Asset Management Plan

Mahere Whakahaere Rawa

WEL NETWORKS 2023

WEL Networks

AN ENERGY COMPANY OF THE FUTURE

Our Vision

To create and support an ***innovative and sustainable energy future***

Our Purpose

Enabling our ***communities to thrive***

Foreward | *Kupu Whakataki*

28 March 2023

Dear Stakeholders,

Thank you for taking the time to review the WEL Networks Limited 2023 Asset Management Plan (AMP).

The 2023 AMP is an overview of our capital and operational expenditure over the next decade. It outlines the investment rationale and performance measures for our assets in order to provide a resilient, safe, efficient and reliable electricity supply through a period of significant change.

In the time since the onset of the COVID-19 global pandemic, the Waikato region has experienced unprecedented growth in construction and business activity. This was accompanied by supply chain difficulties and ensuing price inflation which is still being experienced today. The Reserve Bank of New Zealand has indicated their intent to slow the rate of inflation by tightening monetary policy, with expected flow-on effects of reduced construction and business activity. However, we are yet to see indications of a downturn in growth.

Despite the anticipated economic slowdown, we are beginning to experience an increase in consumer electricity use which is driven by climate change requirements encouraging the use of electricity, enabled by transformational technologies. This trend is expected to continue during the AMP period. This plan factors in the short term macro-economic uncertainty, whilst looking ahead to ensure that WEL is positioning itself to support our community. New technologies such as renewable generation, energy storage systems and new operating frontiers such as flexible demand control, show exciting possibilities that can then be part of the solution mix to meet customers' requirements. This exciting future will bring new challenges and opportunities for WEL and our consumers.

Growth and innovation in the generation, storage and use of electricity, will be increasingly prevalent across our region. In order to enable and manage the introduction of new customer owned technology and changing customer expectations for availability of electricity, WEL is investing in Low Voltage (LV) and Distributed Energy Resource Management Systems (DERMS), increasing network visibility and expanding operational capabilities to support active customer participation in the electricity system. This forms a strong pathway to unlocking greater value that can be shared with all participating customers.

The AMP reflects our vision to create an innovative and sustainable energy future that will enable opportunities for WEL, our customers and our communities. Our vision drives our investment decisions which are focused on safety, sustainability, value for money, continuous improvement and integration of new technologies.

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

Executive Summary

Kōrero Whakarāpopoto

WEL NETWORKS AMP 2023

1 Introduction to our 2023 Asset Management Plan

Following the upheaval caused by COVID-19 during 2020 and 2021, 2022 proved to be a comparatively more settled year. With the spectre of further COVID-19 lockdowns removed, we were able to get back to the focus of serving our community.

2022 was not without challenge, however. Early in the year, Cyclone Dovi caused extensive damage to our network. This was the single largest storm event to affect the network since Cyclone Bola in 1988 and contributed to our worst SAIDI performance in 10 years. Almost exactly one year later New Zealand was hit by Cyclone Gabrielle which caused significant damage to electricity distribution networks across the country including WEL's network. Although the Government transitioned away from using lockdowns in late 2021, Covid-19 and other illnesses continued to impact our ability to plan and carry out our work as efficiently as we would have liked. Inflation at a 30-year high, combined with supply and logistics challenges, put a significant strain on the cost of operating and maintaining the network.

The lessons learned from working through these challenges, reinforced how important the resilient and affordable supply of electricity is to our community.

Our Asset Management Plan (AMP) is the summation of our strategies and plans for providing a resilient and affordable electricity network for the next 10 years. It incorporates the lessons that we have learned from 2022 (and prior years) and describes how we are responding to the changing environment in which we operate and the evolving needs of our community.

Our AMP is not purely a compliance document; it is intended to provide transparency to our community, regulators, and all other stakeholders, over the context in which we make investment decisions and how our asset management practices support the decision-making process. Our AMP sets out our view of the investments which we believe will be required to deliver the best outcomes for our community. However, we note that given the uncertainty of future electricity demand, future changes may be required to the investment programmes and timeframes as described in this document. Our network plans will be revised annually to incorporate updated projections, new regulatory developments, and emerging technologies.

2 The current environment we are operating in

Electricity distribution networks are playing a key role in enabling New Zealand's transition to a low-emissions future. This future will see increased generation of electricity from renewable sources being used to electrify other sectors such as transport and industrial processes. There is considerable uncertainty as to how and when this transition might occur, but we have not delayed in beginning to prepare for it.

We recognise that our customers still largely rely on utility-scale electricity generation as their primary energy source, and we do not anticipate this will change for the majority in the near-term. We are aligning our asset management practices for the crucial role we will continue to play in connecting customers to their energy source, even as Distributed Energy Resources (DER), such as consumer-scale solar and batteries become more prevalent. To fully leverage the advantages of local generation and storage, customers will depend on the resilience, reliability and affordability of our distribution network to import or export energy in support of their DER.

2.1 What has challenged us?

The past few years have challenged us like never before, yet each of the challenges we have overcome have helped us to become a more agile and better prepared network.

We have experienced disruption to global and domestic supply chains, unprecedented in modern times. Following the Covid-19 pandemic; geopolitical uncertainty, extreme weather, and labour shortages have challenged our previous expectations around the supply of materials and inventory management. We worked closely with our suppliers to build and maintain sufficient inventory levels that ensured we were able to meet both network development and customer demand.

The city of Hamilton and the wider Waikato region have experienced much stronger than forecast economic recovery, following the slowdown induced by the global pandemic. In the last 12 months, we received record numbers of enquiries from potential customers across residential, commercial, and industrial sectors which translated to a significant increase in committed customer-initiated work. The level of growth strained our ability to process and deliver customer-initiated projects in a timely manner. To better meet the needs of our growing network, it was determined that two tier one delivery partners would need to be brought on board. After a competitive tender process, Ventia and Downer were awarded contracts, greatly increasing our capacity and improving the timeliness of our delivery of customer-initiated projects.

As we move forward, we will continue to adapt and evolve in response to any new challenges that come our way. Our top priority will always be to maintain the reliability of our network and to support our community in any way we can.

2.1 Where have we improved and what have we achieved?

We take our role as an enabler of the transition towards a low-emission future very seriously. Over recent years we have implemented a range of 'least regrets' initiatives aimed at ensuring our network will continue to provide a resilient, safe, reliable, and efficient electricity distribution service that allows consumers to connect and operate whatever devices they choose.

Keeping our community and our staff safe is our highest priority. Our vision is to be 'Best in Safety' and as a trusted member of the community we're committed to getting everyone - staff and members of the public - home safe every day. We continue to regularly assess our safety maturity and look for ways to develop and improve processes, systems and equipment. We have also continued to 'strive for better' by incorporating insights from staff and contractor feedback, external and internal audits, benchmarking, and investigation findings into our health, safety, and wellbeing strategic roadmap, plans and public safety management system. Over recent years we have developed specific public safety campaigns to provide critical safety information to people living and working around our network.

Through every aspect of our organisation, we are committed to running the network and our business activities, in a sustainable and socially responsible way that delivers positive outcomes for our stakeholders. To achieve this, we have aligned our strategic direction with four of the United Nations (UN) Sustainable Development Goals (SDG):

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

In alignment with these goals, we are promoting a positive workplace for WEL staff, investing in the future of the local community and addressing energy hardship, building resilient infrastructure and promoting sustainable and innovative development of network assets, and assessing our emissions with a view to reducing the relative impact of these over time.

Although what the 'network of the future' looks like remains uncertain, we believe New Zealand's future energy needs require an accelerated evolution of network operation in terms of energy flows, data, and flexibility. To meet this challenge, we have been investing in Distribution System Operator (DSO) capability and systems. The DSO initiative is unlocking visibility of the network, particularly the Low Voltage (LV) network, to understand customers' evolving use of the network. To make the most out of this improved visibility we have greatly enhanced our data analytics capacity. We have incorporated predictive operations and other emerging technology capabilities to improve DER inter-operability, customer access, demand flexibility network and operational capability.

A secure, reliable and resilient electricity supply has always been vital for essential services such as communications, water treatment, emergency response and commercial business. However, the increasing reliance on electricity for household communication, transport, household appliances and the shift to working from home is also demanding the same network performance across all customer groups. This has been demonstrated by the impact of severe weather events and shifting demands following the Covid-19 pandemic which have evolved the way we think about network resilience. In addition to our robust maintenance and renewal programme, we have launched initiatives targeted at increasing resilience to major storm events and relocating assets to mitigate flooding and earthquake risk. We have also invested in ensuring we have robust cyber security systems.

As part of our continuous effort to align customer requirements and business systems and processes, we will seek enhanced operational efficiency and stakeholder alignment through certification to the ISO 55001 standard in this AMP period. The Strategic Asset Management Plan (SAMP) has been created to define the foundation of the improvements and alignment to the ISO 55001 standard. WEL is continuing to improve business capability to manage cost, optimise expenditure, improve risk management, and deliver the service levels our customers demand.

3 Our expectations for the future

We understand that the future operating environment will be shaped by many factors, but the way our customers use, generate, and manage energy will be of particular importance. Our purpose is to "enable our communities to thrive", we do this by delivering a service that meets our customers' needs. This purpose has driven our vision statement "to create and support an innovative and sustainable energy future". This then flows into our E^3 (Extract the core value, Explore energy solutions and Expand into our future state) strategy, where we have developed an evolving approach to understanding and addressing customers changing requirements and energy use patterns.

Changes in customer behaviour will be driven by a combination of factors, including the increased use of new technology like on-site generation, storage systems, electric vehicles, and new types of appliances, in an effort to reduce emissions, increase resilience and a drive to reduce energy costs. We have a responsibility to help facilitate these changes by planning and operating the network in an open-access manner. This will enable customers and service providers to connect devices and conduct energy transactions with minimal restrictions, thereby encouraging greater proliferation of renewable generation and electrification initiatives with their associated carbon-reduction benefits.

We recognise that solely focusing on traditional network reinforcement would be an inefficient and expensive way to cater to the demand we expect to see from renewable generation and electrification. Effective demand management, energy storage, and pricing incentives operating in an open-access environment have the potential to increase the utilisation of existing network infrastructure, minimising or deferring the need for future investment.

Although the final form of open-access networks is still being debated, we are committed to providing an open-access network and assisting the industry in this transition, which we see as an essential enabler for any likely future DSO or similar arrangement.

However, we do not underestimate the challenge of transitioning to an open-access network. This evolution will require considerable effort and investment to provide the required visibility, controllability, flexibility, and stability of all parts of the network. While we have made some progress on our plans for an open-access network, we recognise that many factors could accelerate uptake rates and, if this occurs, we will need to amend our anticipated timeframes and future AMPs.

As we have already highlighted, we are increasingly seeing changes in the way customers use electricity and our network. There are many factors influencing these changes, however decarbonisation stands out as one of the primary drivers. New Zealand has set into law a target for net zero greenhouse gas emissions by 2050. To achieve this will require decarbonising efforts from all industries and sectors.

The electrification of transport has the ability to meaningfully aid New Zealand's decarbonisation goals. To support this, the Government introduced the Clean Car Discount scheme which financially incentivises the purchase of electric vehicles (EV), while disincentivising internal combustion engine vehicles. As a result of this, and an increasing availability of EVs from manufacturers, we expect to continue to see very strong EV growth in our region. While this is a fantastic achievement for emissions reductions, unrestrained charging of EVs has the potential to cause significant congestion on our network.

The anticipated impact of the electrification of transport on network demand remains very uncertain, it will depend not only on uptake rates, but also the degree to which we will be able to manage the additional load. Unmanaged EV charging is a network owner's worst case scenario. Given our projections for EV uptake, we estimate that unmanaged

EV charging would require reinforcement expenditure roughly equivalent to the total current value of our network.

We anticipate that the electrification of process heat, increased uptake of distributed generation (DG), and conversion of residential gas use to electricity, could produce similar outcomes as unmanaged EV charging (albeit to lower degrees). Regardless, we remain committed to supporting our customers in achieving their energy goals and ensuring a sustainable future.

At the time of writing this AMP, a sustainable future is front of mind for many. The mammoth clean-up following Cyclone Gabrielle is still underway in the east of the North Island. Although resilience and reliability have always been main focus areas for distributors, the devastation wrought by Cyclone Gabrielle across the North Island will be causing all networks to reassess their major event resilience, WEL is no different. We expect specific lessons learned from Cyclone Gabrielle will be incorporated into future versions of our AMP as networks complete their post-event reviews.

However, what we already know is that climate change is beginning to increase the frequency and magnitude of storms, flooding, erosion, and subsequently asset damage on our network. We predict that as the effects of climate change increase, seasonal impacts will become increasingly variable, leading to greater uncertainty when trying to plan and schedule work. We anticipate that the cadence of interventions such as vegetation management will need to increase to prevent damage from more frequent and severe storm events. We also believe that higher peak temperatures will increase customer demand in summer, while reducing the operating range and useful life of our assets.

At this point the economic fallout from Cyclone Gabrielle remains uncertain, we expect that economic intervention may be required by the Government or Reserve Bank. However, based on the downturn we are seeing in many of the economic indicators we monitor, we anticipate New Zealand will enter a recession during 2023/24. Subsequent to the Global Financial Crisis (GFC) in 2008, our network experienced a 50% decline in new connection growth in 2009, compared to the year prior. New connection growth then took four years to recover to pre-GFC levels. We anticipate a 2023/24 recession will be a shorter and less severe recession than the recession that followed the GFC. However, we do anticipate it will negatively impact new connection growth and EV uptake for about two years. We will continue to monitor economic conditions and reforecast spending as appropriate in future AMPs.

4 Our strategy to ignite change

In response to societal, regulatory, and climate shifts reshaping the energy landscape, we have embarked on a strategy to unlock our true energy potential. We call this our ‘E^3 Strategy’. We believe that to ensure a thriving WEL Networks for tomorrow we need to focus on: extracting the core value of our network, exploring emerging energy solutions, and expanding into our future state.

By extracting the value of our core, we ensure that we derive the greatest benefit from investments made in our core infrastructure. By exploring energy solutions, we are able to provide what our customers need today and tomorrow for a low-emissions, low-price, choice-driven future. And by expanding into our future state, we are able to incubate new ideas with a view to invest in scale-ups and start-ups, increasing the services we are able to offer.

WEL NETWORKS

E³ STRATEGY

The 'Energy Management Solution' (EMS) is critical in controlling, overseeing and forecasting the flow of electricity whilst dynamically serving our customers.

It also protects our core business and drives value, efficiency and risk reduction.

Energy Management Solution

Extract
the core value

Value

Service

Efficiency

Risk Reduction

Explore
energy solutions

Control

Customer Demand Flexibility Trials

Forecasting

Distributed Generation and Energy Storage Trials

Expand
into our future state

DER Management

Energy and Power Quality Management

LV Network Visibility

Distribution System Operator

5 10-year expenditure forecasts

Our expenditure forecasts are based on our best current information regarding network use and performance trends, and a prudent allowance for readying the network for expected future changes.

While the scope, timing, and cost of projects and initiatives are well understood in the near-term, as the 10-year planning period progresses, these aspects become less certain.

Our forecast 10-year capital and operational expenditure reflects these views.

5.1 Capital expenditure

Our forecast capital expenditure during the AMP period is largely driven by investment in consumer connections, asset renewal, and system growth. Our expenditure profile reflects our expectation of a recession in 2023/24 slowing consumer connection and system growth in the near-term. Following this, consumer connection growth is expected to recover and expenditure on system growth to enable electrification is forecast to increase.

Our forecast capital expenditure during the planning period is set out in Figure 1.

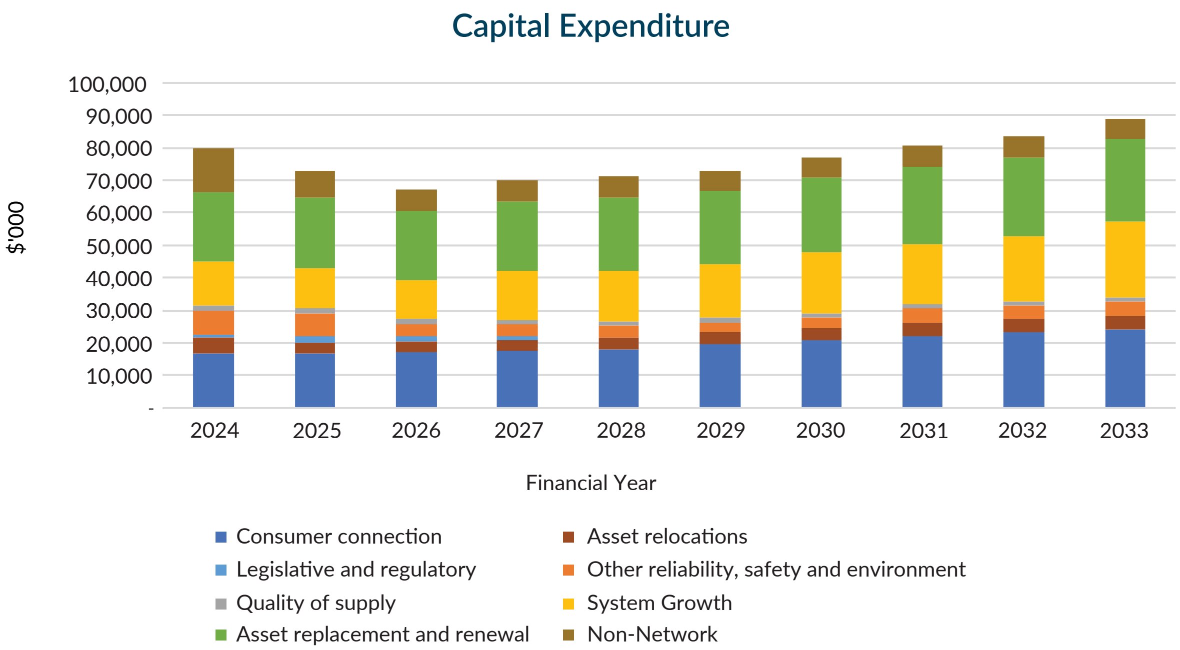


Figure 1: Capital expenditure forecast

Our capital expenditure forecast is summarised in Section 9.2. However, much greater detail can be found regarding each of the capital expenditure categories, throughout Chapters 6, 7, and 8.

5.2 Operational expenditure

Our forecast operational expenditure is expected to remain relatively flat throughout the AMP period. Although it is forecast to remain flat, we expect non-network expenditure (business support and system operations and network support) will continue to account for the majority of our operational expenditure throughout the planning period. We have forecast a slight increase to network operational expenditure, that is directly related to the provision of electricity distribution services, over the 10-year period.

Our forecast operational expenditure during the planning period is set out in Figure 2.

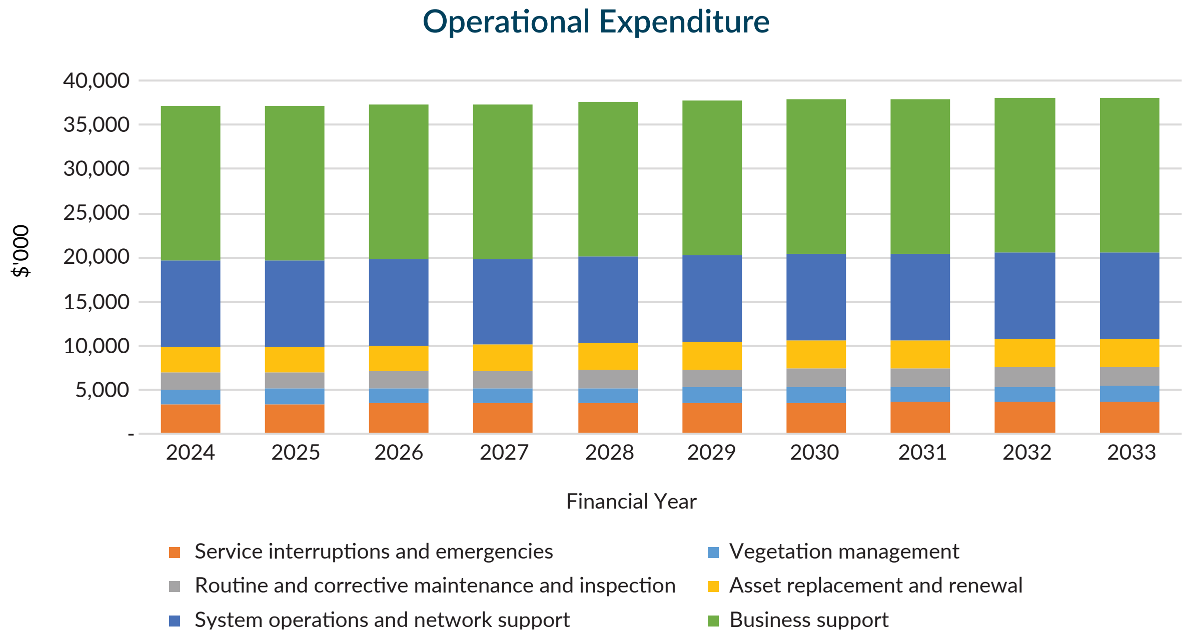


Figure 2: Operational expenditure forecast

Our operational expenditure forecast is summarised in Section 9.4. However, much greater detail can be found regarding each of the operational expenditure categories, throughout Chapters 7 and 8.

6 AMP Overview

Our Asset Management Plan (AMP) describes the nature and characteristics of our assets and investment requirements. It provides an overview of our asset management planning, procedures, and practices, as well as a clear description of our objectives, measures, and targets we aim to achieve for our stakeholders. The plan also details the investments we will need to make over the next ten years and how these activities will be managed to meet the requirements of our current and future stakeholders. The primary purpose of this AMP is to communicate with our stakeholders by providing them with an understanding of:

- The nature and characteristics of the assets we own and operate;
- Our investment and expenditure requirement over the AMP period to achieve our vision of creating an innovative and sustainable energy future and enabling our communities to thrive;
- How stakeholder interests are integrated into our asset management planning, procedures, and practices;
- How our asset management and planning process supports our objectives of safety, high-quality customer experience, cost efficiency, and asset performance; and
- The relationship between our AMP and our strategic plan, and the importance of the AMP as a key planning document.

The AMP covers the ten-year period from 1 April 2023 to 31 March 2033 and was approved by our Board of Directors on 28 March 2023.

Wherever possible, we have endeavoured to explain technical information in simple terms to ensure that this plan provides meaning and value to all of our stakeholders. To complement this approach, we have included a high-level overview of each chapter below:

6.1 Background

Chapter one provides the background context to our plan, describing who we are, our community ownership (by way of the WEL Energy Trust), and how we are governed. It outlines our purpose and values which underpin every facet of our organisation and how we manage our network. The chapter explains the boundaries, geography, and layout of our network and shows the year-on-year increasing demand we are experiencing. The chapter also introduces our key stakeholders and provides a breakdown of approximately 98,000 active customers connected to our network.

6.2 Asset Overview

Chapter two provides an overview of our assets, their current condition, and their predicted condition at the end of the AMP period. The chapter outlines the asset categories, the number of assets within each category, and their respective ages and conditions. It indicates that the vast majority of assets on our network remain in good health and condition.

In addition to the required condition scores, this section describes the Asset Health Index (AHI) assessment tool which we use as part of our Condition Based Risk Management (CBRM) methodology.

6.3 Approach to Asset Management

Chapter three describes the approach we take to managing our assets. The chapter goes into greater depth with regard to our stakeholders, how we solicit their views, and what each of their requirements are. The chapter outlines our commitment to sustainability with the alignment of our strategic direction with four of the United Nations' sustainability development goals. Chapter three also describes our asset management system and policies, along with our approaches to risk management. The chapter concludes with an explanation of the Asset Management Maturity Assessment Tool (AMMAT) and how we utilise it. Our 2023 AMMAT scores were slightly lower than the last full assessment in 2021 due to a more detailed investigation into our gaps to the ISO 55001 framework. On the whole, our asset management maturity is improving.

6.4 Asset Management Governance

Chapter four outlines the governance framework which we apply to asset management. It outlines the processes and policies that support investment planning decisions and establishes clear accountability and expenditure approvals. The chapter also describes the process for identifying and prioritising network expenditure. Customer initiated work, asset renewal, and network development inputs are all fed into the capital plan optimisation process, prior to the formation of the annual works plan. We then use the works delivery model to manage the safe and efficient delivery of the annual works plan.

6.5 Asset Management Performance

Chapter five details our performance objectives, initiatives, measures and targets for the AMP. These objectives cover: safety, customer experience, cost efficiency and asset performance. 2022 proved to be a challenging year for our performance metrics. While some of the targets we did not meet were largely outside of our control, some have highlighted areas we can improve on.

In terms of safety, we managed to realise an injury severity rate of 6.6 in FY22 (against a target of <7), unfortunately we also recorded one public safety incident causing harm. Our target for this category always remains zero. For customer experience, both of our reliability targets were exceeded in 2022. Our average customer experienced 117.27 minutes of supply interruption against a target of 86.27 minutes, and the average customer lost supply 1.64 times in FY22, against a target of 1.52 times. This result was primarily due to the impact of Cyclone Dovi and an increased incidence of car accidents involving poles. Both cost efficiency targets we set were not achieved in FY22. Our operating cost per customer ($334) exceeded our target by 3.9%, while our capital work delivery ($22.2M) was 10.4% higher than our target, due to $2M land procurement which was unbudgeted. Our asset performance target of 60% load factor at GXPs was also not achieved in FY22. More work is required to ensure effective management of the emerging loads to improve our load factor.

6.6 Network Development

Chapter six describes the demand growth our network is facing and the solutions we are planning to implement to mitigate it. This chapter details how electrification, intensification, and other key drivers are predicted to contribute to nearly 30% greater peak-demand on the network over the planning period. The chapter also characterises the capacity, power quality, security of supply, resilience, sustainability, and affordability impacts associated with the increased network demand we are forecasting.

The second half of the chapter breaks down in greater detail how we expect the forecast system demand growth will be observed at each GXP and also down to a zone substation level. From here, the chapter details the constraints we are currently addressing and those we expect to encounter. Although none of our zone substations are currently exceeding their design capacity, without mitigation, a small number are expected to reach their design capacity as early as 2025. Where we have identified or forecast constraints, the proposed projects and solutions (and associated costs) to alleviate these have also been described.

6.7 Non-network Support Systems

Chapter seven describes the systems and non-network expenditure which allow us to efficiently keep the network running. We categorise the support technologies as either network (which we use to distribute electricity to our customers), or non-network (which support the running of the network, but which are not directly involved in the provision of electricity distribution services).

Network technologies include systems such as our Network Management System (NMS) which allows us to control the network in real-time, our smart metering system which manages the data and communications of our smart meter network, and our Geographic Information System (GIS) which allows us to map the geographical location of our network assets. Non-network technologies include systems such as our Enterprise Resource Planning (ERP), network billing, and content management systems.

The last section of this chapter describes our approach to non-network capital and operational expenditure, including our 10-year expenditure forecast for each category.

6.8 Asset Replacement and Renewal

Chapter eight describes our process for asset replacement and renewal. The chapter discusses the importance of maintaining and upgrading the network assets to ensure their continued performance and safety. It highlights the need for effective asset management planning and investment decisions to balance the cost of asset replacement and renewal against the potential risks and benefits.

The chapter outlines the criteria used for assessing the condition and performance of assets and determining their remaining useful life. It also discusses the different options for asset replacement and renewal, including refurbishment, replacement, and upgrades, and the factors that influence these decisions.

Where we have identified condition issues, we describe the projects or programmes which we have planned to remedy them. This chapter also includes detailed breakdowns of forecast expenditure by asset replacement and renewal sub-category.

6.9 Summary of Expenditure Forecasts

Chapter nine outlines the expenditure forecasts for maintaining, renewing, and expanding the network over the next 10 years. The chapter is based on the drivers of expenditure, including population growth, technological changes, and regulatory requirements, detailed in earlier chapters.

The chapter provides a breakdown of our forecast capital and operational expenditure into expenditure categories, such as System Growth, Asset Replacement and Renewal, and Business Support. Overall network capital expenditure is expected to increase by $16M over the 10-year planning period, whereas operational expenditure is expected to remain relatively constant.

Capital expenditure is expected to increase over the planning period, largely due increased System Growth and Customer Connections. While it is projected to remain relatively constant, Asset Replacement and Renewal investment remains one of the other major categories of capital expenditure. Not only is total operational expenditure expected to remain relatively flat, but so too are the categories that make up operational expenditure. Business Support and System Operations and Network Support will continue to make up the majority of operational expenditure over the next 10 years.

Table of Contents | *Ngā Rārangi Take*

1 Background

Kupu Whakataki

1. Background | *Kupu Whakataki*

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 Networks (WEL) is 100% owned, with WEL Energy Trust being the sole shareholder. WEL supplies electricity to the Waikato and small networks in Cambridge and Auckland. Hamilton is the main electrical load centre. Outside Hamilton the network area consists of several smaller townships, rural centres and countryside. Our distribution area map is shown in section 1.2.

WEL owns, maintains and operates over $675 million of electricity network infrastructure. Our network is supplied by three Grid Exit Points (GXP) owned by Transpower and two large, embedded generators at Te Rapa[1] 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 our residential customers. Our network is more than 6,500km in length and of over 200,000 individual asset components. Within the network we maintain and operate twentysix zone substations and seventeen switching stations (11kV) to ensure a reliable supply of electricity to our customers.

The total electricity delivered in 2022 was 1,331GWh with a coincident peak demand of 308MW. WEL have ten broad groups of stakeholders that drive this demand; our customers, developers, electricity retailers, community, regulators, Transpower including in their role as System Operator (SO), service providers, staff, our Board of Directors, and Trust. Customer expectations are identified through surveys and direct interaction to ensure a continual focus on what is important to our customers. Our stakeholder requirements focus our expenditure plans as discussed in detail in Section 3.1.

WEL is committed to delivering on its vision to "Create and support an innovative and sustainable energy future". This is evidenced by our asset management and corporate initiatives to deliver value and enable our community to thrive.

WEL's approach, initiatives and sustainability achievements are discussed further in Chapters 3 and 5.

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

1.1.1 Ownership and Governance

WEL Energy Trust

WEL Networks is 100% community owned. The WEL Energy Trust is the sole shareholder. The Trustees are elected by WEL's customers. Elections are held every three years. The Trust is community owned, and the Trust uses the income it receives to benefit the community that WEL serves.

The Hamilton City Council, The Waikato District Council and The Waipa District Council are WEL's capital beneficiaries.

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

1.1.2 Corporate Purpose and Values

WEL's corporate purpose, vision and values align with the Trust's purpose statement below. This ensures a clear line of sight between the aspirations of the Trust and how WEL operates as a business.

WEL Energy Trust's Purpose: **"Growing investment for our community"**
The Trust's purpose is to grow investment for the community by being diligent shareholders and by utilising WEL's profits effectively in the community through a programme of community grants.

1 Te Rapa gas fired generator is planned to be shut down in June 2023.

WEL Purpose, Vision and Values:

As our communities grow, WEL plays an essential role in the Waikato region's long-term economic and social development. WEL does this by identifying and investing in new technologies that offer benefit, to modernise the network and future proof WEL's communities.

WEL's purpose expresses why it exists, while WEL's vision describes our desired future state. Our values describe the mindset required of our people to ensure WEL's success in this aspiration.

Our Purpose

Enabling our ***communities to thrive***

Our Vision

To create and support an ***innovative and sustainable 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 are 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 each other, the customer and our 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 are 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 is not safe.

1.1.3 Corporate and Organisation Structure

This section details the governance arrangements, organisational structure, and key responsibilities of WEL's Executive Management, Asset Management, Operational teams and supporting functions. The purpose of the governance and organisational structure is to ensure 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, 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 WEL's organisational structure. Additional descriptions of the responsibilities of each group follow.

