of movable parts and damaged interlocks on AIS switchboards;
- Incompatible designs on newer switchboards. Although similar types of switchboards are used, legacy CB units can be incompatible causing a lack of compatible spares. The design has subsequently been standardised; and
- Operational handling and testing of SF_6 gas in GIS switchboards. We are using external service providers for this critical task as they are experts in this field.

Maintenance Undertaken

Visual inspections and partial discharge surveys on switchboards are undertaken every two months.

The following items are checked as part of the survey:

- CT/VT chambers;
- Cable terminations in the switchgear;
- Cable end boxes and cable sealing ends; and
- Outdoor switchyard connections; e.g. insulators, busbars.

Major maintenance is carried out on AIS equipment every nine years, and every twelve years on GIS equipment. Main tasks include:

- Bus maintenance for AIS e.g. general cleaning;
- Insulation resistance tests on the main busbar and connected VTs;
- Contact resistance tests on the main busbar; and
- Gas pressure checks and HV withstand tests on GIS.

Asset Renewal Programme

Renewal of indoor switchboards is generally undertaken in conjunction with CB replacements or as part of network development projects.

A CBRM model has been implemented to assist in replacement prioritisation and forecasting the required level of investment in switchboards.

Zone Substation Buildings

The zone substation buildings category also includes subtransmission switching stations, indoor and outdoor transformer bays and earthing systems.

Risks and Issues

The principal risks and issues associated with zone substation buildings include:

- Physical and environmental risks such as fires, oil spills and vermin. Substations with outdoor switchyards have higher physical and environmental risk than indoor switch rooms;
- Vandalism and graffiti;
- Theft of copper earth wire is a significant safety and cost issue;
- Humidity and high temperatures causing damage to electronic devices and switchboards;

- Water causing damage to control cables at older sites. Our newer sites are installed with sump pumps which remove water accumulated in trenches and basements; and
- Records of earth test results and earthing design are lacking on some older sites.

Maintenance Undertaken

Grass cutting, pest control and general cleaning of substation buildings is conducted monthly.

Substation buildings are inspected every two months. Tasks include inspection of soil erosion surrounding the building, visual cracks, paintwork, general building condition and transformer bunding. Site specific safety risks and defects are recorded in the hazard identification and defect notification systems.

Electrical compliance checks, testing and inspection of LV installations are carried out annually.

Earthing systems are tested every three years.

In 2016 all building sites were assessed for asbestos, followed by the installation of signage and registers at each site. Immediate remedial works were undertaken to remove any identified Asbestos Containing Materials (ACM) from these sites.

Asset Renewal Programme

Older sites are upgraded to the current building and seismic standards. Upgrade projects are completed in conjunction with other capital projects such as CB or switchgear replacements.

Summary of Zone Substation Renewal Expenditure

Table 8.4.3.2 summarises zone substation renewal capital expenditure for the AMP period.

Zone Substation Capex ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
11kV Circuit Breaker (Upgrade)	-	-	260	260	260	260	260	260	260	260
11kV Switching Station/Zone Sub	140	140	140	140	140	140	140	140	140	140
Zone Substation Transformer	-	-	-	-	-	-	-	-	-	-
Total	140	140	400	400	400	400	400	400	400	400

Table 8.4.3.2: Zone Substation Capital Expenditure

8.4.4 Distribution and LV Lines

Distribution and LV Poles

Risks and Issues

The principal risks and issues associated with poles are:

- Falling poles posing a staff and public safety risk or causing damage to property. The risk of failure is greatest with the remaining hardwood poles; and
- Third party damage to poles e.g. car vs pole.

The most common failure modes for distribution and LV poles are:

- Rotten bases and splitting on the heads for wooden poles; and
- Spalding of concrete in concrete poles.

Maintenance Undertaken

The current WEL Networks maintenance strategy for the poles asset class is a combination of preventive and reactive. All poles are inspected, and in selected cases tested, within a five year cycle. Frequency of inspection is based on feeder criticality. Replacement is driven from CBRM and the defect notification process.

WEL use a range of techniques to examine wooden poles. These include vibration analysis, pole scanning and gamma ray imaging. These techniques measure wood density and remaining pole strength. Poles are classified and assigned a renewal date based on imaging results. We are searching for similar techniques to use on concrete poles.

Maintenance of poles includes the repair of stay wire and possum guards.

Asset Renewal Programme

Pole replacement is driven from notifications raised during routine inspections and prioritised using CBRM model. Poles are also replaced as part of other renewal programmes such as the re-conductoring projects which are intended to improve rural reliability.

Distribution and LV Crossarms and Insulators

Risks and Issues

The principal risks and issues associated with crossarms are insulator failure due to:

- Pin corrosion
- Wood rot around the insulator pin hole

Insulator failure can cause wooden crossarms to burn or break causing the conductor to fall to the ground resulting in a public safety hazard and poor network performance.

The major failure mode is insulator failure (40%), followed by hardware failure (18%) and rotten wood (13%). All of the predominant failure modes are deterioration based, with the likelihood increasing with age. These types of failure modes are best managed by periodic inspection and preventative maintenance programs, coupled with a time based replacement.

Maintenance Undertaken

Visual inspections of crossarms are undertaken every five years coinciding with pole and conductor inspections. As faulty insulators are difficult to detect by visual inspection, new corona and ultrasonic diagnostic testing has been introduced as part of the inspection process. This technology has proved reliable in detecting early signs of insulator cracking or high levels of partial discharge.

Asset Renewal Programme

Crossarm failure rates are forecasted to accelerate in the next 10 years. To mitigate this risk, a gradual increase in crossarm renewals is proposed towards the end of the AMP period.

Distribution and LV Conductors

Risks and Issues

The principal risks and issues associated with conductors are:

- Public safety and property damage from live lines falling to the ground;
- Our 16mm^2 copper conductor fleet is failing earlier than expected due to damaged strands from conductors clashing as a result of high wind, bird contact or tree debris predominately in rural areas. This has contributed to poor network performance; and
- 16mm^2 copper conductors prone to breaking while being handled. Due to higher safety risks, we have ceased ‘live line’ work on or under these conductors. This will result in a greater number of planned outages to renew this type of conductor over the AMP period.

Maintenance Undertaken

Inspections for distribution and LV conductors are undertaken as follows:

- Thermal imaging and ultrasonic testing is completed annually on critical sections of distribution conductors;
- The remaining distribution and LV conductors are visually inspected every five years;
- More detailed inspections and condition data capture is conducted every five years; and
- Thermal imaging is also used after major faults to check conductor and joint integrity. Corona discharge inspection is used to check feeders with incidences of insulator failure.
- Planned detailed metallurgical testing on a sampling program has commenced in order to better understand conductor condition.

- A LiDAR survey has been carried out on selected overhead line feeders which identified critical replacements. Non-critical low lines are being scheduled for replacement in conjunction with other asset replacement works. This improves our network over time while providing the best value for our customers.
- A second full network LiDAR survey is being carried out to provide a full picture of the network.

Asset Renewal Programme

WEL has gained substantial experience on re-conductoring projects in the last five years. The learnings coupled with additional testing of different types of conductor sections will enable WEL to strategically replace the remaining aged conductors in the network and calibrate our CBRM model. This will be part of WEL's renewal strategy for this asset class.

Summary of Distribution and LV Line Renewal Expenditure

Table 8.4.4.1 summarises Distribution and LV Lines capital expenditure for the AMP period.

Distribution and LV Line Capex ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Reconductoring	915	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Distribution and LV Poles	1,128	1,104	1,104	1,104	1,104	1,104	1,104	1,140	1,188	1,283
Distribution and LV Crossarms and Insulators	2,310	2,261	2,261	2,261	2,261	2,261	2,356	2,518	2,708	2,945
Non-critical low lines	250	-	-	-	-	-	-	-	-	-
Total	4,603	4,365	4,365	4,365	4,365	4,365	4,460	4,658	4,896	5,228

Table 8.4.4.1: Distribution and LV Lines Capital Expenditure

The capital renewal expenditure for each asset class in the above table is based on the results of the CBRM modelling, resulting Health Index (HI), risk profiles and reported defects from the notification process as discussed in Chapter 2.

From 2025 the rate of crossarm and pole replacement is projected to rise to address the large population of assets installed in the 60s and 70s, which will require an accelerated replacement strategy from 2025-2050.

Crossarms and insulators modelling shows an increasing rate of failures over the planning period and therefore to reduce this risk, an increasing investment strategy has been adopted towards the end of the AMP period. Replacements are prioritised on highest risk items combined into geographical areas for delivery efficiency.

We have reduced the overall spend and the rate at which we ramp to address our ageing assets. The major reduction has been through reviewing our overhead line reliability strategy and the rate at which we replace conductors.

8.4.5 Distribution and LV Cables

Distribution Cables

Risks and Issues

The principal risks and issues associated with distribution are damage caused by excavations or directional drilling, suspected insulation and termination failures due to aged dry paper in PILC cables.

Network outages can be extensive while cable jointing/termination repair work is undertaken.

Maintenance Undertaken

FMECA shows that our limited number of distribution and LV cables failures occur at terminations and cable joints. Routine inspections help us address these termination failures. At the distribution level we've improved our fault detection PILC cable termination inspections by inspecting and measuring PD during periods of high humidity. This has allowed earlier detection of deteriorating terminations and lowered our fault rate. LV cable terminations are routinely inspected.

WEL is implementing a comprehensive PD testing programme to assess overall cable health. PD levels will be mapped and tracked across the length of cables. Testing will begin with our most critical cable routes and to allow more informed project planning.

Asset Renewal Programme

In line with previous years we have allowed limited cable sections to be replaced following faults. We expect that with two years of cable test data we will have a snapshot of our cable network's remaining life. This will allow programming of proactive cable replacements. Given our cable age we expect these replacements to start at low levels beyond this AMPs timeframe.

LV Cables

Risks and Issues

The principal risks and issues for LV cables are cable failure caused by third party excavations or directional drilling and water ingress causing cable joints to fail.

Maintenance Undertaken

Due to their inaccessibility there is no routine maintenance performed on LV cables. However LV connectivity is monitored in real-time via our smart meter network. We are also complementing our current smart meter capabilities with impedance monitoring. It is hoped that this will help to indicate deteriorating sections of cable and enable proactive replacements to be programmed.

Asset Renewal Programme

There is no renewal programme for LV cables. Where cables are replaced this occurs as part of other projects such as upgrades or further LV reticulation development. However an allowance has been made to replace sections of cable following a fault, this expenditure is included under Capitalised Faults (Section 8.4.1).

Table 8.4.5.1 summarises Distribution and LV Cables Capital Expenditure for the AMP period.

Distribution and LV Cables Capex ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Distribution 11kV UG cables	-	-	-	-	-	-	-	-	-	-
LV Underground cables	-	-	-	-	-	-	-	-	-	-
Service and Distribution Pillars	460	450	450	450	450	450	450	450	450	450
Total	460	450	450	450	450	450	450	450	450	450

Table 8.4.5.1: Distribution and LV Cables Capital Expenditure

8.4.6 Distribution Substations and Transformers

Risks and Issues

The principal risks and issues associated with distribution substations and transformers are:

- Insulator cracks;
- Oil leaks due to gasket failure;
- Internal insulation failures;
- Poor conductor connections; and
- External factors such as lightning strikes, birds, possums, vermin, and vegetation.

We have not identified any systemic problems with any particular manufacturer or model of transformer.

The majority of faults are associated with pole top transformers rated up to 100kVA. Pole top transformers have inherent design limitations and it is not practical to assess their internal health condition through Dissolved Gas Analysis (DGA). A thorough inspection routine will increase life cycle maintenance costs beyond the replacement cost.

Copper theft from earthing on our distribution substations and transformers is a serious public safety issue and is costly to identify and replace. Incidences are identified from staff and public reporting and during the network inspection program.

Maintenance Undertaken

Our pole mounted and pad mounted transformers are inspected every five years. Maintenance and testing includes:

- Testing of earth banks;
- Security checks;
- External panel deterioration or damage;
- Vegetation control;
- Cleaning of HV and LV cubicles; and
- Thermal imaging of connections and busbars.

For larger ground based CBD and industrial distribution transformers the maintenance programme includes:

- Smart meter demand monitoring;
- Annual inspection;
- Thermal imaging and ultrasonic inspections of all links, busbars and connections;
- Maintenance checks on tank and cubicles;
- Cleaning equipment and building internal areas; and
- Oil tests conducted on a condition basis for transformers 500kVA and above.

Transformers may be refurbished following replacement by larger transformers (due to growth) and prior to being redeployed back into the network. An economic model has been developed to determine if a transformer should be scrapped or refurbished.

Smart meters are being utilised as data loggers fitted to new ground mounted transformers 300kVA and over. Data loggers record three phase voltage, transformer temperature, three phase transformer currents and one phase of the outgoing circuit current. This data enables more accurate evaluation of transformer loading over time. Further to this, we have developed a tool to aggregate smart meter data relating to their corresponding distribution transformers and will use data loggers where this is not possible.

Asset Renewal Programme

The overall condition of WEL transformers is good and a low replacement rate is currently required. Transformers showing signs of deterioration are addressed through repairs or replacement.

A CBRM model has been implemented to assist in renewal prioritisation and level of investment for distribution substations and transformers. Reliability impacts due to 'daisy-chained' distribution transformers are also considered in the renewal programme.

Summary of Distribution Substations and Transformers Renewal Expenditure

Table 8.4.6.1 summarises Distribution Substations and Transformers capital expenditure for the AMP period.

Distribution Substations and Transformers Capex ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Distribution Transformers(11kV/400V)	838	820	820	820	820	820	820	820	820	820
Total	838	820	820	820	820	820	820	820	820	820

Table 8.4.6.1: Distribution Substations and Transformers Capital Expenditure

The capital renewal expenditure for distribution transformers in the above table is based on the results of the CBRM modelling and resulting HI and risk profiles as discussed in Chapter 2.

8.4.7 Distribution Switchgear

Risks and Issues

Distribution switchgear includes Ring Main Units (RMU), Air Break Switches (ABS), Circuit Breakers (CB), reclosers, sectionalisers, and distribution overhead line fuse units. The principal risks and issues associated with distribution switchgear are:

RMUs:

- The possibility of SF_6 gas leakage from GIS units.
- High levels of partial discharge and mechanical interlock failures have been observed on older oil-filled RMUs.
- A particular model of RMU has an 'over-travel' during operation which poses a significant safety risk. Until replacements can be programmed, a rope and pulley system is used so that these RMUs can be switched at a safe distance.
- Severe failure of old oil-filled RMUs

ABS:

- Older, manually operated ABS are a safety risk to the operator during switching. The most common failure for an ABS is the main contacts being stuck in either an opened or closed position.
- Analysis of the last five years of fault data indicates the major failure modes are faulty line connection, contact issues, cracked or broken insulator, and flashover due to bird strike.

CBs:

- Partial discharge on vacuum bottles in a specific model of switchgear.

Reclosers and Sectionalisers:

- Problems had been experienced with electronic drop out of sectionalisers however, these have all been replaced by a vacuum type, mitigating this risk.

Distribution Overhead Line Fuses:

- Failure due to the deterioration of the fuse element resulting from age and weather conditions.

Maintenance Undertaken

Maintenance and testing is undertaken on switchgear as outlined in the sections below.

RMUs:

RMUs are inspected and tested every five years. Inspection and testing consists of visual inspections, general condition assessment, PD survey, earth testing, vegetation control, oil level, SF_6 gas pressure and through-fault indicator checks. During inspections checks are also made on the operating handles, earth conductor, tank condition, pitch filled terminations, panel steelwork, labels, and warning signs. This work is undertaken in association with distribution transformer inspections. RMUs with busbar extension units also include partial discharge testing and visual inspection of busbar boxes. RMUs are also subject to major maintenance every 10 years. Minor refurbishments such as painting, gasket replacement, lubrication of mechanism, and corrosion treatment are also carried out.

ABS:

Inspections are undertaken every five years and include visual inspections of insulators, arc horns/chutes, contacts and handles. Earth testing is undertaken at the same time. Operations and function checks are carried out on selected switches that are critical to the network (e.g. Open Points). WEL regularly use drones for inspections to gain a bird's eye view of ABS and other line equipment.

Faulty line connection, contact problem and cracked or broken insulators are generally age based failure modes, resulting from exposure to the elements over time. These types of failure modes are best managed by periodic inspection and preventative maintenance programs coupled with a time based replacement.

Flashover by bird or animal is the only major failure mode that is instantaneous. This risk is best managed by engineering/design controls, such as possum guards and taller insulators, rather than a maintenance program.

Appropriate spares holding are kept to ensure faults or defects can be rectified in a timely manner.

CB:

CBs are inspected and tested every three years. Tests undertaken include PD tests, and dynamic tests such as the 'first-trip' test using a CB profile analyser. Tests are also undertaken during servicing. The level of servicing is increased where multiple trips have occurred based on the outcome of CBRM analysis.

Major servicing is undertaken every six years. Servicing includes changing the insulating oil (oil-filled circuit breakers only), trip-timing tests, trip circuit integrity checks, close circuit integrity checks, SCADA alarm and control checks and testing of all functional parts (both electrical and mechanical). This is to ensure they meet the manufacturer's minimum requirements and recommended industry minimum acceptance criteria.

PD surveys on circuit breakers are undertaken during the bi-monthly inspections to track any PD development in the equipment.

Reclosers, Sectionalisers and HV Overhead Line Fuses:
Inspection and maintenance is undertaken every five years. This includes visual inspection, reporting on condition of insulators, handles, earth conductor rating, steelwork, operational verification of line recloser, SCADA and communications signalling, earth test, thermal vision, ultrasound tests and reporting of results.

Asset Renewal Programme

The renewal programme for distribution switchgear is as follows:

RMUs:

- Targeted replacement of oil-filled RMUs, with vacuum and SF_6 type RMUs, is planned within the AMP period;

ABS:

- WEL plan to renew approximately 20 units each year. These are prioritised by risk.
- A programme has been implemented to replace manually operated ABS with vacuum switch units to manage environmental risk posed by possible SF_6 leaks.
- Many ABS associated with two pole transformer structures are being removed completely and in other situations cable end switches are being replaced with solid isolating links;

Reclosers and Sectionalisers:

- A small number of the older models of reclosers will be systematically renewed based on our CBRM assessment.

HV Overhead Line Fuses:

- Renewal of these assets is primarily driven by the need to renew other larger components, primarily crossarms.

Summary of Distribution Switchgear Renewal Expenditure

Table 8.4.7.1 summarises Distribution Switchgear Capital Expenditure for the AMP period.

Distribution and Switchgear Capex (in Nominal Price $000)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
11kV Air Break Switch	472	462	462	462	462	462	462	462	462	462
11kV Reclosers and Sectionalisers	315	308	308	308	308	308	308	308	308	308
11kV Ring Main Unit	337	330	330	330	330	330	330	330	330	330
S&C Link replacement	250	-	-	-	-	-	-	-	-	-
Total	1,374	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100

Table 8.4.7.1: Distribution Switchgear Capital Expenditure

The capital renewal expenditure for each asset class in the above table is based on the results of the CBRM modelling and resulting Health Index (HI) and Risk profiles as discussed in Chapter 2 and detailed in section 8.3 above.

8.4.8 Other Network Assets

Service and Distribution Pillars

Risks and Issues

The principal risks and issues for Service and Distribution Pillars are:

- Damaged LV pillars may pose a risk to public safety; and
- Fibreglass type pillars are fragile and prone to damage.

LV pillars are part of the LV underground network and have been identified as having the highest public safety risk among our asset classes. This is due to the higher accessibility to the public. Safety risks include the probability of electrocution following damage to the unit and live parts being exposed to public contact. Analysis of the last five years of fault data show the major failure modes are connection failures, external damage (i.e. vehicle hitting the pillar), blown fuse and enclosure damage. Minor issues involve vegetation build up around the pillar, obsolete types of pillars, unauthorised use of steel screws used to secure lids and location installed e.g. inside private property.

Maintenance Undertaken

LV pillars are inspected every five years. Inspections determine the physical condition, accessibility, vegetation and location. Maintenance on LV pillars includes lid repairs or renewal.