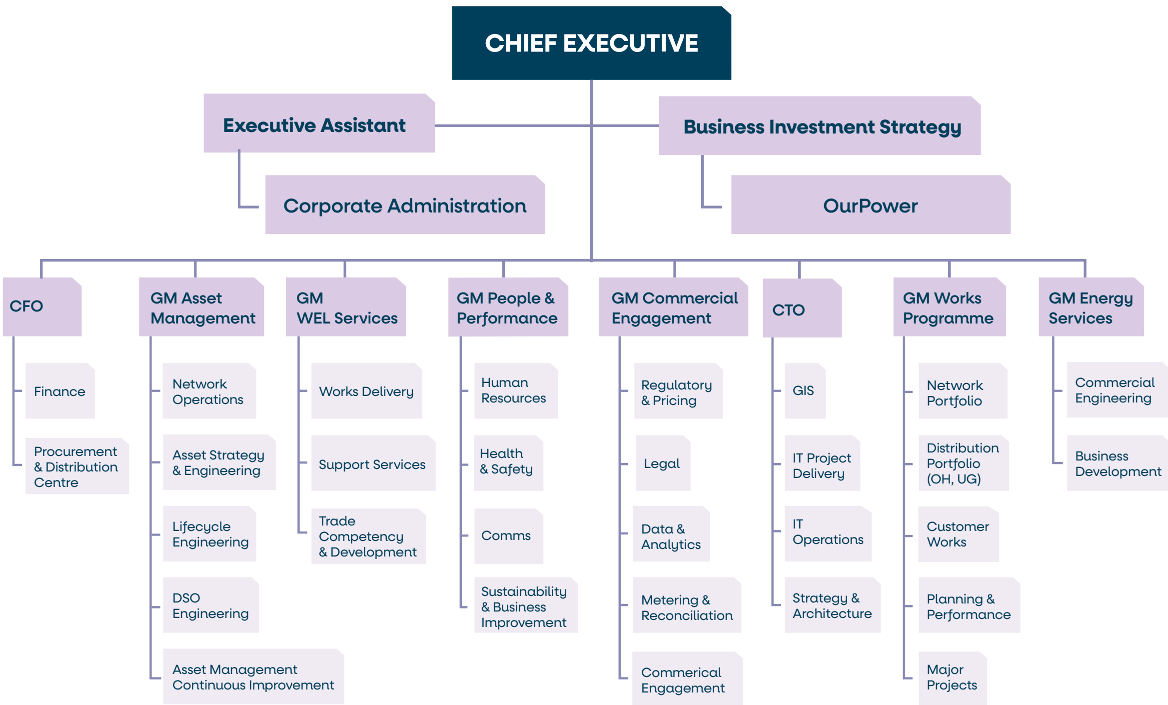


Figure 1.1.3.1: Organisation Structure

Executive Management Team – Chief Executive, Garth Dibley, heads up the 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 Strategy 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
Lifecycle Engineering	▶ 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
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
Asset Management Continuous Improvement	▶ AM continuous improvement reviews and activities ▶ Interface with other business improvement activities and groups ▶ Implementation of actions and improvements to ISO 55001 certification

Table 1.1.3.2: Asset Management Team Responsibilities

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

People and Performance Group – provides the health and safety function to the business, manages the employee life cycle, provides benefits and workforce planning support. Furthermore, this team is responsible for sustainability management, facilities & fleet management, business improvement, communications, 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. In 2022, the Data Analytics team were moved into the Commercial Engagement Group from the Asset Management Group to recognise the companywide importance of the function.

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

Information Services Group – is responsible for information technology, the geographical 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.

The Works Programme group was established to manage the annual works plan following the 2019 review of WEL Networks delivery structure. 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.

In 2023, two Tier One contractors will be introduced to enhance the delivery of Customer Initiated Works (CIW). The companies will be utilised for delivery of a portion of the Annual Works list. Monitoring of delivery is conducted monthly across the three business units to achieve desired outcomes.

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. WEL Networks wants to be involved with technological changes and movement to increase Distributed Energy Resources (DER) for the benefit of the community.

1.1.4 Capability

WEL has implemented several initiatives to enhance its business capabilities and support implementation of our AMP. These are summarised below:

Competency Standards

WEL has developed a work type competency standard based on the Electricity Networks Association (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. WEL has introduced "WEL Educated" a Totara learning management system to record staff competencies and provide a platform for WEL's workplace learning.

Dedicated Team

WEL has a cohesive and dedicated Trade Competency and Development team focused on upskilling the staff working on its network. Developing and delivering a roadmap that provides consistency to WEL's approach is the next step in WEL's maturity in the training space. WEL's regulatory responsibilities, safe work processes, oversight of trainee development and other field training requirements, including an LV management framework, all benefit from our dedicated team developing training content and supporting WEL's people in their learning.

Training

E-Learning modules are produced in-house, using the skills and experience of the Trade Competency and Development team to provide training and assessment on a range of competencies in the framework. A network of workplace assessors is being established based on the varying trade competencies to align all staff with the competency framework. Priority for development and rollout is focused on high-risk tasks.

Certification

WEL is expanding the competency and training to the non-trade staff that support the asset management plan as part of our ISO 55001 implementation.

1.2 WEL Networks' Distribution Area

Network Overview

WEL's network stretches from Hamilton in the southeast, to Raglan in the west to Maramarua in the north. WEL also and operates small, embedded networks in Cambridge and Auckland. WEL's coverage area is illustrated in Figure 1.2.1 below. Assets within our network are grouped according to function.

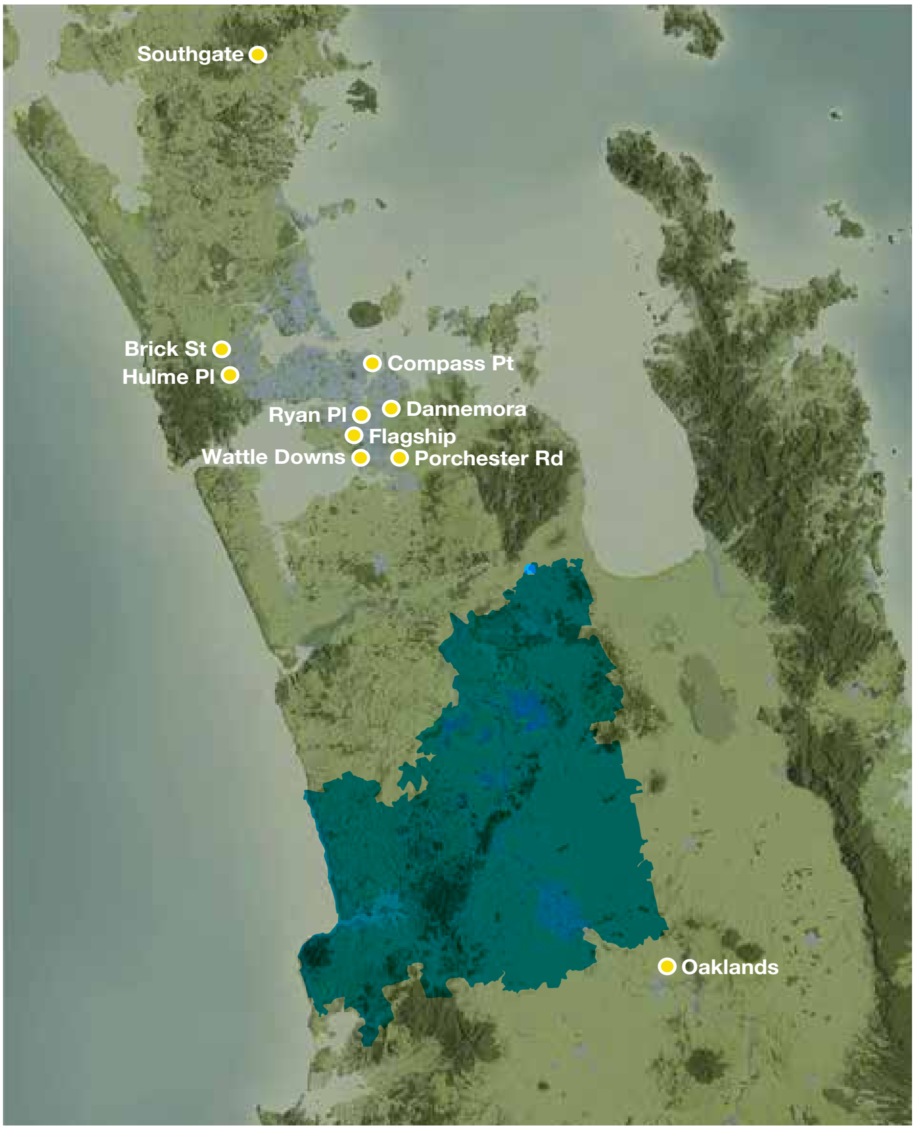


Figure 1.2.1: WEL Networks boundary and small embedded networks in Cambridge and Auckland

Network assets that are used to provide electricity to the WEL distribution area consist of five main elements:

Grid Exit Points, Distributed Generation, 33kV Subtransmission and Zone Substations, 11kV Distribution and the Low Voltage Network.

(1). Grid Exit Point (GXP)

WEL takes 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 WEL's distribution area. In the past 5 years, the Hamilton GXP has on average, provided 722.9 GWh of electricity per annum, which equates to approximately 48% of the total electricity distributed by WEL annually. WEL's 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 WEL's network. There are two large, embedded generators in this region, the Te Rapa gas fired generator and the Te Uku windfarm. In the past 5 years, the Te Kowhai GXP has on average, provided 646.7 GWh of electricity per annum, which equates to approximately 43% of the total electricity distributed by WEL annually. In June 2022 it was announced that the Te Rapa gas fired generator will be shut down and decommissioned in June 2023. This will result in a loss of 44MW of embedded generation and the 18MW load fully supplied by Te Kowhai GXP. 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 WEL's 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. In the past 5 years, the Huntly GXP has on average, provided 119.7 GWh of electricity per annum, which equates to approximately 8% of the total electricity distributed by WEL annually. In 2023 a 35MW Battery energy storage system (BESS) will be connected in the Huntly GXP area.

Table 1.2.2: General description of GXPs supplying WEL

Figure 1.2.3: WEL Network Boundary, 33kV subtransmission network, GXPs and zone substations

(2). Distributed Generation

Two large, distributed generators are connected to WEL's 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

WEL's 33kV subtransmission network transports electricity from Transpower's GXPs to WEL's zone substations which in turn supply the 11kV distribution network. The subtransmission network is 463km in length and consists of an interconnected mesh around Hamilton, with double and single radial circuits in the areas beyond. Zone substations that are supplied with single radial circuits have 11kV distribution circuits providing partial backup.

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

There are 25 zone substations on the network. Zone substations have two transformers except Whatawhata, Glasgow, Finlayson, Raglan, Hampton Downs and Hoeka. Smaller rural zone sub-stations supplying smaller loads have a single transformer.

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

(4). 11kV Distribution

WEL's distribution system takes supply from the zone substations and the Hamilton GXP at 11kV. The distribution system comprises approximately 1,303km 11kV overhead lines, known as feeders; on poles and crossarms, approximately 788km of 11kV underground cables, distribution transformers and switching stations.

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

In other areas the 11kV distribution network is primarily overhead lines; the exception is areas that traverse newer residential areas. All recent and new subdivisions, rural and urban, are reticulated by underground cables in accordance with district plan requirements.

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

Distribution Substations:

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 supplied from these units through 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.

Several of WEL's large customers own distribution networks within their sites. WEL only maintains and operates these where contracted to do so.

(5). Low Voltage Network

WEL manages approximately 1,927km of low voltage (LV) overhead lines and 2,571km of LV cables. Approximately 90% of rural and 40% of the urban low voltage network is overhead lines. All new residential subdivisions, rural and urban, are reticulated with underground cables.

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

1.3 WEL's Operating Environment

The environment in which WEL operates is a key factor in delivering its services. A range of factors determine the operational environment. These include:

- Topography
- Climate
- Land access
- Vegetation
- Regulation

Topography

The topography of the region varies from 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 the region is free-draining and cultivated. However, there are 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. Occasionally, unpredictable extreme weather conditions negatively impact the performance and reliability of WEL's assets. Weather related events cause a sizeable proportion of all interruptions to WEL's 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, particularly vegetation and failure during adverse weather events. Adverse weather events are forecast to increase in frequency, duration and intensity as climate change impacts take effect across the region over time.

Land Access

WEL's ability to access ts 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 permitted to access designated road reserves for installation, maintenance, and repair of electrical equipment under the Electricity Act 1992.

WEL acquires easements for the installation of new assets on private property; to formalise both the landowner's and WEL's legal rights. Obtaining an easement is usually straightforward when a private landowner 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.

WEL's planning systems ensure work commences on obtaining the necessary easement as soon as practical in the planning process. A pragmatic approach is taken to the amount of land required for an easement to reduce expense and any delay in the delivery of new assets.

Vegetation

Vegetation located close to WEL's assets has the potential to interfere with the safe and reliable supply of electricity to our customers. WEL manages all vegetation in accordance with the requirements of the *Electricity (Hazards from Trees) Regulations 2003*. WEL achieves this through patrolling, monitoring and recording sites where vegetation could interfere with the safety and reliability of supply to WEL's customers. WEL trims or removes vegetation as necessary or advises customers of their obligations if at-risk lines cross private property.

Regulation

WEL operates in a highly regulated environment. WEL is community owned, and its size is below the threshold contained within Part 4 of the *Commerce Act 1986*, therefore WEL is exempt from direct price and quality control by the Commerce Commission. WEL remains subject to all other regulatory controls including significant Information Disclosure requirements.

1.4 Electricity Delivered and Demand

In Figure 1.4.1 below, the total electricity delivered at the end of financial year 2022 was 1,331 GWh with a coincident peak demand of 308 MW. The total energy delivered by WEL is growing year on year, while WEL has managed peak load to similar levels across the ten years. This illustrates our effective load management in accordance with WEL's utilisation KPI detailed in Section 5.5.3.

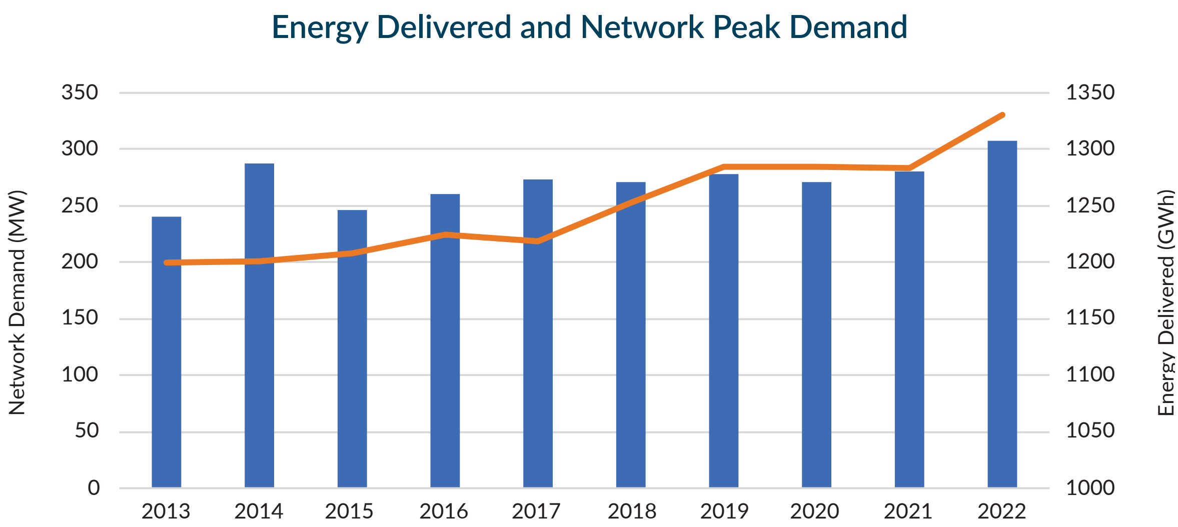


Figure 1.4.1: Electricity Delivered and Peak Demand

Most customers across WEL's urban network have two distinct load profiles throughout the day. Urban customer load is 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 has a similar pattern with dairy farms contributing towards energy demand and peak demand in the summer, during milking times in early morning and mid-afternoon.

1.5 Stakeholders

As a community owned company stakeholder requirements are important to WEL. WEL has significant focus on identifying, consulting and aiming to meet stakeholder expectations.

Identified WEL stakeholders are:

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

Section 3.1 details the stakeholders and their identified requirements.

1.6 WEL's Customers

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

Customer Profiles

At the end of FY22, there were approximately 96,000 connections across WEL's traditional network; and an additional 1,900 within WEL's networks located in Auckland and Cambridge. This is a 1.5% increase on the 2021 financial year. WEL continues to see robust growth in new residential and commercial connections on the network. The breakdown of load by customer group for the end of 2022 financial year is set out in table 1.6.1.

<table>
<tr><th>Customer Group</th><th>Number of Active ICPs</th><th>Electricity Delivered (GWh)</th><th>Demand (MW)</th></tr>
<tr><td>Domestic</td><td>80,353</td><td>562 (42%)</td><td rowspan="4">203 (66%)</td></tr>
<tr><td>Non-Domestic</td><td>12,459</td><td>216 (17%)</td></tr>
<tr><td>Small Scale Distributed Generation</td><td>1,751</td><td>18 (1.38 %)</td></tr>
<tr><td>Streetlights and Unmetered</td><td>337</td><td>8 (0.61%)</td></tr>
<tr><td>Large Commercial</td><td>856</td><td>512 (39%)</td><td>105 (44%)</td></tr>
<tr><td>Embedded Networks</td><td>1,863</td><td>15 (1.15%)</td><td>n/a</td></tr>
<tr><td>TOTAL</td><td>97,619</td><td>1,331 (100%)</td><td>308 (100%)</td></tr>
</table>

Table 1.6.1: Electricity Delivered and Demand by Customer Group

1.6.1 Major Customers

WEL maintains regular contact with its largest customers to ensure their needs are considered in WEL's asset planning and service delivery. In some cases, the specific needs of these customers influence the design and operation of the 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.

WEL's ten largest customers by energy served are:

- Hamilton City Council
- Waikato District Health Board
- Open Dairy Company International
- Datacom Group
- AFFCO
- Sealed Air (New Zealand)
- Foodstuffs
- University of Waikato
- Pact Group Holdings
- Progressive Enterprises

	Electricity Delivered (GWh)	Demand (MW)
Top 10 Customers	163.6	10.5
Percentage of WEL Traditional Network	12.5%	3.4%

Table 1.6.1.1: Major Customers Electricity Delivered and Peak Time Demand

WEL's two largest customers Hamilton City Council and Waikato District Health Board deliver essential services to the community. They have several sites that require a high level of reliability and security of supply. Sites like hospitals have an alternative supply route providing a N-1 supply. Other high value connections, like communications, potable water and sewerage sites receive priority restoration and reliability provisions as required under the Civil Defence and Emergency Management Act 2002.

2 Asset Overview

Tirohanga Whānui Ā-Rawa

WEL NETWORKS AMP 2023

2. Asset Overview

This chapter describes the population, age profile and condition of WEL's assets. The chapter should be read in conjunction with Chapter 8 which discusses the maintenance and renewal methodology and forecast expenditure.WEL captures asset condition data using measurement points within SAP through a mobility solution and other third party systems (i.e. Omicron Test Manager), that are linked to our Computerised Maintenance Management System (CMMS) function in SAP.

2.1 Asset Population and Condition Summary

This year the condition data in this chapter has been derived using our health index to better reflect the actual state of the condition of our assets.

A summary of the population and condition of our assets is shown in Table 2.1.2. Condition 5 represents an asset in 'as new' condition and an asset at condition 0 when it is 'due for immediate replacement'. This conforms to the Commerce Commission's H1-H5 scale. WEL's condition score 0 and 1 align with H1 on the Commerce Commission scale.

Further information on the Asset Health scoring is described in Section 2.1.1.

Condition Score	Description
0- Hazard	Immediate action is required to eliminate hazard
1- Unserviceable	Unserviceable but NOT hazardous. Replacement is required.
2- End of Life	Serviceable but meets replacement criteria.
3- Near End of Life	Serviceable but significant deterioration approaching end of life. Likely to meet replacement criteria at next inspection cycle.
4- Mid Life	Serviceable with moderate deterioration consistent with normal aging and use.
5- Early Life	Serviceable with no significant deterioration. Asset is in pristine condition, as newly installed or equivalent.

Table 2.1.1: WEL's Asset Condition Grades

Assets with condition rating 0 to 2 are addressed through the defect notification process and asset renewal programme. Assets with "unknown" or "N/A" condition rating will be inspected in FY24 through WEL's targeted inspection programme to assess and capture the condition of these assets.

Section	Asset Category	Unit	Quantity	WEL Condition Score						
				0	1	2	3	4	5	Unknown
2.2	**Subtransmission**									
2.2.1	Poles	No.	2,522	0	3	8	110	1,029	1,369	3
2.2.2	Crossarm	No.	2,654	0	1	23	320	850	1,454	6
2.2.3	Subtransmission Lines	km	178	0	0	2	11	47	118	0
2.2.4	Subtransmission Cables	km	285	0	0	6	27	203	50	0
2.2.5	Subtransmission CBs	No.	130	0	0	0	8	8	114	0
2.3	**Zone Substations**									
2.3.1	Power Transformer	No.	49	0	0	2	4	18	25	0
2.3.2	Switchboards	No.	55	0	0	0	6	4	45	0
2.3.3	Substation Buildings	No.	30	0	0	0	6	23	1	0
2.4	**Distribution and LV Lines**									
2.4.1	Poles	No.	36,658	1	39	316	3,426	11,988	20,867	21
2.4.2	Crossarms	No.	67,286	2	63	2,017	10,428	17,873	36,663	240
2.4.3	Distribution and LV Conductors	km	3,229	0	0	28	482	978	1,741	0
2.5	**Distribution and LV Cables**									
2.5.1	Distribution Cables	km	788	0	0	11	93	52	633	
2.5.2	LV Cables	km	2,571	0	0	6	207	165	2,193	
2.6	**Distribution Substations and Transformers**									
2.6.1	Distribution Switching Stations	No.	17	0	0	0	1	10	6	0
2.6.2	Distribution Transformers	No.	6,126	1	3	90	408	1,909	3,692	23
2.7	**Distribution Switchgear**									
2.7.1	Ring Main Units	No.	1,124	0	0	4	101	371	644	4
2.7.2	Distribution Circuit Breakers	No.	386	0	0	6	40	27	313	0
2.7.3	Distribution Air Break Switches	No.	890	0	1	10	60	164	643	12
2.7.4	Distribution Sectionalisers and Reclosers	No.	159	0	1	0	4	30	119	5

Section	Asset Category	Unit	Quantity	WEL Condition Score						
				0	1	2	3	4	5	Unknown
2.8	Other Network Assets									
2.8.1	LV Pillars	No.	29,457	1	43	163	1,043	15,953	12,113	141
2.8.2	Protection Relays	No.	869	0	0	37	73	89	670	0
2.8.3	SCADA & Communications	No.	488	0	0	0	45	87	355	0
2.8.4	Load Control Equipment	No.	6	0	0	0	6	0	0	0
2.8.5	Meters	No.	70,789	0	0	0	7,103	63,686	0	0

Table 2.1.2: 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 AHI for the following asset categories:

- Crossarms and Insulators
- Poles
- Ring Main Units
- LV Pillars
- Overhead Lines Conductors
- Network Switches
- Reclosers
- Sectionalisers
- Distribution Transformers
- Circuit Breakers
- Zone Transformers
- Protection Devices
- Battery Systems

The AHI combines 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 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	Probablity 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: Asset Health Indices (AHI)

WEL's continuous improvement initiatives through its Capability Projects (CPs), have streamlined the processes and systems for capturing condition data in the field. This results in improved data quality and provides insightful information essential in developing robust maintenance strategies.

We have changed the condition scoring criteria to better reflect the true condition of the assets. The new criteria are derived from our heath index. The graphs show both the current asset condition and the forecasted condition at the end of the 10-year AMP period. The forecasted condition score takes into account the planned asset renewal, as detailed in Chapter 8, and the expected deterioration over the same period.

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 and N-1 security between zone substations. The subtransmission network operates at 33kV and is 463km in length, of which 178km is overhead and 285km is underground. Most overhead lines are in rural areas while the underground network is split between the urban and rural areas.

The following asset categories are included within the subtransmission system:

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

Sections 2.2.1 - 2.2.5 discusses these in more detail.

2.2.1 Subtransmission Poles

Population and Age Profile

We have 2,522 subtransmission poles. A decrease of 165, from 2021, as these were replaced by underground cables. Our subtransmission pole types and the expected life of each are in the table below. Our current renewal practice is that new poles are concrete unless site considerations dictate otherwise.

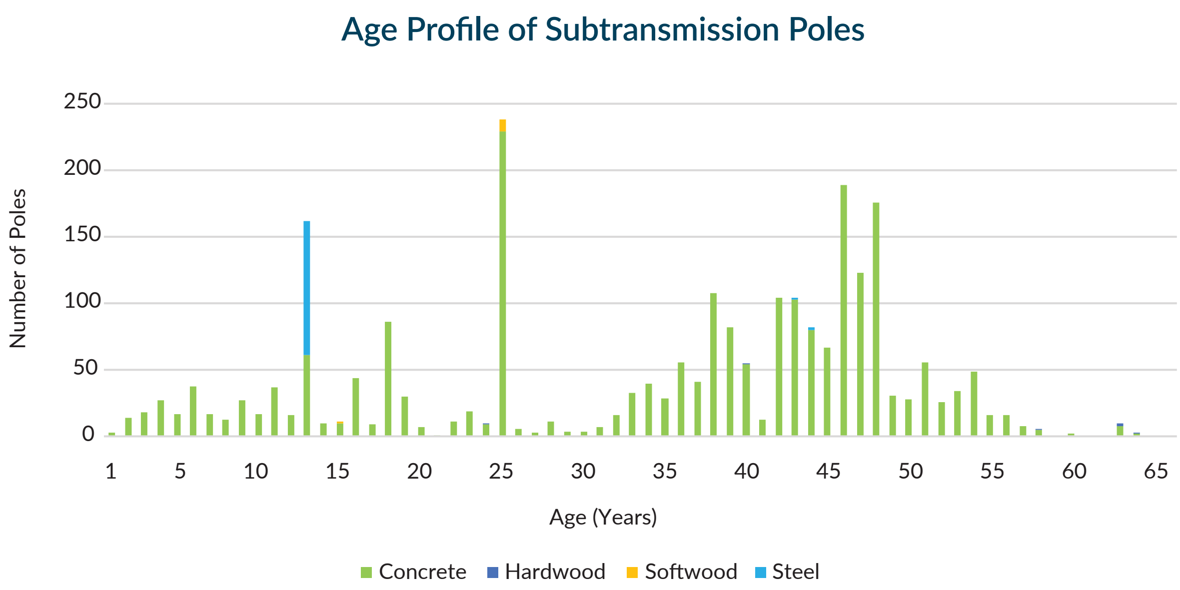
Life expectancy

Asset	Life expectancy (Years)	Number of Assets
Concrete poles	70	2,402
Wooden poles (both softwood and hardwood)	45	16
Steel Poles	45	104

Table 2.2.1.1: Life Expectancy of Subtransmission Poles

Age Profile

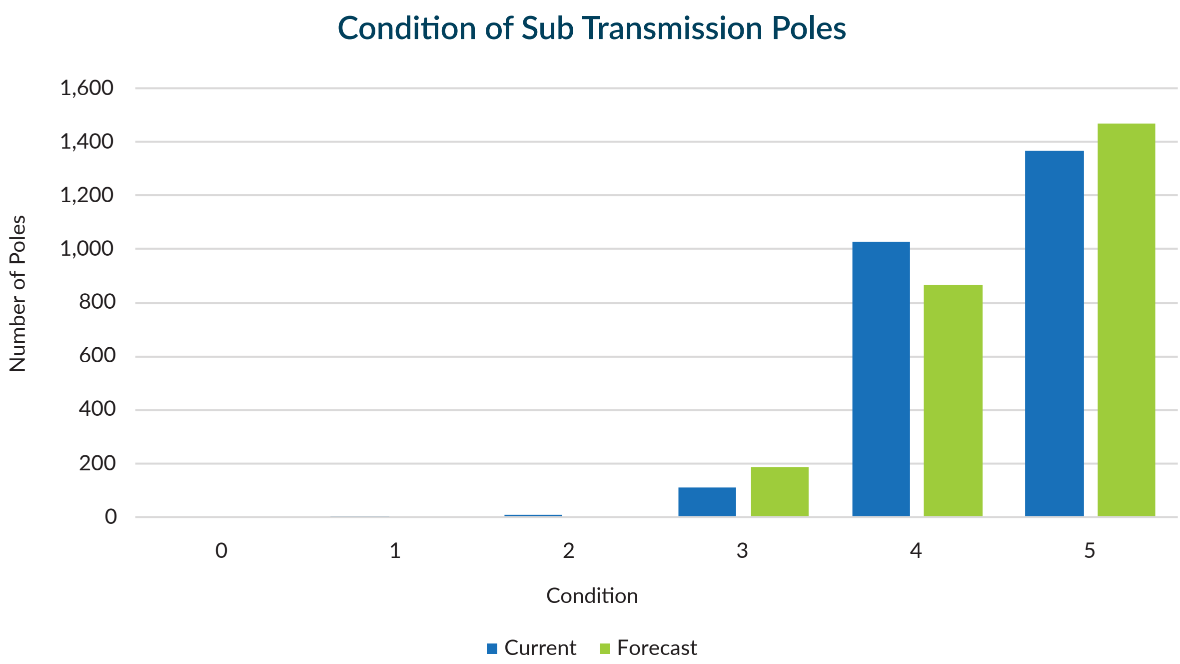
Figure 2.2.1.2: Age Profile of Subtransmission Poles



Condition

Figure 2.2.1.3 shows current and forecast condition post implementation of the AMP asset renewal program detailed in Chapter 8.

Figure 2.2.1.3: Condition of Subtransmission Poles



2.2.2 Subtransmission Crossarms

Population and Age Profile

We have 2,654 subtransmission crossarms, a decrease of 148 from 2021. The decrease aligns with the undergrounding of sections of overhead line in conjunction with roading projects. The majority of crossarms are hardwood. The current practice is to install galvanised steel crossarms for new subtransmission poles and for crossarm replacement due to the increased life expectancy and lower whole of life cost. The life expectancy of subtransmission crossarms is shown in Table 2.2.2.1.

Asset	Life expectancy (Years)	Number of Assets
Steel crossarms	60	827
Hardwood crossarms	45	1,827

Table 2.2.2.1: Life Expectancy of Subtransmission Crossarms

Age Profile

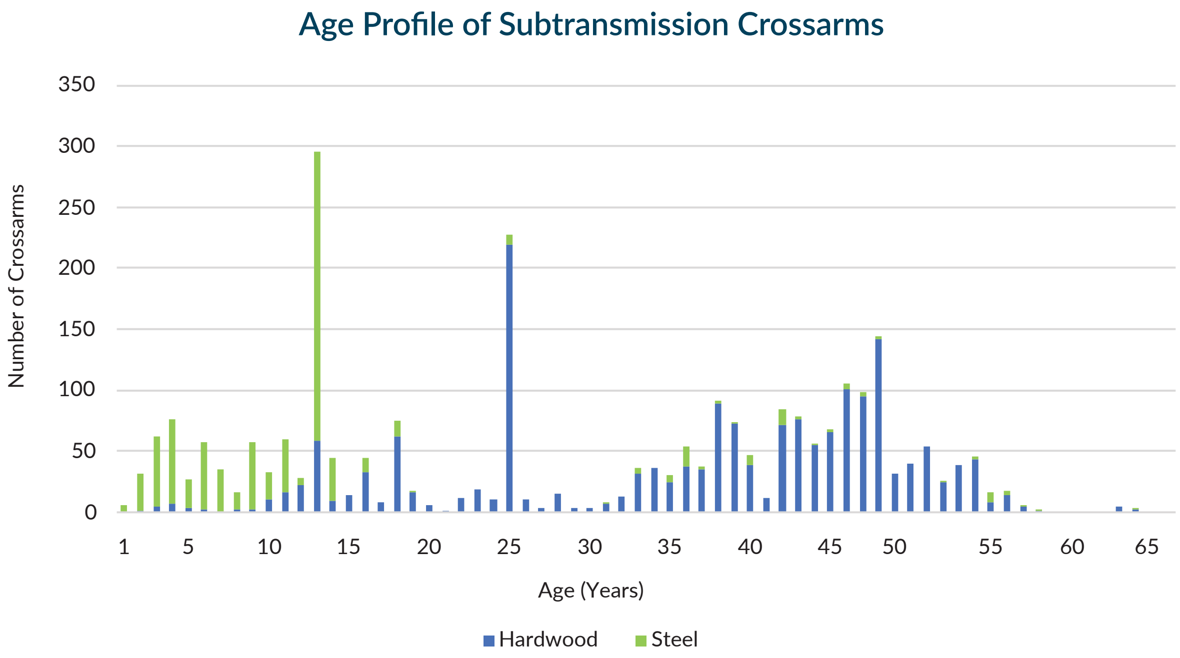


Figure 2.2.2.2: Age Profile of Subtransmission Crossarm

Condition

The condition profile of the subtransmission crossarms is shown in Figure 2.2.2.3. The figure shows current and forecast implementation of the AMP asset renewal program detailed in chapter 8.

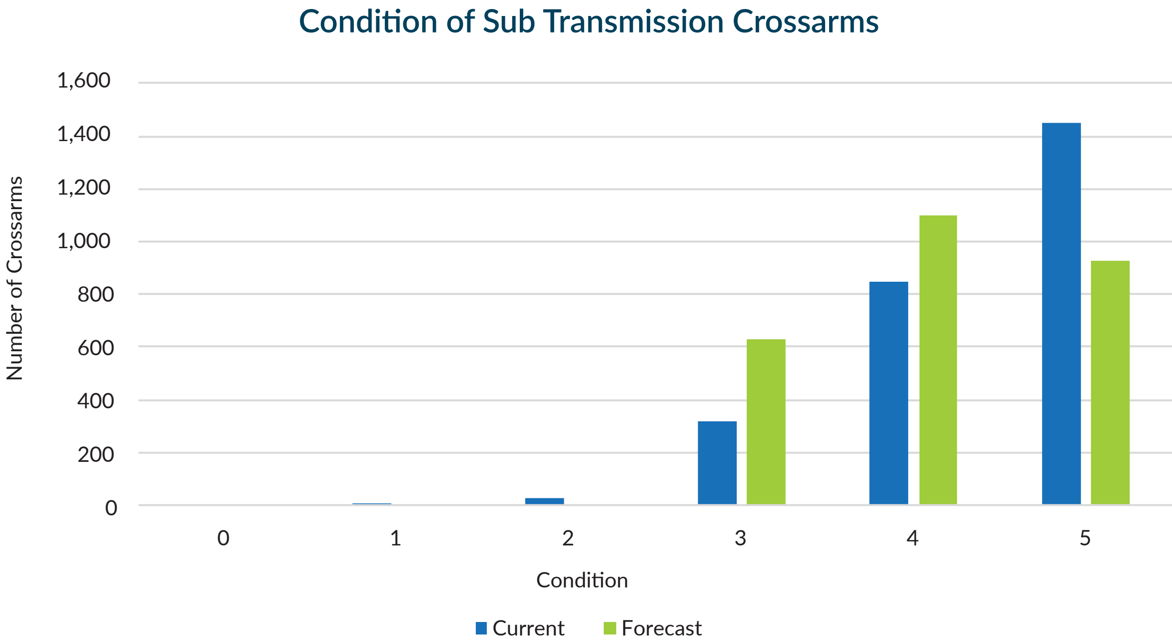


Figure 2.2.2.3: Condition of Subtransmission Crossarms

2.2.3 Subtransmission Lines

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

Population and Age

We have 178km of subtransmission lines in total. A decrease of 9km from 2021 due to the replacement of overhead lines with underground cables.

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 meant alternative options were considered and the installation of various aluminum conductors commenced. We have a small number of copper subtransmission conductors on our network. ACSR was the first aluminum conductor utilised, more recently AAC and AAAC have been adopted as network standards. Table 2.2.3.1 shows the quantity of subtransmission lines by conductor type. Figure 2.2.3.2 shows the age profile of WEL's subtransmission conductors.

Life Expectancy

Cable or Type	Life Expectancy (Years)	Length of Conduct or (km)
AAAC	60	28
AAC	60	42
ACSR	60	107
Copper	60	1

Table 2.2.3.1: Life Expectancy of Subtransmission Conductor

Age Profile

The graph shows the length of line installed in each year. There have been periods of major investment in WEL's subtransmission lines. The spike at year 13 corresponds to the construction of a subtransmission line to the Te Uku Wind Farm, in year 25 the link between Horotiu and Weavers substations was constructed, and several areas of the subtransmission network were strengthened in year 46. The oldest conductors are 63 years old and are located at Horotiu and Dey Street.

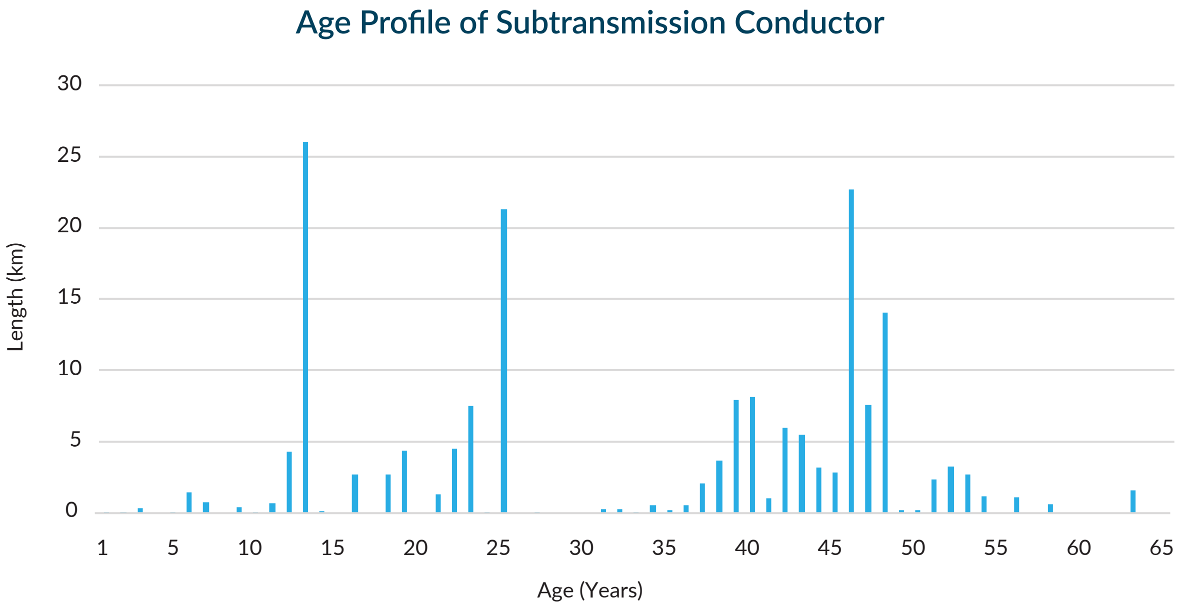


Figure 2.2.3.2 Age Profile of Subtransmission Conductor

Condition

The condition profile of the subtransmission conductors is shown in Figure 2.2.3.3. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

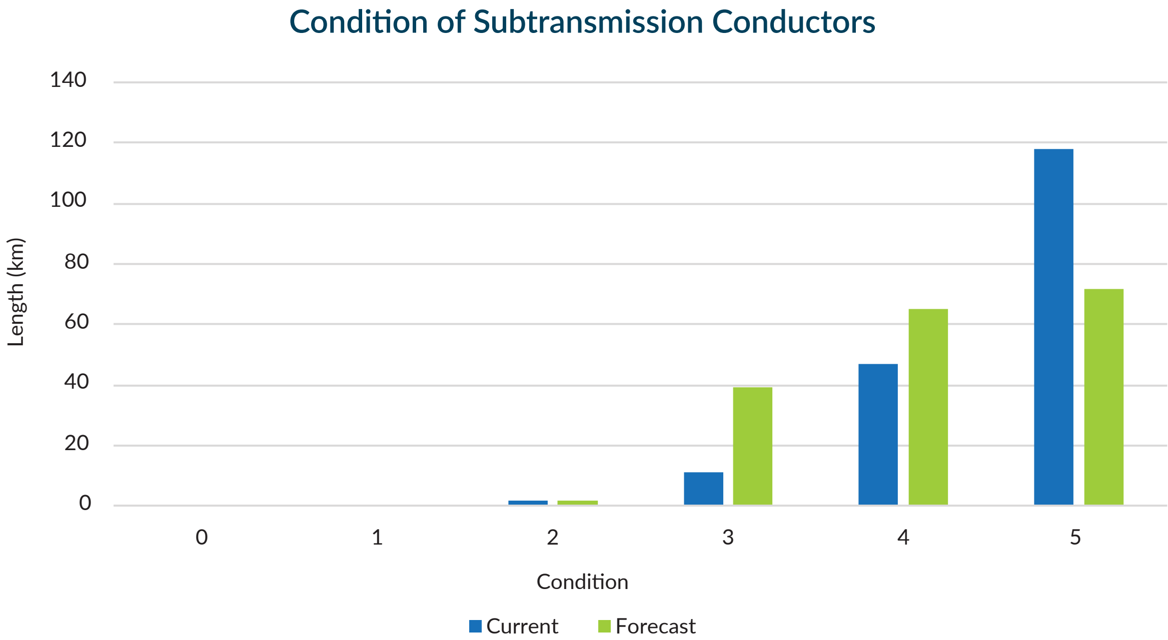


Figure 2.2.3.3: Condition of Subtransmission Conductors

2.2.4 Subtransmission Cables

Subtransmission cables connect GXPs to the zone substations and link the zone substations at 33kV.

Population and age

WEL has 285km of subtransmission cables, with 111km located in Hamilton. There are two types of subtransmission cables in use. Cross-linked polyethylene (XLPE) aluminum 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 aluminum XLPE insulated cables commenced in the mid-1970s. We have standardised the use of XLPE insulated single core aluminum conductor cables with copper wire screens. There are no gas or oil-filled subtransmission cables in the network.

Life Expectancy

Cable or Type	Life Expectancy (Years)	Length of Conduct or (km)
PILC	70	26
XLPE	45	259

Table 2.2.4.1: Life Expectancy of Subtransmission Cables

Age Profile

The age profile of the subtransmission cables is shown in Figure 2.2.4.2. The age of PILC cables ranges from 42 to 53 years and XLPE cables range in age from new to 53 years old. The peak in year 18 is the installation of the cables connecting Avalon, Te Kowhai and Whatawhata. The peak in year 12 is the cables installed as part of the Te Uku Wind Farm project. The oldest cables on the network are located at Bryce St, Brooklyn Rd, and Te Aroha St and their reliability to date has been good.

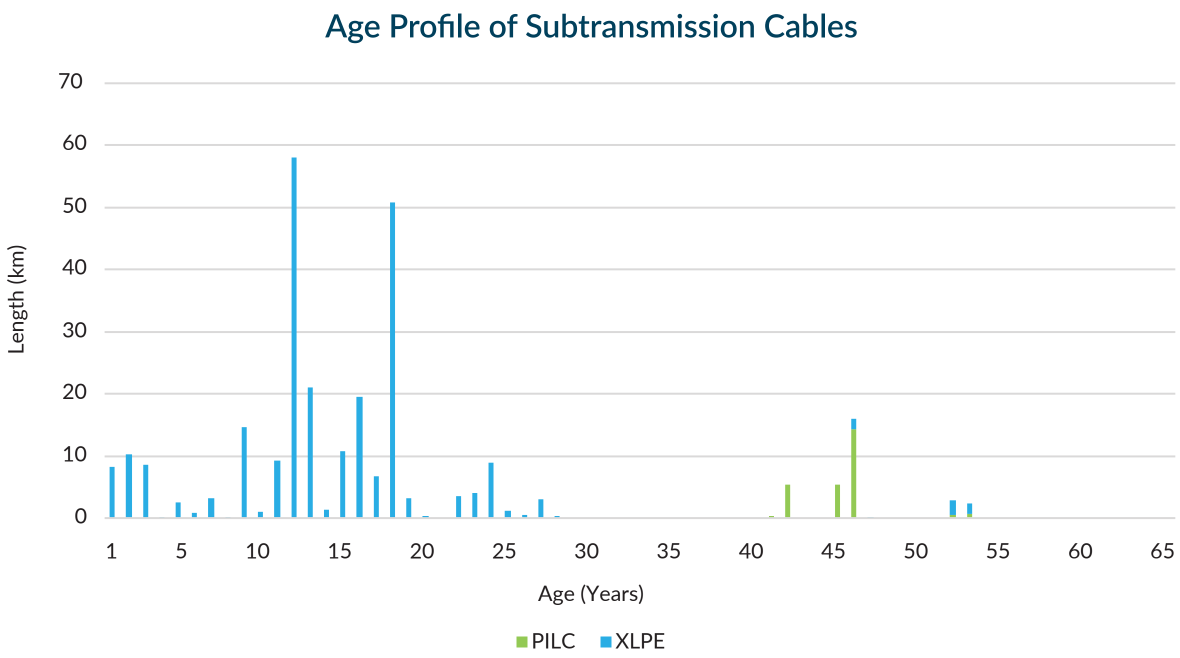


Figure 2.2.4.2: Age Profile of Subtransmission Cables

Condition

The condition of our subtransmission cables is considered to be generally good. The main issues experienced to date are joint/termination failures in a limited number of cables. Root cause analysis attributed the failures to poor workmanship during installation. WEL owns an offline partial discharge (PD) test set and have implemented a programme of PD testing to determine the extent of these problems and to understand the condition of our underground cable assets. Cable joints showing poor results are planned for replacement and prioritised based on PD values. The planned spend relates predominantly to joint failures.

A project to replace these joints for the Te Kowhai to Pukete 33kV cable feeders was completed in FY23.

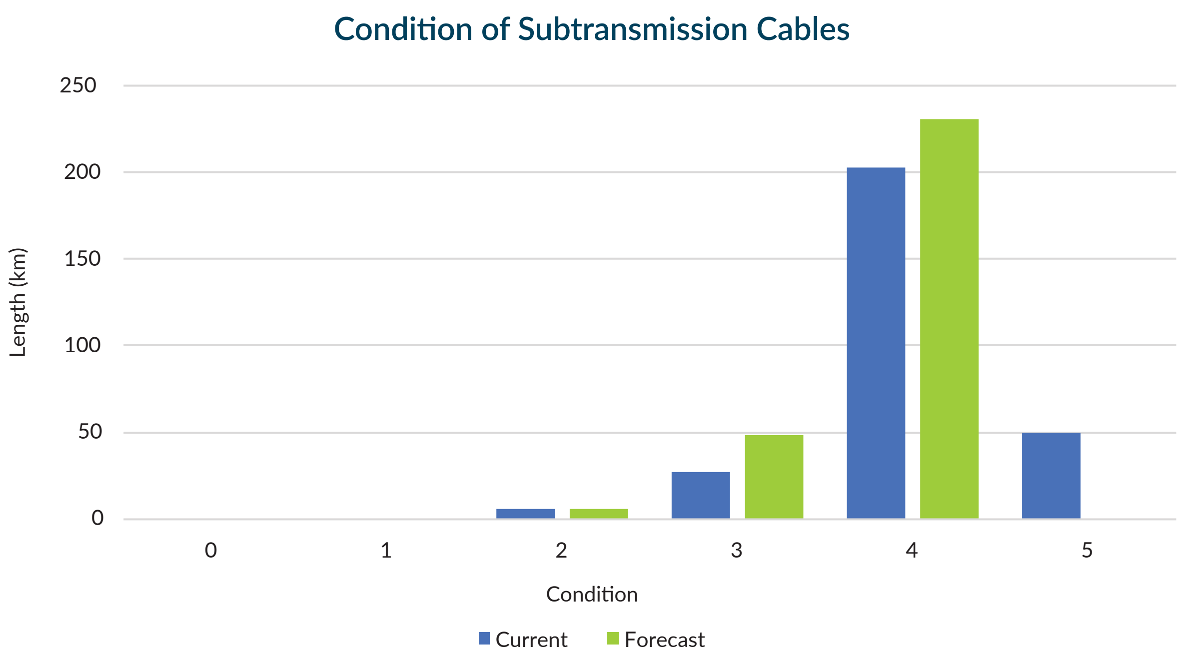


Figure 2.2.4.3: Condition of Subtransmission Cables

2.2.5 Subtransmission Circuit Breakers

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

Population and Age

We own 130 subtransmission (33kV) CBs. Three types of CB are in use on the 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. In recent years, older outdoor switchgear has been upgraded to indoor switchgear. The outdoor fleet is 13% of our total population. Table 2.2.5.1 shows the distribution by type. The average age of our subtransmission CBs is 17 years.

Life Expectancy

Asset	Life expectancy (Years)	Number of Assets
Outdoor Breakers	45	17
Indoor Breakers	60	113

Figure 2.2.5.1: Life Expectancy of Subtransmission CBs

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 15 years were indoor SF_6 type.

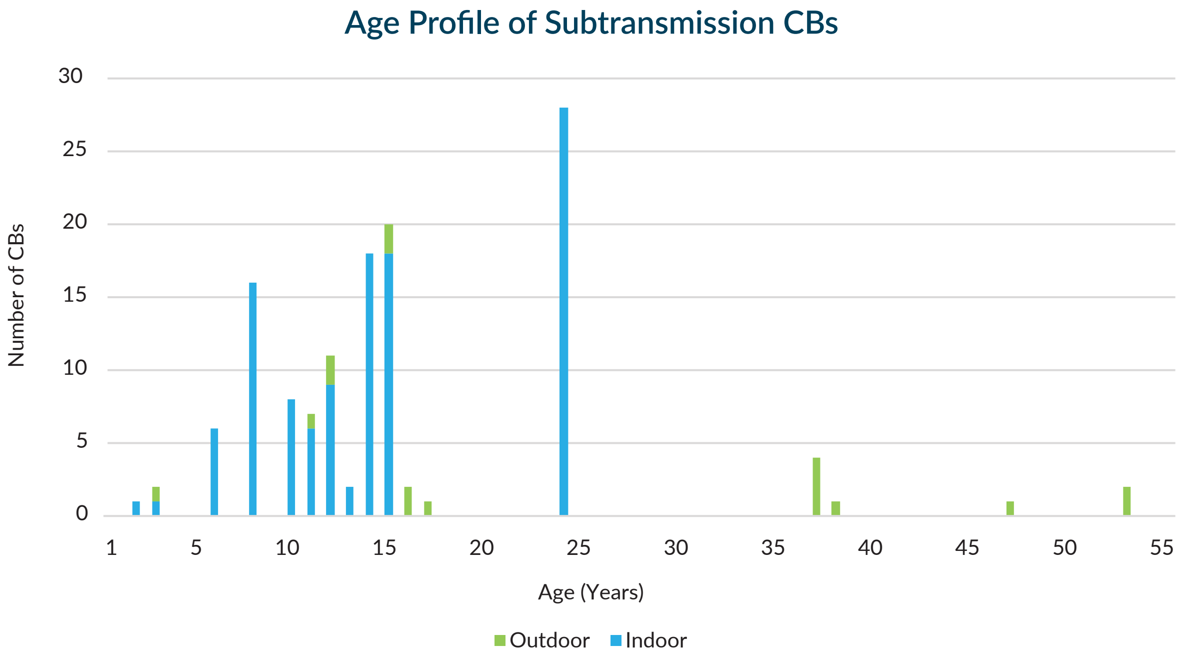


Figure 2.2.5.2: Age Profile of Subtransmission CBs

Condition

All 33kV CBs are maintained in accordance with recognised industry maintenance practices and are in very good condition. The condition profile of the subtransmission CBs is shown in Figure 2.2.5.3.

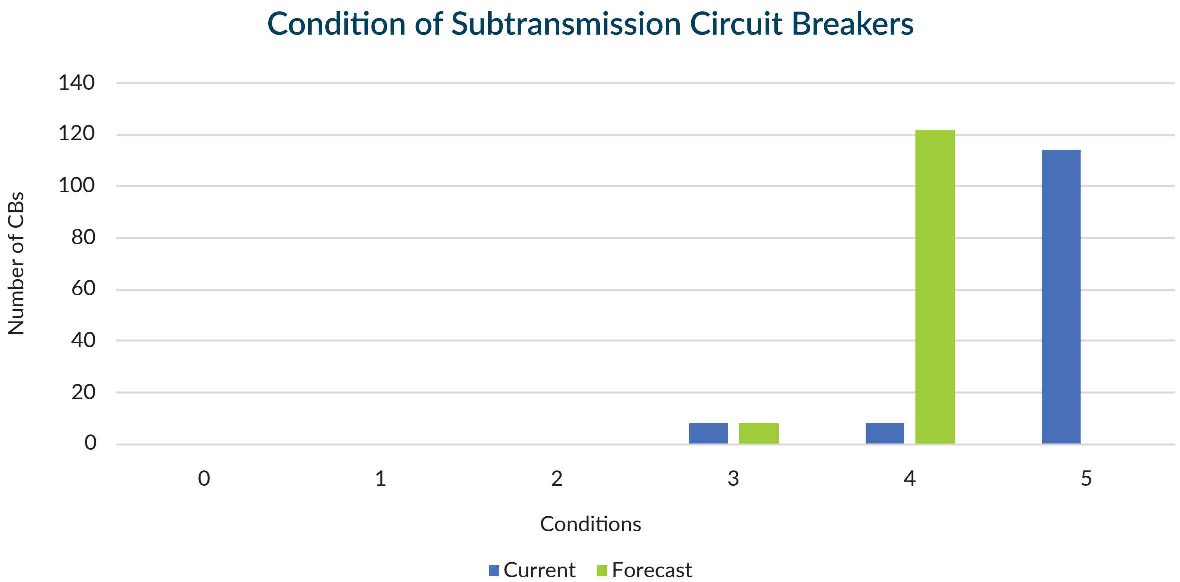


Figure 2.2.5.3: Condition of Subtransmission Circuit Breakers

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. This provides security of supply during fault conditions or planned maintenance. Zone substations include buildings, outdoor structures, foundations, fences, oil interception equipment and auxiliary equipment like low voltage AC and DC power supplies. Major plant items located at substations include power transformers and the associated switchgear.

We operate 25 zone substations with construction dates ranging from the 1930s to 2016. Six of the zone substations have outdoor switchyards which include 33kV CBs, outdoor instrument transformers, switches, insulators and busbars. 19 are based indoors with similar functionality. Of the 25 zone substations; 18 have N-1 security and 7 have N security;in accordance with the WEL security standard, discussed in further detail in Chapter 6.

The zone substation asset class has three asset categories:

- Power transformers
- Indoor switchboards
- Substation buildings

These are discussed in the following sections.

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 44 "in-service" transformers. Two 10MVA, two 15MVA and one 23MVA spare power transformers are 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.

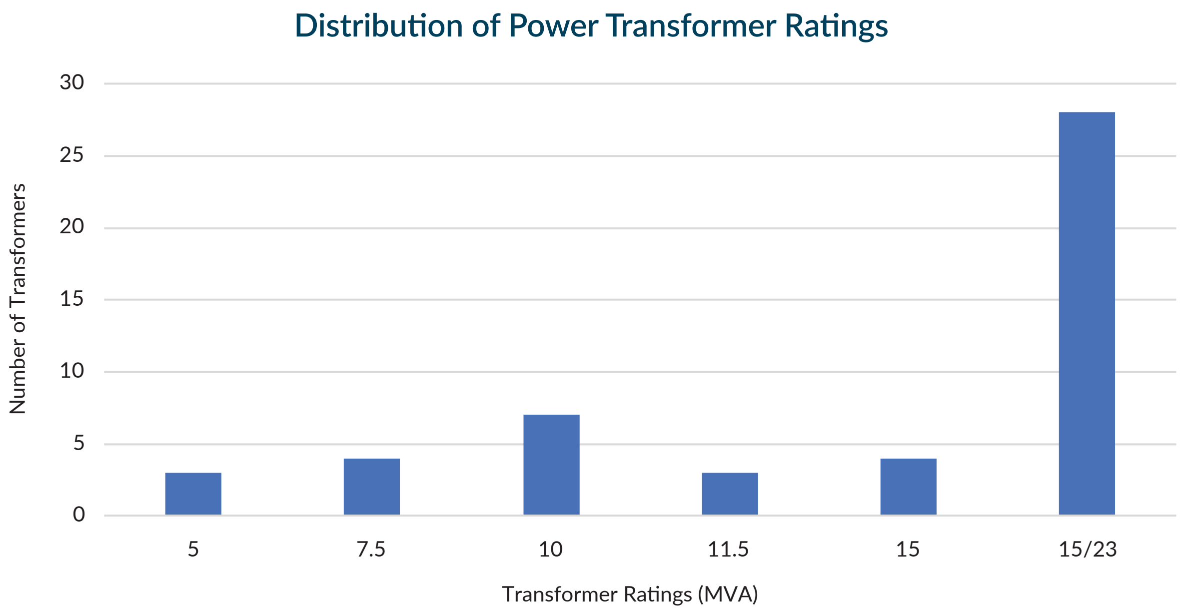


Figure 2.3.1.1: Distribution of Power Transformer by Ratings

Condition

Power transformers are generally in good condition but there are six that have aging issues and we plan to replace those towards the end of the AMP period.

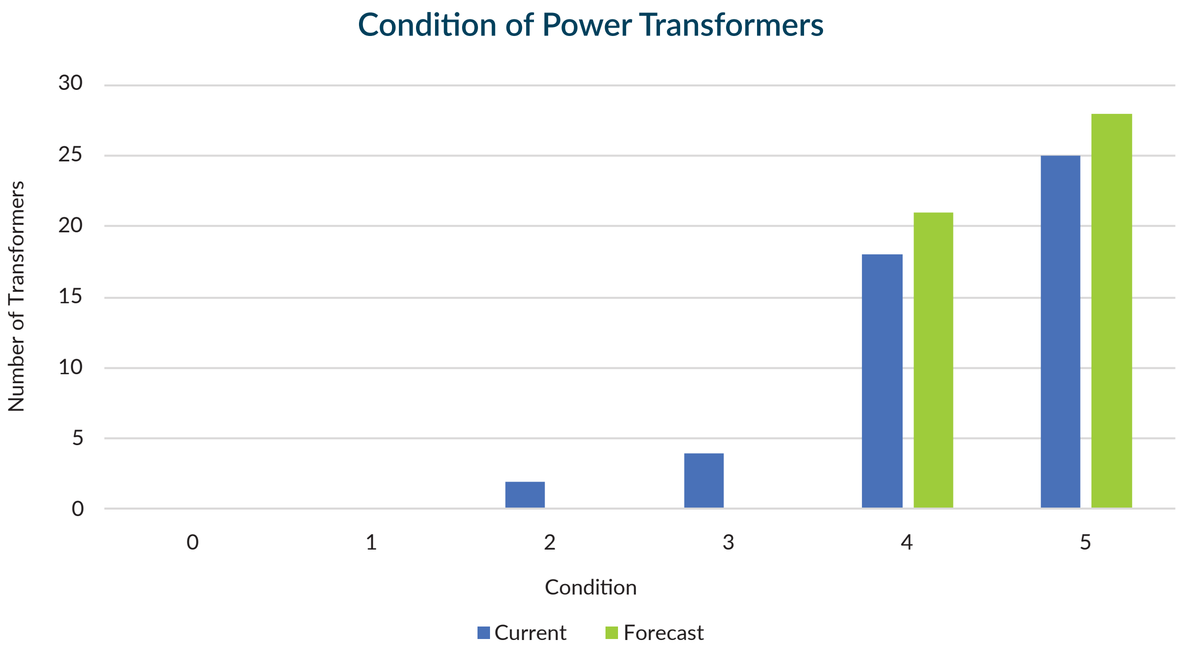


Figure 2.3.1.2: Condition of Power Transformers

2.3.2 Switchboards

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

Population and Age

We own 55 33kV and 11kV switchboards, with 44 being AIS and 11 GIS within our subtransmission network. Generally, the type of switchboard reflects the age of the substation. The life expectancy of switchboards is 60 years.

Age Profile

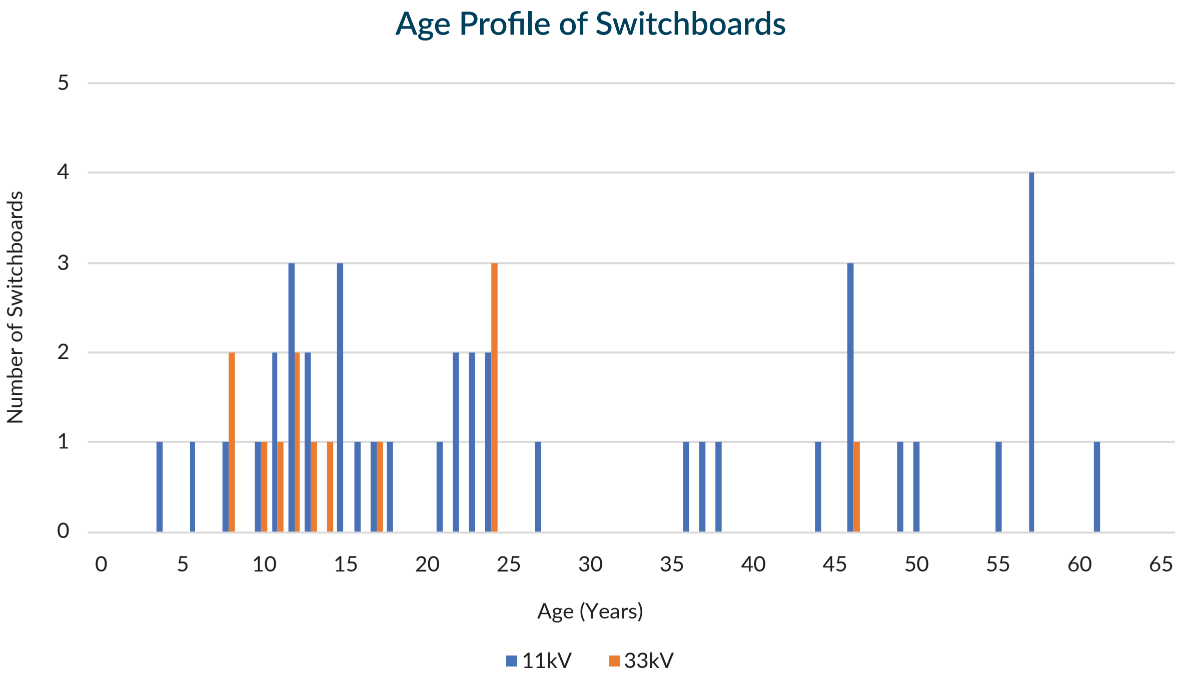


Figure 2.3.2.1: Age Profile of Switchboards

Condition

The condition of the majority of our switchboards is good. Testing shows PD is a problem for some older switchboards and this is actively monitored. We have a programme to fix PD by replacing cable terminations.

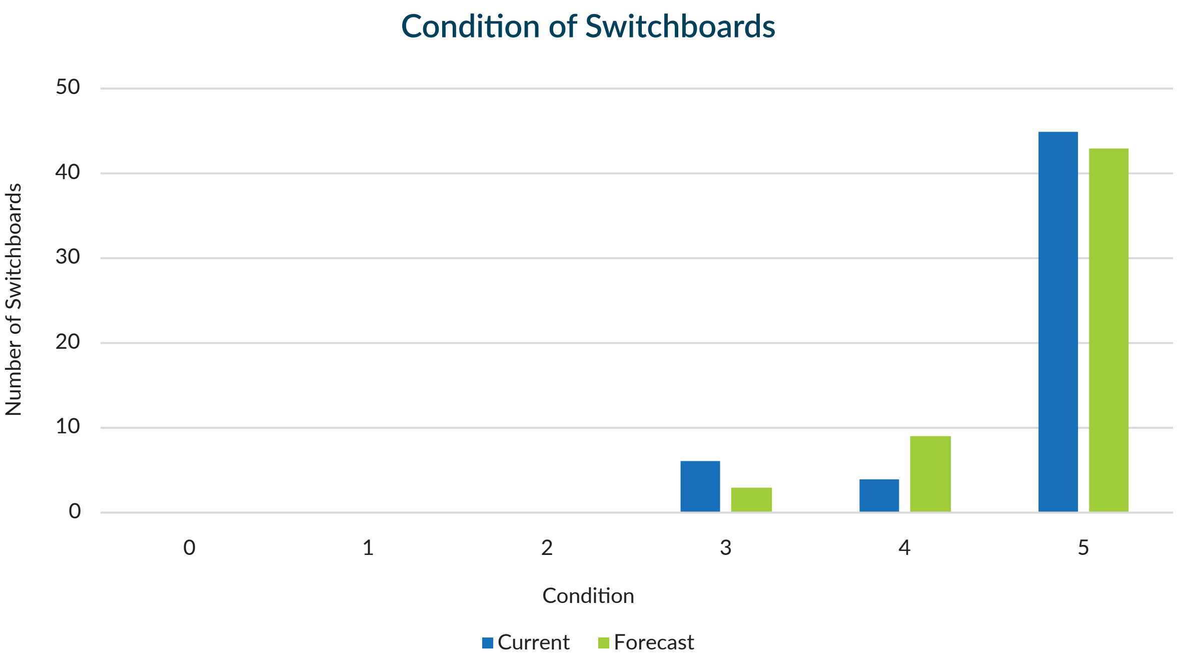


Figure 2.3.2.2: Condition of Switchboards

2.3.3 Substation Buildings

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

Population

There are 30 zone substation buildings across 25 zone substation sites that WEL operates. These were built to meet specific site and regulatory requirements at the time of construction. The construction of our substations occurred over several decades resulting in differing designs.

Age Profile

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

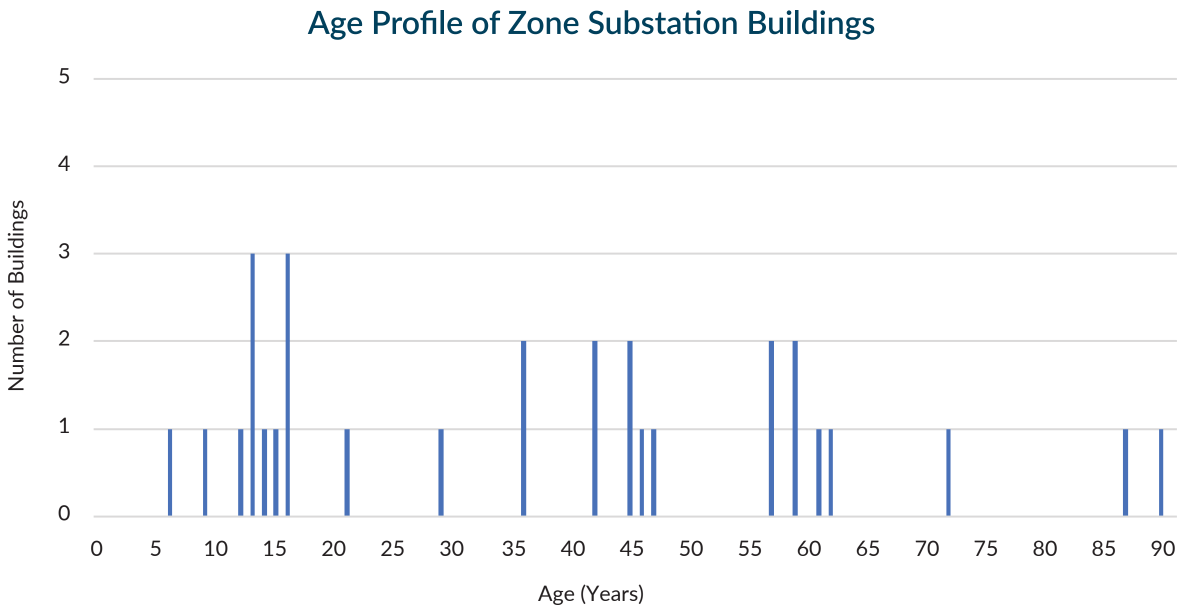


Figure 2.3.3.1: Age Profile of Zone Substation Buildings

Condition

Our substation buildings are in good condition, as illustrated in Figure 2.3.3.2.