Thermal scanning has recently been included as part of the routine inspections. With the introduction of thermal scanning to identify developing connection failures and the component level sub categories driving them, it is forecast that the failure rate will be reduced to a lower constant rate.

To mitigate the external damage failure mode (specifically car vs. pillar) a location assessment is included in the LV pillar periodic condition assessment. This will assess if the LV pillar is at increased risk of vehicle impact, and whether barriers, relocation or the change of LV pillar type (e.g. underground) will reduce this risk.

Asset Renewal Programme

LV Pillars will be renewed based on their type, age and condition with priority given to fibreglass type pillars. Remedial works following the comprehensive inspection programme has been planned and will be carried out based on the priority.

WEL has approved the use of an underground pillar design to replace service pillars that have a high risk of being hit by a vehicle.

Service and Distribution Pillar CBRM models were developed and will be used to further analyse the risks and asset renewal requirements.

Protection Relays

Risks and Issues

The principal risks and issues associated with protection relays are:

- Lack of spares;
- The significant cost of maintenance; and
- Lack of complex protection functionality in older electromechanical relays.

Maintenance Undertaken

Inspections and testing are undertaken every three years. Tests undertaken during inspections are dependent on the type of relay:

- For line differential relays using copper pilots, three yearly tests include primary injection testing, pilot resistance checks, and insulation checks;
- Arc flash schemes, that require access to the light sensors in the switchgear, are maintained at nine yearly intervals to coincide with bus maintenance; and
- For all other relays, maintenance is undertaken on a three year interval to coincide with CB maintenance.

Modular Substation

We have set up a modular substation to expand our in-house knowledge and skills in protection and communications technology. This includes two panels of feeder and transformer protection relays. This enables real-time simulation using similar equipment and devices found in our substations with integration to our NMS. The installed devices can also be used as spares in an emergency. The modular substation setup is kept and maintained in one of our zone substations.

Asset Renewal Programme

Our renewal programme for protection relays over the AMP period includes:

- Replacement of electromechanical relays with modern numerical relays; this work will typically be undertaken in conjunction with other upgrade work at the zone substation or switching station. Priority will be on the CBD area where a substantial number of electromechanical relays operate on critical zone substation feeders; and
- Replacement of Solkor pilot wire protection on 11kV trunk feeders with numerical line differential relays; fibre and patch panels will be installed on these sites to cater for new differential communication requirements.

In consideration of the complex nature of the works, an integrated renewal programme has been developed that will ensure timely integration of protection, SCADA/communications and switchgear renewals. This is reflected in the proposed 10 year spend profile.

A CBRM model for relays has been developed and will be used to further analyse the risks and asset renewal requirements.

SCADA and Communication Devices

Risks and Issues

The principal risks and issues associated with our SCADA and communication devices are primarily related to weak communication signals. Weak signals can be caused by incorrect positioning of antenna, vegetation interference, failed RTUs and batteries, degradation of pilot communication cables and the incompatibility of certain components.

Maintenance Undertaken

SCADA and communications devices are inspected every six months. The tests and maintenance conducted on all remote station equipment include:

- Visual inspections, dusting, cleaning and minor repairs;
- Signal level monitoring;
- Operational checks and measurements;
- Testing, calibration checks, and adjustments;
- Meter reading and downloading of data;
- Checking and reporting status indications and software error logs; and
- Maintenance of databases related to the location, maintenance history and status of equipment and completing test sheets and reports.

Additional comprehensive SCADA ‘point-to-point’ indication testing is also undertaken in conjunction with CB and protection testing to minimise outage windows.

Protection interface integrity is tested through insulation resistance testing on pilot cables and ‘loop-back’ checks on fibre cables.

Asset Renewal Programme

The Conitel Protocol RTUs are replaced progressively with DNP-IP RTUs.

Smart Meters

Risks and Issues

The principal risks and issues associated with smart meters are:

- Loss of communication
- Electronic failure

Maintenance Undertaken

Maintenance functions on smart meters include:

- Sample testing after 7 years and reported
- Recovered meters are refurbished and recertified
- Investigation and repairs on meter self-reported issues
- Repairs carried out on reported failures

Asset Renewal Programme

Smart meters are installed at new installations driven from new connections (e.g. new subdivisions) and where we are nominated as the Meter Service Provider (MSP).

EV Chargers

Risks and Issues

The principal risks and issues associated with EV Chargers are:

- Vandalism
- Electronic failures
- Handle/cable/plug damage due to accidental run overs

Maintenance Undertaken

Maintenance on EV chargers include:

- Service provider scheduled yearly maintenance
- Service provider fault response

Maintenance repairs are undertaken to correct any defects identified.

Asset Renewal Programme

No renewal of these assets is planned during the AMP period as they are within their life expectancy and have an acceptable risk profile, based on their condition.

Load Control Equipment

Risks and Issues

The principal risks and issues associated with our load control injection equipment are long lead-times on replacement parts and compatibility issues with the SFU-G type ripple control converter.

Maintenance Undertaken

The load control injection equipment is inspected every six months. Inspections involve plant testing, visual checks and signal strength tests. Additionally each year the static plants undergo a condition assessment and maintenance by the supplier. WEL's service provider keeps spare parts as part of the service level agreement with WEL.

Asset Renewal Programme

Renewal of the SFU-G type control converters has been incorporated into the plan. The load control injection plant will not be renewed as this technology has been superseded by smart metering technology.

Battery and Charger Systems

Risks and Issues

The principal risks and issues associated with our battery and charger systems are:

- Loss of control of primary equipment when battery or charger systems fail, and
- Environmental factors such as high humidity and high temperature that can reduce life expectancy.

Compared to battery systems installed in substations, battery systems installed in the distribution network (i.e. pole/ground mount equipment) exhibit the highest number of failures due to these units being exposed to harsher environmental conditions (e.g. higher humidity).

Maintenance Undertaken

Due to their criticality, battery and charging systems are inspected six monthly. Tests carried out during these inspections include impedance tests, alarm tests, float voltage and condition. Remote monitoring and load tests are also carried out bi-monthly. There is currently a project in process that will introduce on-line monitoring of our RTU connected battery installations. This monitoring will significantly reduce battery test requirements.

Additionally, discharge tests are carried out every two years on all zone substation and switching station battery banks to ensure that battery performance is up to standard.

Other than testing, no other maintenance is undertaken on batteries and charger systems. Faulty systems are replaced.

Asset Renewal Programme

Distribution equipment batteries are renewed when they fail discharge and impedance tests.

During the AMP period we will renew old or poor condition battery banks and power supplies. Where appropriate, some units will be replaced with dual battery banks and power supplies with higher capacities to provide greater reliability. A standardised design is now utilised for these systems.

CBRM models have been developed for battery and charger systems. It is expected that the outcomes of the risk analysis will enable further mitigation of risks in this asset category.

Summary of Other Network Asset Renewal Expenditure

Table 8.4.8.1 summarises Other Network Assets capital expenditure for the AMP period.

Distribution and Switchgear Capex ($000's)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Protection Relays	255	250	250	250	250	250	250	250	250	250
SCADA and Communications	50	150	150	150	150	150	150	150	150	150
Total	305	400	400	400	400	400	400	400	400	400

Table 8.4.8.1: Other Network Assets Capital Expenditure

The capital renewal expenditure for each asset class in the above table is based on the results of the CBRM modelling and resulting HI and Risk profiles as discussed in Chapter 2 and as detailed in the previous sections.

8.5 OVERALL EXPENDITURE SUMMARY

8.5.1 Maintenance Expenditure

Operational expenditure is in line with our 2020 AMP forecasts. There have been increases in traffic management costs and the introduction of cable testing to determine the remaining life of our cable fleet. These are largely offset by savings created through online monitoring of remote equipment batteries. WEL's network asset base is growing by an average 2% per annum. Through operational efficiency improvements via the Operational Excellence project, the increase in operating costs is limited to 1% per annum across the 10 year period as shown in Figure 8.5.1.1. The increase is primarily due to:

- New cable testing strategy;
- Increased substation building maintenance;
- Field data verification and accelerated inspections to improve the accuracy of asset condition data;
- Increased diagnostic testing such as Corona inspection and pole scan programme resulting in a slight increase in preventive maintenance costs across the AMP period; and
- Proactive repairs on WEL's LV network including service lines inspections.

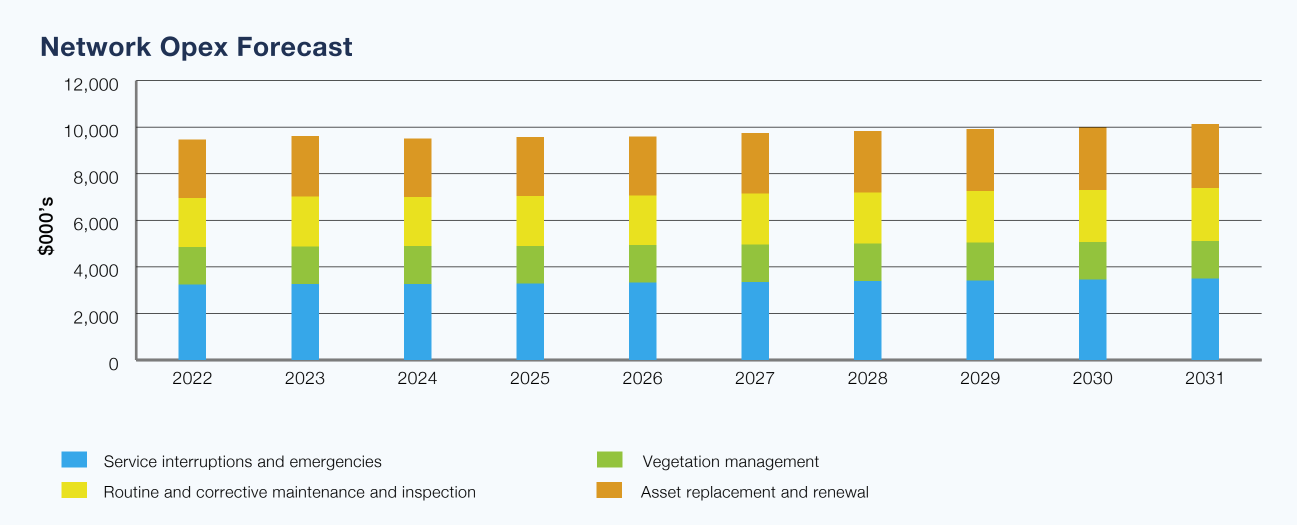

Figure 8.5.1.1: Network Operational Expenditure

8.5.2 Renewal Expenditure

Overall our asset renewal philosophy remains aligned to our previous AMP with a relatively flat five year expenditure followed by an increase to address ageing poles and crossarms. We have reduced the overall spend and the rate at which we ramp to address our ageing assets. The major reduction has been through reviewing our overhead line reliability strategy and the rate at which we replace conductor. The overall spend across the 10 years has been reduced by $38M as shown in Figure 8.5.2.1.

The asset replacement budget is flat through FY22-27 then increases by $1.3M over the next five years to start addressing our ageing crossarms and poles. Capitalised Faults and Notification work will increase slightly over the 10 year period in response to the significantly reduced asset replacement strategy. The increase is limited to $700k through improved Asset Management techniques that allow us to understand the condition of our assets and target our maintenance and asset replacements. There are two assets where our condition data can be improved. These are our overhead conductors and underground cables. For overhead conductor, our condition modelling currently shows significant lengths of conductor should be replaced however, this does not match our experience and physical inspections. We are currently embarking on a three year project where conductor samples will be sent to a material scientist so they can help us assess the remaining conductor life. Until the study findings are known, conductor replacements have been reduced by $23M over the 10 year period. Overhead line reliability will be improved through focusing on long span clashing, conductor joints and connections.

To date no budget has been provided for cable replacement. At the moment most cable faults are caused through human activity or joint failures. These do not require large lengths of cable to be replaced. However we have significant lengths of cable approaching nominal design life and there are increasing lengths of cable requiring replacement due to asset age.

Prudent Asset Management also seeks to lower the cost of replacement for each asset class. We lower these costs through our Operational Excellence initiatives that scope, group and risk-rank replacements. The risk-ranking targets replacements to the highest risk assets and allows us to extend asset life with lower overall risk. The grouping and scoping allows more streamlined replacement planning and execution while lowering the cost and customer outage impact of each replacement.

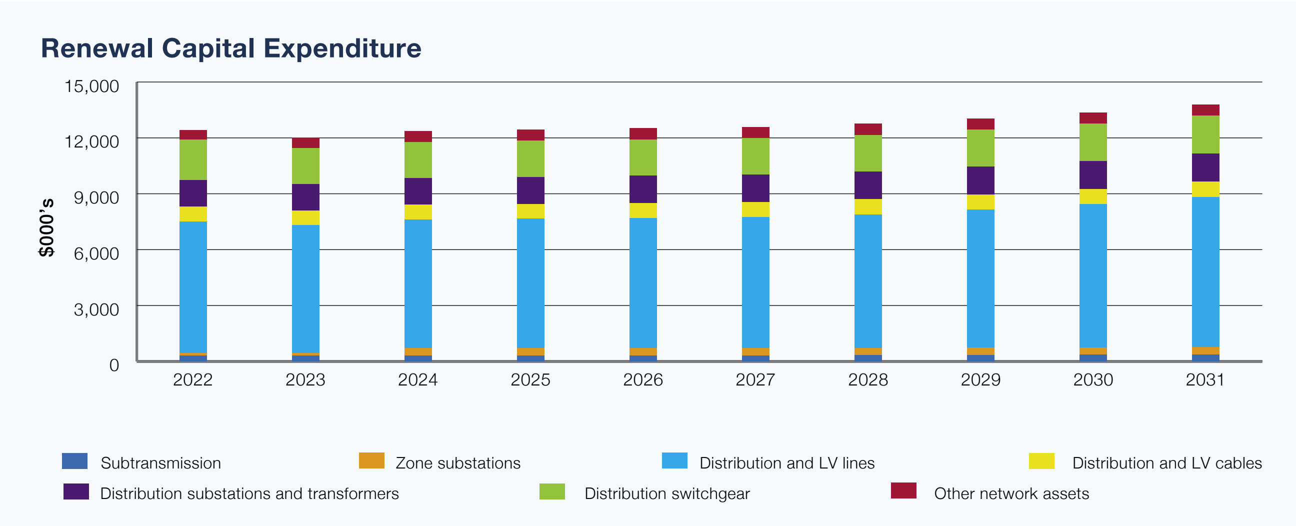

Figure 8.5.2.1: Renewal Capital Expenditure by Asset Type

9

SUMMARY OF EXPENDITURE FORECASTS

9 SUMMARY OF EXPENDITURE FORECASTS

This chapter provides a summary of the expenditure forecasts presented and discussed in previous chapters. It provides an overview of our expenditure in a number of categories over the AMP period.

All figures in this chapter are presented in constant prices which means they exclude the allowance made for expected price inflation.

9.1 INTRODUCTION

This section describes the inputs and assumptions used to forecast our capital and operational expenditure.

9.1.1 Interpreting the Forecasts

The forecasts presented in this chapter are a summary of the expenditure described in previous sections. They are presented here to provide a consolidated view of our expenditure across our business. The expenditure profiles cover the 10 year period of the AMP, 1 April 2021 to 31 March 2031.

As explained previously, the notation adopted in each table refers to financial year-end. For example, the 1 April 2021 to 31 March 2022 financial year is referred to as 2022.

9.1.2 Forecast Inputs and Assumptions

Our forecasts rely on a number of inputs and assumptions. These include:

- Capital contributions
- Cost of financing (FDC);
- Managing forecast uncertainty

Capital Contributions

The customer works expenditure shown is the gross amounts i.e. capital contributions have not been netted out from the forecast.

Cost of Financing (FDC)

The cost of financing has been included in accordance with 2.2 (11) of the Electricity Distribution Services Input Methodologies Determination 2012.

Inflation

The forecasts within this chapter are shown in constant terms as per the Electricity Distribution Information Disclosure Determination 2012. This means that adjustments for inflation have not been accounted for. Where inflation is included in Schedules 11a and 11b in Chapter 10, it is calculated based on two main cost components. These are labour and materials. The per annum inflation adjustments used for each are:

- Labour – 2% throughout the AMP period
- Materials – 2% throughout the AMP period

While the assumed inflation rates follow the general historic trend and provide an indicator for future labour rates and material costs, there is always an inherent level of uncertainty. By way of example, market conditions and pricing can change with relative supply and demand pressures or major economic shocks like the COVID-19 pandemic.

For the purposes of this AMP, we have assumed the change in labour and material is limited to the assumed inflationary pressures rather than modelling specific trends in network components or specific trades in the labour market.

9.2 CAPITAL EXPENDITURE

This section provides an overall summary of the forecast capital expenditure on Assets by category.

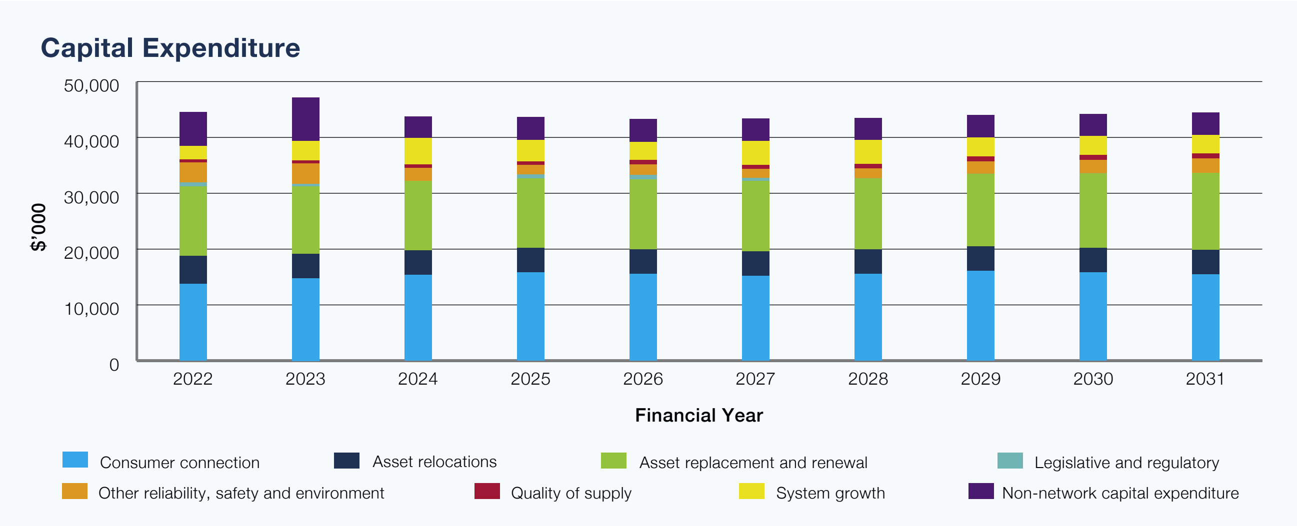

Figure 9.2.1: 10 year Capital Expenditure

9.2.1 Consumer Connection

Forecast customer connection capital expenditure is summarised in the figure below.