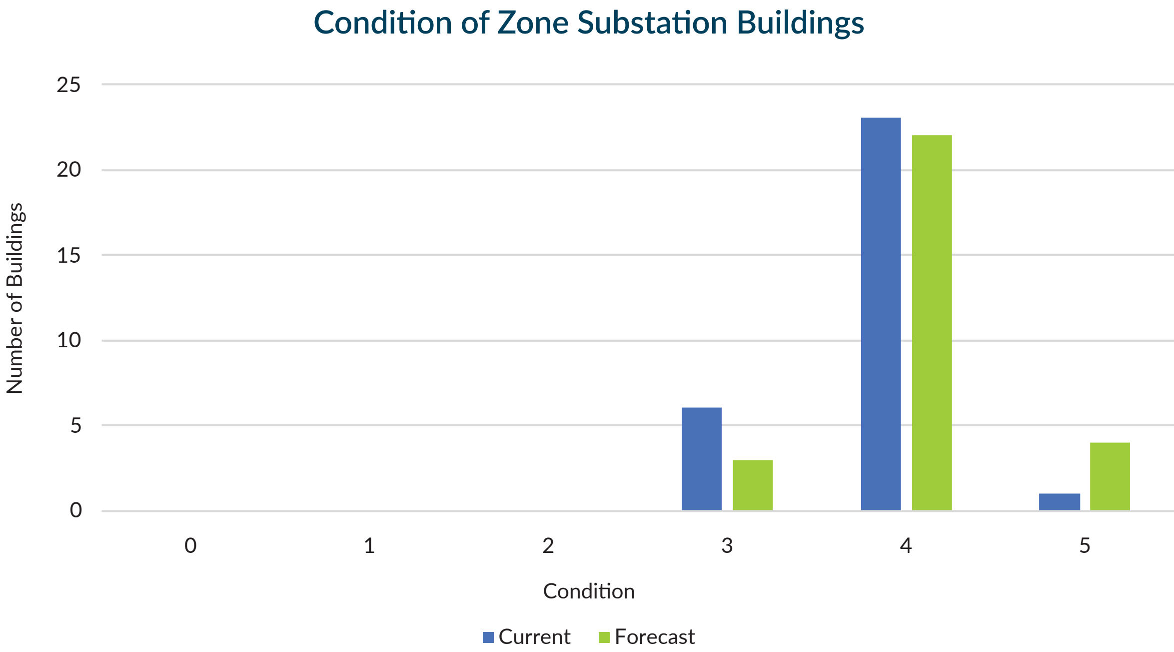


Figure 2.3.3.2: Condition of Zone Substation Buildings

WEL commenced a programme of seismic assessment in 2007. The Zone Substation seismic strengthening recommendations identified have been completed with the exception of Weavers and Glasgow substations. Both of these substations have been identified as having potential liquefaction issues. There is a project in development to investigate these two sites.

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 via overhead lines and underground cables. The total length of distribution and LV circuits is 6,588km, of which 49% is overhead line.

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

- Poles
- Crossarms
- Conductors

2.4.1 Distribution and LV Poles

Poles support the overhead lines. They elevate and isolate conductors and prevent contact with people and property.

Population and Age

WEL own 36,658 poles, the majority are concrete. Table 2.4.1.1 shows the distribution by construction material and the life expectancy.

Pole Type	Life expectancy (Years)	Number of Assets
Concrete	70	34,948
Hardwood	45	150
Softwood	45	1,538
Steel	45	11
Composite	70	11

Table 2.4.1.2 Distribution by Type and Life Expectancy of HV and LV Poles

Age Profile

Most distribution pole assets are in the last third of expected asset life.

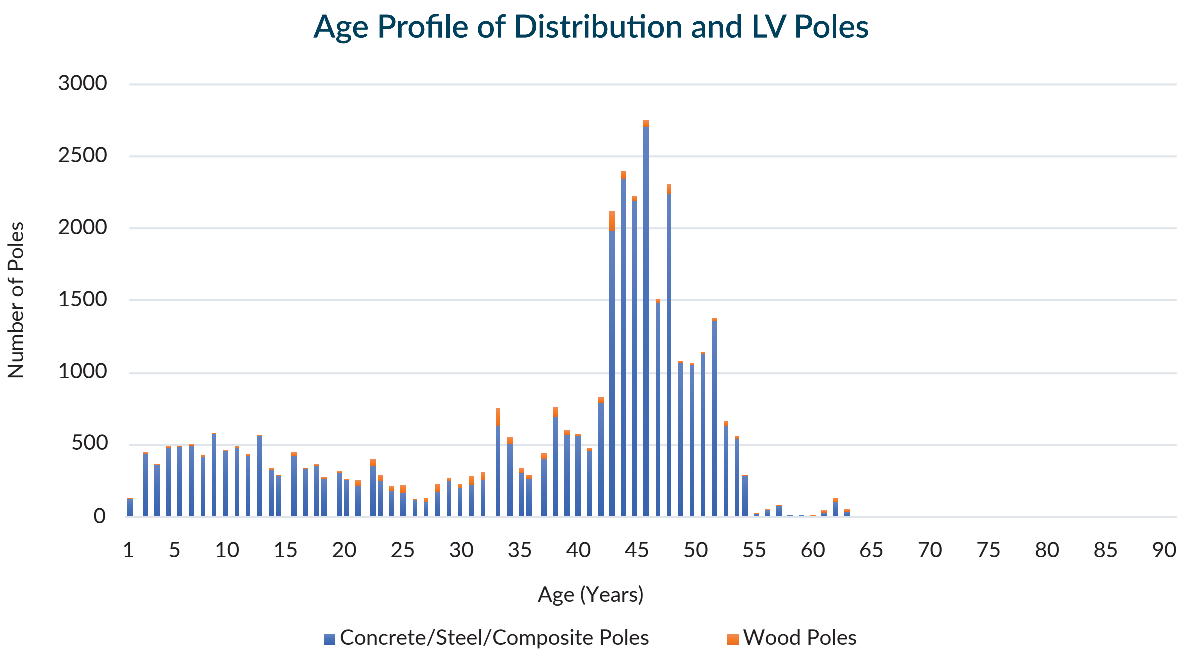


Figure 2.4.1.2: Age Profile of Distribution and LV Poles

Condition

Most concrete poles are in good condition. There are approximately 150 hardwood poles remaining on the network. WEL stopped installing hardwood poles on the network approximately 17 years ago. The remaining hardwood poles have been tested and are monitored for hidden rot at ground level. Poles identified as needing replacement are replaced with concrete.

Poles that are in peat soil areas which are leaning beyond the acceptable limits are either replaced or straightened depending on condition. Specific types or make of concrete poles such as “Brown Brother” poles that do not meet the current design specification are also being targeted for replacement.

The condition of distribution poles is shown in Figure 2.4.1.3. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

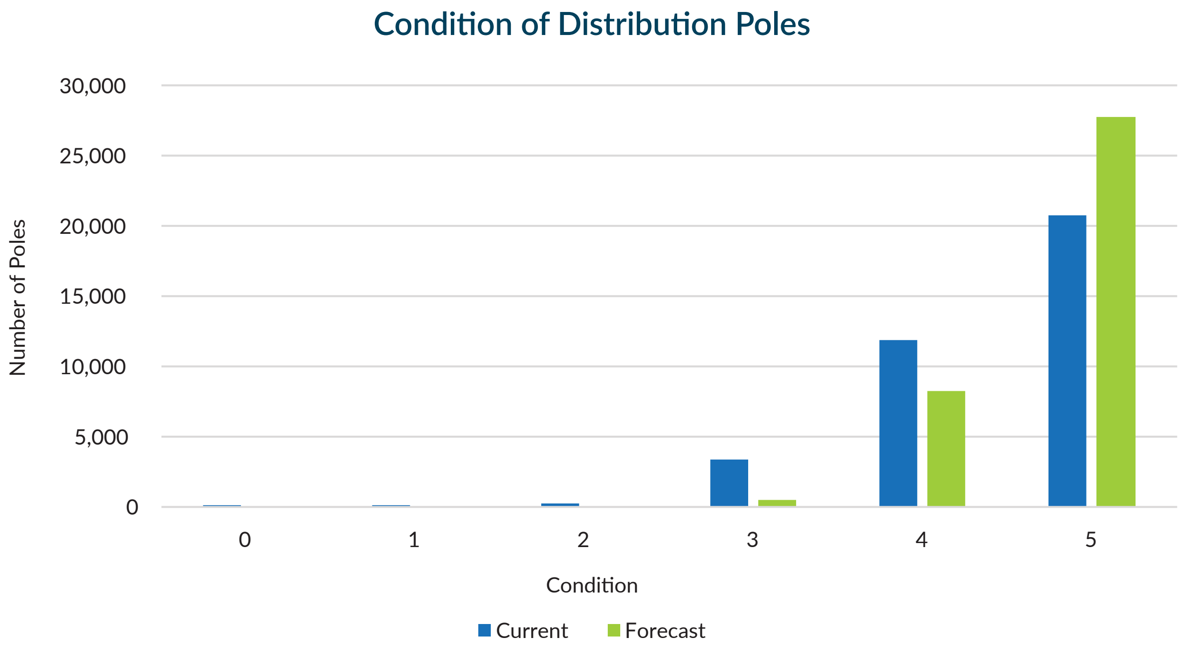


Figure 2.4.1.3: Condition of Distribution Poles

2.4.2 Distribution Crossarms

Crossarms are located at the top of our poles. The crossarm assembly includes the structure and insulators that support and separate each of the phase conductors. Most of WEL's crossarms are hardwood, however over the last 10 years we have introduced steel crossarms on HV circuits. Steel has a longer life than hardwood and this change will mean that the life of the pole and crossarm will be similar. This removes the need to replace crossarms at the pole mid-life. WEL has installed a small number of virtual crossarms which are a type of insulator that attaches the line directly to the pole.

Population and Age

There are 67,286 crossarms installed on the network. The majority are wooden as shown in Table 2.4.2.1.

Life Expectancy

Many wooden crossarms are older than their expected life. Consequently, there is a higher failure rate of aged crossarms, particularly the associated insulators. Chapter 8 details the maintenance strategies designed to address this issue.

Crossarm Type	Life expectancy (Years)	Number of Assets
Wood	45	56,738
Steel	70	8,231
Fiberglass	70	30
Virtual	70	91
Unknown		2,196

Table 2.4.2.1: Life Expectancy of Crossarms

Age Profile

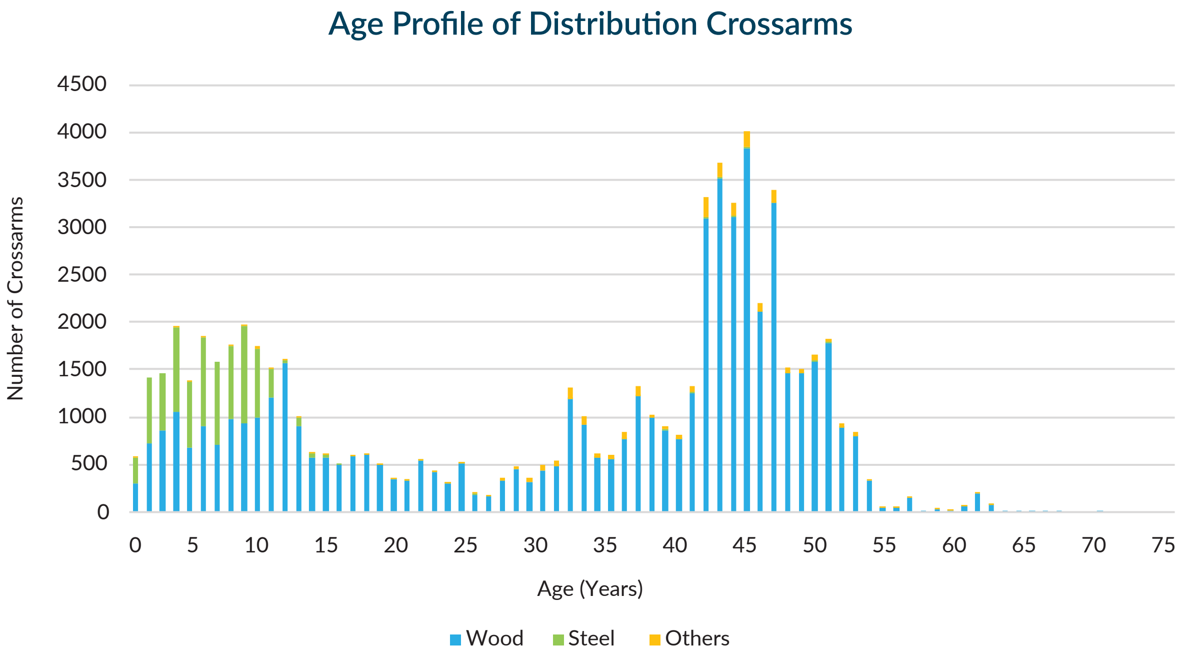


Figure 2.4.2.2: Age Profile of Distribution Crossarms

Condition

WEL's crossarm condition data shows the majority are in a good condition however a number are approaching end of life and need to be addressed. This is shown in Figure 2.4.2.3. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

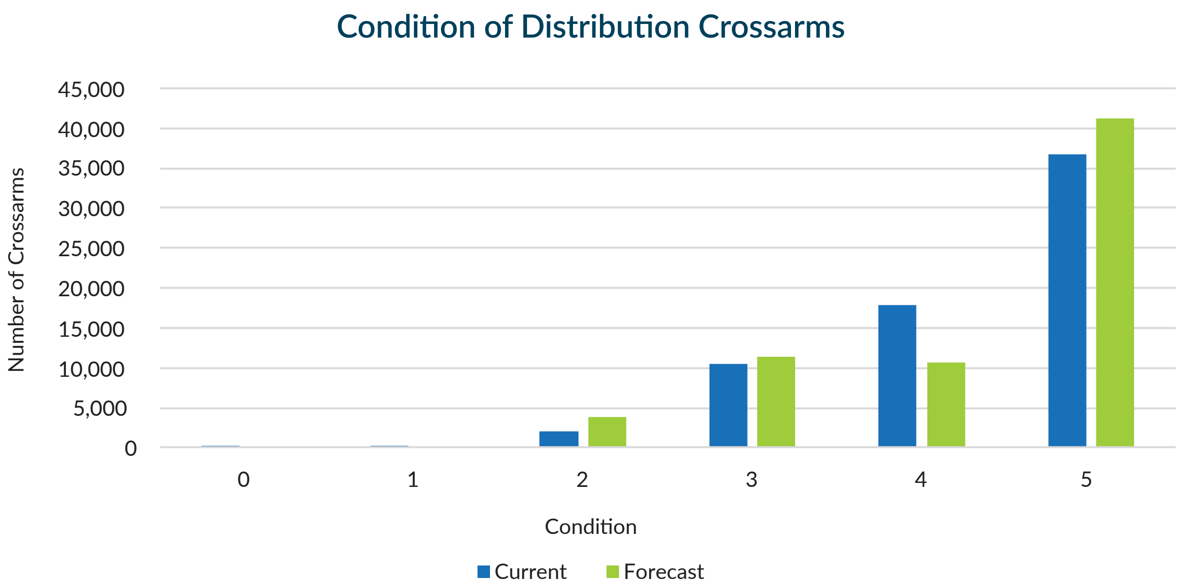


Figure 2.4.2.3: Condition of Distribution Crossarms

2.4.3 Distribution and LV Conductors

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

Population

WEL own 3,229km of overhead distribution and LV lines, of which 1,926km are 11kV distribution lines and 1,303km are LV.

Life Expectancy

Asset	Life expectancy (Years)	Length of Conductors (km)
Aerial Bundled Conductor	60	14
Bare Aluminum	60	332
Bare Aluminum - Steel Reinforced	60	1,451
Bare Copper	60	998
PVC Covered Aluminum	60	120
PVC Covered Copper	60	314

Table 2.4.3.1: Expected life of Distribution and LV Lines

Age Profile

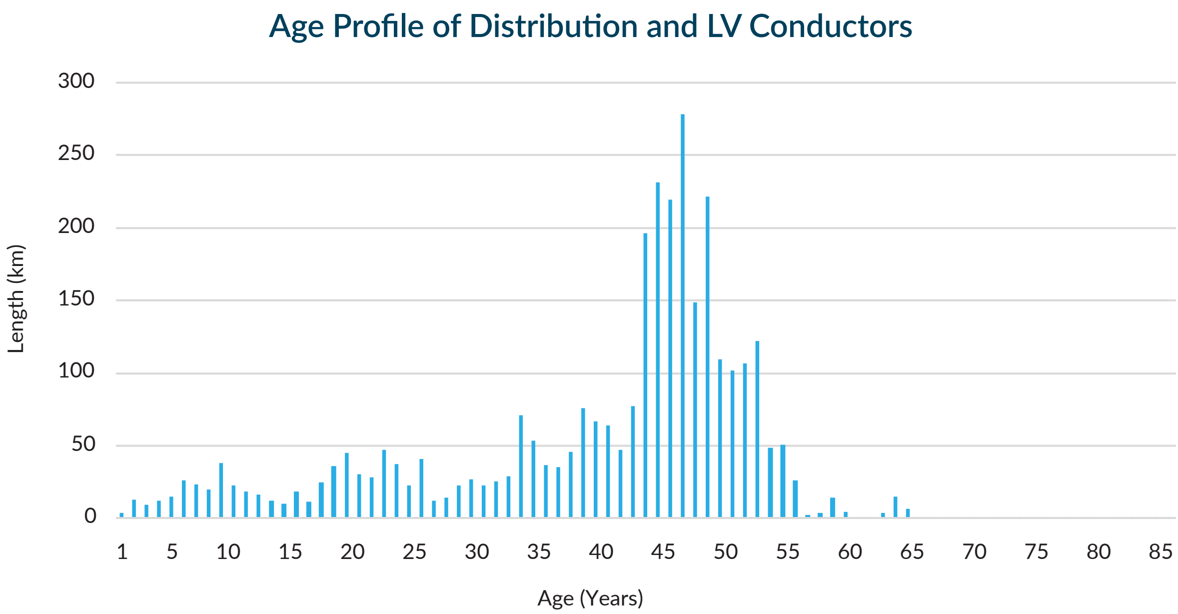


Figure 2.4.3.2: Age Profile of Distribution and LV Conductors

The spike in the graph corresponds with the rapid expansion of the network during the 1970s.

Condition

The condition of overhead line conductors is shown in Figure 2.4.3.3. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

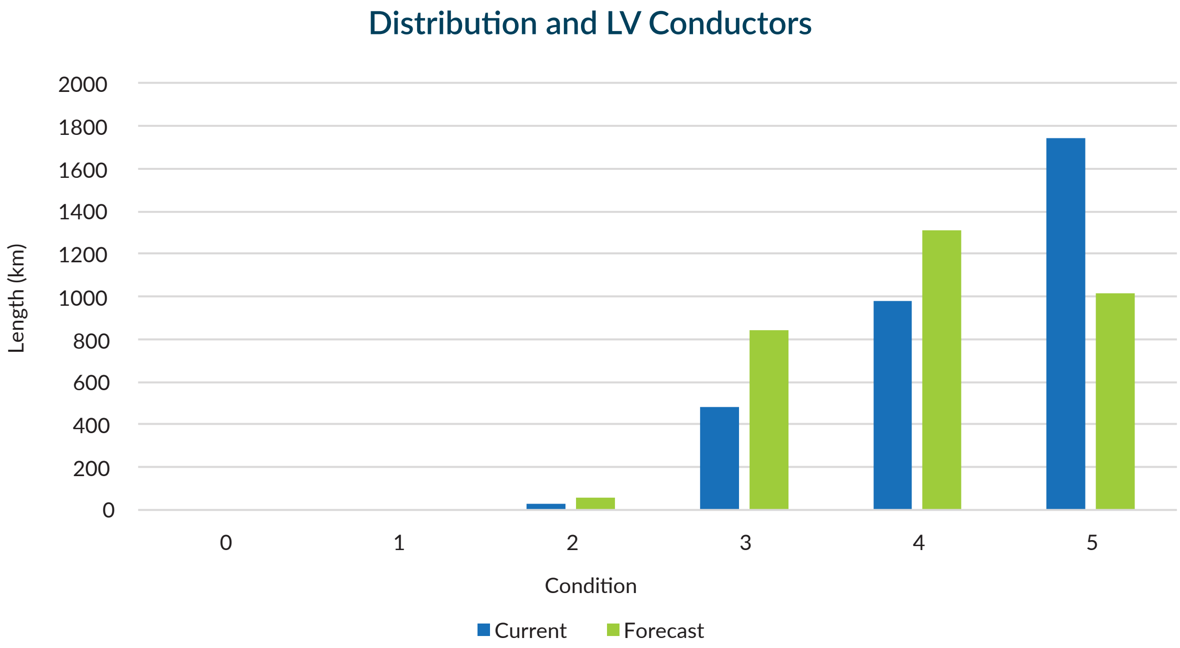


Figure 2.4.3.3: Condition of Distribution and LV Conductors

2.5 Distribution and LV Cables

This section describes our distribution and LV cables. These account for 51% (3,359km) of our distribution network.

2.5.1 Distribution Cables

Distribution cables form part of the 11kV distribution network.

Population and Age

We own 788km of 11kV underground cables. 11kV cable installed prior to 1959 is majority PILC. Between 1976 and 1990 XLPE cable was installed in the Hamilton CBD area with PILC mainly installed in other areas. From 1990 most cable installations have been XLPE. The life expectancy of cables is shown in Table 2.5.1.1 below.

Cable Type	Life expectancy (Years)	Length of Cable (km)
XLPE Cables	55	629
PILC Cables	70	159

Table 2.5.1.1: Life Expectancy of Distribution Cables

Some of the XLPE cables are reaching the end of their expected life. However, operational experience has shown that XLPE cables can usually be safely operated in excess of 55 years.

Age Profile

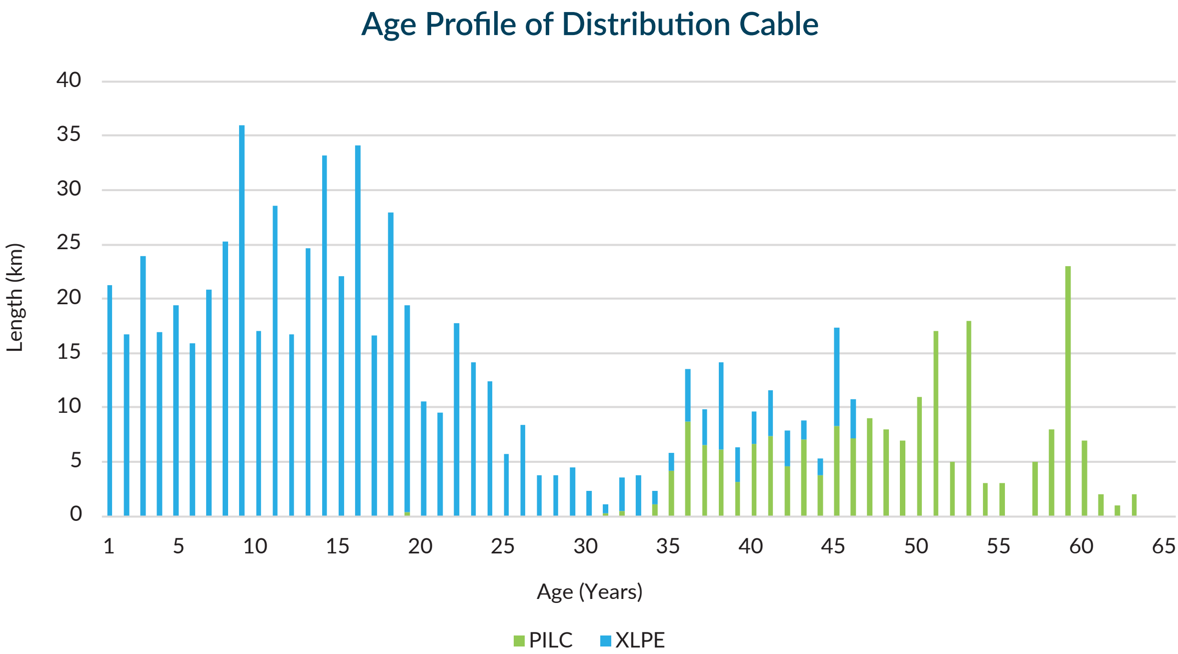


Figure 2.5.1.2: Age Profile of Distribution Cable

Condition

The historical indication of underground cable health is the number of faults that occur on it. A key determining factor of ongoing cable health is the quality of its installation.

We have invested in a new online PD tool and we are underway with a programme of cable testing to better understand the condition of these assets.

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 reliability. Selected critical distribution cables will be subjected to targeted PD testing to identify issues such as termination issues. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

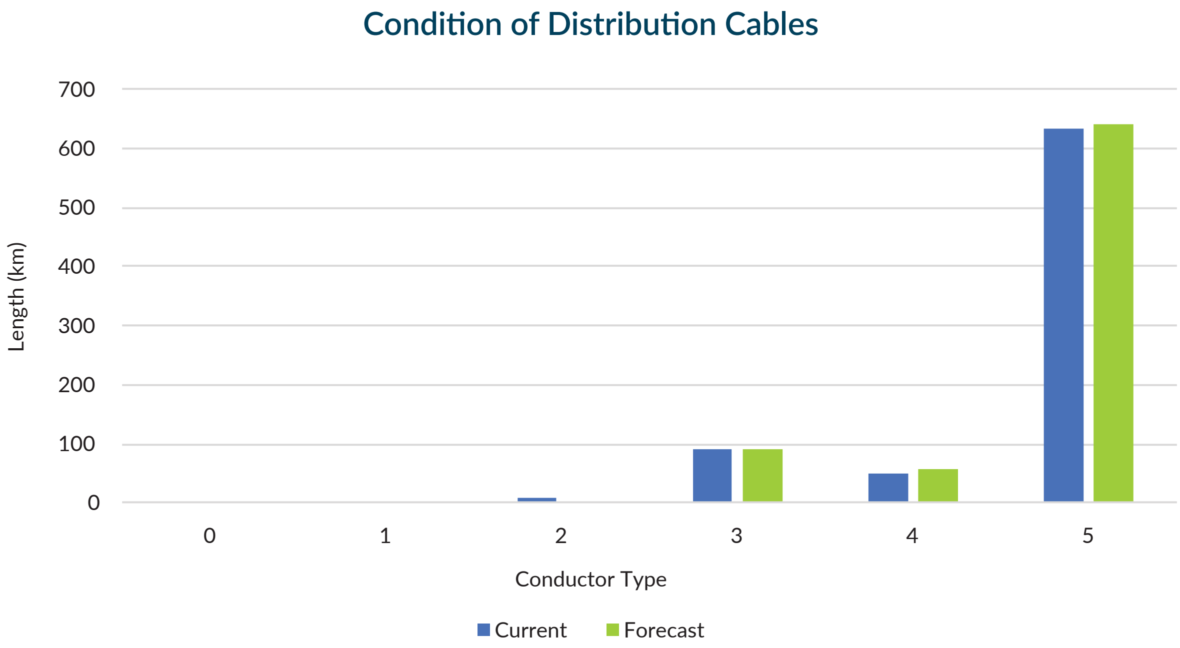


Figure 2.5.1.3: Condition of Distribution Cables

2.5.2 LV Cables

LV cables convey electricity from distribution transformers to customers at a domestic (230V) voltage level.

Population and Age

We have 2,571km of installed LV underground cable, of which 7km is PILC and the balance is XLPE. The majority of LV cable is in the Hamilton area. The life expectancy of LV cables is shown in below Table 2.5.2.1.

Cable Type	Life expectancy (Years)	Length of Cable (km)
XLPE Cables	45	2,564
PILC Cables	70	7

Table 2.5.2.1: Life Expectancy of LV Cable

Age Profile

Figure 2.5.2.2 shows the age profile of the underground LV cables in the network. The 7kms of PILC cable in the network is beyond expected life. Some XPLE cables are reaching the end of their life expectancy. However, operational experience shows that XLPE can be safely operated for longer than 45 years.

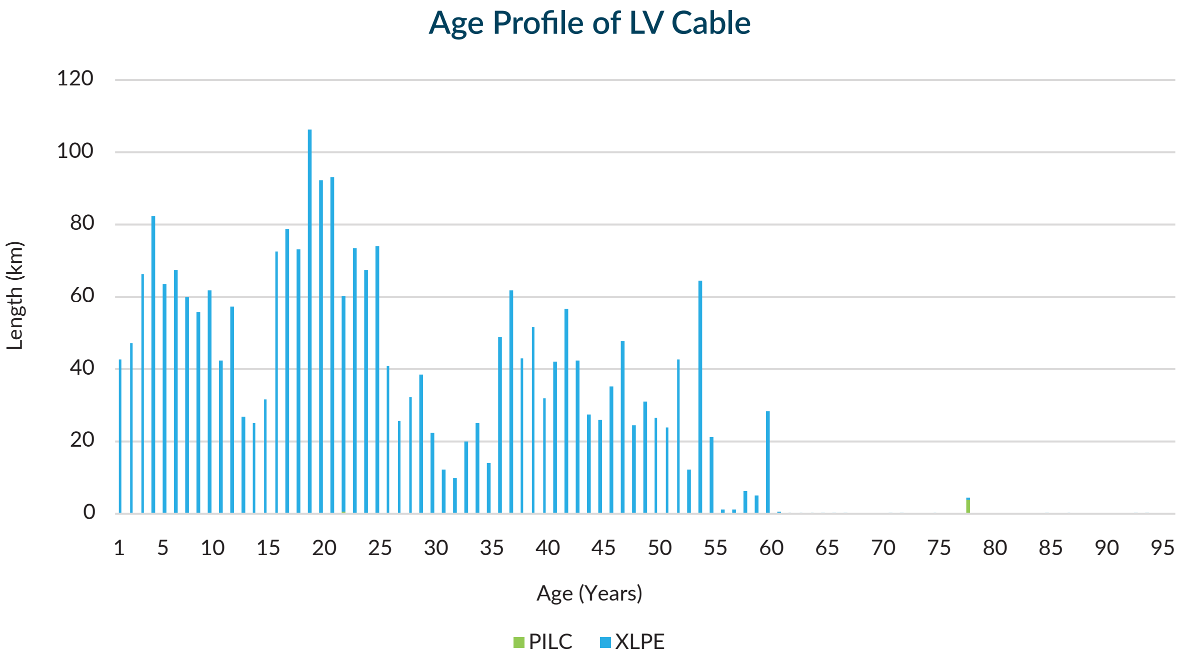


Figure 2.5.2.2: Age Profile of LV Cable

Condition

The condition of underground LV cables is difficult to assess. However, to date the number of failures experienced has been small. Most faults have been caused by damage from external factors. Further investigations to better assess the condition of these underground cables will be carried out over the next two years. It is expected that this study will determine that replacement needs to be undertaken towards the end of the AMP period, to account for this a provision has been made at the end of the AMP period.

2.6 Distribution Substations and Transformers

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

- Distribution switching stations
- Distribution transformers

2.6.1 Distribution Switching Buildings

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

Population and Age

WEL operates 17 distribution (11kV) switching stations that were installed between 1967 and 2018. The design life of switching stations is 50 years, but with regular maintenance the life can be extended significantly. The age profile of the switching station buildings is shown in Figure 2.6.1.1.