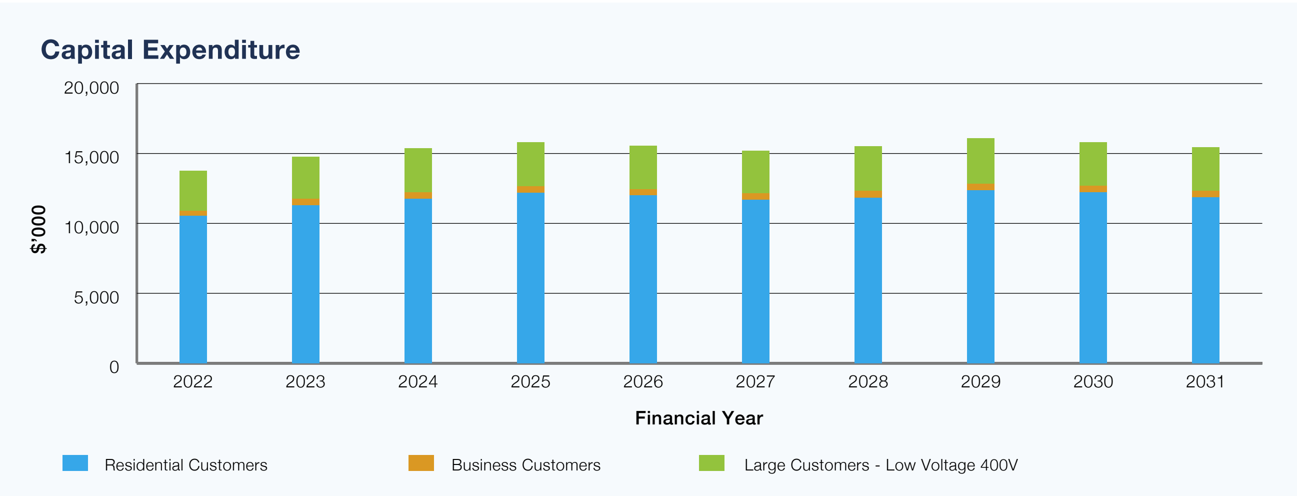

Figure 9.2.1.1: 10 year Consumer Connection Capital Expenditure

9.2.2 System Growth

System growth capital expenditure in Commerce Commission categories

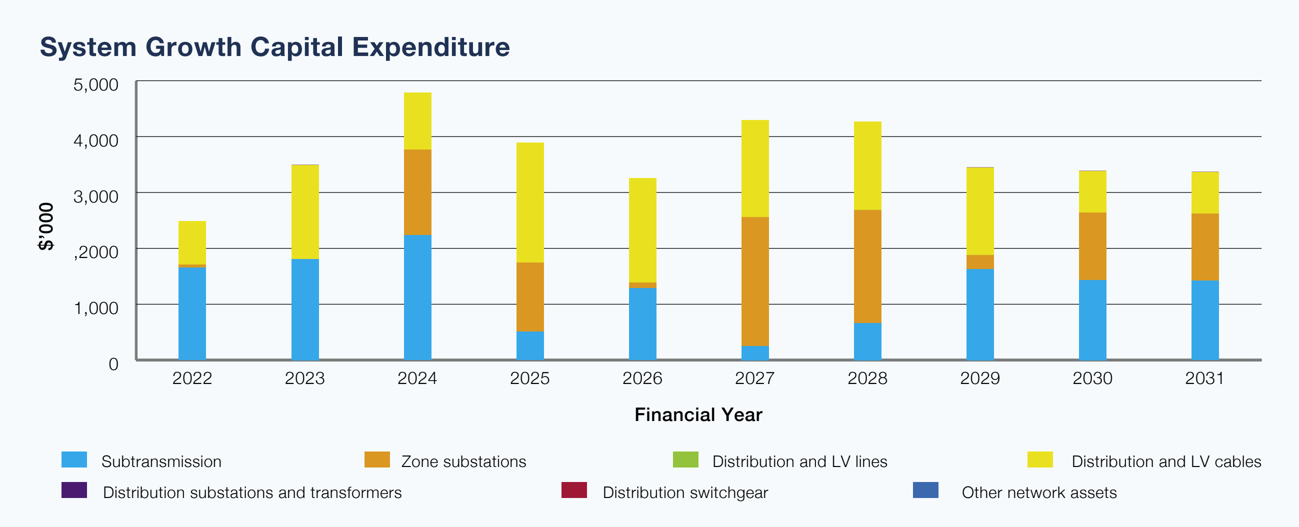

Figure 9.2.2.1: 10 year System Growth Capital Expenditure

9.2.3 Asset Replacement and Renewal

The breakdown of asset replacement and renewal capital expenditure according to Commerce Commission categories is shown below.

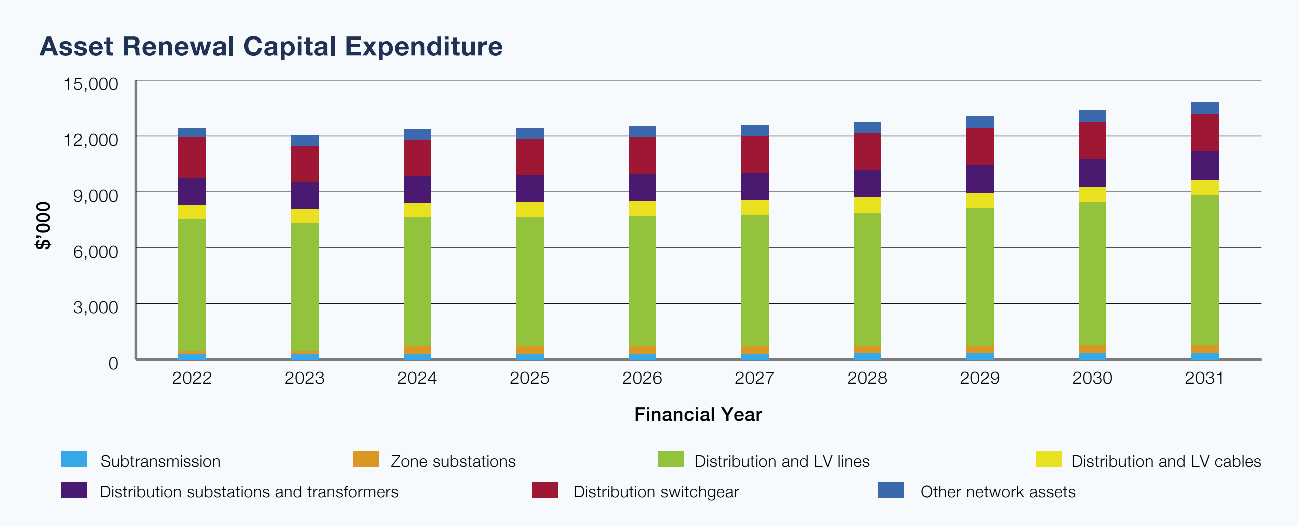

Figure 9.2.3.1: 10 year Asset Replacement and Renewal Capital Expenditure

9.2.4 Asset Relocation

Asset relocation capital expenditure by activity is summarised in the figure below.

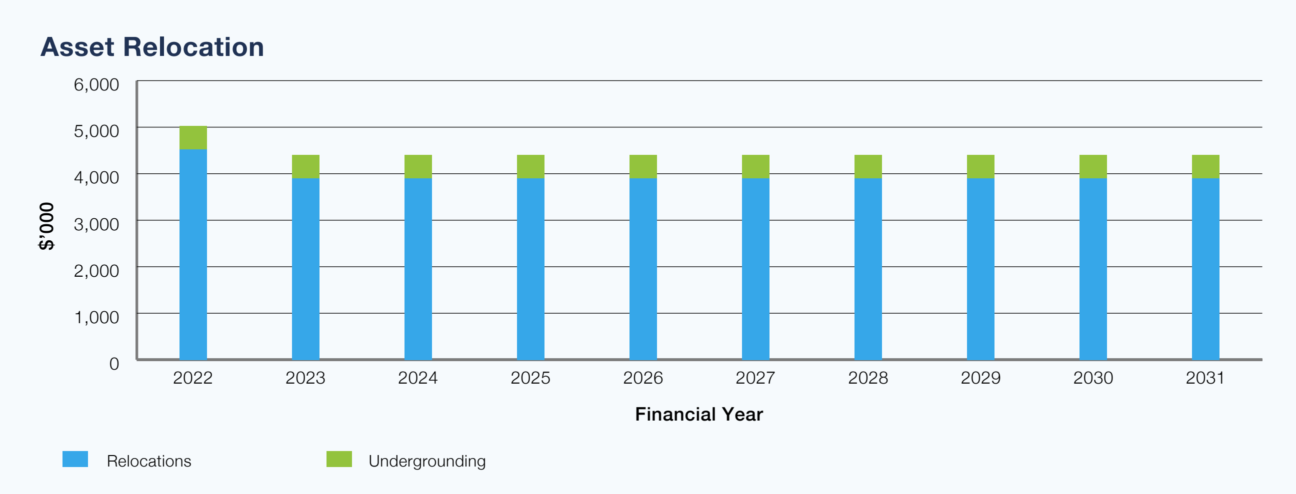

Figure 9.2.4.1: 10 year Asset Relocation Capital Expenditure

9.2.5 Quality of Supply

Quality of supply capital expenditure by activity is summarised in the graph below. We have predicted an increase in our quality of supply expenditure in order to address the voltage impacts of photovoltaic cells (solar PV) and electric vehicles. Both of these new technologies can result in rapid changes in voltage that drive LV network reinforcement.

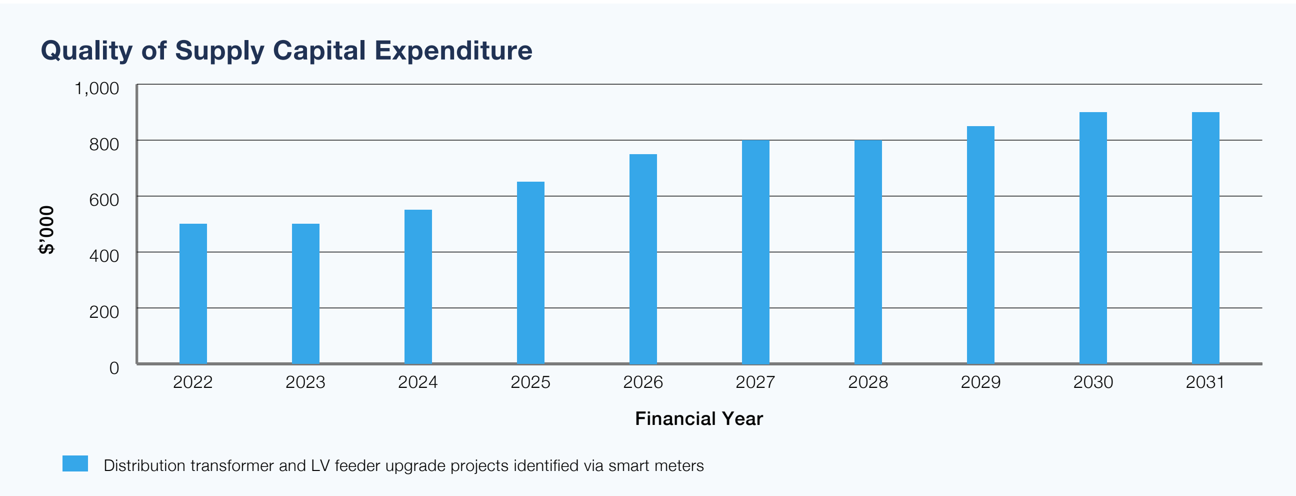

Figure 9.2.5.1: 10 year Quality of Supply Capital Expenditure

9.2.6 Legislative and Regulatory

Legislative and regulatory capital expenditure by activity is summarised in the graph below.

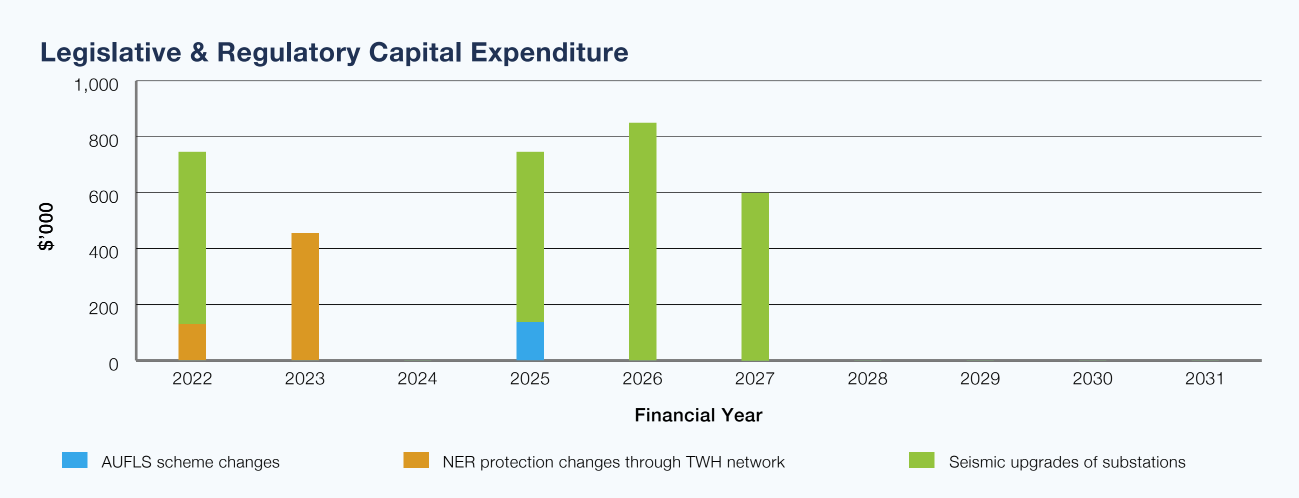

Figure 9.2.6.1: 10 year Legislative and Regulatory Capital Expenditure

9.2.7 Reliability, Safety and Environment

Reliability, Safety and Environmental capital expenditure by activity is summarised in the graph below.

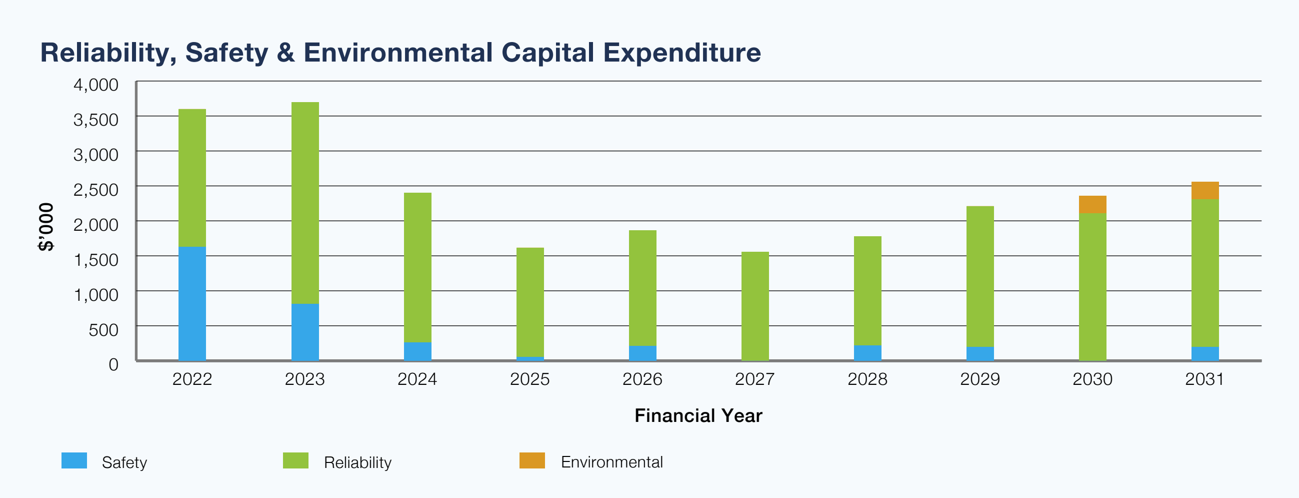

Figure 9.2.7.1: 10 year Reliability, Safety and Environmental Capital Expenditure

9.2.8 Non-network Capital Expenditure

The breakdown of non-network capital expenditure by asset type is summarised in the graph below. The increase in forecast non-network capital expenditure is driven by major SAP upgrades (2023) and the GIS transformation project (2022-2023). There is also an ongoing increase of $2M per annum to accommodate strategic projects.

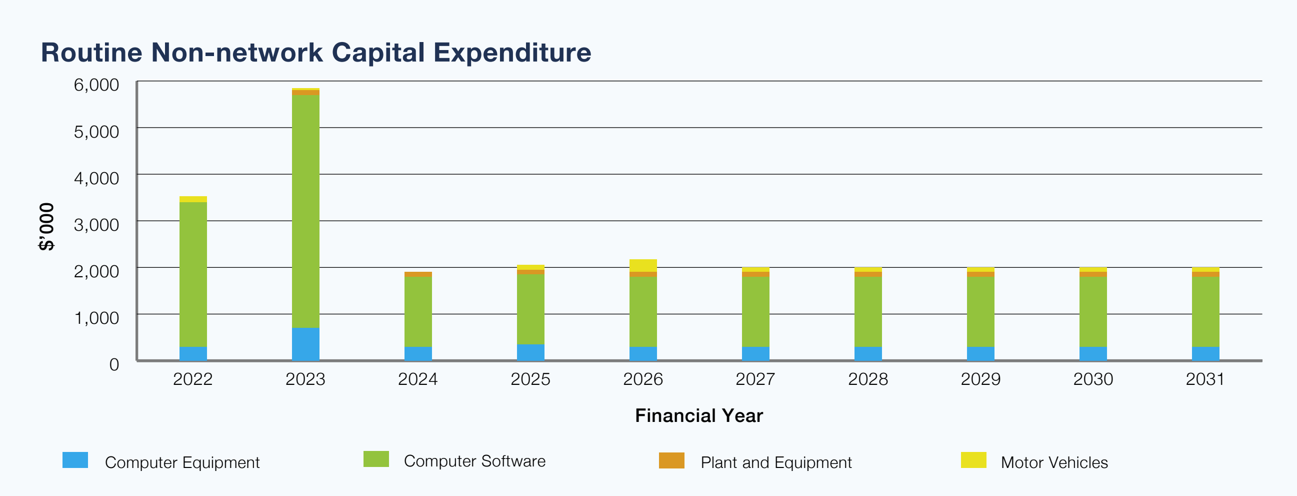

Figure 9.2.8.1: 10 year Routine Non-network Capital Expenditure

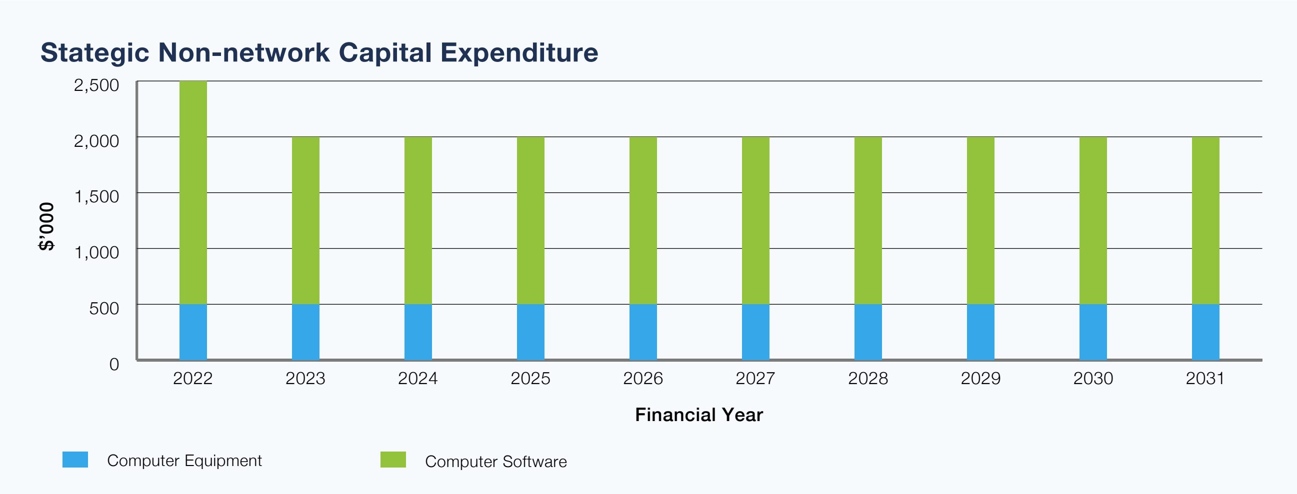

Figure 9.2.8.2: 10 year Strategic (atypical) Non-network Capital Expenditure

9.3 OPERATIONAL EXPENDITURE

This Section provides an overall summary of the forecast operational expenditure by category.

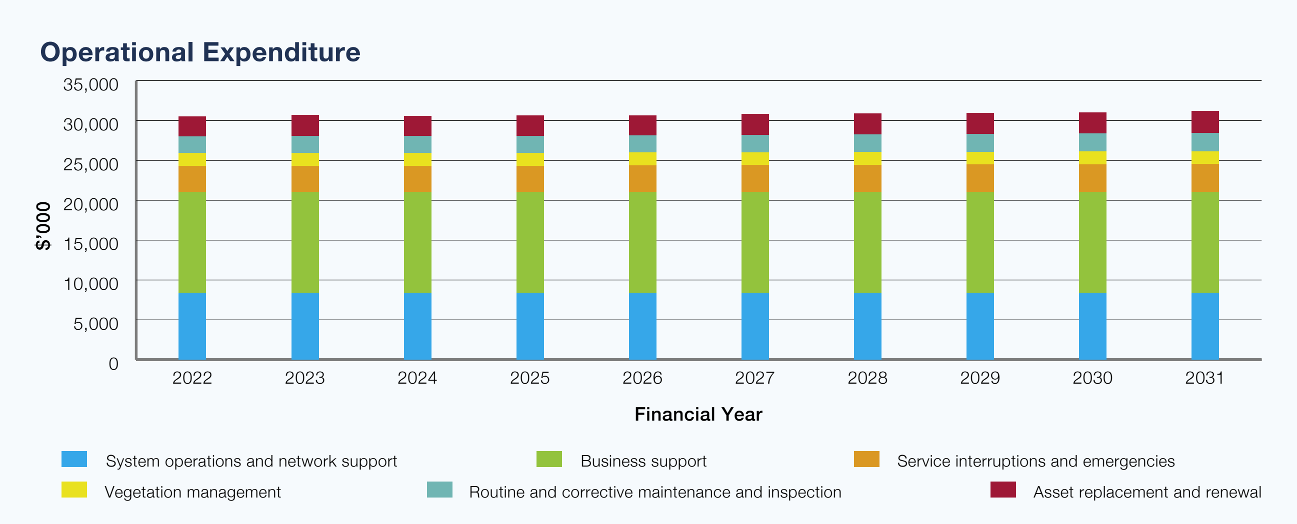

Figure 9.3.1: 10 year Operational Expenditure

9.3.1 Network Operational Expenditure Summary

The expenditure is shown according to the regulatory categories specified by the Commerce Commission.

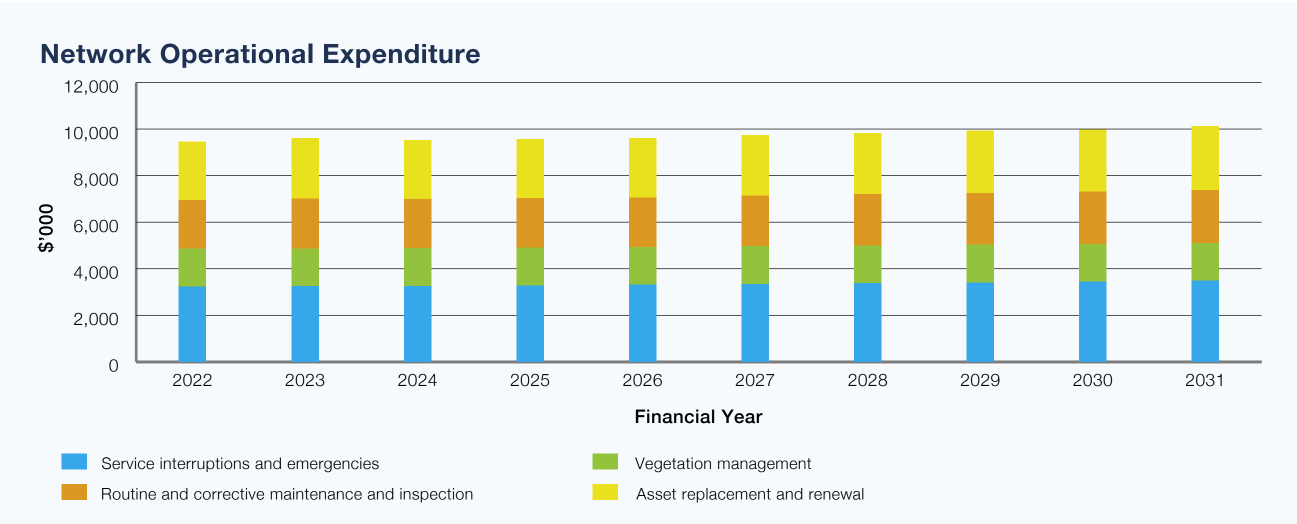

Figure 9.3.1.1: 10 year Network Operational Expenditure

9.3.2 Non-network Operational Expenditure

The breakdown of non-network operational expenditure by Commerce Commission expenditure category is summarised below.

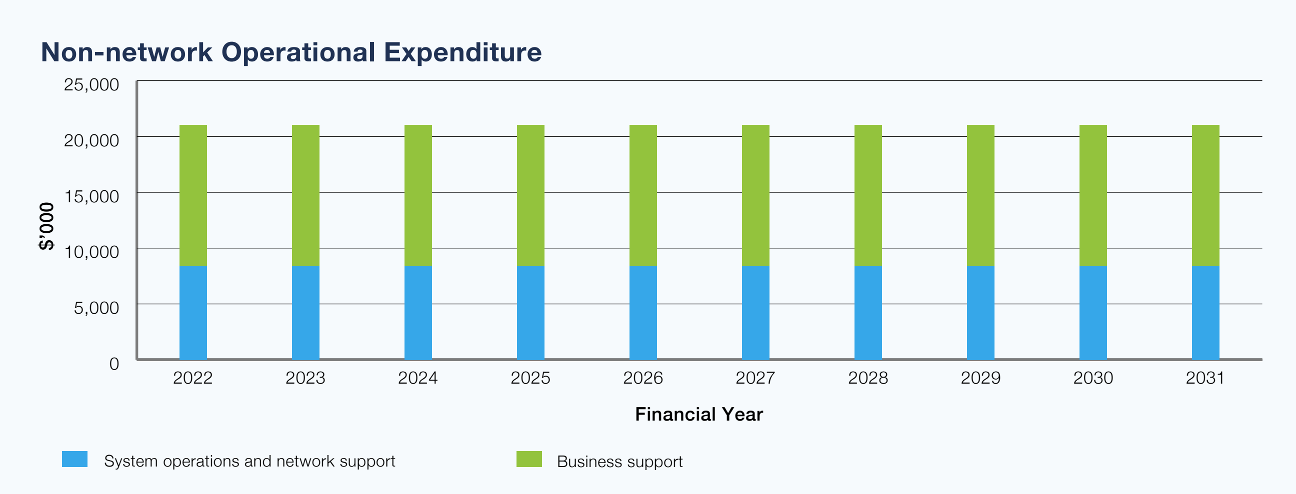

Figure 9.3.2.1: 10 year Non-network Operational Expenditure


CB5017
MSA
MSA
SEL

10

INFORMATION DISCLOSURE SCHEDULES 11A–13

Schedule 11a: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name Wel Networks

AMP Planning Period 1 April 2021 - 31 March 2031

Search ref

7		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8	*For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
9	**11a(i): Expenditure on Assets Forecast**	*$000 (in nominal dollars)*										
10	Consumer connection	14,451	14,041	15,364	16,331	17,123	17,164	17,103	17,823	18,829	18,903	18,819
11	System growth	7,738	2,539	3,635	5,077	4,212	3,594	4,833	4,896	4,039	4,047	4,108
12	Asset replacement and renewal	15,642	12,650	12,513	13,119	13,462	13,814	14,175	14,660	15,284	15,978	16,816
13	Asset relocations	4,396	5,123	4,579	4,671	4,764	4,859	4,957	5,056	5,157	5,260	5,365
14	Reliability, safety and environment:											
15	Quality of supply	520	510	520	584	704	828	901	919	996	1,076	1,097
16	Legislative and regulatory	832	761	472	-	809	938	676	-	-	-	-
17	Other reliability, safety and environment	1,450	3,671	3,846	2,548	1,749	2,059	1,751	2,045	2,589	2,820	3,121
18	**Total reliability, safety and environment**	**2,802**	**4,942**	**4,839**	**3,132**	**3,262**	**3,826**	**3,328**	**2,964**	**3,585**	**3,896**	**4,218**
19	**Expenditure on network assets**	**45,030**	**39,294**	**40,929**	**42,330**	**42,823**	**43,257**	**44,396**	**45,398**	**46,894**	**48,084**	**49,326**
20	Expenditure on non-network assets	6,210	6,140	8,162	4,139	4,384	4,604	4,513	4,603	4,695	4,789	4,885
21	**Expenditure on assets**	**51,239**	**45,435**	**49,091**	**46,468**	**47,207**	**47,861**	**48,909**	**50,001**	**51,589**	**52,872**	**54,211**
22												
23	plus Cost of financing	-	-	-	-	-	-	-	-	-	-	-
24	less Value of capital contributions	6,951	6,823	7,406	7,273	7,459	7,599	7,556	7,489	7,599	7,775	7,742
25	plus Value of vested assets	-	-	-	-	-	-	-	-	-	-	-
26												
27	**Capital expenditure forecast**	**44,288**	**38,612**	**41,685**	**39,195**	**39,748**	**40,262**	**41,352**	**42,511**	**43,989**	**45,097**	**46,469**
28												
29	Assets commissioned	43,883	38,896	41,531	39,319	39,720	40,236	41,298	42,453	43,915	45,042	46,400

Schedule 11a: Report On Forecast Capital Expenditure

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This information is not part of audited disclosure information.

Company Name
Wel Networks

AMP Planning Period
1 April 2021 - 31 March 2031

Search ref												
30		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
31	*For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
32		*$000 (in constant prices)*										
33	Consumer connection	14,451	13,766	14,767	15,389	15,819	15,546	15,187	15,516	16,070	15,817	15,438
34	System growth	7,738	2,489	3,493	4,785	3,891	3,255	4,292	4,262	3,447	3,386	3,370
35	Asset replacement and renewal	15,642	12,402	12,027	12,362	12,437	12,512	12,587	12,762	13,045	13,370	13,795
36	Asset relocations	4,396	5,023	4,401	4,401	4,401	4,401	4,401	4,401	4,401	4,401	4,401
37	Reliability, safety and environment:											
38	Quality of supply	520	500	500	550	650	750	800	800	850	900	900
39	Legislative and regulatory	832	746	454	-	747	850	600	-	-	-	-
40	Other reliability, safety and environment	1,450	3,599	3,697	2,401	1,616	1,865	1,555	1,780	2,210	2,360	2,560
41	**Total reliability, safety and environment**	**2,802**	**4,845**	**4,651**	**2,951**	**3,013**	**3,465**	**2,955**	**2,580**	**3,060**	**3,260**	**3,460**
42	**Expenditure on network assets**	**45,030**	**38,524**	**39,339**	**39,888**	**39,561**	**39,179**	**39,423**	**39,521**	**40,023**	**40,234**	**40,465**
43	Expenditure on non-network assets	6,210	6,020	7,845	3,900	4,050	4,170	4,007	4,007	4,007	4,007	4,007
44	**Expenditure on assets**	**51,239**	**44,544**	**47,184**	**43,788**	**43,611**	**43,349**	**43,430**	**43,528**	**44,030**	**44,241**	**44,472**
45												
46	**Subcomponents of Expenditure on Assets (where known)**											
47	Energy efficiency and demand side management, reduction of energy losses	370	-	-	-	-	-	-	-	-	-	-
48	Overhead to underground conversion	4,089	5,023	4,401	4,401	4,401	4,401	4,401	4,401	4,401	4,401	4,401
49	Research and development	-	-	-	-	-	-	-	-	-	-	-
50												

Schedule 11a: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

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Company Name Wel Networks

AMP Planning Period 1 April 2021 - 31 March 2031

Search ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
52	*For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
53	**Difference Between Nominal and Constant Price Forecasts**	*$000*										
54	Consumer connection	-	275	597	942	1,304	1,618	1,916	2,307	2,759	3,086	3,381
55	System growth	-	50	142	293	321	339	541	634	592	661	738
56	Asset replacement and renewal	-	248	486	757	1,025	1,302	1,588	1,898	2,239	2,608	3,021
57	Asset relocations	-	100	178	270	363	458	555	654	756	859	964
58	Reliability, safety and environment:											
59	Quality of supply	-	10	20	34	54	78	101	119	146	176	197
60	Legislative and regulatory	-	15	18	-	62	88	76	-	-	-	-
61	Other reliability, safety and environment	-	72	149	147	133	194	196	265	379	460	561
62	**Total reliability, safety and environment**	**-**	**97**	**188**	**181**	**248**	**361**	**373**	**384**	**525**	**636**	**758**
63	**Expenditure on network assets**	**-**	**770**	**1,590**	**2,442**	**3,262**	**4,078**	**4,974**	**5,876**	**6,870**	**7,849**	**8,862**
64	Expenditure on non-network assets	-	120	317	239	334	434	506	596	688	782	878
65	**Expenditure on assets**	**-**	**890**	**1,907**	**2,680**	**3,596**	**4,512**	**5,479**	**6,472**	**7,558**	**8,631**	**9,739**
66												
67		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5					
68	**11a(ii): Consumer Connection** *For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**					
69	Consumer types defined by EDB*	*$000 (in constant prices)*										
70	Residential Customers	12,251	10,556	11,278	11,745	12,172	11,998					
71	Business Customers	1,530	352	488	498	474	461					
72	Large Customers - Low Voltage 400V	670	2,857	3,001	3,146	3,174	3,087					
73	Large Customers - Medium Voltage 11kV	-	-	-	-	-	-					
74	Large Customers - High Voltage 33kV	-	-	-	-	-	-					
75	**include additional rows if needed*											
76	**Consumer connection expenditure**	**14,451**	**13,766**	**14,767**	**15,389**	**15,819**	**15,546**					
77	less Capital contributions funding consumer connection	3,740	3,754	3,556	3,818	3,978	4,092					
78	**Consumer connection less capital contributions**	**10,711**	**10,012**	**11,211**	**11,572**	**11,841**	**11,454**					
79	**11a(iii): System Growth**											
80	Subtransmission	2,566	1,654	1,808	2,235	510	1,288					
81	Zone substations	4,188	55	-	1,530	1,237	100					
82	Distribution and LV lines	-	-	-	-	-	-					
83	Distribution and LV cables	985	780	1,684	1,020	2,144	1,867					
84	Distribution substations and transformers	-	-	-	-	-	-					
85	Distribution switchgear	-	-	-	-	-	-					
86	Other network assets	-	-	-	-	-	-					
87	**System growth expenditure**	**7,738**	**2,489**	**3,493**	**4,785**	**3,891**	**3,255**					
88	Less Capital contributions funding system growth											
89	**System growth less capital contributions**	**7,738**	**2,489**	**3,493**	**4,785**	**3,891**	**3,255**					
90												

Schedule 11a: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name
Wel Networks

AMP Planning Period
1 April 2021 - 31 March 2031

Search ref							
91		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
92		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
93	**11a(iv): Asset Replacement and Renewal**	*$000 (in constant prices)*					
94	Subtransmission	860	310	309	311	313	315
95	Zone substations	1,015	140	140	400	400	400
96	Distribution and LV lines	8,595	7,061	6,863	6,904	6,945	6,986
97	Distribution and LV cables	1,359	788	784	790	795	801
98	Distribution substations and transformers	1,015	1,437	1,429	1,439	1,449	1,459
99	Distribution switchgear	2,138	2,177	1,917	1,930	1,943	1,957
100	Other network assets	660	488	586	589	592	595
101	**Asset replacement and renewal expenditure**	**15,642**	**12,402**	**12,027**	**12,362**	**12,437**	**12,512**
102	less capital contributions funding asset replacement and renewal	656	575	587	598	610	621
103	**Asset replacement and renewal less capital contributions**	**14,987**	**11,827**	**11,441**	**11,764**	**11,828**	**11,891**
104							
105		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
106		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
107	**11a(v): Asset Relocations**						
108	*Project or programme**	*$000 (in constant prices)*					
109	Undergrounding	-	500	500	500	500	500
110	Other Relocations	2,396	-	2,401	3,901	3,901	3,901
111	Peacockes Development	1,500	2,000	1,500	-	-	-
112	Hamilton City Council	500	1,023	-	-	-	-
113	Chedworth Properties (Spine Road)	-	1,500	-	-	-	-
114		-	-	-	-	-	-
115		-	-	-	-	-	-
116	**include additional rows if needed*						
117	All other project or programmes - asset relocations						
118	**Asset relocations expenditure**	**4,396**	**5,023**	**4,401**	**4,401**	**4,401**	**4,401**
119	less capital contributions funding asset relocations	2,556	2,483	3,240	2,821	2,821	2,821
120	**Asset relocations less capital contributions**	**1,840**	**2,541**	**1,161**	**1,580**	**1,580**	**1,580**
121							

Schedule 11a: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name Wel Networks

AMP Planning Period 1 April 2021 - 31 March 2031

Search ref							
122		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
123		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
124	**11a(vi): Quality of Supply**						
125	Project or programme*	*$000 (in constant prices)*					
126	Network Work Upgrade Due To DG applications	20	-	-	-	-	-
127	Distribution Transformer and LV Feeder Upgrade projects Identified vis Smart Meters	500	500	500	550	650	750
128							
129							
130							
131	**include additional rows if needed*						
132	All other projects or programmes - quality of supply						
133	**Quality of supply expenditure**	**520**	**500**	**500**	**550**	**650**	**750**
134	less capital contributions funding quality of supply						
135	**Quality of supply less capital contributions**	**520**	**500**	**500**	**550**	**650**	**750**
136							
137		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
138		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
139	**11a(vii): Legislative and Regulatory**						
140	*Project or programme**	*$000 (in constant prices)*					
141	AUFLS scheme changes	-	-	-	-	137	-
142	NER protection changes through TWH Network	-	130	454	-	-	-
143	Seismic upgrades of substations	472	616	-	-	610	850
144							
145	**include additional rows if needed*						
146	All other projects or programmes - legislative and regulatory	360	-	-	-	-	-
147	**Legislative and regulatory expenditure**	**832**	**746**	**454**	**-**	**747**	**850**
148	Less capital contributions funding legislative and regulatory						
149	**Legislative and regulatory less capital contributions**	**832**	**746**	**454**	**-**	**747**	**850**
150							

Schedule 11a: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name
Wel Networks

AMP Planning Period
1 April 2021 - 31 March 2031

Search ref							
151		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
152	**11a(viii): Other Reliability, Safety and Environment**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
153	Project or programme*	*$000 (in constant prices)*					
154	Air-conditioning for substations	101	-	-	101	110	100
155	CBD IOT Fault Indication	-	47	63	63	-	-
156	Confined spaces	201	68	126	210	-	210
157	Distribution System Operator enabling	-	-	175	250	250	300
158	Fibre installation (Discretionary)	50	51	51	51	55	55
159	Fibre routes	270	252	149	350	250	300
160	Garden Place Switching Station Bypass	778	864	-	-	-	-
161	Gordonton Zone Substation Upgrade	-	1,556	627	-	-	-
162	LV Visibility	-	-	-	175	200	250
163	Massey	-	700	686	-	-	-
164	Multi Circuit Rationalisation	-	-	-	-	-	-
165	Network Reliability Project	-	61	400	530	650	650
166	Substation Door Upgrade	51	-	-	51	51	-
167	Te Uku Zone Substation Upgrade	-	-	1,420	620	50	-
168	Zone Substation Oil Containment	-	-	-	-	-	-
169	**include additional rows if needed*						
170	All other projects or programmes - other reliability, safety and environment						
171	**Other reliability, safety and environment expenditure**	**1,450**	**3,599**	**3,697**	**2,401**	**1,616**	**1,865**
172	less capital contributions funding other reliability, safety and environment						
173	**Other reliability, safety and environment less capital contributions**	**1,450**	**3,599**	**3,697**	**2,401**	**1,616**	**1,865**
174							

Schedule 11a: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name Wel Networks

AMP Planning Period 1 April 2021 - 31 March 2031

Search ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
176		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
177	**11a(ix): Non-network Assets**						
178	Routine expenditure						
179	*Project or programme**	*$000 (in constant prices)*					
180	Computer Equipment	575	300	700	300	350	300
181	Computer Software	1,655	3,000	5,000	1,500	1,500	1,500
182	Plant and Equipment	100	100	100	100	100	100
183	Motor Vehicles	295	120	45	-	100	270
184							
185	**include additional rows if needed*						
186	All other projects or programmes - routine expenditure						
187	**Routine expenditure**	**2,625**	**3,520**	**5,845**	**1,900**	**2,050**	**2,170**
188	**Atypical expenditure**						
189	*Project or programme**						
190							
191							
188							
189							
190							
191	**include additional rows if needed*						
192	All other projects or programmes - atypical expenditure	3,585	2,500	2,000	2,000	2,000	2,000
193	**Atypical expenditure**	**3,585**	**2,500**	**2,000**	**2,000**	**2,000**	**2,000**
194							
195	**Expenditure on non-network assets**	**6,210**	**6,020**	**7,845**	**3,900**	**4,050**	**4,170**

Schedule 11b: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.

EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name: Wel Networks
AMP Planning Period: 1 April 2021 - 31 March 2031

Search ref

7		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8	*For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
9	**Operational Expenditure Forecast**	*$000 (in nominal dollars)*										
10	Service interruptions and emergencies	3,163	3,296	3,379	3,464	3,550	3,658	3,768	3,881	3,999	4,119	4,245
11	Vegetation management	1,596	1,665	1,681	1,715	1,749	1,784	1,820	1,856	1,893	1,931	1,970
12	Routine and corrective maintenance and inspection	3,660	2,092	2,157	2,112	2,129	2,129	2,177	2,201	2,225	2,241	2,286
13	Asset replacement and renewal	749	2,503	2,582	2,527	2,547	2,547	2,605	2,634	2,663	2,682	2,735
14	**Network opex**	**9,168**	**9,555**	**9,800**	**9,818**	**9,976**	**10,118**	**10,370**	**10,573**	**10,780**	**10,974**	**11,235**
15	System operations and network support	9,741	8,538	8,709	8,883	9,061	9,242	9,427	9,616	9,808	10,004	10,204
16	Business support	12,004	12,927	13,186	13,450	13,719	13,993	14,273	14,558	14,850	15,147	15,449
17	**Non-network opex**	**21,745**	**21,466**	**21,895**	**22,333**	**22,780**	**23,235**	**23,700**	**24,174**	**24,658**	**25,151**	**25,654**
18	**Operational expenditure**	**30,913**	**31,021**	**31,695**	**32,151**	**32,755**	**33,353**	**34,070**	**34,747**	**35,438**	**36,124**	**36,889**
19		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
20		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
21		*$000 (in constant prices)*										
22	Service interruptions and emergencies	3,163	3,231	3,248	3,264	3,280	3,313	3,346	3,379	3,413	3,447	3,482
23	Vegetation management	1,596	1,632	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616
24	Routine and corrective maintenance and inspection	3,660	2,092	2,157	2,112	2,129	2,129	2,177	2,201	2,225	2,241	2,286
25	Asset replacement and renewal	749	2,503	2,582	2,527	2,547	2,547	2,605	2,634	2,663	2,682	2,735
26	**Network opex**	**9,168**	**9,458**	**9,603**	**9,519**	**9,572**	**9,605**	**9,744**	**9,830**	**9,917**	**9,986**	**10,119**
27	System operations and network support	9,741	8,371	8,371	8,371	8,371	8,371	8,371	8,371	8,371	8,371	8,371
28	Business support	12,004	12,674	12,674	12,674	12,674	12,674	12,674	12,674	12,674	12,674	12,674
29	**Non-network opex**	**21,745**	**21,045**	**21,045**	**21,045**	**21,045**	**21,045**	**21,045**	**21,045**	**21,045**	**21,045**	**21,045**
30	**Operational expenditure**	**30,913**	**30,503**	**30,648**	**30,564**	**30,617**	**30,650**	**30,789**	**30,875**	**30,962**	**31,031**	**31,164**
31	**Subcomponents of Operational Expenditure (where known)**											
32	Energy efficiency and demand side management, reduction of energy losses	235	223	223	223	223	223	223	223	223	223	223
33	Direct billing*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	Research and development	-	73	73	73	73	73	73	73	73	73	73
35	Insurance	616	717	740	750	760	770	770	770	770	770	770
36	** Direct billing expenditure by suppliers that direct bill the majority of their consumers*											
37												
38												

Schedule 11b: Report On Forecast Capital Expenditure

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.

EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

Company Name: Wel Networks
AMP Planning Period: 1 April 2021 - 31 March 2031

Search ref

39		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
40		**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
41	**Difference Between Nominal and Real Forecasts**	*$000*										
42	Service interruptions and emergencies	-	65	131	200	270	345	422	502	586	672	763
43	Vegetation management	-	33	65	99	133	168	204	240	277	315	354
44	Routine and corrective maintenance and inspection	-	-	-	-	-	-	-	-	-	-	-
45	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
46	**Network opex**	**-**	**97**	**197**	**299**	**404**	**513**	**626**	**743**	**863**	**988**	**1,116**
47	System operations and network support	-	167	338	512	690	871	1,056	1,245	1,437	1,633	1,833
48	Business support	-	253	512	776	1,045	1,319	1,599	1,884	2,176	2,473	2,776
49	**Non-network opex**	**-**	**421**	**850**	**1,288**	**1,735**	**2,190**	**2,655**	**3,129**	**3,613**	**4,106**	**4,609**
50	**Operational expenditure**	**-**	**518**	**1,047**	**1,587**	**2,138**	**2,703**	**3,281**	**3,872**	**4,476**	**5,093**	**5,725**

Schedule 12a: Report On Asset Condition

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

Company Name	Wel Networks
AMP Planning Period	1 April 2021 - 31 March 2031

Search ref

					Asset condition at start of planning period (percentage of units by grade)							
7												
8												
9	**Voltage**	**Asset Category**	**Asset Class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade Unknown**	**Data Accuracy (1–4)**	**% of Asset Forecast to be Replaced in next 5 years**
10	All	Overhead Line	Concrete poles / steel structure	No.	0.02%	0.12%	0.88%	7.80%	85.98%	5.21%	3	16.69%
11	All	Overhead Line	Wood poles	No.	0.11%	0.66%	4.76%	8.63%	81.85%	3.98%	3	41.08%
12	All	Overhead Line	Other pole types	No.	-	-	-	-	-	-	N/A	-
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km	-	-	-	56.18%	43.82%	-	1	-
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km	-	-	-	-	-	-	N/A	-
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km	-	-	2.00%	11.15%	86.85%	-	1	-
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km	-	-	-	-	-	-	N/A	-
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km	-	-	-	-	-	-	N/A	-
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km	-	-	-	3.43%	96.57%	-	1	-
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km	-	-	-	-	-	-	N/A	-
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km	-	-	-	-	-	-	N/A	-
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km	-	-	-	-	-	-	N/A	-
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km	-	-	-	-	-	-	N/A	-
23	HV	Subtransmission Cable	Subtransmission submarine cable	km	-	-	-	-	-	-	N/A	-
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.	-	-	12.90%	67.74%	19.35%	-	4	-
25	HV	Zone substation Buildings	Zone substations 110kV+	No.	-	-	-	-	-	-	N/A	-
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	-	-	-	-	100.00%	-	4	-
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.	-	-	6.06%	6.06%	87.88%	-	4	-
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.	-	-	-	-	-	-	N/A	-
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.	-	-	-	-	100.00%	-	4	-
30	HV	Zone substation switchgear	33kV RMU	No.	-	-	-	16.67%	83.33%	-	4	-
31	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.	-	-	-	-	-	-	N/A	-
32	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.	-	-	-	-	-	-	N/A	-
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	-	-	-	-	-	-	N/A	-
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.	-	-	-	-	-	-	N/A	-
35												

Schedule 12a: Report On Asset Condition

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

Company Name Wel Networks
AMP Planning Period 1 April 2021 - 31 March 2031

Search ref

36					Asset condition at start of planning period (percentage of units by grade)							
37												
38	**Voltage**	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.	-	-	-	18.37%	81.63%	-	3	-
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km	-	0.01%	1.54%	13.08%	85.36%	-	3	2.97%
41	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km	-	-	-	-	-	-	N/A	-
42	HV	Distribution Line	SWER conductor	km	-	-	-	-	-	-	N/A	-
43	HV	Distribution Cable	Distribution UG XLPE or PVC	km	-	-	12.52%	12.12%	75.36%	-	1	-
44	HV	Distribution Cable	Distribution UG PILC	km	-	-	-	47.26%	52.74%	-	1	-
45	HV	Distribution Cable	Distribution Submarine Cable	km	-	-	-	-	-	-	N/A	-
46	HV	Distribution Switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	-	-	-	0.57%	99.43%	-	4	35.20%
47	HV	Distribution Switchgear	3.3/6.6/11/22kV CB (Indoor)	No.	-	1.59%	10.23%	6.82%	81.36%	-	4	11.09%
48	HV	Distribution Switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	0.02%	0.10%	2.27%	7.15%	90.47%	-	4	1.39%
49	HV	Distribution Switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.	-	-	-	-	-	-	N/A	-
50	HV	Distribution Switchgear	3.3/6.6/11/22kV RMU	No.	-	-	1.67%	14.20%	84.13%	-	4	3.55%
51	HV	Distribution Transformer	Pole Mounted Transformer	No.	-	0.17%	3.53%	20.59%	75.71%	-	3	5.49%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.	-	0.15%	4.62%	21.90%	73.33%	-	3	4.85%
53	HV	Distribution Transformer	Voltage regulators	No.	-	-	-	-	100.00%	-	4	9.09%
54	HV	Distribution Substations	Ground Mounted Substation Housing	No.	-	-	-	-	-	-	N/A	-
55	LV	LV Line	LV OH Conductor	km	-	0.05%	1.61%	10.76%	87.58%	-	1	-
56	LV	LV Cable	LV UG Cable	km	-	-	21.90%	35.34%	42.76%	-	1	-
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km	-	0.65%	8.90%	8.04%	82.41%	-	1	-
58	LV	Connections	OH/UG consumer service connections	No.	-	-	-	-	-	-	N/A	-
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	2.36%	15.63%	1.77%	80.24%	-	3	9.99%
60	All	SCADA and Communications	SCADA and communications equipment operating as a single system	Lot	-	-	5.18%	-	94.82%	-	3	3.03%
61	All	Capacitor Banks	Capacitors including controls	No.	-	-	-	-	100.00%	-	4	-
62	All	Load Control	Centralised plant	Lot	-	-	-	-	100.00%	-	3	-
63	All	Load Control	Relays	No.	-	-	-	-	-	-	N/A	-
64	All	Civils	Cable Tunnels	km	-	-	-	-	-	-	N/A	-

Schedule 12b: Report On Forecast Capacity

This schedule requires a breakdown of current and forecast capacity and utilisation for each zone substation and current distribution transformer capacity. The data provided should be consistent with the information provided in the AMP. Information provided in this table should relate to the operation of the network in its normal steady state configuration.

Company Name Wel Networks

AMP Planning Period 1 April 2021 - 31 March 2031

Search ref

7 **12b(i): System Growth - Zone Substations**

8	Existing Zone Substations	Current Peak Load (MVA)	Installed Firm Capacity (MVA)	Security of Supply Classification (type)	Transfer Capacity (MVA)	Utilisation of Installed Firm Capacity %	Installed Firm Capacity +5 years (MVA)	Utilisation of Installed Firm Capacity + 5yrs %	Installed Firm Capacity Constraint +5 years (cause)	Explanation
9	Avalon Dr	18.0	23.8	N-1	12	76%	23.8	80%	No constraint within +5 years	
10	Borman	17.4	20.6	N-1	16	84%	20.6	95%	No constraint within +5 years	Limited by the 33kV OH conductor.
11	Bryce St	16.1	22.9	N-1	14	70%	22.9	79%	No constraint within +5 years	
12	Chartwell	15.6	25.9	N-1	15	60%	25.9	64%	No constraint within +5 years	
13	Claudelands	19.6	22.9	N-1	20	86%	22.9	90%	No constraint within +5 years	
14	Cobham	11.7	25.9	N-1	11	45%	25.9	52%	No constraint within +5 years	
15	Finlayson Rd	3.2	-	N	4	-	-	-	No constraint within +5 years	
16	Glasgow St	7.6	-	N	8	-	-	-	No constraint within +5 years	
17	Gordonton	7.1	5.0	N	7	142%	5.0	146%	Transformer	Meets WEL network security criteria
18	Hampton Downs	1.7	-	N	2	-	-	-	No constraint within +5 years	
19	Hoeka Rd	7.5	-	N	10	-	-	-	No constraint within +5 years	
20	Horotiu	13.4	18.0	N-1	11	74%	18.0	105%	No constraint within +5 years	New substation planned to support industrial development
21	Kent St	16.2	22.9	N-1	18	71%	22.9	72%	No constraint within +5 years	
22	Latham Court	17.6	22.9	N-1	13	77%	22.9	78%	No constraint within +5 years	
23	Ngaruawahia	5.5	7.5	N-1	6	73%	7.5	92%	No constraint within +5 years	
24	Peacockes Rd	16.2	25.9	N-1	12	63%	25.9	82%	No constraint within +5 years	
25	Pukete - Anchor	18.9	30.0	N-1	18	63%	30.0	63%	No constraint within +5 years	3-winding TX - owned Contact Energy.
26	Pukete - WEL's 11kV	10.5	12.6	N-1	10	83%	12.6	95%	No constraint within +5 years	3-winding TX - owned Contact Energy.
27	Raglan	5.1	-	N	3	-	-	-	No constraint within +5 years	Transfer capacity is limited due to voltage constraints.
28	Sandwich Rd	20.4	28.2	N-1	19	72%	28.2	75%	No constraint within +5 years	
29	Tasman	21.4	30.0	N-1	20	71%	30.0	86%	No constraint within +5 years	New substation planned to support Industrial and residential development
30	Te Kauwhata	5.3	10.0	N-1	5	53%	10.0	59%	No constraint within +5 years	
31	Te Uku	2.0	5.0	N	2	40%	5.0	46%	No constraint within +5 years	
32	Wallace Rd	10.4	30.0	N-1	12	35%	30.0	37%	No constraint within +5 years	
33	Weavers	8.9	9.0	N-1	9	99%	9.0	122%	Transformer	Load can be transferred to the adjacent Glasgow St Substation in the event of a transformer outage
34	Whatawhata	4.4	-	N	4	-	-	-	No constraint within +5 years	
35										

Schedule 12c: Report On Forecast Network Demand

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

Company Name: Wel Networks
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Search ref

7	**12c(i): Consumer Connections**						
8	*Number of ICPs connected in year by consumer type*						
9		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
10	*For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
11	*Consumer types defined by EDB**						
12	Residential customers	1,527	1,313	1,300	1,300	1,300	1,300
13	Business customers	89	140	150	150	150	150
	Large customers - Low Voltage 400V	51	20	20	20	20	20
	Large customers - Medium Voltage 11kV	(5)	1	1	1	1	1
14	Large customers - High Voltage 33kV	-	-	-	-	-	-
15	Asset specific customers	-	-	-	-	-	-
16	Unmetered customers	1	-	-	-	-	-
17	**Connections total**	**1,663**	**1,474**	**1,471**	**1,471**	**1,471**	**1,471**
18	**include additional rows if needed*						
19	**Distributed Generation**						
20	Number of connections	195	250	300	350	400	450
21	Capacity of distributed generation installed in year (MVA)	1	1	1	2	2	2

Schedule 12c: Report On Forecast Network Demand

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

Company Name: Wel Networks
AMP Planning Period: 1 April 2021 - 31 March 2031

Search ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
22	**12c(ii) System Demand**						
24	Maximum coincident system demand (MW) — *For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
25	GXP demand	183	224	233	238	243	251
26	plus distributed generation output at HV and above	96	50	50	50	50	50
27	**Maximum coincident system demand**	**279**	**274**	**283**	**288**	**293**	**301**
28	less net transfers to (from) other EDBs at HV and above						
29	**Demand on system for supply to consumers' connection points**	**279**	**274**	**283**	**288**	**293**	**301**
30	**Electricity Volumes Carried (GWh)**						
31	Electricity supplied from GXPs	950	1,061	1,103	1,146	1,189	1,233
32	less electricity exports to GXPs	90	80	78	75	73	71
33	plus electricity supplied from distributed generation	440	436	437	439	439	439
34	less net electricity supplied to (from) other EDBs	(15)	(15)	(15)	(15)	(15)	(15)
35	**Electricity entering system for supply to ICPs**	**1,315**	**1,432**	**1,478**	**1,524**	**1,570**	**1,616**
36	less total energy delivered to ICPs	1,262	1,375	1,419	1,464	1,508	1,552
37	**Losses**	**53**	**57**	**58**	**60**	**62**	**64**
38							
39	**Load factor**	**54%**	**60%**	**60%**	**60%**	**61%**	**61%**
40	**Loss ratio**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**

Schedule 12d: Report Forecast Interruptions And Duration

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned and unplanned SAIFI and SAIDI on the expenditures forecast provided in Schedule 11a and Schedule 11b.

Company Name: Wel Networks
AMP Planning Period: 1 April 2021 - 31 March 2031

Search ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
9	*For year ended*	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	60.0	64.0	65.5	67.0	68.0	68.0
12	Class C (unplanned interruptions on the network)	61.2	59.4	58.4	57.5	56.6	56.5
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.30	0.41	0.42	0.43	0.43	0.43
15	Class C (unplanned interruptions on the network)	1.00	0.99	0.97	0.96	0.94	0.94

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	3	WEL's Asset Management Policy is reviewed every three years with the last update in Feburary 2019. It is used to guide the development and delivery of the AMP. All key staff are aware of the Asset Management Policy and how it guides the AMP.		Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it.	Top management. The management team that has overall responsibility for asset management.	
10	Asset management strategy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	2.5	There are strong linkage to company strategy and evidence of alignment with other organisational strategies. The flow of Strategic Goals into the AM Strategy is being documented but is not finalised.		In setting an organisation's asset management strategy, it is important that it is consistent with any other policies and strategies that the organisation has and has taken into account the requirements of relevant stakeholders. This question examines to what extent the asset management strategy is consistent with other organisational policies and strategies (eg, as required by PAS 55 para 4.3.1 b) and has taken account of stakeholder requirements as required by PAS 55 para 4.3.1 c). Generally, this will take into account the same polices, strategies and stakeholder requirements as covered in drafting the asset management policy but at a greater level of detail.	Top management. The organisation's strategic planning team. The management team that has overall responsibility for asset management.	
11	Asset management strategy	In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	3	WEL have a number of tools to evaluate asset lifecycle, the most significant being condition based risk modeling (CBRM). This applies from each asset's initial purchase, taking into account total life cycle costs, condition and risk information which determines the overall health of the assets.		Good asset stewardship is the hallmark of an organisation compliant with widely used AM standards. A key component of this is the need to take account of the lifecycle of the assets, asset types and asset systems. (For example, this requirement is recognised in 4.3.1 d) of PAS 55). This question explores what an organisation has done to take lifecycle into account in its asset management strategy.	Top management. People in the organisation with expert knowledge of the assets, asset types, asset systems and their associated life-cycles. The management team that has overall responsibility for asset management. Those responsible for developing and adopting methods and processes used in asset management	
26	Asset management plan(s)	How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems?	3	Asset lifecycle decisions are made using CBRM and FMECA to priorities based on risk, reliability and safety considerations and balance capital and operational expenditure. Planning falls directly out of the AMP, which prioritises spend based on lifecycle condition.		The asset management strategy needs to be translated into practical plan(s) so that all parties know how the objectives will be achieved. The development of plan(s) will need to identify the specific tasks and activities required to optimise costs, risks and performance of the assets and/or asset system(s), when they are to be carried out and the resources required.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers.	
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	3	The AMP and its projects and maintenance spend plan are communicated and approved through our project definition documents. Spend plans and a high level overview of the plan are presented to the executive and the board prior to final approval. This information goes to those stakeholders who require the information for work and strategy planning purposes and directly to external parties as required by Regulation. The AMP is also available to all through the company intranet.		Plans will be ineffective unless they are communicated to all those, including contracted suppliers and those who undertake enabling function(s). The plan(s) need to be communicated in a way that is relevant to those who need to use them.	The management team with overall responsibility for the asset management system. Delivery functions and suppliers.	