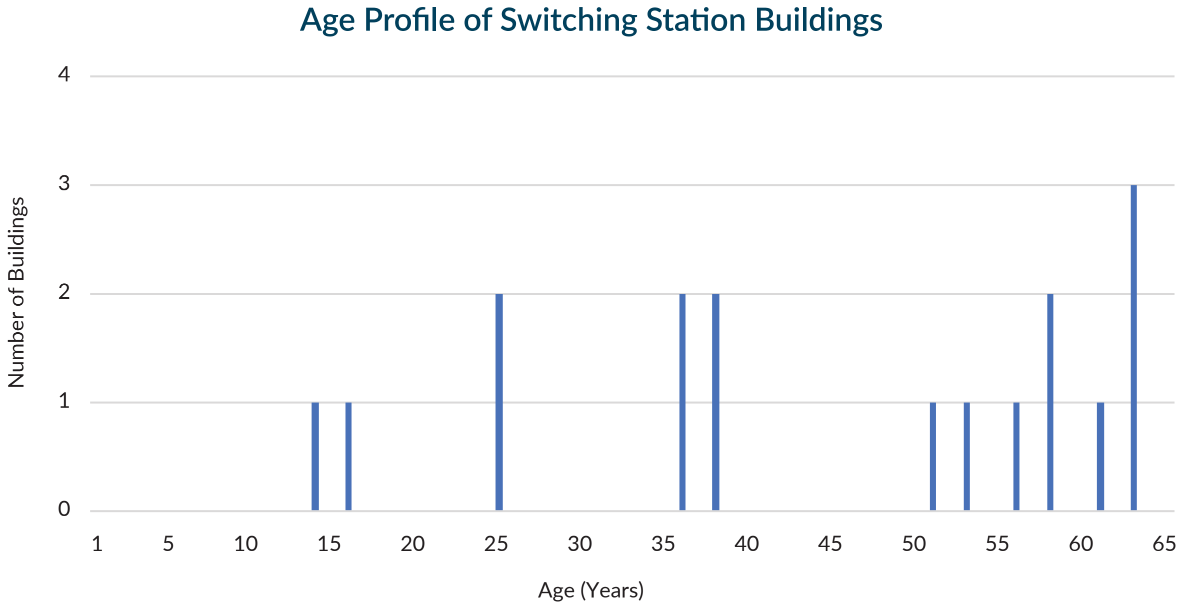


Figure 2.6.1.1: Age Profile of Switching Station Buildings

Condition

The condition profile of switching stations is shown in Figure 2.6.1.2. The shift in condition score reflects the decreased condition expected due to increased age over the planning period.

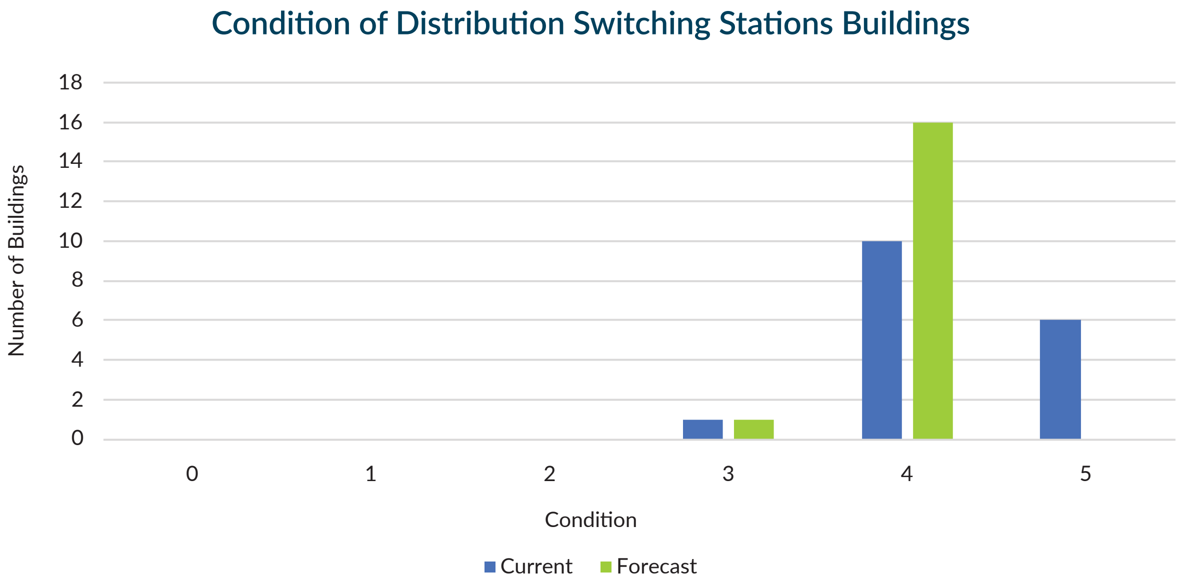


Figure 2.6.1.2: Condition of Distribution Switching Station Buildings

Seismic Ratings

The seismic ratings of most of the buildings have been assessed. WEL commenced a program of seismic assessment in 2007, which is due to be completed in FY27. Massey St switching station and Kent St substation are currently having strengthening work undertaken and are on track for completion by the end of FY23.

The results of the seismic assessments to date are shown in Figure 2.6.1.3. New guidance for seismic strengthening of buildings was issued by MBIE in July 2022. Buildings that do not meet IL3 requirements will be reassessed prior to strengthening works.

Seven sites have seismic mitigation work planned during the AMP period:

- The Garden Place switching station will be bypassed and decommissioned
- Anglesea switching station is located at the ground floor of a multi-story complex. 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 for strengthening between FY25-27

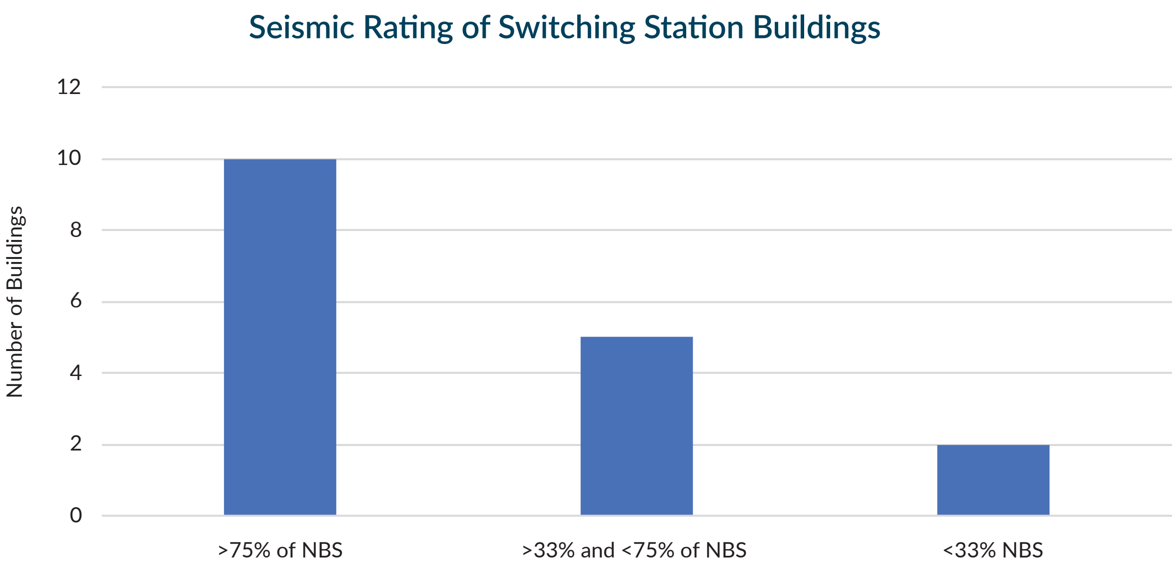


Figure 2.6.1.3: Seismic Rating of Switching Station Buildings

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

2.6.2 Distribution Transformers

Distribution transformers step down electricity supply from 11kV distribution voltage to LV (230V). Transformers allow adjustments to ensure the supply voltage remains within statutory limits.

Distribution transformers are either mounted on poles or on the ground. After the Christchurch earthquakes industry practice changed and now requires large transformers (>200kVA) for new development or asset renewal to be ground mounted.

Population

We own 4,058 pole mounted transformers and 2,068 ground mounted transformers.

Due to economies of scale WEL purchases transformers in a limited number of predefined sizes. The standard pole mounted transformer sizes we utilise are 15, 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.

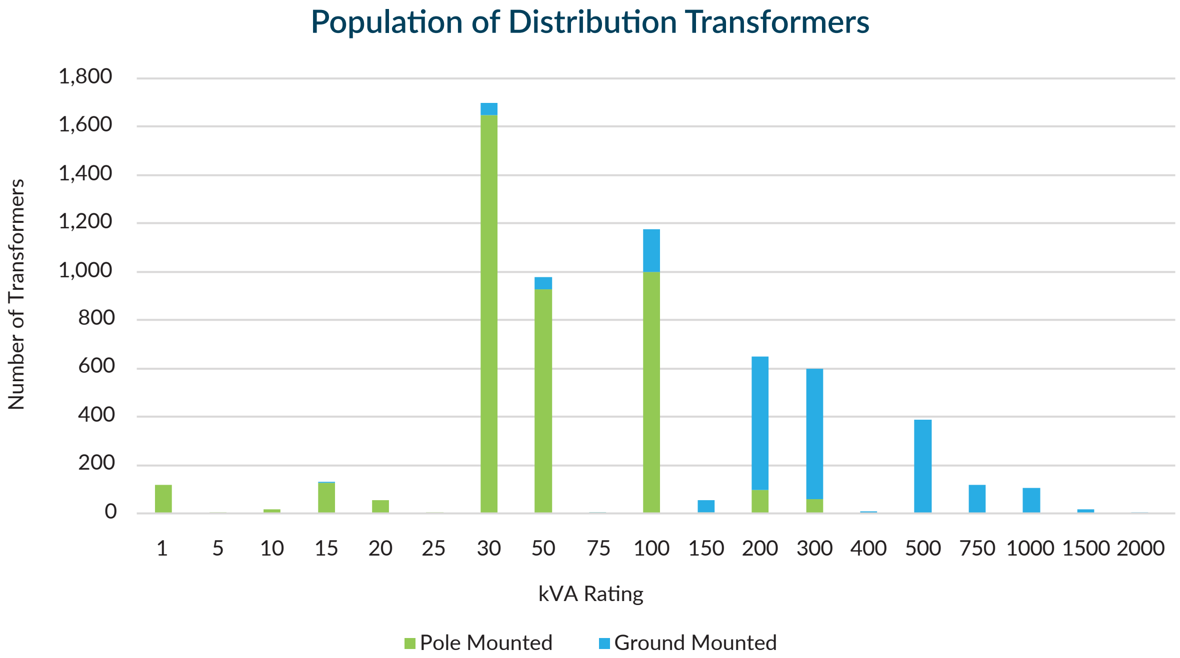


Figure 2.6.2.1: Population of Distribution Transformers

Age Profile

Figure 2.6.2.2 shows the age profile of our distribution transformers. The average age is 23 years. Pole mounted transformers are majority 100kVA and below compared to ground mounted transformers with larger capacity typically from 100kVA to 2MVA. Pole-mounted transformers are mostly in rural areas where harsh environments affect their condition, whereas ground-mounted transformers are mostly in urban areas. Large capacity ground-mounted transfomers ranging from 500kVA to 2MVA are generally housed in a building, which means their life expectancy is greater than pole-mounted transformers which are outdoors. The design life of a transformer is 50 years. The true life will be determined by the environment that they are installed in, the loading on the transformer and the number and size of faults they are exposed to. Therefore, it is common for distribution transformers to significantly exceed their design life.

The population of distribution transformers is young compared to other asset classes and they are generally in good condition. However, there are a small number that have exceeded their life expectancy but, they are still operating effectively due to their condition.

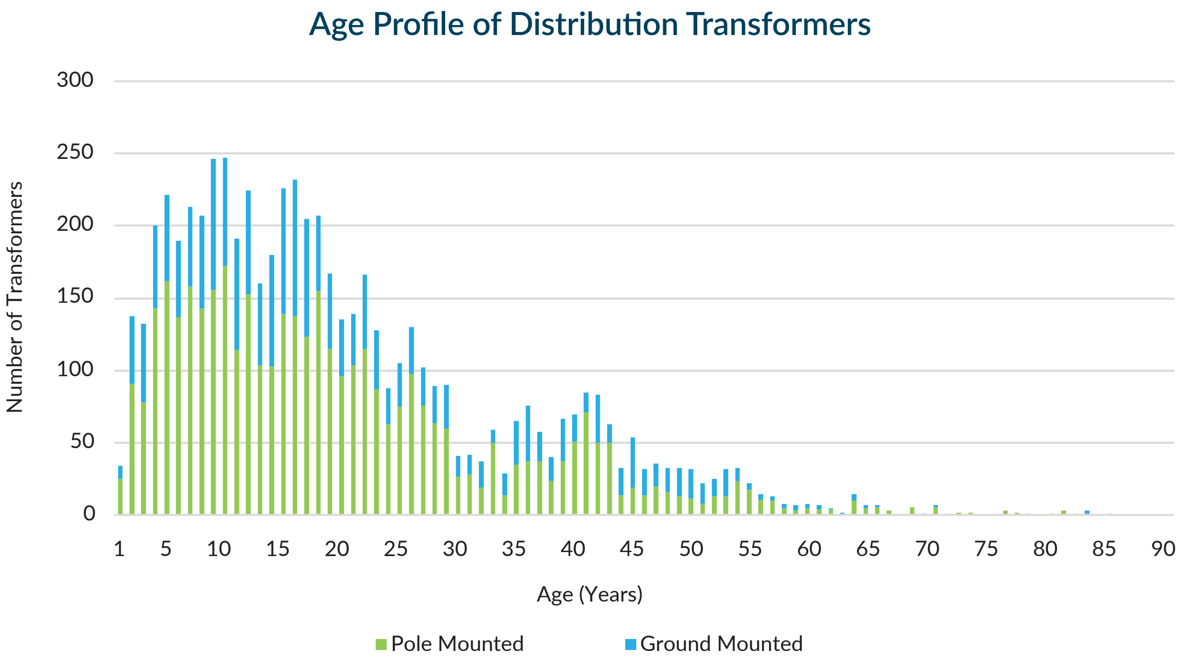


Figure 2.6.2.2: Age Profile of Distribution Transformers

Condition

Figure 2.6.2.3 shows the condition profile of our distribution transformers. The figure shows current and forecast implementation of the AMP asset renewal program.

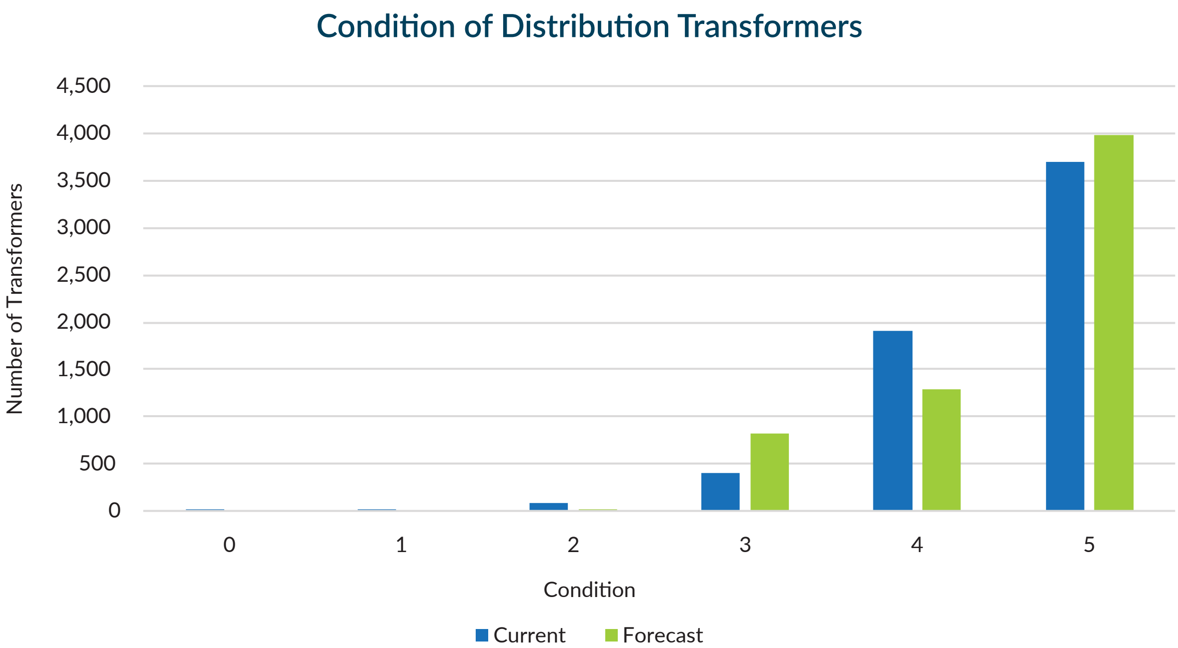


Figure 2.6.2.3: Condition of Distribution Transformers

2.7 Distribution Switchgear

Four distribution switch types exist within the network. They are:

- Ring Main Units (RMUs)
- Circuit Breakers (includes the modern SF_6 and Vacuum types)
- Air Break Switches
- 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 connect to 11kV cables. There are 1,124 RMUs in operation on the network ranging from new to approximately 65 years old. While the design life is 50 years depending on the environmental conditions that they are installed in, RMUs can have a life far in excess of the design life. Older RMUs are typically oil insulated with new RMUs being SF_6 gas-insulated switchgear.

For sustainability reasons WEL has started installing SF_6 - Vacuum type (Hybrid) RMUs with vacuum bottles as the quenching medium within an SF_6 enclosure. This is expected to reduce the volume of SF_6 gas being installed in WEL's network. We are also investigating the use of SF_6 free RMUs, it is expected that this review will be complete early in FY24.

Population and Age

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

Asset	Life expectancy (Years)	Number of Assets
Oil Filled RMU	50	349
Gas Filled	55	658
Hybrid (SF_6 + vacuum)	55	117

Table 2.7.1.1: Life Expectancy of RMUs

Age Profile

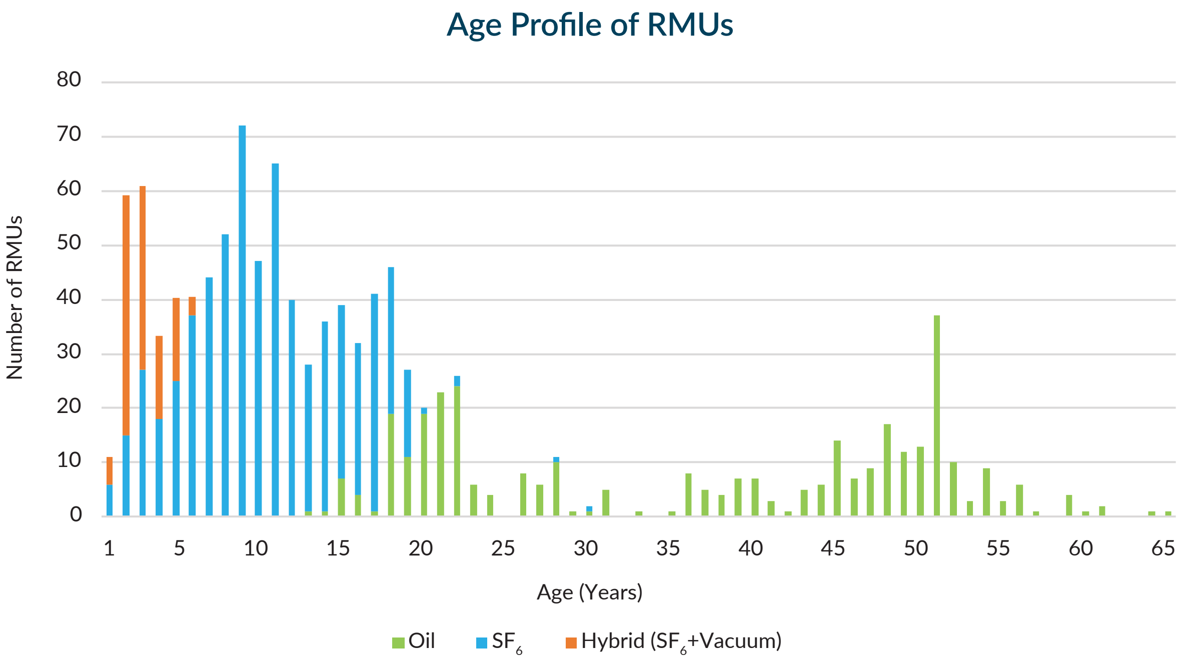


Figure 2.7.1.2: Age Profile of RMUs

Condition

The distribution of RMU conditions is shown in Figure 2.7.1.3. The figure shows current and forecast condition post AMP asset renewal program.

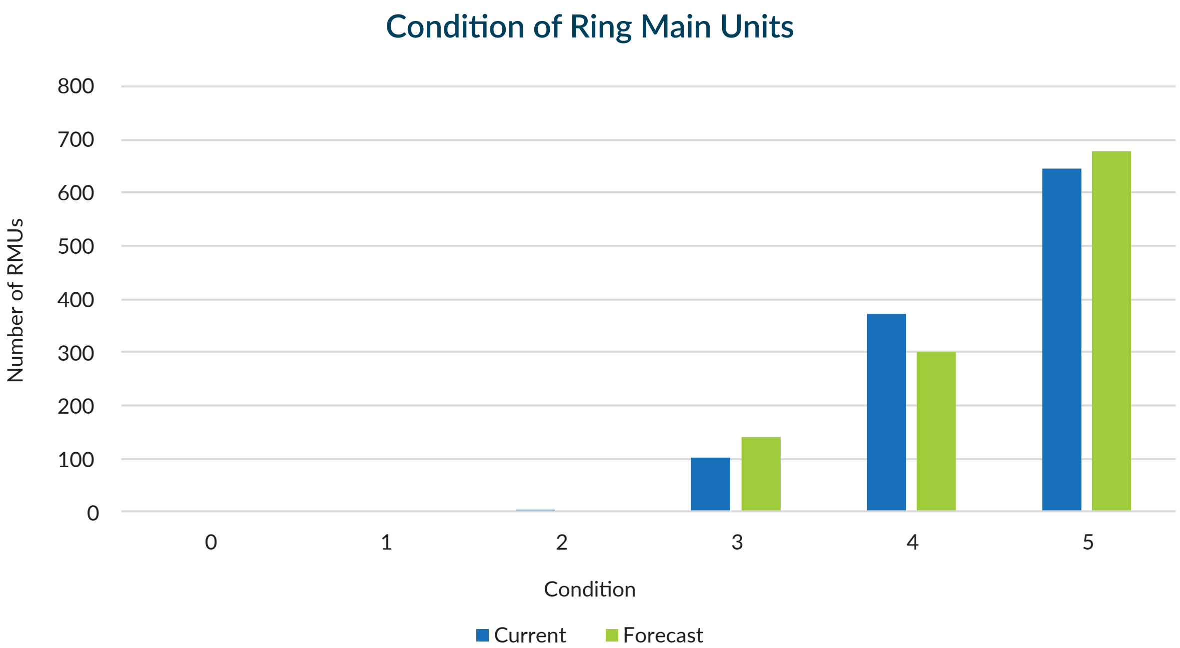


Figure 2.7.1.3: Condition of Ring Main Units

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 operated manually or automatically. When operating automatically they interrupt the flow of electricity if the current exceeds predetermined limits.

Population and Age

WEL has 386 distribution CBs on our network which range in age from new to over 55 years old. The CBs deployed are a mix of technologies which include oil filled, SF_6 and vacuum as shown in Figure 2.7.2.2. The oil-filled CBs are the oldest. The life expectancy of CBs by type is shown in Table 2.7.2.1.

Asset	Life expectancy (Years)	Number of Assets
Mineral Oil	55	85
SF_6	55	27
Vacuum	55	274

Table 2.7.2.1: Life Expectancy of Distribution CBs

Age Profile

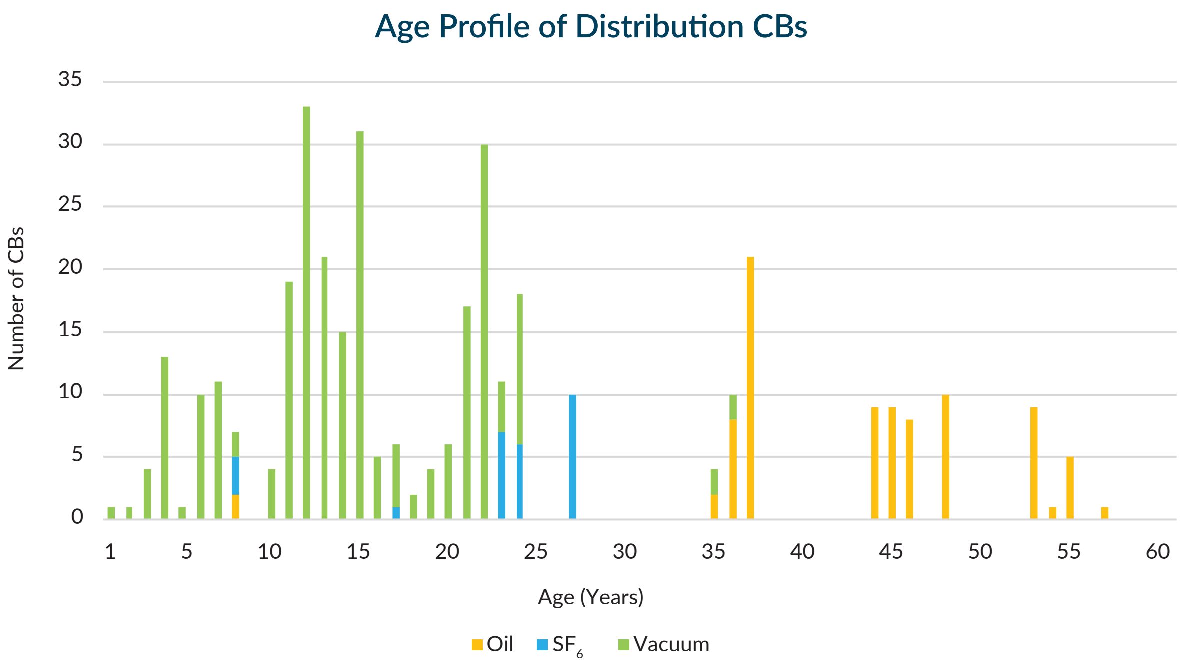


Figure 2.7.2.2: Age Profile of Distribution CBs

Condition

Routine condition monitoring indicates there are no significant maintenance problems. Since the number of operations of the CBs is 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 due to fewer operational safety issues and lower maintenance requirements. The circuit breaker fleet is predominantly a young fleet, located indoors with well-structured maintenance plans. This enables these circuit breakers to remain in very good condition. We had experienced a deterioration of the opening time for some of the older oil filled CBs. These units are currently undergoing replacement. There is renewal planned on some of the other older oil filled CBs towards the back of the AMP period.

The condition of CBs is summarised in Figure 2.7.2.3. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

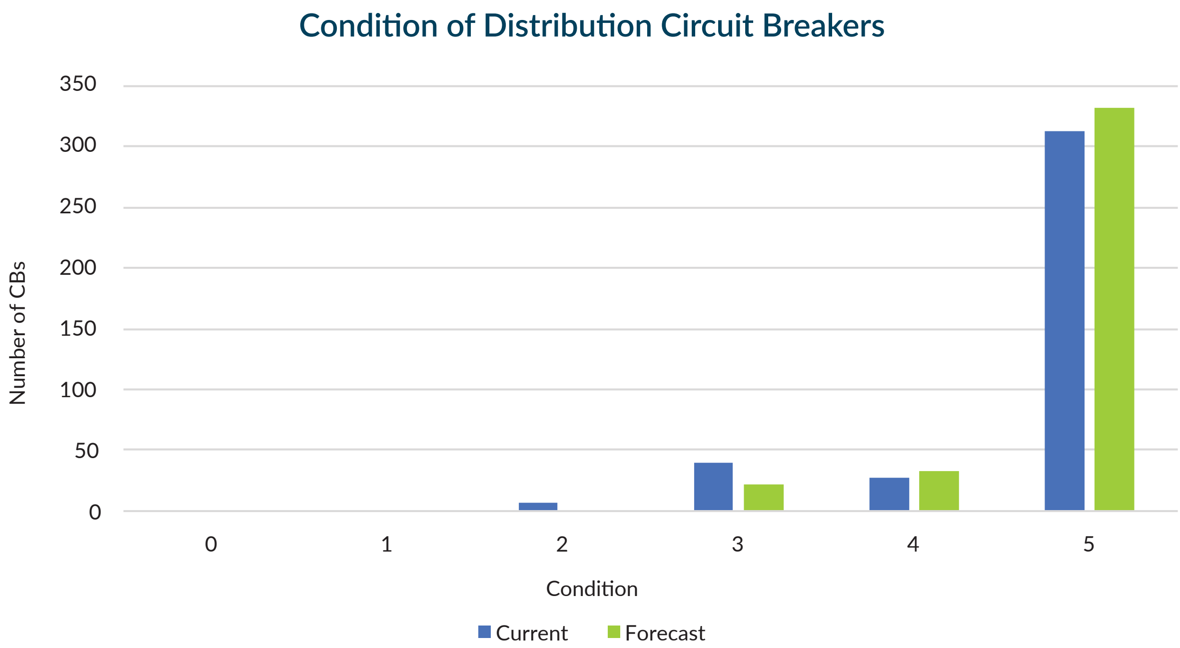


Figure 2.7.2.3: Condition of Distribution CBs

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 can 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 and Age

We own 890 ABSs and can remotely operate 139 from our centralised control room. This has the advantage of reducing customer outage impacts (SAIDI) and improving safety. Remotely operated ABSs are largely in rural areas as remote control capability provides greater benefit than in urban areas. The life expectancy of ABSs ranges from 35 to 40 years. The replacement programme for ABSs is discussed further in Chapter 8. The age profile of ABSs is shown in Figure 2.7.3.1.

Age Profile

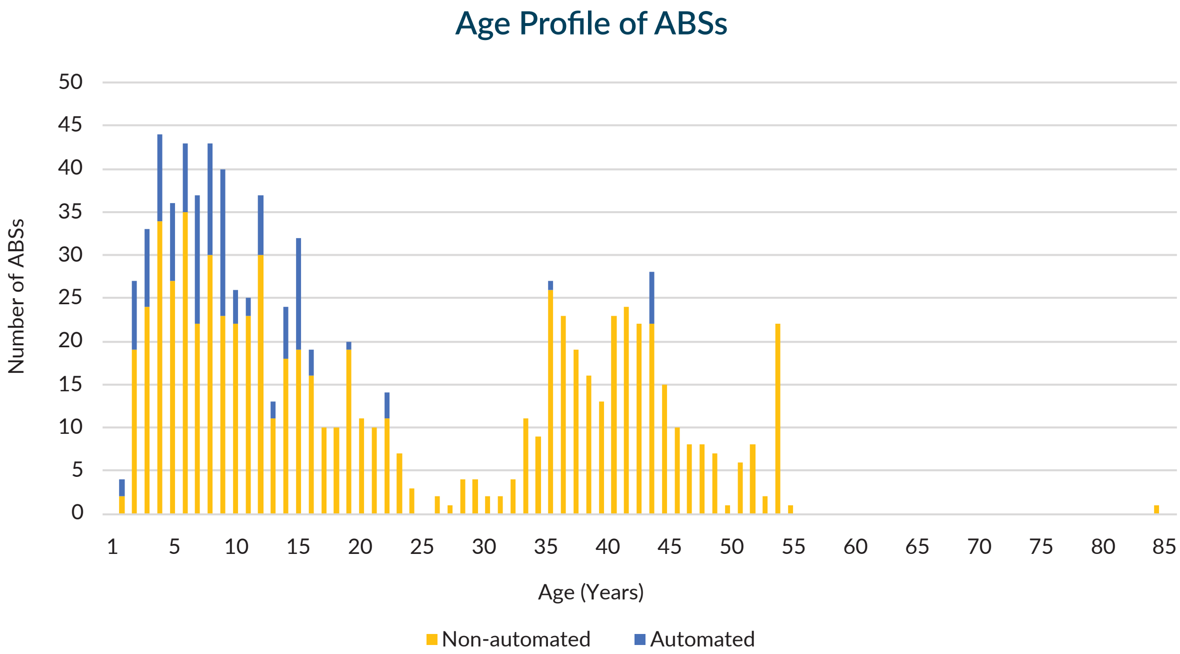


Figure 2.7.3.1: Age Profile of ABSs

Condition

The condition of the ABS fleet is good. However, there are a number of issues that will be addressed over the AMP period. In particular, obsolete fuse-panel switches, switches prone to insulator failures, and old operational critical switches. The renewal strategy to address this is discussed in Chapter 8. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

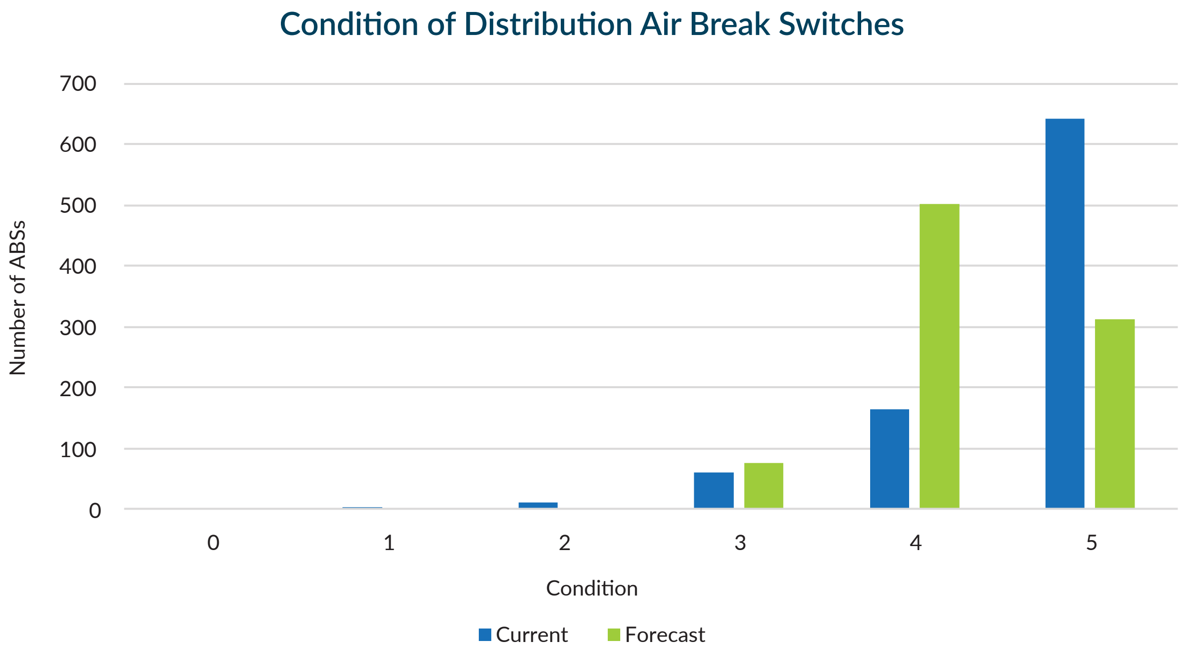


Figure 2.7.3.2: Condition of Distribution ABS

2.7.4 Distribution Reclosers and Sectionalisers

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 if the fault has cleared or isolate the area with the fault and restore the upstream customers.