Company Name Wel Networks **AMP Planning Period** 1 April 2021 - 31 March 2031 **Asset Management Standard Applied**

Record/Documented Information	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication.	The organisation does not have a documented asset management policy.	The organisation has an asset management policy, but it has not been authorised by top management, or it is not influencing the management of the assets.	The organisation has an asset management policy, which has been authorised by top management, but it has had limited circulation. It may be in use to influence development of strategy and planning but its effect is limited.	The asset management policy is authorised by top management, is widely and effectively communicated to all relevant employees and stakeholders, and used to make these persons aware of their asset related obligations.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's asset management strategy document and other related organisational policies and strategies. Other than the organisation's strategic plan, these could include those relating to health and safety, environmental, etc. Results of stakeholder consultation.	The organisation has not considered the need to ensure that its asset management strategy is appropriately aligned with the organisation's other organisational policies and strategies or with stakeholder requirements. OR The organisation does not have an asset management strategy.	The need to align the asset management strategy with other organisational policies and strategies as well as stakeholder requirements is understood and work has started to identify the linkages or to incorporate them in the drafting of asset management strategy.	Some of the linkages between the long-term asset management strategy and other organisational policies, strategies and stakeholder requirements are defined but the work is fairly well advanced but still incomplete.	All linkages are in place and evidence is available to demonstrate that, where appropriate, the organisation's asset management strategy is consistent with its other organisational policies and strategies. The organisation has also identified and considered the requirements of relevant stakeholders.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's documented asset management strategy and supporting working documents.	The organisation has not considered the need to ensure that its asset management strategy is produced with due regard to the lifecycle of the assets, asset types or asset systems that it manages. OR The organisation does not have an asset management strategy.	The need is understood, and the organisation is drafting its asset management strategy to address the lifecycle of its assets, asset types and asset systems.	The long-term asset management strategy takes account of the lifecycle of some, but not all, of its assets, asset types and asset systems.	The asset management strategy takes account of the lifecycle of all of its assets, asset types and asset systems.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's asset management plan(s).	The organisation does not have an identifiable asset management plan(s) covering asset systems and critical assets.	The organisation has asset management plan(s) but they are not aligned with the asset management strategy and objectives and do not take into consideration the full asset life cycle (including asset creation, acquisition, enhancement, utilisation, maintenance decommissioning and disposal).	The organisation is in the process of putting in place comprehensive, documented asset management plan(s) that cover all life cycle activities, clearly aligned to asset management objectives and the asset management strategy.	Asset management plan(s) are established, documented, implemented and maintained for asset systems and critical assets to achieve the asset management strategy and asset management objectives across all life cycle phases.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication.	The organisation does not have plan(s) or their distribution is limited to the authors.	The plan(s) are communicated to some of those responsible for delivery of the plan(s). OR Communicated to those responsible for delivery is either irregular or ad-hoc.	The plan(s) are communicated to most of those responsible for delivery but there are weaknesses in identifying relevant parties resulting in incomplete or inappropriate communication. The organisation recognises improvement is needed as is working towards resolution.	The plan(s) are communicated to all relevant employees, stakeholders and contracted service providers to a level of detail appropriate to their participation or business interests in the delivery of the plan(s) and there is confirmation that they are being used effectively.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	3	The Asset Planning and Engineering Team are responsible facilitating the development of the AMP every year. To facilitate this, an annual works delivery plan is produced which in turn clearly defines the delivery responsibilities in terms of resource and timeline.		The implementation of asset management plan(s) relies on (1) actions being clearly identified, (2) an owner allocated and (3) that owner having sufficient delegated responsibility and authority to carry out the work required. It also requires alignment of actions across the organisation. This question explores how well the plan(s) set out responsibility for delivery of asset plan actions.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team.	
31	Asset management plan(s)	What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? (Note this is about resources and enabling support)	3	The annual works delivery plan outlines resource requirements based on agreed delivery timelines. Annual budgets are set to allow resource allocation. Arrangements are in place to source external staff for workload peaks and for specialist technical requirements.		It is essential that the plan(s) are realistic and can be implemented, which requires appropriate resources to be available and enabling mechanisms in place. This question explores how well this is achieved. The plan(s) not only need to consider the resources directly required and timescales, but also the enabling activities, including for example, training requirements, supply chain capability and procurement timescales.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team. Where appropriate the procurement team and service providers working on the organisation's asset-related activities.	
33	Contingency planning	What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities?	3	Business continuity and disaster recovery plans are in place and various scenarios are tested regularly. Emergency stock is held at various sites in case the primary equipment becomes unavailable. Priorities for systems to return to service after an event are documented. This is in alignment with WEL's Disaster Recovery Policy.		Widely used AM practice standards require that an organisation has plan(s) to identify and respond to emergency situations. Emergency plan(s) should outline the actions to be taken to respond to specified emergency situations and ensure continuity of critical asset management activities including the communication to, and involvement of, external agencies. This question assesses if, and how well, these plan(s) triggered, implemented and resolved in the event of an incident. The plan(s) should be appropriate to the level of risk as determined by the organisation's risk assessment methodology. It is also a requirement that relevant personnel are competent and trained.	The manager with responsibility for developing emergency plan(s). The organisation's risk assessment team. People with designated duties within the plan(s) and procedure(s) for dealing with incidents and emergency situations.	
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	3	Accountability for delivery of the AM strategy sits with the GM Asset Management. This is delegated through to the engineering and support teams for operational delivery. Authority, responsibility and accountability are defined for each person or role which enable the asset management team to manage and deliver the AMP strategy, objectives and plans.		In order to ensure that the organisation's assets and asset systems deliver the requirements of the asset management policy, strategy and objectives responsibilities need to be allocated to appropriate people who have the necessary authority to fulfil their responsibilities. (This question, relates to the organisation's assets eg, para b), s 4.4.1 of PAS 55, making it therefore distinct from the requirement contained in para a), s 4.4.1 of PAS 55).	Top management. People with management responsibility for the delivery of asset management policy, strategy, objectives and plan(s). People working on asset-related activities.	
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	3	The operational model in use by WEL includes both in-house and external resource. Decisions are made throughout each AMP period on the most effective delivery mechanism for required works. This optimises in-house resources and provides reliable workstreams for our preferred contractors.		Optimal asset management requires top management to ensure sufficient resources are available. In this context the term 'resources' includes manpower, materials, funding and service provider support.	Top management. The management team that has overall responsibility for asset management. Risk management team. The organisation's managers involved in day-to-day supervision of asset-related activities, such as frontline managers, engineers, foremen and chargehands as appropriate.	

Company Name Wel Networks **AMP Planning Period** 1 April 2021 - 31 March 2031 **Asset Management Standard Applied**

Record/Documented Information	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
The organisation's asset management plan(s). Documentation defining roles and responsibilities of individuals and organisational departments.	The organisation has not documented responsibilities for delivery of asset plan actions.	Asset management plan(s) inconsistently document responsibilities for delivery of plan actions and activities and/or responsibilities and authorities for implementation inadequate and/or delegation level inadequate to ensure effective delivery and/or contain misalignments with organisational accountability.	Asset management plan(s) consistently document responsibilities for the delivery of actions but responsibility/authority levels are inappropriate/ inadequate, and/or there are misalignments within the organisation.	Asset management plan(s) consistently document responsibilities for the delivery actions and there is adequate detail to enable delivery of actions. Designated responsibility and authority for achievement of asset plan actions is appropriate.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's asset management plan(s). Documented processes and procedures for the delivery of the asset management plan.	The organisation has not considered the arrangements needed for the effective implementation of plan(s).	The organisation recognises the need to ensure appropriate arrangements are in place for implementation of asset management plan(s) and is in the process of determining an appropriate approach for achieving this.	The organisation has arrangements in place for the implementation of asset management plan(s) but the arrangements are not yet adequately efficient and/or effective. The organisation is working to resolve existing weaknesses.	The organisation's arrangements fully cover all the requirements for the efficient and cost effective implementation of asset management plan(s) and realistically address the resources and timescales required, and any changes needed to functional policies, standards, processes and the asset management information system.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's plan(s) and procedure(s) for dealing with emergencies. The organisation's risk assessments and risk registers.	The organisation has not considered the need to establish plan(s) and procedure(s) to identify and respond to incidents and emergency situations.	The organisation has some ad-hoc arrangements to deal with incidents and emergency situations, but these have been developed on a reactive basis in response to specific events that have occurred in the past.	Most credible incidents and emergency situations are identified. Either appropriate plan(s) and procedure(s) are incomplete for critical activities or they are inadequate. Training/ external alignment may be incomplete.	Appropriate emergency plan(s) and procedure(s) are in place to respond to credible incidents and manage continuity of critical asset management activities consistent with policies and asset management objectives. Training and external agency alignment are in place.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Evidence that managers with responsibility for the delivery of asset management policy, strategy, objectives and plan(s) have been appointed and have assumed their responsibilities. Evidence may include the organisation's documents relating to its asset management system, organisational charts, job descriptions of post-holders, annual targets/objectives and personal development plan(s) of post-holders as appropriate.	Top management has not considered the need to appoint a person or persons to ensure that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s).	Top management understands the need to appoint a person or persons to ensure that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s).	Top management has appointed an appropriate people to ensure the assets deliver the requirements of the asset management strategy, objectives and plan(s) but their areas of responsibility are not fully defined and/ or they have insufficient delegated authority to fully execute their responsibilities.	The appointed person or persons have full responsibility for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s). They have been given the necessary authority to achieve this.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Evidence demonstrating that asset management plan(s) and/or the process(es) for asset management plan implementation consider the provision of adequate resources in both the short and long term. Resources include funding, materials, equipment, services provided by third parties and personnel (internal and service providers) with appropriate skills competencies and knowledge.	The organisation's top management has not considered the resources required to deliver asset management.	The organisations top management understands the need for sufficient resources but there are no effective mechanisms in place to ensure this is the case.	A process exists for determining what resources are required for its asset management activities and in most cases these are available but in some instances resources remain insufficient.	An effective process exists for determining the resources needed for asset management and sufficient resources are available. It can be demonstrated that resources are matched to asset management requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	2.5	The AMP is considered to be one of our core strategic documents and planning and budgeting around our network assets falls out of the detail in the plan. Work delivery expectations are clear and communicated through staff forums and meetings.		Widely used AM practice standards require an organisation to communicate the importance of meeting its asset management requirements such that personnel fully understand, take ownership of, and are fully engaged in the delivery of the asset management requirements (eg, PAS 55 s 4.4.1 g).	Top management. The management team that has overall responsibility for asset management. People involved in the delivery of the asset management requirements.	
45	Outsourcing of asset management activities	Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy?	2.5	Performance of WEL's contractors are closely monitored through their KPIs. We manage contractors with a robust contractor on-boarding process, establishment of preferred contractors, a contractor performance management system and a competency matrix. This ensures that requirements and expectations are met.		Where an organisation chooses to outsource some of its asset management activities, the organisation must ensure that these outsourced process(es) are under appropriate control to ensure that all the requirements of widely used AM standards (eg, PAS 55) are in place, and the asset management policy, strategy objectives and plan(s) are delivered. This includes ensuring capabilities and resources across a time span aligned to life cycle management. The organisation must put arrangements in place to control the outsourced activities, whether it be to external providers or to other in-house departments. This question explores what the organisation does in this regard.	Top management. The management team that has overall responsibility for asset management. The manager(s) responsible for the monitoring and management of the outsourced activities. People involved with the procurement of outsourced activities. The people within the organisations that are performing the outsourced activities. The people impacted by the outsourced activity.	
48	Training, awareness and competence	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	2	A Workforce Capability Plan has been developed to identify resource requirements in areas other than WEL Services. The roles in this plan associated with delivering asset management objectives are planned and approved for implementation. Arrangements are in place to source external staff for workload peaks and for specialist technical requirements. An annual works plan based around the AMP is created and implemented. It clearly defines the human resource requirements on a monthly basis. Through the resource planning process and plan WEL is effective in matching competencies and capabilities to the asset management requirements including the plan for both internal and contracted activities.		There is a need for an organisation to demonstrate that it has considered what resources are required to develop and implement its asset management system. There is also a need for the organisation to demonstrate that it has assessed what development plan(s) are required to provide its human resources with the skills and competencies to develop and implement its asset management systems. The timescales over which the plan(s) are relevant should be commensurate with the planning horizons within the asset management strategy considers e.g. if the asset management strategy considers 5, 10 and 15 year time scales then the human resources development plan(s) should align with these. Resources include both 'in house' and external resources who undertake asset management activities.	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	
49	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	3	WEL has developed a work type competency standard that sets the minimum levels fo knowledge, skills and experience required for staff working on of near WEL network assets. The competencies required for positions within the Asset Management team are defined in position descriptions. Competencies are confirmed 6 monthly for WEL field staff and for each contract or project for our contractors. Records are held in our secure systems managed by the People and Performance team.		Widely used AM standards require that organisations to undertake a systematic identification of the asset management awareness and competencies required at each level and function within the organisation. Once identified the training required to provide the necessary competencies should be planned for delivery in a timely and systematic way. Any training provided must be recorded and maintained in a suitable format. Where an organisation has contracted service providers in place then it should have a means to demonstrate that this requirement is being met for their employees. (eg, PAS 55 refers to frameworks suitable for identifying competency requirements).	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	

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Evidence of such activities as road shows, written bulletins, workshops, team talks and management walk-abouts would assist an organisation to demonstrate it is meeting this requirement of PAS 55.	The organisation's top management has not considered the need to communicate the importance of meeting asset management requirements.	The organisations top management understands the need to communicate the importance of meeting its asset management requirements but does not do so.	Top management communicates the importance of meeting its asset management requirements but only to parts of the organisation.	Top management communicates the importance of meeting its asset management requirements to all relevant parts of the organisation.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's arrangements that detail the compliance required of the outsourced activities. For example, this this could form part of a contract or service level agreement between the organisation and the suppliers of its outsourced activities. Evidence that the organisation has demonstrated to itself that it has assurance of compliance of outsourced activities.	The organisation has not considered the need to put controls in place.	The organisation controls its outsourced activities on an ad-hoc basis, with little regard for ensuring for the compliant delivery of the organisational strategic plan and/or its asset management policy and strategy.	Controls systematically considered but currently only provide for the compliant delivery of some, but not all, aspects of the organisational strategic plan and/or its asset management policy and strategy. Gaps exist.	Evidence exists to demonstrate that outsourced activities are appropriately controlled to provide for the compliant delivery of the organisational strategic plan, asset management policy and strategy, and that these controls are integrated into the asset management system	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Evidence of analysis of future work load plan(s) in terms of human resources. Document(s) containing analysis of the organisation's own direct resources and contractors resource capability over suitable timescales. Evidence, such as minutes of meetings, that suitable management forums are monitoring human resource development plan(s). Training plan(s), personal development plan(s), contract and service level agreements.	The organisation has not recognised the need for assessing human resources requirements to develop and implement its asset management system.	The organisation has recognised the need to assess its human resources requirements and to develop a plan(s). There is limited recognition of the need to align these with the development and implementation of its asset management system.	The organisation has developed a strategic approach to aligning competencies and human resources to the asset management system including the asset management plan but the work is incomplete or has not been consistently implemented.	The organisation can demonstrate that plan(s) are in place and effective in matching competencies and capabilities to the asset management system including the plan for both internal and contracted activities. Plans are reviewed integral to asset management system process(es).	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Evidence of an established and applied competency requirements assessment process and plan(s) in place to deliver the required training. Evidence that the training programme is part of a wider, co-ordinated asset management activities training and competency programme. Evidence that training activities are recorded and that records are readily available (for both direct and contracted service provider staff) e.g. via organisation wide information system or local records database.	The organisation does not have any means in place to identify competency requirements.	The organisation has recognised the need to identify competency requirements and then plan, provide and record the training necessary to achieve the competencies.	The organisation is the process of identifying competency requirements aligned to the asset management plan(s) and then plan, provide and record appropriate training. It is incomplete or inconsistently applied.	Competency requirements are in place and aligned with asset management plan(s). Plans are in place and effective in providing the training necessary to achieve the competencies. A structured means of recording the competencies achieved is in place.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
50	Training, awareness and competence	How does the organisation ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience?	2.5	The competencies required for positions within the Asset Management team, Maintenance Team and field service teams are outlined for each job. Competencies are matched to work tasks by the Dispatch teams. Competencies are confirmed 6 monthly for WEL field staff. Any competency shortfall is identified and addressed as required.		A critical success factor for the effective development and implementation of an asset management system is the competence of persons undertaking these activities. organisations should have effective means in place for ensuring the competence of employees to carry out their designated asset management function(s). Where an organisation has contracted service providers undertaking elements of its asset management system then the organisation shall assure itself that the outsourced service provider also has suitable arrangements in place to manage the competencies of its employees. The organisation should ensure that the individual and corporate competencies it requires are in place and actively monitor, develop and maintain an appropriate balance of these competencies.	Managers, supervisors, persons responsible for developing training programmes. Staff responsible for procurement and service agreements. HR staff and those responsible for recruitment.	
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	2.5	Two way communications is in place for all relevant stakeholders. Contract managers have regular operational and management meetings with preferred contractors. Regular operations meetings are carried out between delivery, planning and engineering. The AMP is publicly available to anyone via our website		Widely used AM practice standards require that pertinent asset management information is effectively communicated to and from employees and other stakeholders including contracted service providers. Pertinent information refers to information required in order to effectively and efficiently comply with and deliver asset management strategy, plan(s) and objectives. This will include for example the communication of the asset management policy, asset performance information, and planning information as appropriate to contractors.	Top management and senior management representative(s), employee's representative(s), employee's trade union representative(s); contracted service provider management and employee representative(s); representative(s) from the organisation's Health, Safety and Environmental team. Key stakeholder representative(s).	
59	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?	2.5	The organisation has established documentation that comprehensively describes all the main elements of its asset management system and the interactions between them. The AMP, policy, process documents and strategies are all regularly reviewed in line with externally certified WEL business management systems.		Widely used AM practice standards require an organisation maintain up to date documentation that ensures that its asset management systems (ie, the systems the organisation has in place to meet the standards) can be understood, communicated and operated. (eg, s 4.5 of PAS 55 requires the maintenance of up to date documentation of the asset management system requirements specified throughout s 4 of PAS 55).	The management team that has overall responsibility for asset management. Managers engaged in asset management activities.	
62	Information management	What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system?	3	The WEL asset management systems contain the necessary information that supports effective asset management. The WEL systems include the GIS, NMS and ERP. When gaps are identified, the required changes are made to each system's metadata. Frequent audits and reviews of operating effectiveness are undertaken and continual improvement initiatives are regularly implemented. Asset data is backed up in accordance with the WEL ISSP.		Effective asset management requires appropriate information to be available. Widely used AM standards therefore require the organisation to identify the asset management information it requires in order to support its asset management system. Some of the information required may be held by suppliers. The maintenance and development of asset management information systems is a poorly understood specialist activity that is akin to IT management but different from IT management. This group of questions provides some indications as to whether the capability is available and applied. Note: To be effective, an asset information management system requires the mobilisation of technology, people and process(es) that create, secure, make available and destroy the information required to support the asset management system.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Operations, maintenance and engineering managers	

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Record/Documented Information	**Maturity Level 0**	**Maturity Level 1**	**Maturity Level 2**	**Maturity Level 3**	**Maturity Level 4**
Evidence of a competency assessment framework that aligns with established frameworks such as the asset management Competencies Requirements Framework (Version 2.0); National Occupational Standards for Management and Leadership; UK Standard for Professional Engineering Competence, Engineering Council, 2005.	The organisation has not recognised the need to assess the competence of person(s) undertaking asset management related activities.	Competency of staff undertaking asset management related activities is not managed or assessed in a structured way, other than formal requirements for legal compliance and safety management.	The organisation is in the process of putting in place a means for assessing the competence of person(s) involved in asset management activities including contractors. There are gaps and inconsistencies.	Competency requirements are identified and assessed for all persons carrying out asset management related activities - internal and contracted. Requirements are reviewed and staff reassessed at appropriate intervals aligned to asset management requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Asset management policy statement prominently displayed on notice boards, intranet and internet; use of organisation's website for displaying asset performance data; evidence of formal briefings to employees, stakeholders and contracted service providers; evidence of inclusion of asset management issues in team meetings and contracted service provider contract meetings; newsletters, etc.	The organisation has not recognised the need to formally communicate any asset management information.	There is evidence that the pertinent asset management information to be shared along with those to share it with is being determined.	The organisation has determined pertinent information and relevant parties. Some effective two way communication is in place but as yet not all relevant parties are clear on their roles and responsibilities with respect to asset management information.	Two way communication is in place between all relevant parties, ensuring that information is effectively communicated to match the requirements of asset management strategy, plan(s) and process(es). Pertinent asset information requirements are regularly reviewed.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The documented information describing the main elements of the asset management system (process(es)) and their interaction.	The organisation has not established documentation that describes the main elements of the asset management system.	The organisation is aware of the need to put documentation in place and is in the process of determining how to document the main elements of its asset management system.	The organisation in the process of documenting its asset management system and has documentation in place that describes some, but not all, of the main elements of its asset management system and their interaction.	The organisation has established documentation that comprehensively describes all the main elements of its asset management system and the interactions between them. The documentation is kept up to date.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Details of the process the organisation has employed to determine what its asset information system should contain in order to support its asset management system. Evidence that this has been effectively implemented.	The organisation has not considered what asset management information is required.	The organisation is aware of the need to determine in a structured manner what its asset information system should contain in order to support its asset management system and is in the process of deciding how to do this.	The organisation has developed a structured process to determine what its asset information system should contain in order to support its asset management system and has commenced implementation of the process.	The organisation has determined what its asset information system should contain in order to support its asset management system. The requirements relate to the whole life cycle and cover information originating from both internal and external sources.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
63	Information management	How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent?	3	The organisation has effective controls in place that ensure the data held is of the requisite quality and accuracy and is consistent. The controls are regularly reviewed and improved where necessary. Where misalignment or inconsistencies are identified, they get addressed.		The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale. This question explores how the organisation ensures that information management meets widely used AM practice requirements (eg, s 4.4.6 (a), (c) and (d) of PAS 55).	The management team that has overall responsibility for asset management. Users of the organisational information systems.	
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	3	Frequent audits and reviews of operating effectiveness of all asset management systems are undertaken by internal and external parties and continual improvement initiatives are regularly implemented.		Widely used AM standards need not be prescriptive about the form of the asset management information system, but simply require that the asset management information system is appropriate to the organisations needs, can be effectively used and can supply information which is consistent and of the requisite quality and accuracy.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Users of the organisational information systems.	
69	Risk management process(es)	How has the organisation documented process(es) and/ or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle?	3	Under our AS/NZS ISO 31000:2009 aligned risk management framework WEL has a number of processes to ensure its assets are risk assessed and documented. It includes CBRM modelling, reviews of risks during PSMS NZS:7901 assessments, risk and audit reviews on top risk items, safety in design processes, notification processes and measurement point data capture, structured PM plans, RCA and FMECA studies and the AMP processes.		Risk management is an important foundation for proactive asset management. Its overall purpose is to understand the cause, effect and likelihood of adverse events occurring, to optimally manage such risks to an acceptable level, and to provide an audit trail for the management of risks. Widely used standards require the organisation to have process(es) and/or procedure(s) in place that set out how the organisation identifies and assesses asset and asset management related risks. The risks have to be considered across the four phases of the asset lifecycle (eg, para 4.3.3 of PAS 55).	The top management team in conjunction with the organisation's senior risk management representatives. There may also be input from the organisation's Safety, Health and Environment team. Staff who carry out risk identification and assessment.	
79	Use and maintenance of asset risk information	How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs?	3	Our AS/NZS ISO 31000:2009 aligned risk management framework ensure identified risks are communicated to the business. This then feeds in to our work type competency standards which are updated to include any additional training required for managing risks.		Widely used AM standards require that the output from risk assessments are considered and that adequate resource (including staff) and training is identified to match the requirements. It is a further requirement that the effects of the control measures are considered, as there may be implications in resources and training required to achieve other objectives.	Staff responsible for risk assessment and those responsible for developing and approving resource and training plan(s). There may also be input from the organisation's Safety, Health and Environment team.	
82	Legal and other requirements	What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system?	3	There is a good level of regulatory oversight and mechanisms for keeping up-to-date with regulatory changes. The Executive have to report and confirm that all legislative and regulatory requirements have been met on a quarterly basis. Any breaches are reported to the Board.		In order for an organisation to comply with its legal, regulatory, statutory and other asset management requirements, the organisation first needs to ensure that it knows what they are (eg, PAS 55 specifies this in s 4.4.8). It is necessary to have systematic and auditable mechanisms in place to identify new and changing requirements. Widely used AM standards also require that requirements are incorporated into the asset management system (e.g. procedure(s) and process(es))	Top management. The organisations regulatory team. The organisation's legal team or advisors. The management team with overall responsibility for the asset management system. The organisation's health and safety team or advisors. The organisation's policy making team.	

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Record/Documented Information	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls.	There are no formal controls in place or controls are extremely limited in scope and/or effectiveness.	The organisation is aware of the need for effective controls and is in the process of developing an appropriate control process(es).	The organisation has developed controls that will ensure the data held is of the requisite quality and accuracy and is consistent and is in the process of implementing them.	The organisation has effective controls in place that ensure the data held is of the requisite quality and accuracy and is consistent. The controls are regularly reviewed and improved where necessary.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The documented process the organisation employs to ensure its asset management information system aligns with its asset management requirements. Minutes of information systems review meetings involving users.	The organisation has not considered the need to determine the relevance of its management information system. At present there are major gaps between what the information system provides and the organisations needs.	The organisation understands the need to ensure its asset management information system is relevant to its needs and is determining an appropriate means by which it will achieve this. At present there are significant gaps between what the information system provides and the organisations needs.	The organisation has developed and is implementing a process to ensure its asset management information system is relevant to its needs. Gaps between what the information system provides and the organisations needs have been identified and action is being taken to close them.	The organisation's asset management information system aligns with its asset management requirements. Users can confirm that it is relevant to their needs.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisation's risk management framework and/or evidence of specific process(es) and/ or procedure(s) that deal with risk control mechanisms. Evidence that the process(es) and/or procedure(s) are implemented across the business and maintained. Evidence of agendas and minutes from risk management meetings. Evidence of feedback in to process(es) and/ or procedure(s) as a result of incident investigation(s). Risk registers and assessments.	The organisation has not considered the need to document process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle.	The organisation is aware of the need to document the management of asset related risk across the asset lifecycle. The organisation has plan(s) to formally document all relevant process(es) and procedure(s) or has already commenced this activity.	The organisation is in the process of documenting the identification and assessment of asset related risk across the asset lifecycle but it is incomplete or there are inconsistencies between approaches and a lack of integration.	Identification and assessment of asset related risk across the asset lifecycle is fully documented. The organisation can demonstrate that appropriate documented mechanisms are integrated across life cycle phases and are being consistently applied.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisations risk management framework. The organisation's resourcing plan(s) and training and competency plan(s). The organisation should be able to demonstrate appropriate linkages between the content of resource plan(s) and training and competency plan(s) to the risk assessments and risk control measures that have been developed.	The organisation has not considered the need to conduct risk assessments.	The organisation is aware of the need to consider the results of risk assessments and effects of risk control measures to provide input into reviews of resources, training and competency needs. Current input is typically ad-hoc and reactive.	The organisation is in the process ensuring that outputs of risk assessment are included in developing requirements for resources and training. The implementation is incomplete and there are gaps and inconsistencies.	Outputs from risk assessments are consistently and systematically used as inputs to develop resources, training and competency requirements. Examples and evidence is available.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
The organisational processes and procedures for ensuring information of this type is identified, made accessible to those requiring the information and is incorporated into asset management strategy and objectives	The organisation has not considered the need to identify its legal, regulatory, statutory and other asset management requirements.	The organisation identifies some of its legal, regulatory, statutory and other asset management requirements, but this is done in an ad-hoc manner in the absence of a procedure.	The organisation has procedure(s) to identify its legal, regulatory, statutory and other asset management requirements, but the information is not kept up to date, inadequate or inconsistently managed.	Evidence exists to demonstrate that the organisation's legal, regulatory, statutory and other asset management requirements are identified and kept up to date. Systematic mechanisms for identifying relevant legal and statutory requirements.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
88	Life cycle activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?	3	We have a suite of process documents that ensure the AMP plans are implemented for the whole asset lifecycle. Process documentation is version controlled and regularly reviewed by the respective subject matter experts to ensure it is up to date.		Life cycle activities are about the implementation of asset management plan(s) i.e. they are the "doing" phase. They need to be done effectively and well in order for asset management to have any practical meaning. As a consequence, widely used standards (eg, PAS 55 s 4.5.1) require organisations to have in place appropriate process(es) and procedure(s) for the implementation of asset management plan(s) and control of lifecycle activities. This question explores those aspects relevant to asset creation.	Asset managers, design staff, construction staff and project managers from other impacted areas of the business, e.g. Procurement	
91	Life cycle activities	How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance?	3	A robust process to create the AMP leads to a consequential requirement for structured work plans. These plans feed into the capital works and maintenance schedules, ensuring the works are properly planned. KPIs are put in place for both in-house and external contract work.		Having documented process(es) which ensure the asset management plan(s) are implemented in accordance with any specified conditions, in a manner consistent with the asset management policy, strategy and objectives and in such a way that cost, risk and asset system performance are appropriately controlled is critical. They are an essential part of turning intention into action (eg, as required by PAS 55 s 4.5.1).	Asset managers, operations managers, maintenance managers and project managers from other impacted areas of the business	
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	3	There are a number of measures in place to assess asset performance. These include SAIDI performance metrics, fault analyses, Health indexes, measurement points in SAP, fault numbers and cost and impact, all of which are fed into CBRM modelling program.		Widely used AM standards require that organisations establish implement and maintain procedure(s) to monitor and measure the performance and/or condition of assets and asset systems. They further set out requirements in some detail for reactive and proactive monitoring, and leading/lagging performance indicators together with the monitoring or results to provide input to corrective actions and continual improvement. There is an expectation that performance and condition monitoring will provide input to improving asset management strategy, objectives and plan(s).	A broad cross-section of the people involved in the organisation's asset-related activities from data input to decision-makers, i.e. an end-to end assessment. This should include contactors and other relevant third parties as appropriate.	

Company Name	Wel Networks	AMP Planning Period	1 April 2021 - 31 March 2031	Asset Management Standard Applied	
Record/Documented Information	**Maturity Level 0**	**Maturity Level 1**	**Maturity Level 2**	**Maturity Level 3**	**Maturity Level 4**
Documented process(es) and procedure(s) which are relevant to demonstrating the effective management and control of life cycle activities during asset creation, acquisition, enhancement including design, modification, procurement, construction and commissioning.	The organisation does not have process(es) in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning.	The organisation is aware of the need to have process(es) and procedure(s) in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning but currently do not have these in place (note: procedure(s) may exist but they are inconsistent/incomplete).	The organisation is in the process of putting in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning. Gaps and inconsistencies are being addressed.	Effective process(es) and procedure(s) are in place to manage and control the implementation of asset management plan(s) during activities related to asset creation including design, modification, procurement, construction and commissioning.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Documented procedure for review. Documented procedure for audit of process delivery. Records of previous audits, improvement actions and documented confirmation that actions have been carried out.	The organisation does not have process(es)/ procedure(s) in place to control or manage the implementation of asset management plan(s) during this life cycle phase.	The organisation is aware of the need to have process(es) and procedure(s) in place to manage and control the implementation of asset management plan(s) during this life cycle phase but currently do not have these in place and/or there is no mechanism for confirming they are effective and where needed modifying them.	The organisation is in the process of putting in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during this life cycle phase. They include a process for confirming the process(es)/ procedure(s) are effective and if necessary carrying out modifications.	The organisation has in place process(es) and procedure(s) to manage and control the implementation of asset management plan(s) during this life cycle phase. They include a process, which is itself regularly reviewed to ensure it is effective, for confirming the process(es)/ procedure(s) are effective and if necessary carrying out modifications.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Functional policy and/ or strategy documents for performance or condition monitoring and measurement. The organisation's performance monitoring frameworks, balanced scorecards etc. Evidence of the reviews of any appropriate performance indicators and the action lists resulting from these reviews. Reports and trend analysis using performance and condition information. Evidence of the use of performance and condition information shaping improvements and supporting asset management strategy, objectives and plan(s).	The organisation has not considered how to monitor the performance and condition of its assets.	The organisation recognises the need for monitoring asset performance but has not developed a coherent approach. Measures are incomplete, predominantly reactive and lagging. There is no linkage to asset management objectives.	The organisation is developing coherent asset performance monitoring linked to asset management objectives. Reactive and proactive measures are in place. Use is being made of leading indicators and analysis. Gaps and inconsistencies remain.	Consistent asset performance monitoring linked to asset management objectives is in place and universally used including reactive and proactive measures. Data quality management and review process are appropriate. Evidence of leading indicators and analysis.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
99	Investigation of asset-related failures, incidents and nonconformities	How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated?	3	WEL have defined the appropriate responsibilities and authorities through Root Cause Analysis (RCA) process and the ICAM investigation model. Agreed actions from non-conformities are put into the AR system for implementation and monitoring. All outages causing greater than 0.3 SAIDI minutes are investigated, 0.5 are reported to the Executive. Significant outages or issues may result in the event being recording in the company risk register.		Widely used AM standards require that the organisation establishes implements and maintains process(es) for the handling and investigation of failures incidents and non-conformities for assets and sets down a number of expectations. Specifically this question examines the requirement to define clearly responsibilities and authorities for these activities, and communicate these unambiguously to relevant people including external stakeholders if appropriate.	The organisation's safety and environment management team. The team with overall responsibility for the management of the assets. People who have appointed roles within the asset-related investigation procedure, from those who carry out the investigations to senior management who review the recommendations. Operational controllers responsible for managing the asset base under fault conditions and maintaining services to consumers. Contractors and other third parties as appropriate.	
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	3	WEL has an internal audit process, defined in our quality management system, which looks at various aspects of our business. In addition we have external specialists review our asset management systems. The business process audits and field quality and safety audits are carried out as BAU.		This question seeks to explore what the organisation has done to comply with the standard practice AM audit requirements (eg, the associated requirements of PAS 55 s 4.6.4 and its linkages to s 4.7).	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit teams, together with key staff responsible for asset management. For example, Asset Management Director, Engineering Director. People with responsibility for carrying out risk assessments	
109	Corrective and preventative action	How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance?	3	Significant monitoring is undertaken to identify potential asset or functional failures before they result in a safety or operational failure. Where possible systems are designed to fail safe if asset components fail and strict rules exist for corrective actions to be completed or operational restrictions implemented. These are captured in various documents and reporting frameworks across WEL. Outcomes from RCA investigations are captured in the AR and FAR systems, within which corrective and preventive actions are identified and documented once complete. Asset failures are captured in SAP via notifications. These lead to jobs which then get scheduled. All job progress is captured as a business kpi.		Having investigated asset related failures, incidents and non-conformances, and taken action to mitigate their consequences, an organisation is required to implement preventative and corrective actions to address root causes. Incident and failure investigations are only useful if appropriate actions are taken as a result to assess changes to a businesses risk profile and ensure that appropriate arrangements are in place should a recurrence of the incident happen. Widely used AM standards also require that necessary changes arising from preventive or corrective action are made to the asset management system.	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit and incident investigation teams. Staff responsible for planning and managing corrective and preventive actions.	

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	Record/Documented Information	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
	Process(es) and procedure(s) for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances. Documentation of assigned responsibilities and authority to employees. Job Descriptions, Audit reports. Common communication systems i.e. all Job Descriptions on Internet etc.	The organisation has not considered the need to define the appropriate responsibilities and the authorities.	The organisation understands the requirements and is in the process of determining how to define them.	The organisation are in the process of defining the responsibilities and authorities with evidence. Alternatively there are some gaps or inconsistencies in the identified responsibilities/ authorities.	The organisation have defined the appropriate responsibilities and authorities and evidence is available to show that these are applied across the business and kept up to date.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
	The organisation's asset-related audit procedure(s). The organisation's methodology(s) by which it determined the scope and frequency of the audits and the criteria by which it identified the appropriate audit personnel. Audit schedules, reports etc. Evidence of the procedure(s) by which the audit results are presented, together with any subsequent communications. The risk assessment schedule or risk registers.	The organisation has not recognised the need to establish procedure(s) for the audit of its asset management system.	The organisation understands the need for audit procedure(s) and is determining the appropriate scope, frequency and methodology(s).	The organisation is establishing its audit procedure(s) but they do not yet cover all the appropriate asset-related activities.	The organisation can demonstrate that its audit procedure(s) cover all the appropriate asset-related activities and the associated reporting of audit results. Audits are to an appropriate level of detail and consistently managed.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
	Analysis records, meeting notes and minutes, modification records. Asset management plan(s), investigation reports, audit reports, improvement programmes and projects. Recorded changes to asset management procedure(s) and process(es). Condition and performance reviews. Maintenance reviews	The organisation does not recognise the need to have systematic approaches to instigating corrective or preventive actions.	The organisation recognises the need to have systematic approaches to instigating corrective or preventive actions. There is ad-hoc implementation for corrective actions to address failures of assets but not the asset management system.	The need is recognised for systematic instigation of preventive and corrective actions to address root causes of non compliance or incidents identified by investigations, compliance evaluation or audit. It is only partially or inconsistently in place.	Mechanisms are consistently in place and effective for the systematic instigation of preventive and corrective actions to address root causes of non compliance or incidents identified by investigations, compliance evaluation or audit.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

Schedule 13: Report On Asset Management Maturity

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	
113	Continual improvement	How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle?	3	The business is certified to the ISO 9001 quality management standard that requires continual improvement as fundamental to how we operate. This principle is used when reviewing any of the controlled document suite. In alignment with this Standard, we use the AMP prioritisation tool to assess the risk value for assets. We have considered the following quantifiable risk values: ▪ Health and Safety ▪ Network Reliability ▪ Network Capacity ▪ Environmental ▪ Voltage Compliance ▪ Financial ▪ Planned Outage For asset replacement these costs are assessed against the cost to our customers if assets failed and balanced for the overall lowest cost to our community.		Widely used AM standards have requirements to establish, implement and maintain process(es)/procedure(s) for identifying, assessing, prioritising and implementing actions to achieve continual improvement. Specifically there is a requirement to demonstrate continual improvement in optimisation of cost risk and performance/condition of assets across the life cycle. This question explores an organisation's capabilities in this area—looking for systematic improvement mechanisms rather that reviews and audit (which are separately examined).	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. Managers responsible for policy development and implementation.	
115	Continual improvement	How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation?	3	WEL actively engages internally and externally with other asset management practitioners, professional bodies, industry forums and relevant conferences. Actively investigates and evaluates new practices and evolves its asset management activities using appropriate developments. We review the standards implemented by other EDBs to see if they are of use to WEL.		One important aspect of continual improvement is where an organisation looks beyond its existing boundaries and knowledge base to look at what 'new things are on the market'. These new things can include equipment, process(es), tools, etc. An organisation which does this (eg, by the PAS 55 s 4.6 standards) will be able to demonstrate that it continually seeks to expand its knowledge of all things affecting its asset management approach and capabilities. The organisation will be able to demonstrate that it identifies any such opportunities to improve, evaluates them for suitability to its own organisation and implements them as appropriate. This question explores an organisation's approach to this activity.	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. People who monitor the various items that require monitoring for 'change'. People that implement changes to the organisation's policy, strategy, etc. People within an organisation with responsibility for investigating, evaluating, recommending and implementing new tools and techniques, etc.	

Company Name	Wel Networks	AMP Planning Period	1 April 2021 - 31 March 2031	Asset Management Standard Applied	
Record/Documented Information	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
Records showing systematic exploration of improvement. Evidence of new techniques being explored and implemented. Changes in procedure(s) and process(es) reflecting improved use of optimisation tools/techniques and available information. Evidence of working parties and research.	The organisation does not consider continual improvement of these factors to be a requirement, or has not considered the issue.	A Continual Improvement ethos is recognised as beneficial, however it has just been started, and or covers partially the asset drivers.	Continuous improvement process(es) are set out and include consideration of cost risk, performance and condition for assets managed across the whole life cycle but it is not yet being systematically applied.	There is evidence to show that continuous improvement process(es) which include consideration of cost risk, performance and condition for assets managed across the whole life cycle are being systematically applied.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.
Research and development projects and records, benchmarking and participation knowledge exchange professional forums. Evidence of correspondence relating to knowledge acquisition. Examples of change implementation and evaluation of new tools, and techniques linked to asset management strategy and objectives.	The organisation makes no attempt to seek knowledge about new asset management related technology or practices.	The organisation is inward looking, however it recognises that asset management is not sector specific and other sectors have developed good practice and new ideas that could apply. Ad-hoc approach.	The organisation has initiated asset management communication within sector to share and, or identify 'new' to sector asset management practices and seeks to evaluate them.	The organisation actively engages internally and externally with other asset management practitioners, professional bodies and relevant conferences. Actively investigates and evaluates new practices and evolves its asset management activities using appropriate developments.	The organisation's process(es) surpass the standard required to comply with requirements set out in a recognised standard. The assessor is advised to note in the Evidence section why this is the case and the evidence seen.