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

We own a total of 76 sectionalisers and 83 reclosers on our network.

Age Profile

The life expectancy of sectionalisers and reclosers is 40 years. Figure 2.7.4.1 shows age profile of the reclosers and sectionalisers. The dropout sectionalisers that were historically used on the network have been replaced with a vacuum enclosed type to address reliability issues.

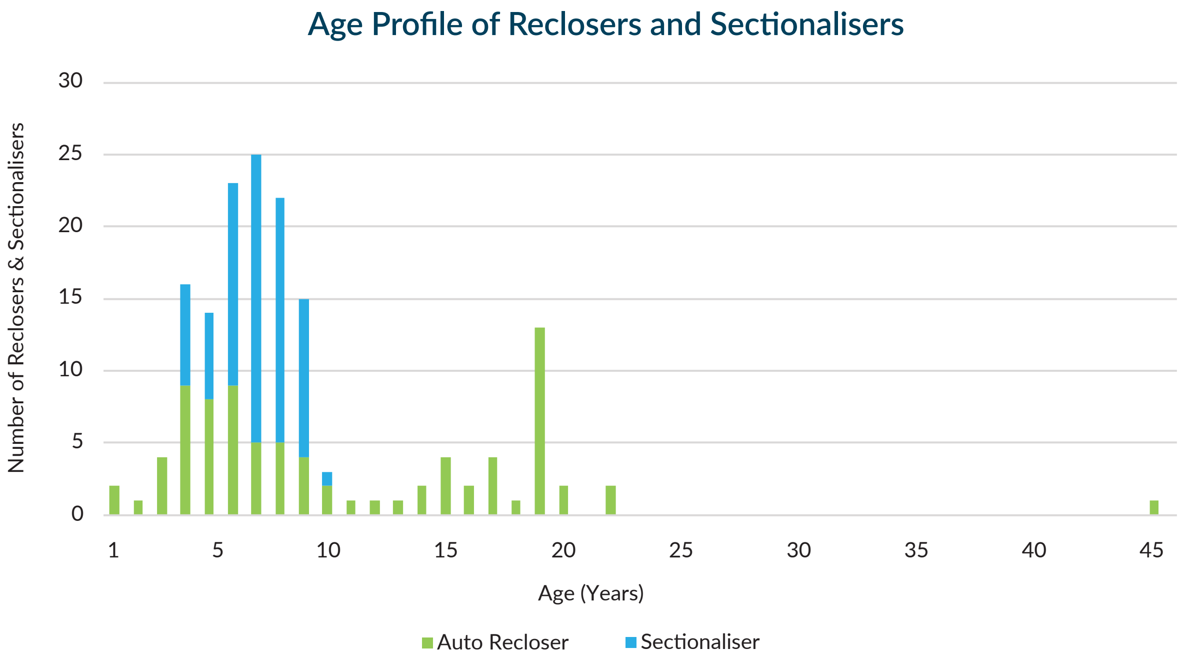


Figure 2.7.4.1: Age Profile of Reclosers and Sectionalisers

Condition

Most reclosers and sectionalisers are in good condition as shown in Figure 2.7.4.2. Ancillary devices such as communication systems, protection and battery systems are maintained periodically in accordance with maintenance standards. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

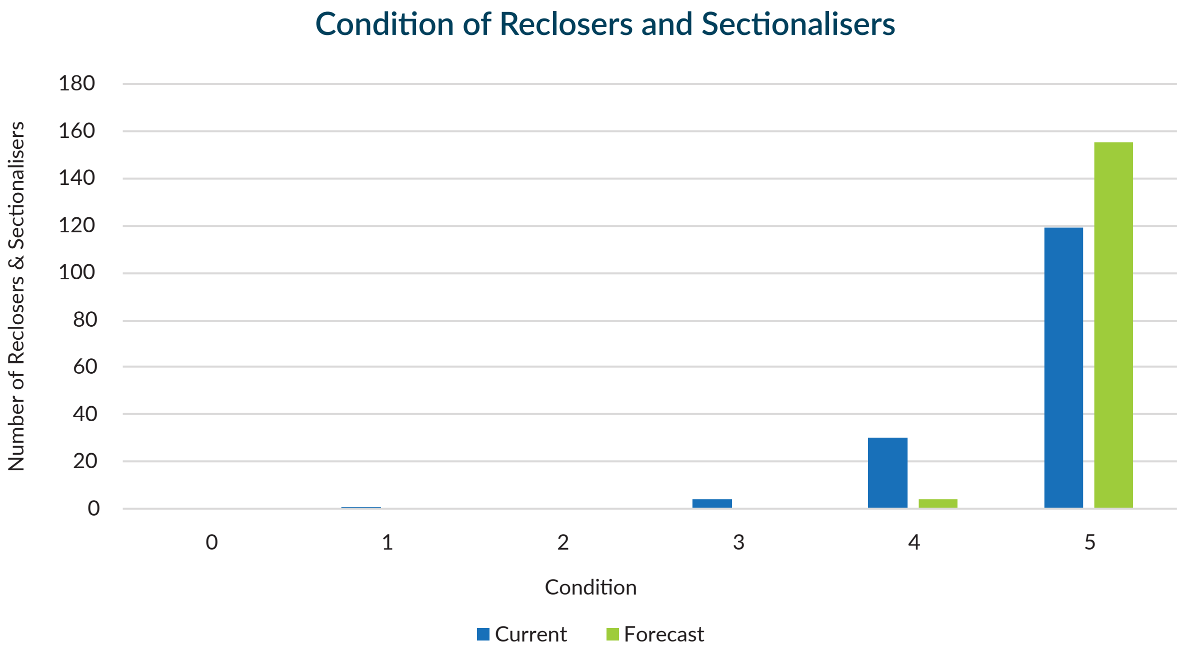


Figure 2.7.4.2: Condition Reclosers and Sectionalisers

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
- SCADA & Communications
- Load Control Equipment
- 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 29,457 LV pillars on the network, an increase of 996 since the 2020 AMP, due to network growth.

Age Profile

The expected life of LV pillars is 45 years. The age profile of LV pillars is shown in Figure 2.8.1.1.

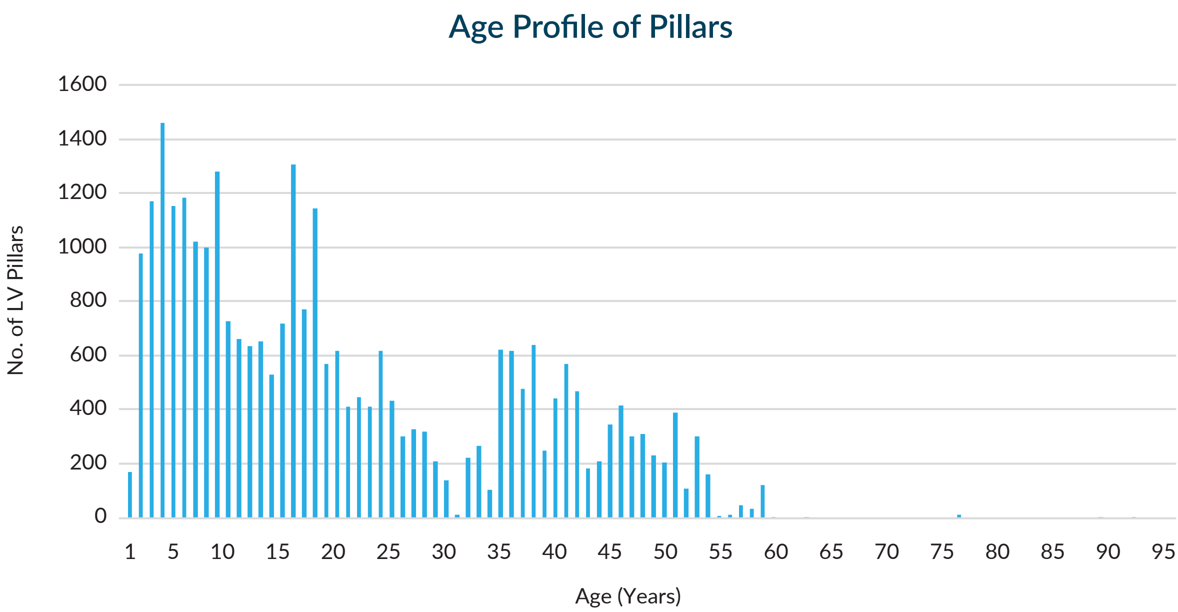


Figure 2.8.1.1: Age Profile of LV Pillars

Condition

The condition of LV pillars is shown in Figure 2.8.1.2. They are in good condition and are patrolled regularly as damage can result in a public health and safety risk. A targeted inspection programme was undertaken in 2017 to check that pillars were secure and to identify and remove any metallic screws used to fasten the lids. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

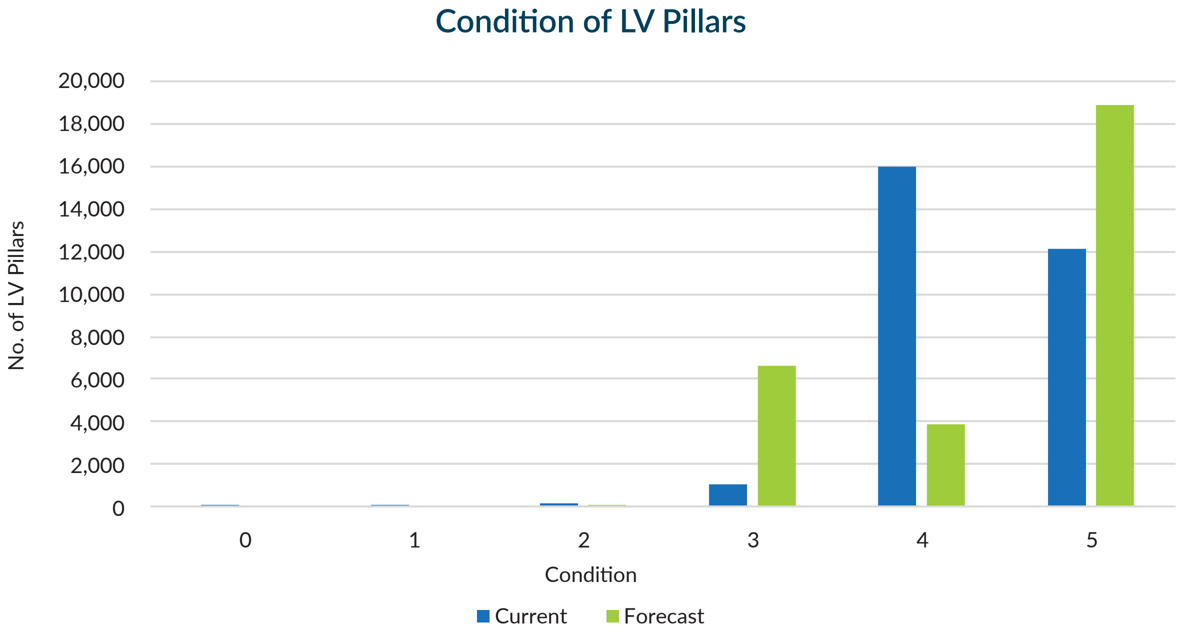


Figure 2.8.1.2: Condition of LV Pillars

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 and Age

We own 869 relays in total, with a mixture of electromechanical and numeric protection relays, with electromechanical representing, the older relays.

Asset	Life expectancy (Years)	Number of Assets
Numerical	30	689
Electro-mechanical	40	180

Figure 2.8.2.1: Type of Protection Equipment

Protection relays installed in the last 10 years are all numerical relays. WEL has aged electro-mechanical relays that are already past their design life. However, with good maintenance, experience has demonstrated that the life of electro-mechanical can be extended to 70 years. Figure 2.8.2.2 illustrates the age profile of the protection equipment.

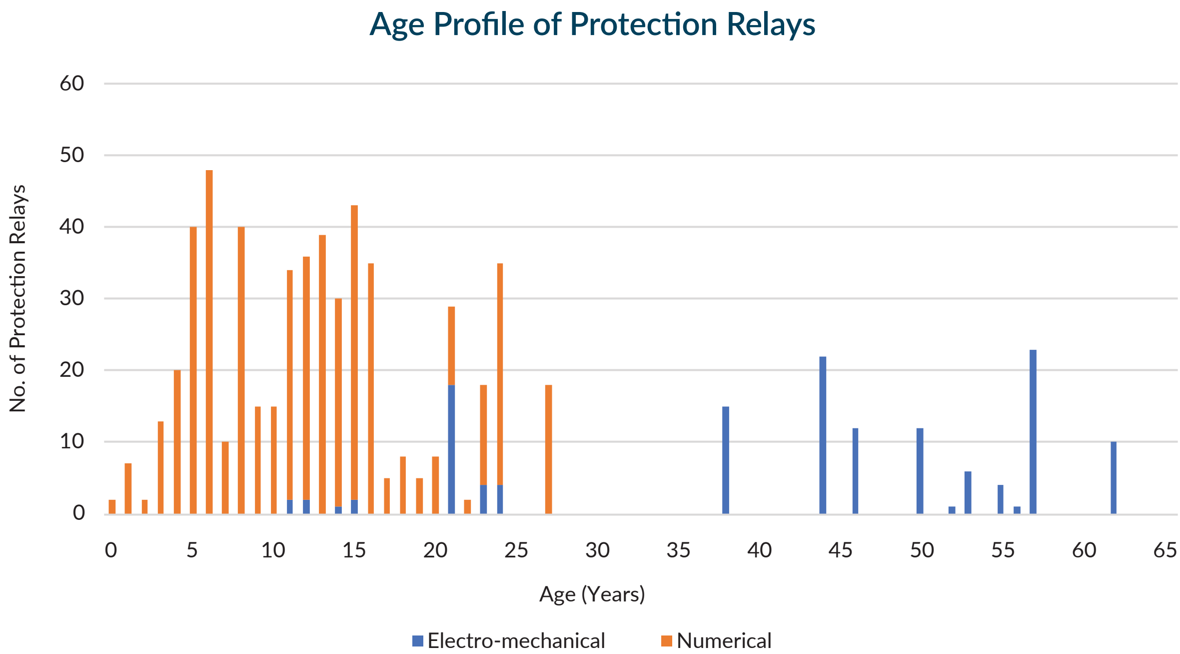


Figure 2.8.2.2: Age Profile of Protection Relays

Condition

The condition of the relays is good and they continue to operate reliably, however replacement of the older electro-mechanical relays will allow other features such as fault monitoring and events recording. This is discussed further in Chapter 8. The condition profile is shown in Figure 2.8.2.3. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

WEL uses a protection database to manage numerical relay configuration data, as it is critical to the correct operation of the relays in the field.

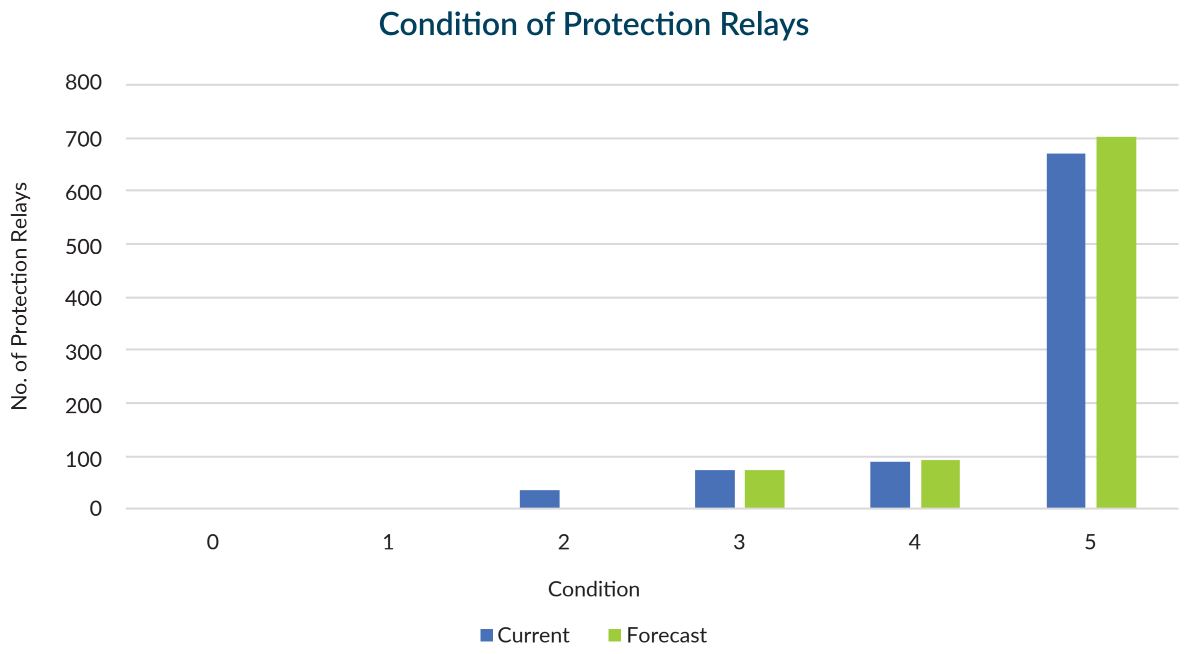


Figure 2.8.2.3: Condition of Protection Relays

2.8.3 SCADA and Communications

SCADA and communications are the foundation of network automation and monitoring. The primary components of this supporting infrastructure are the Remote Terminal Units (RTUs).

Population

We own 488 RTUs. The older fleet are progressively upgraded or replaced to provide improved functionality and communications capability.

Age Profile

The life expectancy of the supporting infrastructure, including the RTUs, is 15 years for numerical type RTUs and 30 years for early digital-type RTUs. The age profile of SCADA related equipment (RTUs) is shown in Figure 2.8.3.1.

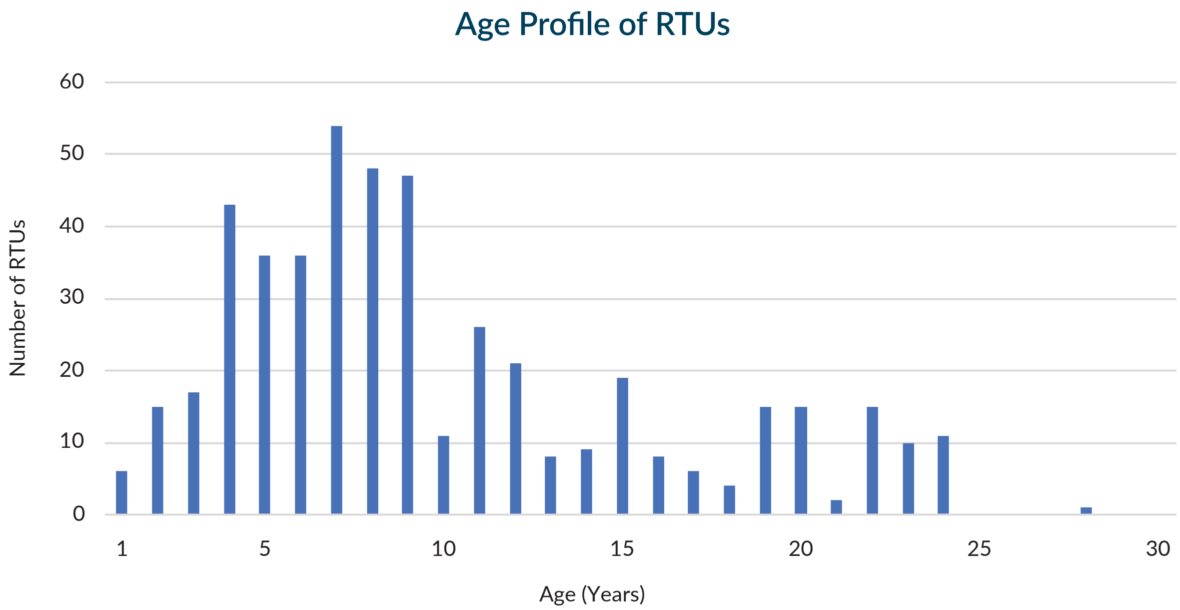


Figure 2.8.3.1: Age Profile of RTUs

Condition

The condition of RTUs is shown in Figure 2.8.3.2 below. The figure shows current and forecast condition post implementation of the AMP asset renewal program.

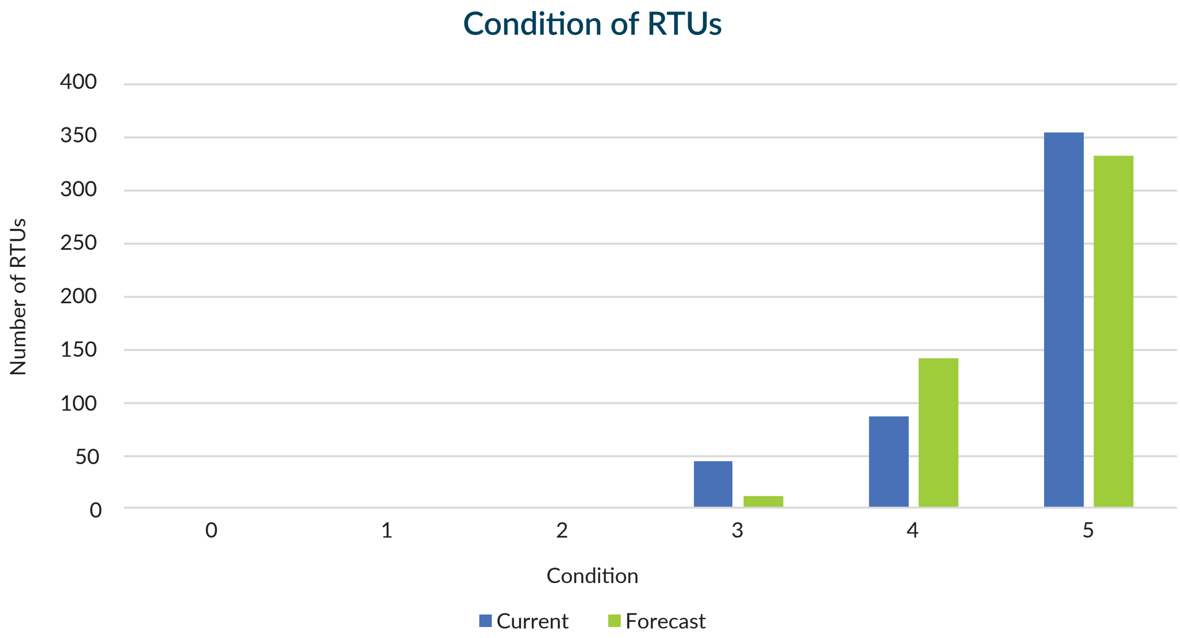


Figure 2.8.3.2: Condition of RTUs

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.

Historically management functionality is used to manage GXP capacity limits and controls street lighting.

Our smart meter system can send signals to meters via mesh radio to perform load control functions in a similar way to the ripple system. This has been tested as a proof of concept and has been utilised in some instances as a backup for streetlight control. Over this AMP period the form and function of load management systems is likely to change significantly. The focus will change from GXP management to circuit management and expanding the interruptible load market, benefitting all involved. To achieve this, it is likely that the load management equipment will also change significantly. The focus will shift from equipment that is designed to manage predictable network constraints to equipment that is more dynamic. WEL is currently testing a number of products to enable this change. It is also important to ensure that all parties within the electricity industry have open access to this equipment. This will ensure the lowest cost to the customers and the greatest benefit to those offering the load. This will also mean that it is likely that WEL will contract load management services from other third-party providers.

Over the next five years WEL will complete a number of the trials currently underway and use this information to develop the long-term strategy for load management equipment including the phasing out of ripple equipment.

Population and Age

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. 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 built in ripple functionality. The life expectancy of load control equipment is 30 years. The age profile of WEL's load control equipment is shown in Figure 2.8.4.1.

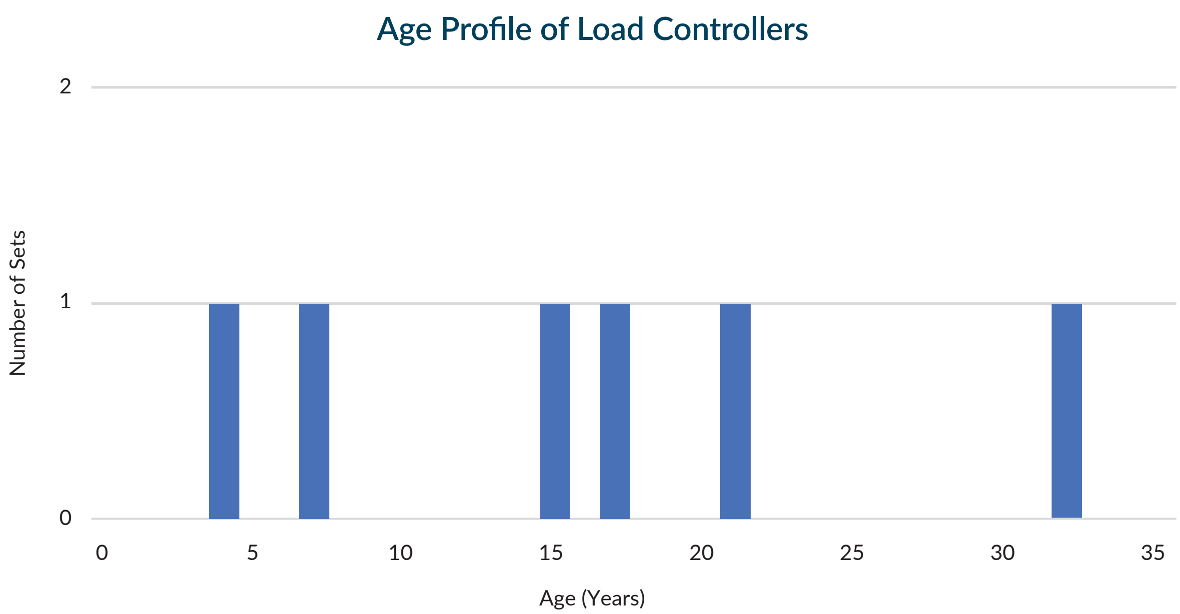


Figure 2.8.4.1: Age Profile of Load Controllers

Condition

The load control equipment is in good condition (condition 3) and is not expected to change condition within the AMP period. It is believed that the load control strategy review will recommend that load control equipment is changed to a different type prior to the current load control equipment needing replacement.

2.8.5 Meters

We have a range of meters from 33kV meters down to LV smart meters. Further information about the Smart Meter system is contained in Chapter 7.

Population

The subtransmission and distribution meters are used for revenue protection, load control, operation, fault management and network protection. WEL has 70,789 LV smart meters installed. Most of these meters are installed as network monitoring meters in series with revenue meters. Smart meters can also function as data loggers returning power quality information.

Age Profile

The average age of the subtransmission and distribution meters is seven years. Low voltage smart meters are installed as compliant meters under the Electricity Industry Participation Code 2010 (Code), requiring strict auditing of procedures and controlled maintenance and inspection management over their expected life of 15 years. However failure rates have been low and it is expected that a life in excess of 20 years will be realised for meters that are used for network monitoring. The lifecycle strategy of the metering fleet has a number of changing variables, including continuing metering functionality developments, in particular meters with decision making capabilities, use of gateway devices for other purposes which can provide similar information, installation restrictions and recertification requirements. Over the next two years WEL will develop a detailed metering strategy that will include a renewal programme. The number of smart meters installed over recent years is shown in Figure 2.8.5.1.

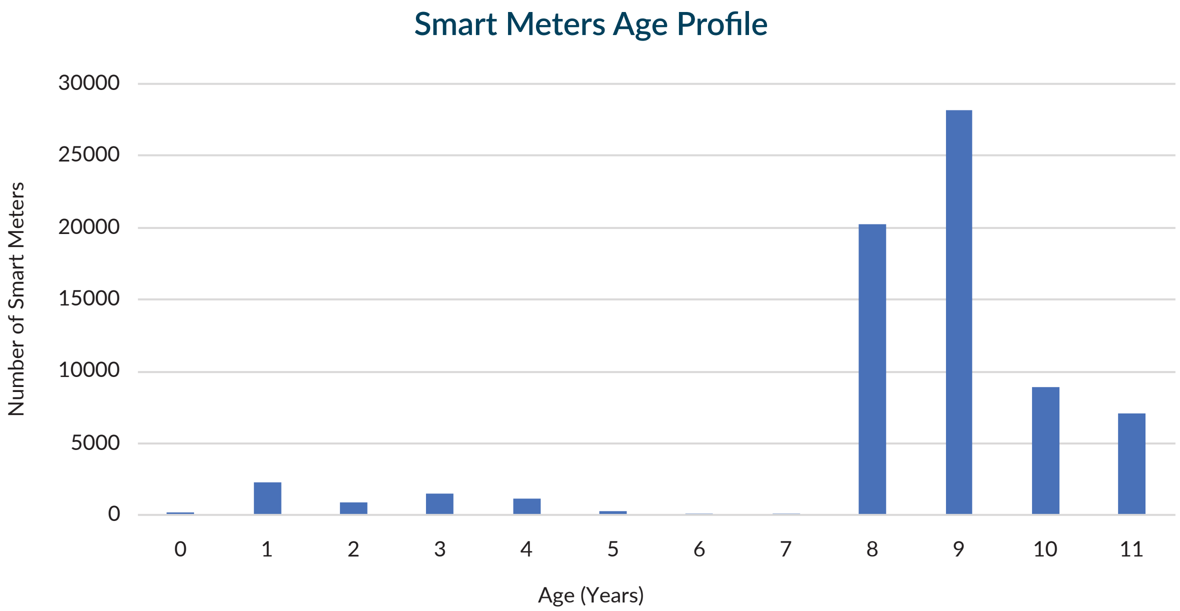


Figure 2.8.5.1: Smart Meters Age Profile

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 Disaster Recovery Centre (DRC) and one for the WEL corporate office and depot.

Both generators are in excellent condition. The Battery Energy Storage System (BESS) also provides black start capability and backup power for short durations.

2.9.2 Emergency Critical Spares

We have the following critical spares reserved for emergency conditions:

- Materials to construct a 4km overhead 33kV line
- Substation battery bank
- Protection relays
- Substation communication equipment
- Five zone transformers, two 10MVA, two 15MVA and one 23MVA transformer
- One 33kV circuit breaker

RMUs, cables and distribution transformers all have minimum reorder values that ensure they are always kept in stock so not included in the critical spares. Zone transformers are 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 field staff. These buildings are 16 and 18 years old, respectively. Both buildings are in very good condition. WEL is planning to build a new office with warehousing in FY25-26 to supplement existing buildings.

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, Smart Meter Data System and Mobility Systems. The condition of the control room NMS equipment is good with all computer hardware replaced in 2020. The software upgrade was also completed in the same year. An upgrade of the GIS system is currently underway. An upgrade to the ERP system is currently in planning. 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. Vehicles are replaced with appropriate vehicle types based on the replacement and sustainability policies.

2.10 Assets Owned by WEL at GXPs

The WEL owned assets located at GXPs are covered in the previous sections. For clarity they are summarised below.

Hamilton GXP

Hamilton GXP has the following assets:

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

Te Kowhai GXP

Te Kowhai GXP has the following assets:

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

Huntly GXP

Huntly GXP has the following assets:

- Communications equipment
- Metering equipment
- RTUs
- Protection relays
- 33kV Switchgear

3 Approach to Asset Management

Whakahaere Rawa

WEL NETWORKS AMP 2023

3. Approach to Asset Management

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

3.1 Stakeholder Requirements

This section describes our understanding of stakeholder and sustainability management requirements. Stakeholders include:

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

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

WEL engages with stakeholders to:

- Understand key issues
- Understand customer development requirements
- Facilitate customer needs through network development planning
- Collaborate to identify options to address those issues

The expectations of stakeholders are detailed in the table below (in no particular order).

Stakeholder group	Engagement	Expectations
Customers Residential Small to medium business Large customers Generators	Surveys CIW feedback Post fault feedback Feedback from regular meetings with top 20 commercial customers. Proactively advise large commercial customers of planned maintenance outages	Public safety around assets An acceptable quality of supply is received Actively discuss planned maintenance outages Facilitating customer developments Enabling customers to benefit from new technologies
Developers Subdivisions Relocations New Connections	Stakeholder consultation Customer Self Service Portal	Facilitate development plans Fair pricing Good customer service and communication
All members of the community	Social media Media releases Public Safety Campaigns	Safety of assets The network is efficient Environmental impacts are minimised Remediation is undertaken where necessary Timely communication of potential outages
Regulators Commerce Commission Electricity Authority Worksafe	AMP Industry meetings Industry participation groups Workshops Consultations	Meet health and safety, and regulatory requirements, including information disclosure Proactive engagement on regulatory issues. Reporting and notification of issues and non conformances Act as a prudent PCBU
Transpower Grid Development System Operator	Transmission pricing reviews Industry groups Network development planning Emergency planning	Consult on asset management planning Engagement on commercial and other industry issues Effective interaction on operational matters
Electricity retailers Any authorised retailer operating in, or planning to operate in WEL's region	Industry groups and workshops Distribution pricing consultations Bilateral negotiations Direct communications (email, phone calls, etc.) Notification of outages	Effective communication Delivery of effective business to business services Use of transparent, simple, and appropriate network price structures Fair contractual arrangements Timely outage notifications

Stakeholder group	Engagement	Expectations
Partners Electrical contractors Equipment suppliers Industry groups (EA, EEA, ENA etc.) Local and Regional Councils	Industry groups and workshops Contract meetings Emergency planning Development Planning and coordination	Predictable, transparent, and commercially sound interactions Safety of assets Meet PCBU requirements to consult, coordinate and co-operate
Staff	Monthly all staff meeting Team briefings Rolling message TV Screens Weekly CEO email "The Monitor" Intranet messaging	Safe and enjoyable working environment Fair and equitable remuneration for work performed Enabling diversity in the workforce Health, safety, wellness policies and initiatives Work/life balance
Board of Directors	Reports Regular meetings	Provide 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 the assets Managing business risk Seeking opportunities for growth Efficient operation Developing organisational capability
WEL Energy Trust	Reports Regular meetings	Support region's long-term economic and social development Provide dividends to the Trust for distribution to the community through initiative support and grants Invest in new technologies that benefit people, modernise the network and future proof communities

3.1.1 Sustainability

The Management and Board of WEL are committed to managing the business in a sustainable way and embracing the principles of corporate social responsibility. We have chosen to align our activities to four of the United Nations' Sustainability Development Goals (SDGs), which have the most impact and best alignment to our strategic direction.

The following SDG goals support our company values and are directly relevant to the activities encompassed in the 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

- Minimise 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 theuptake of electric vehicles
- Investigate the use of data analytics from smart meter data to develop new systems to improveservices to our community

Resilient Infrastructure — **Aligned to Industry Innovation and Infrastructure (SDG 9)**

Build resilient infrastructure and promote sustainable and innovative development of network assets

- Optimise network asset management through delivery efficiency
- Monitor and reduce SAIDI (customer outage times) through a resilient network
- Develop micro-grid and 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 and grid scale batteries

Greenhouse Gas Emissions — **Aligned to Climate Action (SDG 13)**

WEL will undertake an assessment of its greenhouse gas (GHG) emissions with a view to mreducing the relativeimpact of its emissions over time. All measurements will be regularly validated by Toitu Envirocare

- Measure GHG emissions and verify using Toitu carbon reduce certification
- Convert our pool vehicle fleet to electric vehicles (EV) or hybrid
- Investigate solar generation and battery installation options
- Expand the hybrid technology battery powered hydraulics/diesel trucks across the fleet

Globally there is a move towards sustainability and carbon zero. The New Zealand Government has released the Climate Change Response (Zero Carbon) Amendment Act 2019. This is the framework to enable New Zealand to develop and implement clear and stable climate change policies.

The government has formed the Climate Change Commission, who monitor and review progress towards New Zealand's goals for reducing emissions and adapting to the changing climate.

The longer-term objective for New Zealand is to achieve carbon zero by 2050. The electricity sector has a pivotal role in this transformation enabling the transportation sector and industry to move from carbon-based fuels to renewable energy, primarily electric vehicles, and electrification of industrial heat. Electrification directly impacts the network and provides opportunities for DER and smart energy solutions.

In conjunction with CO_2 reductions, we must control and lower other greenhouse gas emissions. The electricity system currently relies on greenhouse gases such as Sulphur Hexafluoride (SF_6) within electrical equipment. SF_6 is an excellent gas for electrical insulation but it is a potent greenhouse gas. Little SF_6 is released from WEL owned equipment to the atmosphere and we run a recovery and reuse programme during servicing. However, we are investigating options to reduce the use of SF_6 based equipment as technology allows, and as renewal opportunities present.

We own twenty-five public EV chargers saving approximately 280,000kg of CO_2e between April 2021 and March 2022. Where practicable we are transitioning our light fleet from internal combustion engines to hybrid and EV alternatives. As technology advances, we will review options for the utilities and heavy fleet.

The government's carbon zero aspirations are driving industry and the transportation sector to develop a roadmap to transition towards electrification. Industrial electrification and EV fast-chargers impact us as they create large point loads on the network. Home EV charging can place large loads at any location within the network. There is an underlying expectation by users that power will be available. Supplying these high loads, and the substantial changes in load and therefore voltage, require LV management and potential network upgrades.

3.1.2 Diversity and Inclusivity

Diversity and inclusivity are essential components of a successful business. We value the diversity of thought and experience of our people. The Diversity and Inclusivity Policy details a commitment to fostering a workplace where everyone is treated respectfully, fairly and is provided the opportunity to reach their full potential. In achieving this we believe we will have a stronger, more creative, and resilient organisation.

3.1.3 Balancing Stakeholder Requirements

We have a diverse set of stakeholders, and achieving the appropriate balance between their requirements is necessary. This is particularly relevant where the outcomes sought are mutually exclusive. Generally, our stakeholder needs align and can be met without conflict. However, when they do not align, we apply a prioritisation framework which prioritises safety, followed by legal and regulatory requirements. Any remaining stakeholder requirements are reviewed and prioritised on a case-by-case basis.

3.2 Asset Management System

Effective asset management is crucial to achieving our objectives. Our asset management system consists of various planning documents that describe the implementation and alignment of our Business Objectives to the delivery and management of our assets. Each year we undertake a business planning process. We update our documents listed below to reflect any changes that have a material impact on our asset management principles, objectives or practises.

The system provides a line of sight from Business planning and objectives to the management of our assets and ultimately the distribution of electricity to our customers. are updated. The asset management system enables effective decision making, ensuring alignment with the company vision, values, and strategic plan; and gives effect to the Asset Management Policy and Asset Management Objectives. It provides the means to achieve the objectives through implementation of processes that are effectively controlled.

We have an asset management system that links corporate objectives and day-to-day activities in alignment with ISO 55001 (Figure 3.2.1). It comprises the following elements:

Asset Management Policy: aligns WEL's asset management principles with corporate objectives (Vision, Values and Strategic Plan).

Strategic Asset Management Plan (SAMP): communicates and aligns the company strategic objectives, the asset management policy and the asset management objectives. The SAMP documents the key performance indicators to measure the achievement of the asset management objectives, that influence the maintenance, renewals and capital investment in the network.

Asset Management Plan: documents the asset lifecycle model, aligns high-level objectives to relevant processes and activities, and details our 10-year investment plans. Constraints are identified and investments made as required to achieve our AM objectives.

Annual Works Plan (AWP): gives effect to the 10 year investment plan and defines the list of projects to be delivered in the next period. WEL's work plans consider each element of the asset lifecycle.

Together these documents communicate the performance objectives established for the network.

In 2021 WEL completed a two-year programme of work called Operational Excellence. This achieved alignment between the asset management system and the ISO Standard, ISO 55001:2014 Asset Management – Management Systems - Requirements. This includes the development of a SAMP to the guidance specified in ISO 55002:2018 Annex C – SAMP.

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.

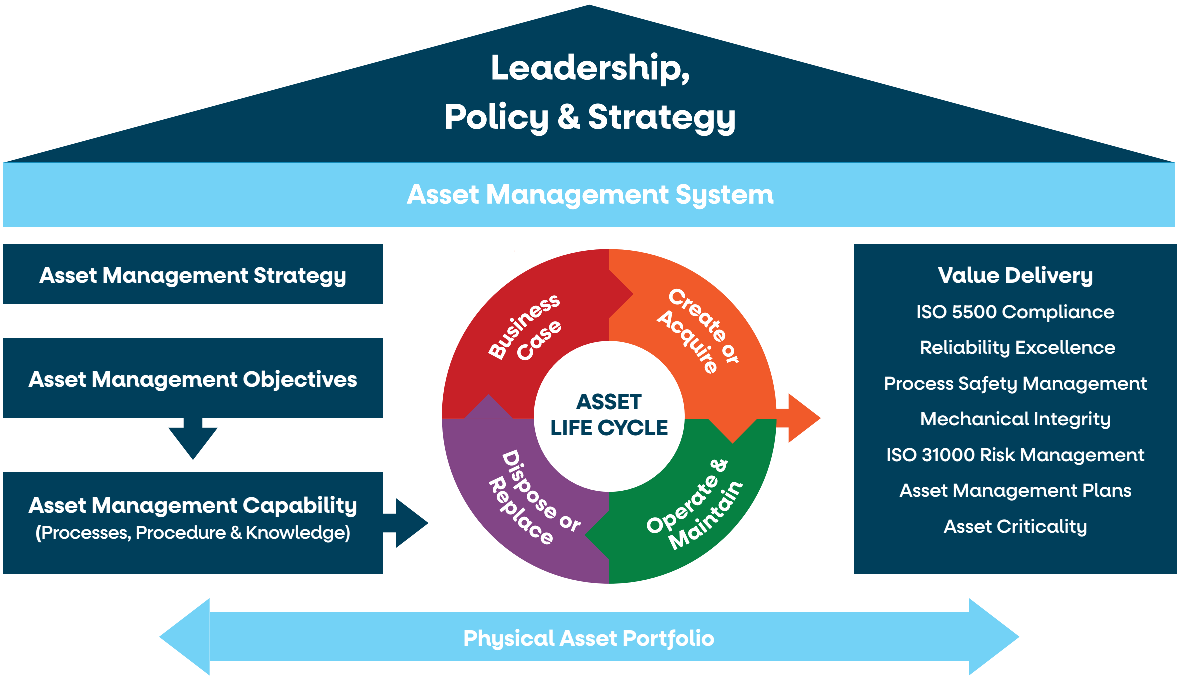


Figure 3.2.1: ISO 55001 Asset Management System

Further information on our journey to operational excellence and ISO 55001 certification is described in section 3.4.4 and 4.1 of the AMP.

The asset management framework is shown in Section 4.1

3.2.1 Asset Management Policy

In alignment with our values, WEL is committed to the following principles.

A

Agile

Actively investigate non-network solutions to address network constraints

Explore new technologies that align to WEL strategic goals

Support Distribution System Operator (DSO) enablement

B

Build the business

Provide an enduring, safe, and reliable distribution network

Develop our network to meet current and future requirements and performance

Support regional growth through effective network growth planning

C

Care for each other, the customer and our assets

Engage with our stakeholders and customers to identify needs for network development planning

Target best practice network asset reliability, resiliency, performance, and safety

Implement a risk based, quality systems approach to asset management that is ISO 55001 compliant

D

Do the right thing

Act with integrity and transparency to gain the trust and respect of our community

Provide appropriate levels of skilled resource to enable the achievement of asset management objectives

Implement asset management plans that:

- Propose efficient levels of expenditure
- Manage risk in the asset portfolio
- Meet WEL Sustainability goals
- Ensure customer service levels are met, consistently over the long-term

E

Every Day - Home Safe

Our people take responsibility for management of asset risks to ensure the safety of:

- Themselves
- Their colleagues
- Their contractors, and members of the public

Our assets are safe, reliant and do not adversely impact the environment

Comply with all applicable legislative and regulatory requirements, and industry and internal standards

Asset Management Objectives – Our asset management objectives are centred around ensuring a resilient, safe, reliable and efficient electricity distribution service that meets the requirements of our community. As part of our journey to ISO 55001 certification the Asset Management policy was updated in January 2023. We are also reviewing our asset management objectives to enable better alignment through our Asset Management System.

3.2.2 Strategic Asset Management Plan

The SAMP defines the Asset Management System and gives direction to asset management through alignment of asset management policy and objectives. It provides the means to achieve the objectives, through implementation of effectively controlled processes.

The SAMP aligns asset management policy and sets objectives which support the delivery of the three components that form part of the AMP, as discussed further in Section 4.1:

1. **Network development**
   We invest in meeting the capacity deficiency required to support localised areas of growth, while considering network security against established security criteria. We aim to meet customer requirements in a cost effective timely manner.
2. **Non-Network Investments**
   We invest in non-network assets to increase operational flexibility and improve and support evidence-based asset management decision making. We are investigating new non-network solutions like solar generation and battery installation, to support customer demand and improve demand response. We have substantial expertise in tools and data analytics using smart meter data; and continue to develop new systems from smart meter data to improve services to our customers.
3. **Maintenance and renewal**
   The approach to asset maintenance and renewal aims to maintain consistent and sustainable levels of service over the long-term. The principal methodology employed is Condition Based Risk Management (CBRM). Outcomes from asset and network reliability analysis are utilised in the CBRM to support the prioritisation of the renewal plan. This approach and the forecast renewal and maintenance expenditure over the AMP period are discussed further in Chapter 8.

Annual Works Plan

The AWP is our programme of approved work, and forms part of the AMP. It is expected to be completed within the regulatory period. Inputs to the AWP include network development to meet network load growth, asset renewal to ensure they remain fit for purpose, and customer initiated works such as new connections and developments.

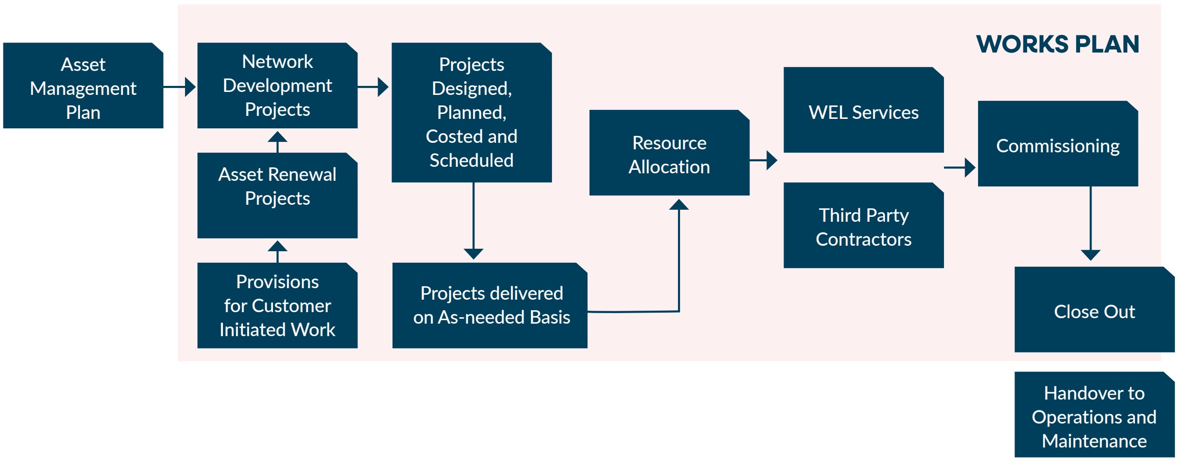


Figure 3.2.2.1: Works Plan

The governance of works planning is discussed in Chapter 4, and the associated performance indicators and targets are described in Chapter 5.

The AWP allows us to balance resources and investment on a risk-prioritised basis. We use internal and external labour through formal labour contracts. Sufficient lead times enable planning and resource scheduling, ensuring work is coordinated and undertaken safely. We recently reviewed and updated our work planning processes and augmented our SAP capabilities to improve coordination of network projects.

The focus of annual works planning is safe and efficient delivery of planned and unplanned works. Meeting customer needs involves four 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
4. Alignment of activities to minimise disruption

Specification of each job complies with our engineering standards, to ensure the network is developed consistently. We have developed processes for identification of projects, defining the scope of works and developing detailed plans. Works delivery in the field is undertaken safely, minimising impacts on network customers and delivered to a high standard.

In Chapter 6, we describe how we have a good understanding of the forecast volumes of work in each category and make provision for resources and infrastructure required to deliver the work in accordance with agreed internal work schedules. We use our history of project costs and performance along with design scoping for larger projects to inform its capacity planning.

Integral to WEL's asset management approach is continual improvement. Jobs are reviewed during delivery and on completion. Assets created on the network by projects are captured in the SAP asset information system and maintained throughout their life.

We are working toward certification in ISO 55001:2014, Asset Management. We undertake regular asset management maturity assessments using the ISO 55001 framework to benchmark and identify improvement actions. The AM improvement programme is currently focused on the enabling functions required to deliver a safe, resilient and reliable service. Key areas identified for improvement are:

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

3.3 Risk Management Framework

In this section we describe our approach to risk management. Risk management is a fundamental discipline that supports the management of its business, people, network, and assets. It requires robust processes for assessing and managing asset-related risk. Risk management is key to delivering our goal of keeping people safe.

3.3.1 Risk Management Policy

The Risk Management Policy aligns with the requirements of NZS/AS ISO 31000:2018 and is a key document for managing day-to-day operations and longer-term network planning and design. It ensures risk management is a primary focus of management and operating processes. It supports improved decision making to enable the maximisation of improvement opportunities while ensuring risk is considered and managed. We have developed and maintain a 'risk aware' culture across the business. Staff are empowered and enabled to identify, evaluate and escalate risks when required. We have implemented processes to evaluate, prioritise, and mitigate these identified risks.

Risk Accountabilities

Ultimate responsibility for risk management resides with the Board of Directors. The Board of Directors issue Risk Appetite and Risk Tolerance statements. The Board of Directors has 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 Board is updated about critical risks by the Chief Executive as part of the regular management reporting functions.

The Risk Lead provides management oversight of WEL's risk management and audit processes. Each staff member is supported by the Risk Lead to ensure they understand the risk management process and how it applies to them. This includes active engagement in the identification of new risks and controls, ensuring they are captured and appropriately escalated.

Suppliers and contractors are required to ensure they understand WEL's risk management process and how it applies to them. As part of the contractor onboarding process, they are required to demonstrate they conform to WEL's risk management requirements.

3.3.2 Risk Management Framework

The 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.

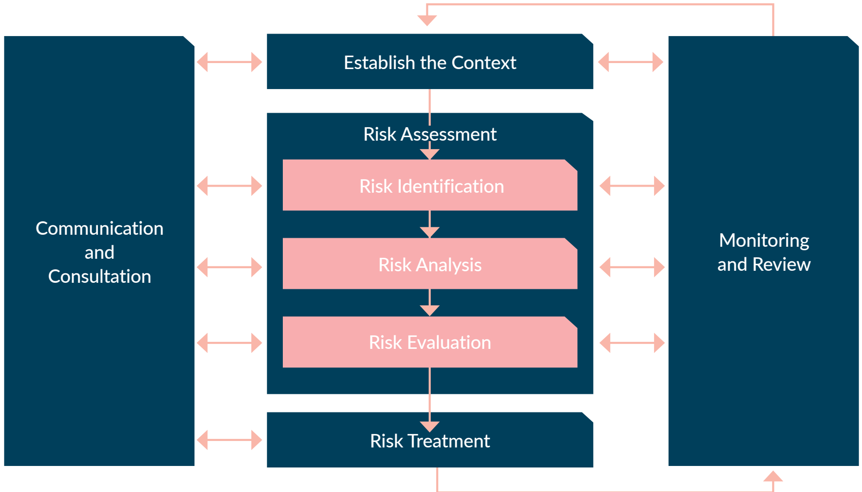


Figure 3.3.2.1: Risk Management Framework

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

Establish the Context

The risk context is established by assessing many factors including impacts on the business, accessibility by the public, exposure of staff, location in the community e.g. rural or urban, asset age and condition, inspection programmes and data quality.

Risk Identification

The asset management risks are identified through several mechanisms including the hazard identification process, asset inspection and condition monitoring programmes, regular risk meetings, and audit results or event analysis. New asset risks are assessed and ratified by the Asset Management team.

Risk Analysis

When a potential new risk is raised, an analysis is completed to understand the nature and extent of the risk. This includes discussion with relevant staff. Managers from the Asset Management team meet on a regular basis and review a selection of risks. This provides a formal mechanism for risk assessment, risk monitoring and the identification of new or emerging risks.

Risk Evaluation

Each risk is evaluated against established criteria to determine the degree of acceptability of any controls or treatments. 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. We note that under the Health and Safety at Work Act 2015, cost is not considered to be a reason to not proceed with any risk treatment, unless it is grossly disproportionate to the risk. The treated risk is 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, 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 reviews and 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 suggested. The internal audit programme utilises both internal auditors and independent third-party auditors to conduct a range of audits to verify performance and identify improvements.

Risk Management Database

WEL uses the Risk Wizard Risk Management application to support the risk management framework. This software based process is aligned to AS/NZS ISO 31000:2018. It ensures we have a structured approach to the management of risk that assists 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.

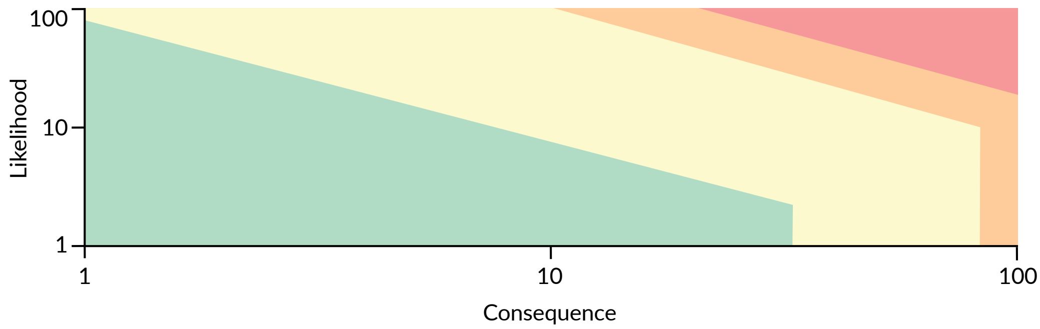


Figure 3.3.2.2: Risk Classification

There are two aspects to the classification of risk:

- likelihood
- consequence

Likelihood is determined from:

- **Historical data** – internally from within WEL and from 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 > $50,000,000
- **Reputation** – this looks at the impacts on various groups of internal and external stakeholders including WEL's customer and community and is categorised from little public interest through to national outrage

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 3.3.2.2 above, and descriptions are:

- **Extreme** risks are considered intolerable. Risk reduction actions must be applied to reduce the likelihood or consequences of the risk, or the activity is curtailed
- **High** risks are unacceptable without further controls unless the cost or practicability of such controls outweighs the benefits
- **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
- **Low** risks are usually acceptable

3.3.3 WEL Principal Risk Categories

The Board has ultimate responsibility for the system of risk management and internal control; and through the Audit and Risk Committee reviews the effectiveness of the overarching risk management framework. The Audit and Risk Committee reviews the principal risk categories every six months and assesses them against their established risk appetite and tolerance. This review is supported by consideration of six-monthly risk performance reports.

All WEL risks are categorised based on the table below.

Risk category	Risk description
Health and safety	Failure to provide a safe workplace and safeguard the public
Mental health	Failure to provide sufficient wellbeing support in the workplace
Information technology and cyber	Failure to manage a secure IT system Failure to manage a secure OT system
Security of supply Under adverse conditions	Failure to deliver a reliable network, including during natural disasters
Security of supply Under normal conditions	Sub-optimal investment in assets due to changing patterns in consumer energy efficiency practices and the impacts Asset class failure prior to scheduled replacement
Security of supply Supply chain	Failure to manage inventory supply chain resulting in the inability to maintain or build the network
Strategic plan	Failure to position the business for long-term value
Delivering on major projects	Inability to design and deliver major programmes due to poor scoping and management
Legislative and compliance	Failure to manage legislative and regulated obligations
Revenue and revenue assurance	Failure to manage trading obligations and managing the impacts of emerging technologies or new business models Failure to manage non-regulated revenue exposures
Finance, inc. treasury, banking, funding	Failure to manage financial risks which results in breach of covenants Failure to manage financial risks which impacts the dividends paid to the Trust
Fraud	Failure to protect WEL from fraud
Social license to operate	Reputational damage to shareholder, public, employees and customers, resulting in damage and/or loss to our social licence to operate
People and culture	Failure to have the right people, resource levels and capability in place to deliver business as usual and strategic initiatives Failure to have a positive, constructive, and collaborative culture.
Pandemic	Failure to provide a safe workplace and safeguard the public Failure to maintain business continuity due to workers becoming unwell or being asked to isolate
Climate change	Failure to safeguard our assets from the impacts of climate change related weather events

Table 3.3.3.1: WEL Principal Risk Categories

3.3.4 Managing Asset-related Safety Risk

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

The Public Safety Management System (PSMS) aligns with NZS 7901:2014 Safety Management Systems for Public Safety and reflects our approach to managing asset-based safety risk. The PSMS is certified against the Electricity (Safety) Regulations:2010 - ESR 50 and 51. The key principle in managing asset and infrastructure risk is to reduce the residual risk to being as low as reasonably practicable.

Asset Failure Risk Management

The Asset Management team is responsible for managing risk associated with our assets, and the delivery of works programmes, the maintenance programme, and operation of the assets. WEL Services and contractors also have a responsibility for managing any operational and delivery risks.

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

3.3.5 Resilience and High Impact Low Probability (HILP) Events

While natural disasters and emergency situations are infrequent, should they occur, we recognise they can have a significant impact on assets, operations and safety of the network.

WEL actively identifies areas and sections of the network that may be subject to HILP events and has developed response plans. In line with good industry practice we operate our major plant and subtransmission network in accordance with security standards outlined in Chapter 6. All substations and major network buildings have been assessed for seismic strength. Those that fail to reach the required NBS% standard are identified for strengthening to Importance Level IL3 or IL4 depending on risk and importance criteria. All new network buildings are designed to meet the IL4 standard.

Lifeline Utility

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

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

WEL is a participating member of the Waikato Lifelines Utility Group (WLUG) which has overall goals to:

- Assist members to meet their obligations under the CDEM Act
- Coordinate and 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
- 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. Our membership in WLUG enables access to regional and national studies undertaken for natural, technological, and biological hazards. These studies have allowed us to identify the top ranked hazards and develop comprehensive vulnerability assessments which identify risks in terms of importance, vulnerability, resilience, and impact on each major asset on the network.

Major Event Procedures

A major event procedure governs actions required when events such as storm, 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. It requires the following actions to be taken:

- Prepare for impending weather that is forecast. Teams are required to prepare, 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
- Respond to Civil Defence requirements to prioritise the restoration of supply to critical sites

We have adopted the CIMs (Coordinated Incident Management System) for responding to major incidents and have specific procedures and designated people responsible for each of the following areas:

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

There is a dedicated Disaster Recovery facility which allows all the above functions to continue should the main Maui Street office not be available for any reason.

Contingency Planning

We have contingency plans for loss of significant assets or groups of assets, including total loss of supply from the grid. Development of specific plans for zone substations and critical subtransmission (33kV) circuits are ongoing. Our contingency plans include switching processes to ensure essential services, as much as is practicable, can continue to receive power supply in the event of a major outage. We have entered arrangements to gain priority access to emergency generation should the need arise. We store all the components required to build a 4km 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 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. After each exercise, we hold a debrief and discussion of any potential improvements and lessons learnt.

Disaster Recovery Site

We operate our system control centre at our Maui Street premises. When this is unavailable for any reason, the Disaster Recovery (DR) site provides for business continuity facilities, and 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, we have additional substations which can be used for SCADA operations, these were used when needed for social distancing during Government enforced Covid restrictions. Operators can also conduct some SCADA functions from home.

COVID-19

COVID-19 tested WEL's resilience and contingency planning. In 2020, after the pandemic was declared, we swiftly reviewed and implemented our business continuity plan. Several measures were enabled to prioritise the health and safety of staff and communities and ensure essential electricity services were maintained across the Waikato region.

Lessons learnt during the initial COVID-19 response are now incorporated in our wider pandemic response and disaster recovery processes. WEL has also included 'Pandemic' as one of our risk category areas.

3.3.6 Asset Related Climate Change Risk

Climate change is identified as one of the most significant business risks that WEL faces. As a community owned organisation, we are committed to take the necessary actions to manage and mitigate business risks over the long term, and 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), we are 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
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

As part of long-term planning for the network around the impacts of climate change, WEL has undertaken a risk impact assessment based on the RCP 8.5 (high end) climate projections for 30-year and 80-year time horizons. RCP 8.5 is the high-end Representative Concentration Pathway emissions trajectory modelled by the Intergovernmental Panel on Climate Change (IPCC;2014). Asset assessments use two approaches, asset vulnerability and criticality, and the number of customers served. The results from this work will influence long-term asset planning. Following Cyclone Dovi, we undertook a review of our incident response and improvements were recommended and implemented. These improvements were realised and made a material impact in our recent response to Cyclone Gabrielle. We are presently undertaking a post incident review from our Cyclone Gabrielle response to identifying any further improvements.

3.4 Assessment of Asset Management Performance

This section describes the assessment tool WEL uses to assess asset management capability.

3.4.1 Asset Management Maturity Assessment Tool

The Asset Management Maturity Assessment Tool (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 AMMAT tool has 31 questions, which are grouped into six key areas. The questions relate to the key components of the PAS55 framework for asset management.

3.4.2 The Purpose of AMMAT

The purpose of the assessment is to evaluate WEL's performance against the selected components of the PAS55 Standard. The self-assessment informs stakeholders about the level of competency WEL has achieved at the time of assessment. Note: the PAS55 Standard was superseded by ISO 55001:2014 in January 2015.

3.4.3 2023 AMMAT Assessment

Our 2023 assessment is summarised below.

The results indicate decline in the scores since the last full assessment undertaken in 2021. The changes are the result of a reassessment of the PAS55 score, following an external audit for ISO 55001 preparedness. However, the overall Asset Management maturity has improved since the 2021 audit when compared with the ISO 55001 Standard. We are working towards certification to ISO 55001:2014, this is detailed further in Section 4.1.

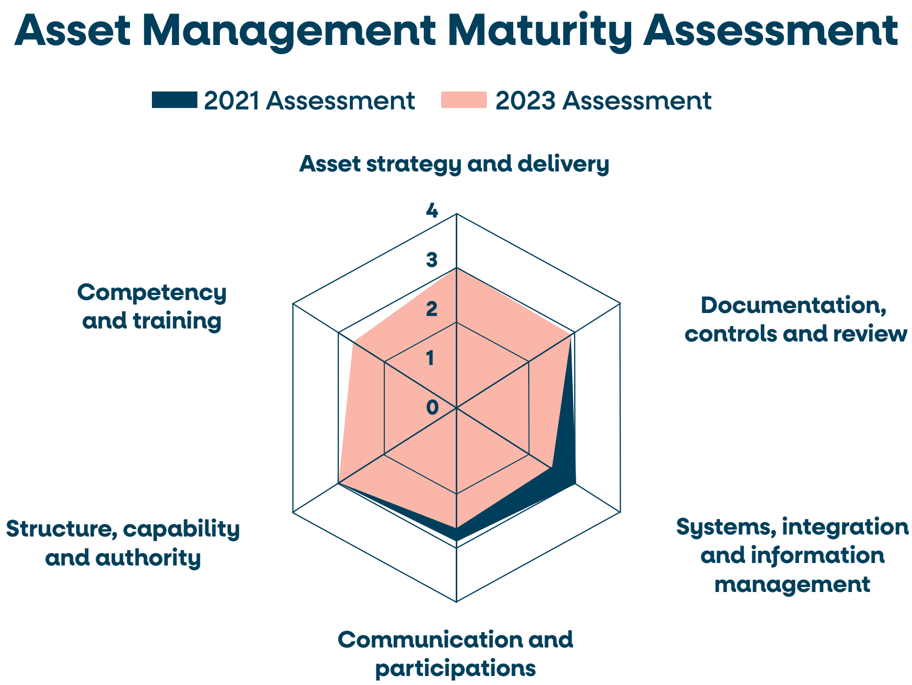


Figure 3.4.3.1: 2023 AMMAT Result

3.4.4 Improvements

In 2021 WEL completed a two-year programme of work called Operational Excellence. The purpose of the programme was to unlock greater capability within the business, to manage down cost and improve risk management. The programme aimed to:

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

This workstream is complete, and future improvement initiatives will be aimed at embedding and continuously improving key components of the Operational Excellence programme. This approach supports the continued improvement of our asset management system in alignment with the ISO 55001 standard, including the alignment of the current SAMP to the guidance specified in ISO 55002:2018 Annex C – SAMP as discussed in section 4.1.