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APPENDIX

APPENDIX A: GLOSSARY

Abbreviation	Description
AAAC	All Aluminium Alloy Conductor
AAC	All Aluminium Conductor
ABS	Air Break Switch
AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
AHI	Asset Health Index
AIS	Air Insulated Switchgear
AMMAT	Asset Management Maturity Assessment Tool
AMP	Asset Management Plan
AUFLS	Automatic Under Frequency Load Shedding
CB	Circuit Breaker
CBRM	Condition Based Risk Management
CDEM	Civil Defence Emergency Management
Code	Electricity Industry Participation Code 2010
CoF	Consequences of Failure
DC	Direct Current
DGA	Dissolved Gas Analysis
DMS	Distribution Management System
DRC	Disaster Recovery Centre
EDB	Electricity Distribution Business
ENA	Electricity Networks Association
ERP	Enterprise Resource Planning
EV	Electric Vehicle
FDC	Cost of Financing
FMEA	Failure Modes and Effects Analysis
GIS	Gas Insulated Switchgear
GIS	Geographic Information System
GWh	Gigawatt Hour
GXP	Grid Exit Point
HI	Health Index
HILP	High Impact Low Probability
HV	High Voltage
ICP	Installation Control Point
IT	Information Technology
kV	Kilovolts

Abbreviation	Description
kW	Kilowatt
LiDAR	Light Detection and Ranging
LV	Low Voltage
MVA	Mega Volt Ampere
MW	Megawatt
N	N system security means that the system is not able to tolerate the failure of any single component in the network. Any failure will result in a loss of supply
N-1	N-1 means that the system must be able to tolerate the failure of any single component in the network without affecting the supply of electricity
NMS	Network Management System
NPV	Net Present Value
OH	Overhead Lines
OLTC	On-Load Tap Changer
OMS	Outage Management System
P1	Priority 1
PCD	Post Contingent Demand
PCR	Post Contingent Rating
PD	Partial Discharge
PDD	Project Definition Document
PILC	Paper Insulated, Lead Covered
PoF	Probability of Failure
PPE	Personal Protective Equipment
PV	Photovoltaic
RAMC	Risk and Audit Management Committee
RCA	Root Cause Analysis
RCM	Reliability Centred Maintenance
RFP	Request for Proposals
RMU	Ring Main Unit
RTU	Remote Terminal Unit
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAMP	Strategic Asset Management Plan
SAP	Systems Applications and Processes
SCADA	Supervisory Control and Data Acquisition
SF_6	Sulphur Hexafluoride

Abbreviation	Description
SFRA	Sweep Frequency Response Analysis
SO	System Operator
TRIFR	Total Recordable Injury Frequency Rate
Trust	WEL Energy Trust
UG	Underground Assets
VoLL	Value of Lost Load
WEL	WEL Networks Ltd
WLUG	Waikato Lifelines Utilities Group
XLPE	Cross Linked Polyethylene

APPENDIX B: INFORMATION DISCLOSURE COMPLIANCE

Reference	Requirement	Document Reference
Summary		
3.1	The AMP must include a summary that provides a brief overview of the AMP contents and highlights information that the EDB considers significant.	Executive Summary
Background and Objectives		
3.2	The AMP must include details of the background and objectives of the EDB's asset management and planning processes	1.1.2, 1.1.3; 3.2
Purpose Statement		
3.3	The AMP must include a purpose statement that:	
3.3.1	Makes clear the purpose and status of the AMP in the EDB's asset management practices. The purpose statement must also include a statement of the objectives of the asset management and planning processes	Executive Summary; 1.1.3
3.3.2	States the corporate mission or vision as it relates to asset management.	Executive Summary; 1.1.2
3.3.3	Identifies the documented plans produced as outputs of the annual business planning process.	Executive Summary; 3.2
3.3.4	States how the different documented plans relate to one another with specific reference to any plans specifically dealing with asset management.	Executive Summary; 3.2
3.3.5	Includes a description of the interaction between the objectives of the AMP and other corporate goals, business planning processes and plans.	Executive Summary; 3.2
AMP Period		
3.4	The AMP must state that the period covered by the plan is 10 years or more from the commencement of the financial year.	Executive Summary
3.5	The AMP must state the date on which the AMP was approved by the Board of Directors.	Executive Summary
Stakeholder Interests		
3.6	The AMP must include a description of stakeholder interests (owners, consumers etc) which identifies important stakeholders and indicates:	3.1
3.6.1	The AMP must include a description of how the interests of stakeholders are identified.	3.1
3.6.2	The AMP must include a description of what these interests are.	3.1
3.6.3	The AMP must include a description of how these interests are accommodated in asset management practices.	3.1
3.6.4	The AMP must include a description of how conflicting interests are managed.	3.1.1
Accountabilities and Responsibilities		
3.7	The AMP must include a description of the accountabilities and responsibilities for asset management on at least three levels, including:	1.1.3
3.7.1	Governance—a description of the extent of director approval required for key asset management decisions and the extent to which asset management outcomes are regularly reported to directors.	1.1.3

Reference	Requirement	Document Reference
3.7.2	Executive—an indication of how the in-house asset management and planning organisation is structured.	1.1.3
3.7.3	Field operations—an overview of how field operations are managed, including a description of the extent to which field work is undertaken in-house and the areas where outsourced contractors are used.	1.1.3; 4.3
Assumptions		
3.8	The AMP must include all significant assumptions.	6.1.1; 8.2.1; 8.3.2; 9.1.2
3.8.1	All significant assumptions must be quantified where possible.	6.1.1; 8.2.1; 8.3.2; 9.1.2
3.8.2	All significant assumptions must be clearly identified in a manner that makes their significance understandable to interested persons.	6.1.1; 8.2.1; 8.3.2; 9.1.2
3.8.3	The identification of significant assumptions must include a description of changes proposed where the information is not based on the EDB's existing business.	6.1.1; 8.2.1; 8.3.2; 9.1.2
3.8.4	The identification of significant assumptions must include a description of the sources of uncertainty and the potential effect of the uncertainty on the prospective information.	6.1.4; 9.1
3.8.5	The identification of significant assumptions must include a description of the price inflator assumptions used to prepare the financial information disclosed in nominal New Zealand dollars in the Report on Forecast Capital Expenditure set out in Schedule 11a and the Report on Forecast Operational Expenditure set out in Schedule 11b.	9.1
Material Difference in Information		
3.9	The AMP must include a description of the factors that may lead to a material difference between the prospective information disclosed and the corresponding actual information recorded in future disclosures.	6.1.4; 9.1.2
Asset Management Strategy and Delivery		
3.10	The AMP must include an overview of asset management strategy and delivery.	3.2.2, 4.1
Systems and Information Management Data		
3.11	The AMP must include an overview of systems and information management data	7.2
3.12	The AMP must include a statement covering any limitations in the availability or completeness of asset management data and disclose any initiatives intended to improve the quality of this data.	8.2.6; 8.4
Asset Management Processes		
3.13	The AMP must include a description of the processes used within the EDB for:	
3.13.1	Managing routine asset inspections and network maintenance.	8.1; 8.2; 8.4
3.13.2	Planning and implementing network development projects.	4.2; 4.3
3.13.3	Measuring network performance.	5.3
3.14	The AMP must include an overview of asset management documentation, controls and review processes.	4.1; 4.2
Communication Processes		
3.15	The AMP must include an overview of communication and participation processes.	3.1

Reference	Requirement	Document Reference
Financial Values		
3.16	The AMP must present all financial values in constant price New Zealand dollars except where specified otherwise.	9.1.2
Disclosure Requirements		
3.17	The AMP must be structured and presented in a way that the EDB considers will support the purposes of AMP disclosure set out in clause 2.6.2 of the determination.	Throughout the document
Assets Covered		
4	The AMP must provide details of the assets covered, including:	
4.1	A high-level description of the service areas covered by the EDB and the degree to which these are interlinked, including:	1.2
4.1.1	The region(s) covered.	1.2
4.1.2	Identification of large consumers that have a significant impact on network operations or asset management priorities.	1.3.1
4.1.3	A description of the load characteristics for different parts of the network.	1.2.2
4.1.4	Peak demand and total energy delivered in the previous year, broken down by sub-network, if any.	1.2.2
Network Configuration		
4.2	The AMP must provide a description of the network configuration, including:	
4.2.1	Identifying bulk electricity supply points and any distributed generation with a capacity greater than 1 MW. State the existing firm supply capacity and current peak load of each bulk electricity supply point.	1.2; 6.3
4.2.2	A description of the subtransmission system fed from the bulk electricity supply points, including the capacity of zone substations and the voltage(s) of the subtransmission network(s). The AMP must identify the supply security provided at individual zone substations, by describing the extent to which each has n-x subtransmission security or by providing alternative security class ratings.	1.2; 6.1.1; 6.3; 6.3.1; 6.3.2; 6.3.3
4.2.3	A description of the distribution system, including the extent to which it is underground.	1.2; 2.5
4.2.4	A brief description of the network's distribution substation arrangements.	1.2; 2.6
4.2.5	A description of the low voltage network including the extent to which it is underground.	1.2; 2.4; 2.5
4.2.6	An overview of secondary assets such as protection relays, ripple injection systems, SCADA and telecommunications systems.	2.8
Sub-networks		
4.3	If sub-networks exist, the network configuration information referred to in subclause 4.2 above must be disclosed for each sub-network.	No sub-networks exist that meet disclosure threshold in definitions
Network Asset Information		
4.4	The AMP must describe the network assets by providing the following information for each asset category by-	
4.4.1	Voltage levels.	2.2–2.9

Reference	Requirement	Document Reference
4.4.2	Description and quantity of assets.	2.2–2.9
4.4.3	Age profile.	2.2–2.9
4.4.4	A discussion of the condition of the assets, further broken down into more detailed categories as considered appropriate. Systemic issues leading to the premature replacement of assets or parts of assets should be discussed.	2.2–2.9
Network Asset Information by Asset Category		
4.5	The asset categories discussed in subclause 4.4 should include at least the following:	
4.5.1	Sub transmission. The categories listed in the Report on Forecast Capital Expenditure in Schedule 11a (iii)	2.2–2.10
4.5.2	Zone substations. Assets owned by the EDB but installed at bulk electricity supply points owned by others	2.10
4.5.3	Distribution and LV lines. EDB owned mobile substations and generators whose function is to increase supply reliability or reduce peak demand	2.9.1
4.5.4	Distribution and LV cables. Other generation owned by the EDB.	2.9.1
Service Levels		
5	The AMP must clearly identify or define a set of performance indicators for which annual performance targets have been defined. The annual performance targets must be consistent with business strategies and asset management objectives and be provided for each year of the AMP planning period. The targets should reflect what is practically achievable given the current network configuration, condition and planned expenditure levels. The targets should be disclosed for each year of the AMP planning period.	5.2–5.5
6	The AMP must include performance indicators for which targets have been defined in clause 5 above must include SAIDI and SAIFI values for the next five disclosure years.	5.3.3
7	The AMP must include performance indicators for which targets have been defined in clause 5 above should also include:	
7.1	Consumer oriented indicators that preferably differentiate between different consumer types.	5.3
7.2	Indicators of asset performance, asset efficiency and effectiveness, and service efficiency, such as technical and financial performance indicators related to the efficiency of asset utilisation and operation.	5.4; 5.5
8	The AMP must describe the basis on which the target level for each performance indicator was determined. Justification for target levels of service includes consumer expectations or demands, legislative, regulatory, and other stakeholders' requirements or considerations. The AMP should demonstrate how stakeholder needs were ascertained and translated into service level targets.	3.1; 5.1; 5.2-5.5
9	Targets should be compared to historic values where available to provide context and scale to the reader.	5.2-5.5
10	Where forecast expenditure is expected to materially affect performance against a target defined in clause 5 above, the target should be consistent with the expected change in the level of performance.	5.3.3
Network Development Planning		
11	AMPs must provide a detailed description of network development plans, including—	
11.1	A description of the planning criteria and assumptions for network development.	6.1.1

Reference	Requirement	Document Reference
11.2	Planning criteria for network developments should be described logically and succinctly. Where probabilistic or scenario-based planning techniques are used, this should be indicated and the methodology briefly described.	6.1.1
11.3	A description of strategies or processes (if any) used by the EDB that promote cost efficiency including through the use of standardised assets and designs.	4.3.
11.4	The use of standardised designs	4.3
Network Efficient Operation		
11.5	A description of strategies or processes (if any) used by the EDB that promote the energy efficient operation of the network.	6.1.2
Equipment Capacity		
11.6	A description of the criteria used to determine the capacity of equipment for different types of assets or different parts of the network.	6.1.2
Project Prioritisation		
11.7	A description of the process and criteria used to prioritise network development projects and how these processes and criteria align with the overall corporate goals and vision.	4.1; 4.2
Demand Forecasts		
11.8	The AMP must provide details of demand forecasts, the basis on which they are derived, and the specific network locations where constraints are expected due to forecast increases in demand.	6.1.4, 6.3
11.8.1	The AMP must explain the load forecasting methodology and indicate all the factors used in preparing the load estimates.	6.1.4
11.8.2	The AMP must provide separate forecasts to at least the zone substation level covering at least a minimum five year forecast period. Discuss how uncertain but substantial individual projects/developments that affect load are taken into account in the forecasts, making clear the extent to which these uncertain increases in demand are reflected in the forecasts.	6.1.4–6.3
11.8.3	The AMP must identify any network or equipment constraints that may arise due to the anticipated growth in demand during the AMP planning period.	6.3
11.8.4	The AMP must discuss the impact on the load forecasts of any anticipated levels of distributed generation in a network, and the projected impact of any demand management initiatives.	6.1.3
Network Development Options		
11.9	The AMP must provide analysis of the significant network level development options identified and details of the decisions made to satisfy and meet target levels of service, including:	6.3
11.9.1	The reasons for choosing a selected option for projects where decisions have been made.	6
11.9.2	The alternative options considered for projects that are planned to start in the next five years and the potential for non-network solutions described.	6.3–6.4
11.9.3	The consideration of planned innovations that improve efficiencies within the network, such as improved utilisation, extended asset lives, and deferred investment.	4.2; 5.5

Reference	Requirement	Document Reference
Network Development Programme		
11.10	A description and identification of the network development programme including distributed generation and non-network solutions and actions to be taken, including associated expenditure projections. The network development plan must include-	6.3–6.4
11.10.1	A detailed description of the material projects and a summary description of the non-material projects currently underway or planned to start within the next 12 months.	6.3–6.4
11.10.2	A summary description of the programmes and projects planned for the following four years (where known).	6.3–6.4
11.10.3	An overview of the material projects being considered for the remainder of the AMP planning period.	6.3–6.4
Distributed Generation		
11.11	A description of the EDB's policies on distributed generation, including the policies for connecting distributed generation. The impact of such generation on network development plans must also be stated.	6.1.3; 7.1
Non-network Solutions		
11.12	A description of the EDB's policies on non-network solutions, including-	6.1.1; 7.1
11.12.1	Economically feasible and practical alternatives to conventional network augmentation. These are typically approaches that would reduce network demand and/or improve asset utilisation.	6.1.1; 7.1
11.12.2	The potential for non-network solutions to address network problems or constraints.	4.2.2; 7.1
Lifecycle Asset Management Planning (Maintenance and Renewals)		
12	The AMP must provide a detailed description of the lifecycle asset management processes, including:	
12.1	The key drivers for maintenance planning and assumptions.	8.2
Maintenance Programme		
12.2	Identification of routine and corrective maintenance and inspection policies and programmes and actions to be taken for each asset category, including associated expenditure projections. This must include-	8.4
12.2.1	The approach to inspecting and maintaining each category of assets, including a description of the types of inspections, tests and condition monitoring carried out and the intervals at which this is done.	8.4
12.2.2	Any systemic problems identified with any particular asset types and the proposed actions to address these problems.	8.4
12.2.3	Budgets for maintenance activities broken down by asset category for the AMP planning period.	8.4
Renewal Programme		
12.3	Identification of asset replacement and renewal policies and programmes and actions to be taken for each asset category, including associated expenditure projections. This must include-	8
12.3.1	The processes used to decide when and whether an asset is replaced or refurbished, including a description of the factors on which decisions are based, and consideration of future demands on the network and the optimum use of existing network assets.	4.2; 8
12.3.2	A description of innovations made that have deferred asset replacement.	4.2; 8
12.3.3	A description of the projects currently underway or planned for the next 12 months.	8.4

Reference	Requirement	Document Reference
12.3.4	A summary of the projects planned for the following four years (where known).	8.4
12.3.5	An overview of other work being considered for the remainder of the AMP planning period.	8.4
12.4	The asset categories discussed in subclauses 12.2 and 12.3 above should include at least the categories in subclause 4.5 above.	8.4
Non-network Development, Maintenance and Renewal		
13	AMPs must provide a summary description of material non-network development, maintenance and renewal plans, including—	
13.1	A description of non-network assets.	2.9; 7.2
13.2	Development, maintenance and renewal policies that cover them.	7.3
13.3	A description of material capital expenditure projects (where known) planned for the next five years.	7.3
13.4	A description of material maintenance and renewal projects (where known) planned for the next five years.	7.3
Risk Management		
14	AMPs must provide details of risk policies, assessment, and mitigation, including:	
14.1	Methods, details and conclusions of risk analysis.	3.3
14.2	Strategies used to identify areas of the network that are vulnerable to high impact low probability events and a description of the resilience of the network and asset management systems to such events.	3.3.5
14.3	A description of the policies to mitigate or manage the risks of events identified in subclause 14.2.	3.3.5
14.4	Details of emergency response and contingency plans.	3.3.5
Evaluation of Performance		
15	AMPs must provide details of performance measurement, evaluation, and improvement, including:	
15.1	A review of progress against plan, both physical and financial.	5.3.4; 5.3.5; 5.4.4; 5.5.4; 8.1
15.2	An evaluation and comparison of actual service level performance against targeted performance.	5.2-5.5
15.3	An evaluation and comparison of the results of the asset management maturity assessment disclosed in the Report on Asset Management Maturity set out in Schedule 13 against relevant objectives of the EDB's asset management and planning processes.	3.4
15.4	An analysis of gaps identified in subclauses 15.2 and 15.3 above. Where significant gaps exist (not caused by one-off factors), the AMP must describe any planned initiatives to address the situation.	3.4.3 5.2-5.5
Capability to Deliver		
16	AMPs must describe the processes used by the EDB to ensure that:	
16.1	The AMP is realistic and the objectives set out in the plan can be achieved.	Throughout the document
16.2	The organisation structure and the processes for authorisation and business capabilities will support the implementation of the AMP plans.	1.1.4

APPENDIX C: DIRECTOR CERTIFICATION

Certification for Year-beginning Disclosures

Pursuant to clause 2.9.1 of Section 2.9

We, Robert James Campbell, and Carolyn Mary Steele, being directors of WEL Networks Limited certify that, having made all reasonable enquiry, to the best of our knowledge:

a. The following attached information of WEL Networks Limited prepared for the purposes of clauses 2.4.1, 2.6.1, 2.6.3, 2.6.6 and 2.7.2 of the Electricity Distribution Information Disclosure Determination 2012 in all material respects complies with that determination.

b. The prospective financial or non-financial information included in the attached information has been measured on a basis consistent with regulatory requirements or recognised industry standards.

c. The forecasts in Schedules 11a, 11b, 12a, 12b, 12c and 12d are based on objective and reasonable assumptions which both align with WEL Networks Limited's corporate vision and strategy and are documented in retained records.

Director

3 March 2021

Director

3 March 2021

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