4 Asset Management Governance

Mana Whakahaere Rawa

WEL NETWORKS AMP 2023

4. Asset Management Governance

The following outlines WEL's asset management governance framework, in which established processes support investment planning decisions with clear accountability and expenditure approvals. Later sections describe our approach to works delivery.

4.1 ISO 55001 Certification

The business is committed to continuous improvement to the Asset Management System (AMS) to achieve certification to ISO 55001:2014. The path to ISO 55001 certification is seen as a natural progression of the business and builds on our existing capability.

The asset management activities focus is on outcomes that deliver safe, reliable and cost-effective power to customers. Asset management GAP assessments against the requirements of ISO 55001: 2014 have been undertaken, which identified areas for improvement to meet the requirements. Improvement initiatives under the operational excellence projects positioned WEL so that most current improvement opportunities are focused on the linkage of processes.

The journey to ISO 55001 certification requires the development of WEL's Strategic Asset Management Plan (SAMP). The SAMP translates strategic business objectives, aligns these to the Asset Management Policy, and describes the implementation of the policy through the setting of Asset Management objectives. The objectives drive the individual strategies for the creation, operation, maintenance, and renewal of the assets, and sets the requirements for eventual disposal.

The indicative timing for the certification project is a 15-month period with the intent of undertaking the formal certification audit during 2024.

The WEL ISO 55001 Asset Management System is shown in Figure 4.1.1.

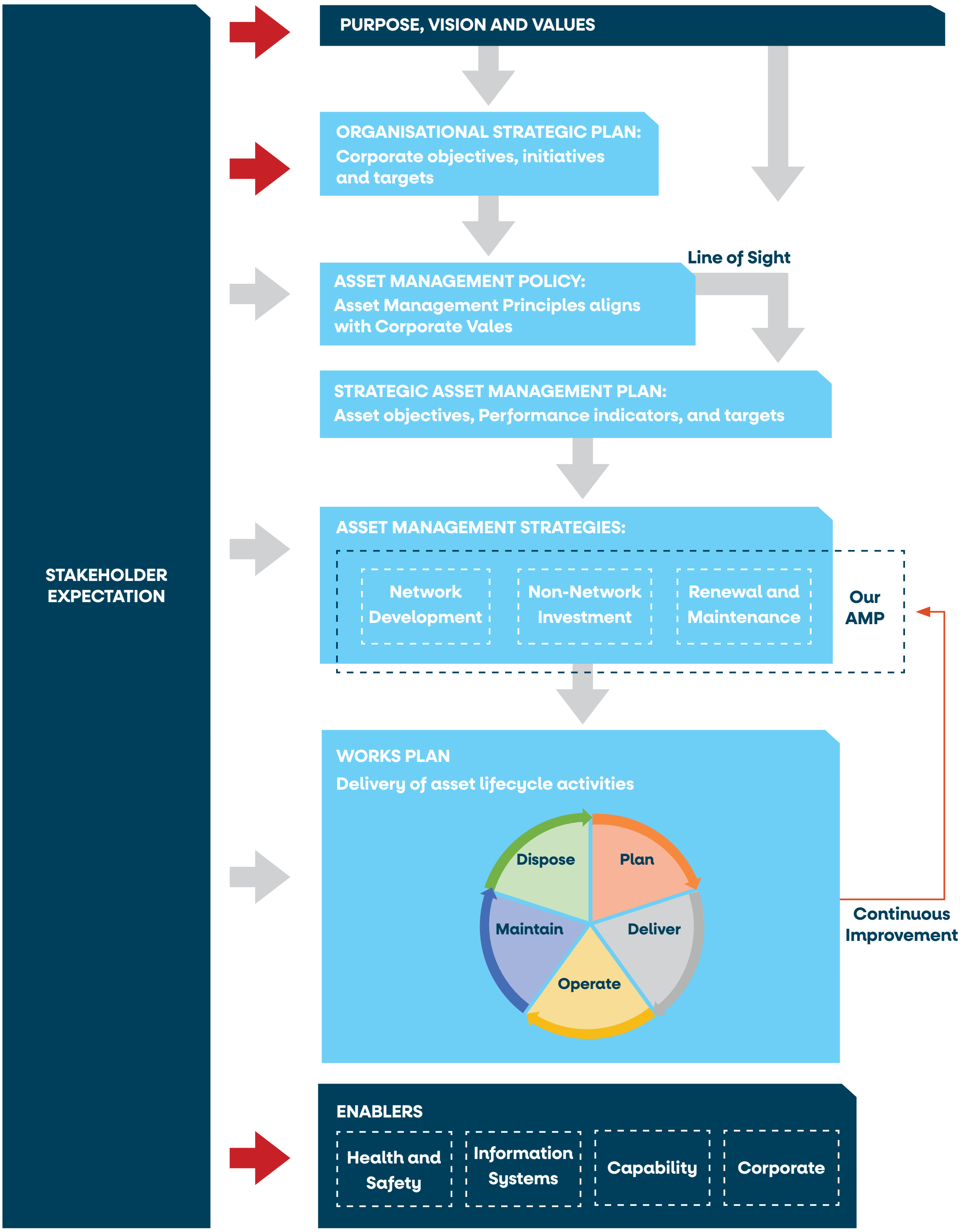


Figure 4.1.1: WEL ISO 55001 Asset Management System

The Strategic Asset Management Plan (SAMP) defines clear and measurable objectives for delivery to meet asset requirements, as discussed in the following sections. The AMP details how we deliver on objectives, achieve the required standards and outputs, such as regulatory disclosures, and ensures communication and performance measures are met. Network expenditure requirements are developed, and defined, to form individual Project Definition Documents (PDD) and later optimised to form the Annual Works Plan (AWP). Strategic objectives outlined in the SAMP are:

Safety

Provide a safe environment for our staff, contractors and the public

Comply with Legislative and Regulatory requirements

Customer Experience

Reliability of supply

Quality of our service

Cost Efficiency

Works delivery is safe, of high quality and on-time

Essential skills and knowledge is developed and retained

Use systems that support efficiency

Extract the Value of our core

Mobility of field staff

ISO 55001 Certification: support data driven asset management decisions

Modernise our data systems

WEL Balanced comprehensive wellbeing initiative to support UN SDG3

Explore Energy Solutions

Provide customers needs today and for the future

Low voltage visibility - Manager DER

Expand our current offering of ancilliary services

Expand into our future state

Renewable Generation - grow WELs generation portfolio

Explore opportunities for solar, wind, hydro and batteries

Figure 4.1.2: WEL Strategic Goals

The alignment from WEL's stakeholders through the SAMP and AMP to the AWP is illustrated in Figure 4.1.3.

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 asset management policy in the following areas: » Health and Safety. Environment and Substainability, Legislative and Regulatory » Network Growth » Network 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 governance requirements
Annual Works Plan	▸ Operational and Capital Maintenance works ▸ Reactive Maintenance provision ▸ Customer Initiated Works ▸ Network Development ▸ Resourcing Schedule

Figure 4.1.3: WEL Strategic Asset Planning Objective Alignment

4.2 Investment Planning and Delivery

Investment planning capability is required for efficient delivery of stakeholder and regulatory requirements.

Effective planning by the Asset Management team provides assurance that risks to the asset portfolio are controlled and opportunities for improvement are realised. Data driven decision-making techniques are needed to identify an acceptable balance of risk, performance and cost, while achieving the asset management objectives.

Identifying and prioritising network expenditure follows the processes outlined below.

Customer Initiated Work, Asset Renewal, and Network Development are input to the Capital Plan and follow an optimisation process prior to the formation of the AWP. A detailed description of the key components of these processes are detailed in the following sections.

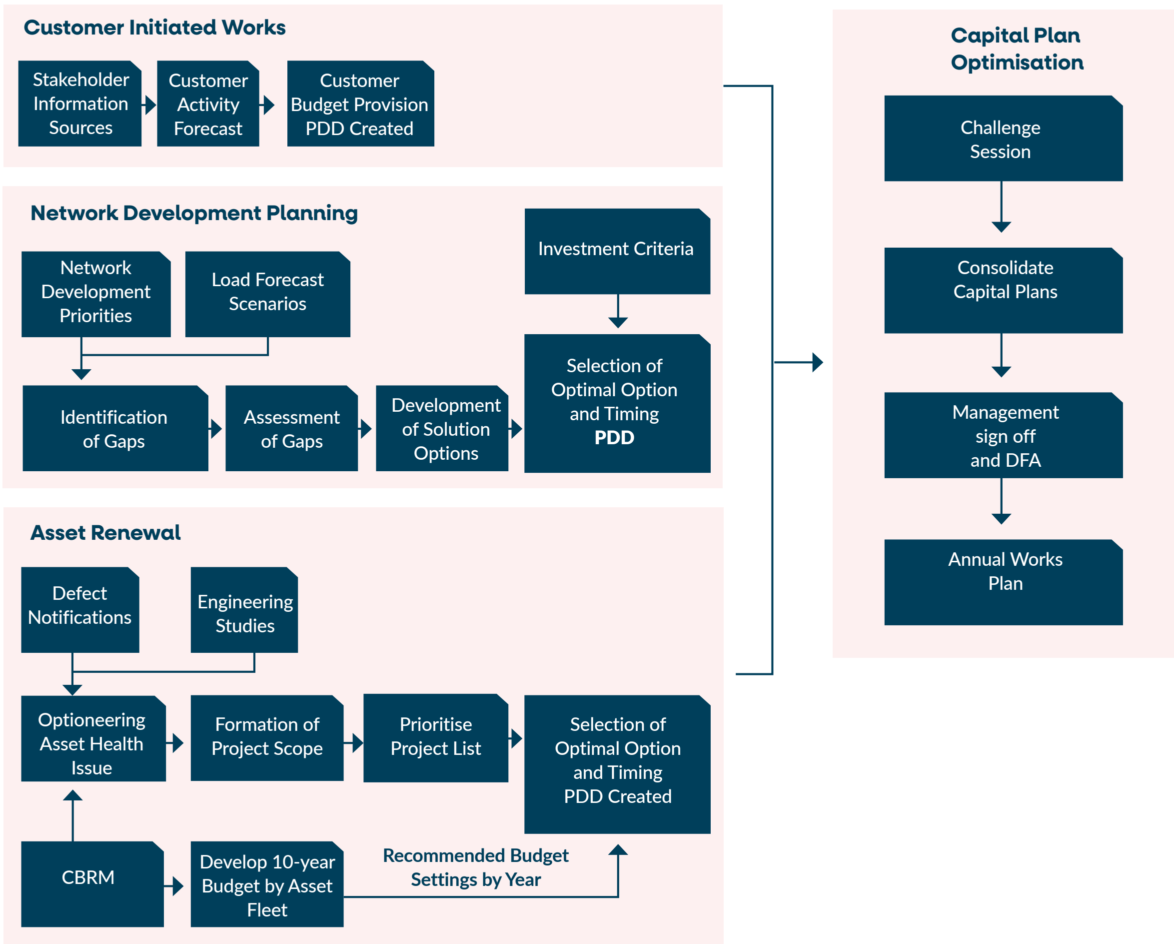


Figure 4.2.1: Network capital expenditure process

4.2.1 Customer Initiated Works

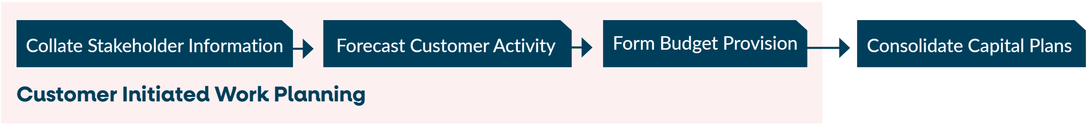


Figure 4.2.1.1: Customer Initiated Works Planning process

Forecasting Customer Initiated Works is done through analysis of external information and historical WEL data. It is assumptive and based on predicted future growth within the Waikato region. Residential and commercial connections are determined from Waikato University National Institute of Demographic and Economic Analysis (NIDEA), utilising population forecast data, council and WEL data. Relocation forecasting is derived from historical data and includes council and roading forward work plans.

All forecasts for Customer Initiated Works are outlined in a PDD and circulated for approval.

Customer Activity Forecast

Customers are initially directed to the WEL Networks website to complete their application for the required scope of work. The Customer Works Portfolio Team process the request, targeting delivery timeframes in accordance with Service Level Agreements and keep the customer informed of the status of the request. All customer work is designed and delivered by external service partners due to growth in this area.

Customer Contributions

The Customer Works Team assesses the works required, advises of any applicable customer costs and initiates any works required to fulfil the customer request.

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

Customer Initiated Works budgets are included in the PDD and approved via the capital plan optimisation and governance process. The budget flows to the AWP where it is resourced and scheduled in conjunction with other capital works priorities.

4.2.2 Network Development

An asset management outcome is the provision of a resilient, and reliable network that enables its community to thrive. This is achieved through best practice network design including outage segregation, back-feeds and reliable equipment that is fit for purpose and optimally maintained. Where possible, technological advances are utilised to enhance WEL's resilience and restoration response.

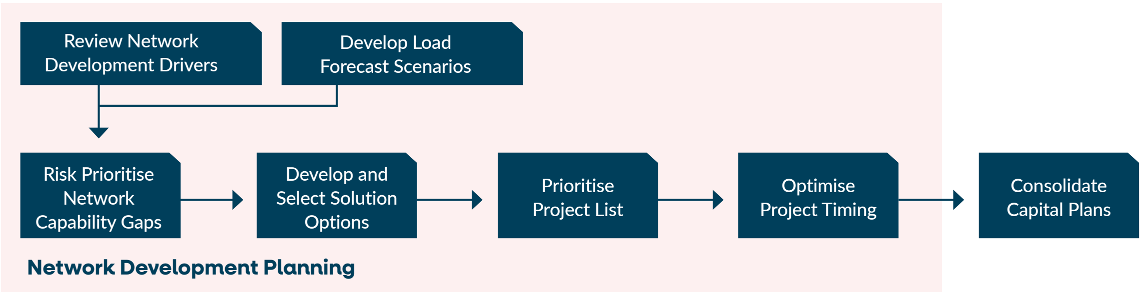


Figure 4.2.2.1: Network development planning process

Network Development Drivers

WEL's investment options are prioritised by criteria defined from consultation with stakeholders. The areas and drivers that are identified as key focus areas, shown below and detailed in the following subsections.

Area	Driver
Health and Safety	Confined space management Substation egress LV network supply hazard detection
System Growth	Network Growth LV capacity and imbalance management Security of Supply DER connection assessment
Reliability Performance	Communication network reinforcement IoT comms for 3rd party device integration Network visibility improvements Zone substation refurbishments
Technology Change	Obsolescence DERs have impact on demand pattern or energy flow direction Software and hardware enhancements Large volume of data management and AI data analytics
Legislative and Regulatory	Seismic Voltage compliance management Unregistered DER detection
Quality of Supply	Voltage regulation Voltage coordination between upstream and downstream voltage regulation devices ICP load exceeds contracted or installed capacity
Environment, Resilience and Sustainability	Zone substation oil management Resilience planning for future climate related events DER optimisation to reduce network losses and carbon footprint

Table 4.2.2.2: Network development priority focus areas and drivers

Health and Safety

A priority is investment to address safety concerns and safety related asset issues. Most safety related risks are addressed in the design and selection of equipment on the network through WEL's "Safety in Design" (SiD) process and the PSMS. Where safety related investments are recommended from incident investigations and risk review meetings, they are assessed on individual merit.

System Growth

As peak demand grows, new capacity is required to enhance the network. The process for enhancement commences with an assessment of forecast future demand followed by identification of areas where current network capacity isinsufficient to meet demand, and future security requirements. The level of security required on the network is defined as part of the network design security criteria. Assessing the need for growth and security investment is the responsibility of the Asset Strategy and Engineering team.

Reliability Performance

As assets age and/or demand grows, the reliability and performance of sections of the network can degrade driving investment to maintain reliability performance. Typically, this results in the replacement of assets and provides the opportunity to install further sectionalising of circuits, back-feed options, and addition of new feeders.

Technology Change

Obsolescence, technology changes, and software and hardware enhancements, are drivers for investment expenditure. This is 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 Information Technology (IT) team is accountable for all corporate systems, hardware, and software investments, while the Network Operations team is accountable for SCADA and network automation investments.

Transition to a Distribution System Operator (DSO) model requires extending the core focus beyond the network management function. The WEL DSO transition journey commenced in 2021, the guiding principle in our DSO vision is enabling long term sustainability, and empowering solutions that deliver the highest customer benefits. This involves implementation of innovative solutions that combine engineering, data and technology capabilities from customer and utility perspectives, delivering the most efficient and cyber secured solutions.

Legislative and Regulatory

The Regulatory Compliance Policy requires compliance with all relevant legal, regulatory, and environmental obligations. Where non-compliances are discovered, staff take all reasonable steps to address and remediate them in a timely manner. We maintain compliance or take reasonable steps to achieve compliance throughout the AMP period.

Quality of Supply

We observe the regulatory requirements regarding quality of supply across the network. Where standards are not met, we take reasonable steps to address and remediate any issues. The use of smart meters enables us to proactively identify sites where there is potential non-compliance.

Sustainability

Sustainability is driven by the collective requirements of multiple stakeholders and sustainable asset management practices are fundamental to our future. We aim to minimise the environmental impact of our operations and embrace initiatives to protect our customers and reduce energy hardship within the community. We are experiencing more frequent impacts from extreme weather events, most recently from the tropical cyclones hitting the region. As a result, our storm response processes are being improved following every event.

We have a diverse and inclusive workplace and actively support sustainable practices, using the following principles:

- Recognition that protecting the environment today is essential to a sustainable business future
- Seeking to reduce impact on the environment over time through the investigation, and where appropriate, the delivery of sustainability initiatives
- Greenhouse gas emissions are measured, verified, and managed through ‘Toitu carbon reduce’ certification by Toitu Envirocare
- Commitment to reducing relative greenhouse gas footprint over time
- Ensuring all staff go home safely every day and that its network assets are operated and maintained with public safety as a top priority
- To be an employer of choice offering a great place to work where employees are valued and supported
- Implementing a sustainable procurement model for material suppliers

Environment

Our aim is to minimise the impact of WEL's assets on the environment and community. We target being a leader in the community and wider industry. Our environmental management system for network activities requires actions to reduce our greenhouse gas emissions. We have introduced a 100% electric lines truck, hybrid technology EWP trucks, and a fleet of 100% electric survey vehicles fuelled by a solar array.

Resilience

This involves minimising impacts from climate events on our assets. We have undertaken studies to understand the assets at risk and are adding this as an input to our CBRM. Future assets will be designed for climate and network resilience.

Load Forecast Scenarios

The forecasting methodology is discussed in Section 6.4.

Prioritise Network Capability Gaps

Network security criteria (outlined in Chapter6) establishes resilience levels for the network. Resilience comprises the following elements:

1. Reliability of assets – how likely the assets can perform within set conditions for a time duration
2. Resilience of the network topology – how quickly the network can restore supply following disturbances
3. Response – the time it takes for us to identify the fault location and how we respond to that fault
4. Repair/Restore – the time it takes for us to undertake a repair and return the network to service.

A gap analysis is performed between the criteria and WEL's existing network capability out to the end of the AMP plan period. For example, the Hamilton GXP currently does not meet this criterion for approximately 36 hours every year. WEL forecasts this gap to widen to 953 hours by the end of the planning period due to expansion and infill of the Hamilton city urban boundary, and decarbonisation and fuel switching in various economic sectors. This is before the interventions described in Chapter 6. This gap analysis drives several network development projects (see Section 6.9.1).

Solution Development

Evaluations using cost/benefit analysis determine the optimal solution. Risk, funding, and resource constraints are considered when programming the delivery of the selected option. WEL's options include traditional network, non-network solutions and emerging technologies like network scale batteries or customer load profiling systems. The selected project option forms the draft spend profile. The spend profile and individual projects are approved through the PDD and capital plan optimization process (refer to Section 4.2) and disclosed in the AMP.

Optimise Project Delivery

Project delivery is optimised to enable risks and resource constraints to be mitigated while maintaining network safety. This levels costs and minimises interruption as far as reasonably practicable.

Network Development budgets are included in the PDD and approved via the capital plan optimisation and governance process. The budgets flow through into the annual work plan where they are resourced and scheduled in conjunction with other capital works priorities.

4.2.3 Asset Renewal

The Asset Renewal Planning process identifies asset health-related issues and develops work proposals to address these issues prioritised by risk. The output of the Asset Renewal Planning process is PDDs that contain a specification of asset renewal projects to be completed over a ten-year planning horizon.

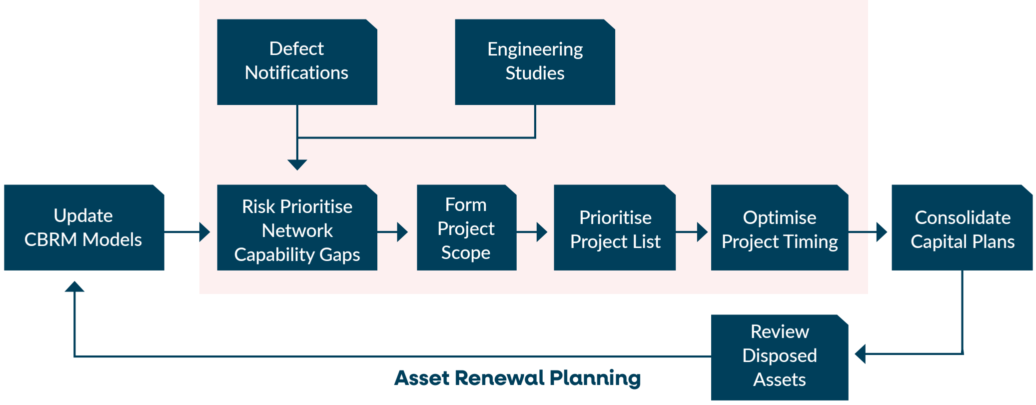


Figure 4.2.3.1: Asset renewal process

The objective of Asset Renewal is the achievement of an optimised balance between cost, planned and unplanned maintenance and network reliability and safety experienced by our customers. Our asset renewal aims for planned asset replacements at the best whole of life cost across all planned work and reduces reactive maintenance. Optimisation of network maintenance and asset renewal using asset management models such as Whole of Life Cycle Cost (WLCC) analysis and Condition Based Risk Management (CBRM) minimises expenditure for WEL and the customer, whilst maintaining acceptable network reliability and safety. The following discuss each individual part of the asset renewal process outlined in figure 4.2.3.1 above.

Defect Notifications

Assets exhibiting defects are identified by field staff during routine network inspections as defined in the asset maintenance strategy. Assets displaying defects that are urgent are dealt with immediately through fault and notification budgets. Assets displaying defects that are low urgency and can be remedied within a five-year period, are identified as Defect Notifications. The Defect Notification process also allows us to identify non-urgent replacements that are considered as part of the CBRM and work prioritisation process. Defect Notification is a key input to the Asset Renewal Process.

Engineering Studies

Engineering studies consider assets that are not performing to design specifications and abnormalities from condition monitoring information captured during routine inspections. They include localised areas of study such as line inspections by Unmanned Aerial Vehicle (UAV) to identify and correct poor performance from sections of line, and inspections performed by field staff. LiDAR and overhead line helicopter inspection surveys have been undertaken on strategic targeted locations within the network to capture asset condition in areas with difficult terrain or access for ground inspections. Data from these inspection programmes was analysed to provide insights that drive replacement strategies. Issues derived from asset condition information held in company databases are assessed to understand overall asset portfolio health.

Engineering studies assess the impact of changes in technology, asset or component obsolescence, critical spares procurement and make recommendations on the optimal solution for the assets' life cycle.

These studies, combined with defect notifications identify issues within assets and staff assess the impact of these issues using the CBRM process.

Condition Based Risk Management Input

The optimal cost option is determined through WLCC analysis using CBRM which aggregates the following four main risk areas:

- Network Outage
- Environmental
- Safety
- Financial

WEL considers Legal and Regulatory risk along with the risks outlined above.

The budget and scope of capital maintenance is defined via two processes.

1 – CBRM is used to determine long term asset replacement strategy. This generates the overall spend plan for each asset class for the next 1-10 years and beyond. This process estimates the quantum of asset failures anticipated annually for the chosen replacement strategy and informs the longer-term risk profile and expected notifications and faults budget.

2 – Prioritisation of assets to be targeted for replacement is based on the mitigated risk per dollar spend. The network assets forecast to require replacement within the next five years are identified and submitted for scoping. Notifications with low urgency form the mainstay of this process as the assets have been identified by field staff as requiring remediation, with timeframes that enable a coordinated and planned response.

The CBRM model identifies assets with high risk score requiring replacement. Overhead line equipment identified in this process is submitted for scoping and logical grouping, enabling efficient delivery with minimal customer interruption. Assets such as transformer and ring main unit replacements are identified through engineering studies focussed on reviewing previous test results, inspection data and network architecture/loading considerations.

Risk Prioritisation and Asset Health Issues

This process considers all outputs from CBRM, engineering studies and Defects Notifications, and identifies the optimal solution for the asset. Safety in Design (SiD) and environmental factors are considered in the process. A balance is required between the optimal time for replacement, asset condition and health, network needs, risk and return on investment.

Project Scope Definition

When an asset is recommended for replacement, it is submitted for scoping. Scoping defines the assets within each outage group that require replacement within the next five years. WEL has a planning map tool that assists this process and highlights other notifications or projects in the area. For each replacement, risks and constraints that may add cost, complexity or long lead times for the project are identified. The asset database is updated with the estimated cost for each project using the defined scope information and historical cost information from SAP. Outage times and SAIDI are estimated to ensure they are considered during the Capital Plan Optimisation process.

4.2.4 Project Definition Document

All projects require PDDs to move through to the AWP process. The PDD provides the project description and expected outcomes, scope of work, cost and resource estimations, and the outage and commissioning requirements. The PDD is approved by all impacted parties throughout the project planning lifecycle including scopers and estimators, designers, planners, and project managers. The PDD estimate determines the required Delegated Financial Authority for approval and funding for the project.

PDD authors and reviewers take a SiD approach throughout the planning, engineering and design process, and consider any issues which may affect the safety of personnel, contractors, the public and the assets over the project duration and the asset lifecycle.

Optimising individual projects during the development of the PDD, ensures minimization of network outages, whilst maximizing resource utilisation. The goal is efficiency of project delivery.

Following approval of the PDD, associated budgets, resource planning for detailed design and project construction are used to produce a high-level project delivery timeline.

4.2.5 Capital Plan Optimisation

Capital Plan Optimisation is focused on consolidating the PDDs and subjects them to an appropriate level of internal challenge against scope, budget, need and proposed solution. The Consolidated Capital Plan requires management signoff, ensuring financial accountability before entry into the AWP (covered in Section 4.3).

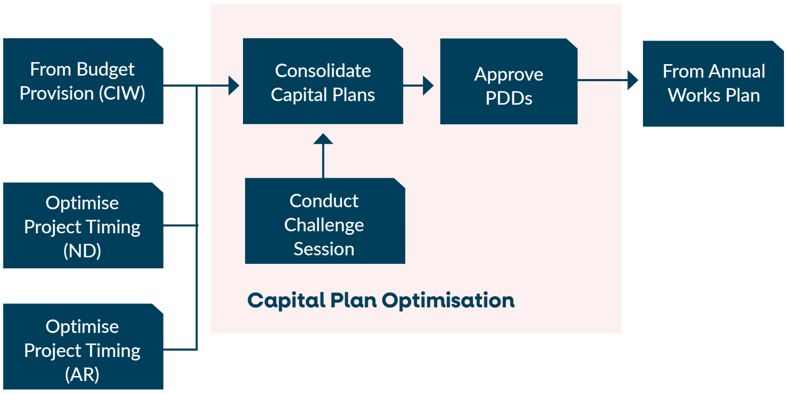


Figure 4.2.5.1: Capital plan optimisation process

The Consolidated Capital Plan combines workflows and estimated programme delivery with design requirements and construction resources. It is an integrated schedule and includes network projects, maintenance, provision for reactive maintenance, faults and non-network projects. The Consolidated Capital plan is approved by the Chief Executive.

Challenge Session

All PDDs are subject to a robust internal review and challenge session where all aspects of the project are scrutinised, to ensure delivery of value to stakeholders and alignment with our strategic objectives. Challenges include safety, project risk, ROI, budget and spend profile. The sessions are conducted with identified stakeholders, including asset management, works programme and works delivery teams and members of the Executive Management team.

Management Sign off and Delegated Financial Authority Governance

The delegated financial authority (DFA) structure sets the financial approval level for the Chief Executive, the Executive Management team, and Senior Managers.

Financial approval limits are aligned with the organisational structure; limits are set corresponding to a person's position and role within the organisation. Expenditure limits are set and differentiated between budgeted and unforeseen expenditure. Unforeseen expenditure limits are set significantly lower than budgeted expenditure.

4.3 Annual Works Plan

Works Delivery is tasked with the safe delivery of work to established quality and engineering standards on time and to budget. Network assets are commissioned and maintained for reliability and to deliver their intended function over the expected design life.

Impacts we manage, while delivering our works plan include:

- localised areas of higher-than-expected network growth
- external events (e.g. storms)
- third party damage
- global material shortages
- global pandemics

The following points detail our delivery optimisation and improvements:

Works Delivery Plan

The Works Delivery Plan consists of project, capital, and maintenance work delivered by WEL Services and external contractors. We have enhanced our ability to plan and schedule work and maximise resourcing to ensure minimal disruption to our customers. We have contracted two Tier One delivery partners to support delivery of the planned works. This enables the AWP to be delivered without impacting day-to-day maintenance and fault responses.

The work management process detailed below aims to manage the safe and efficient delivery of the AWP. It aligns the strategic objectives to works delivery, enabling control of expense and scheduled work. Any improvement actions are captured in our FAR system and form part of our continual improvement process.

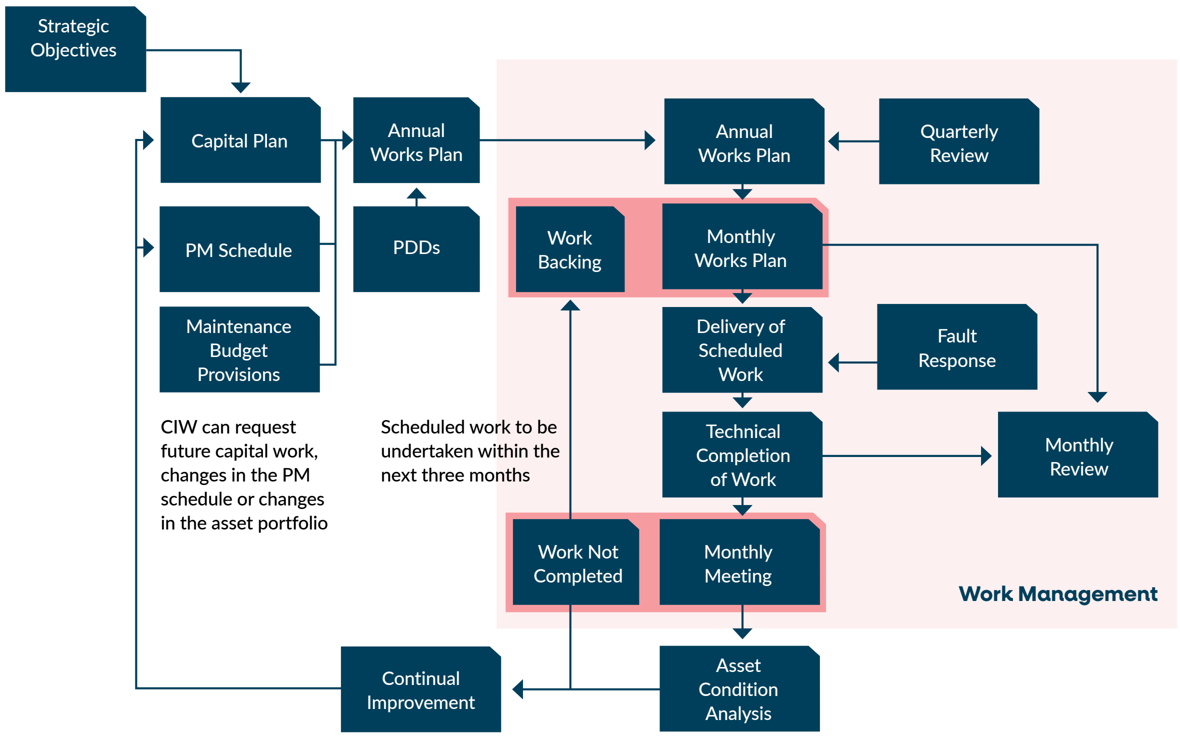


Figure 4.3.1: Works Management Process

The AWP is reviewed and planned at the commencement of the calendar year, and influences resource planning and works scheduling, ensuring specific staff competencies and craft types are available. Works capacity is reviewed quarterly to ensure delivery of work throughout the financial year and informs resource planning for internal teams and contractors.

A monthly work schedule refines the capacity planning to confirm available resources are not committed to other projects and deliver the schedule each month. Tier One delivery partners will deliver all Customer Initiated Works ensuring resources are available for the scheduled network development and asset renewal projects.

SAP functional location reporting

Functional location reporting in SAP enhances our ability to package work by geographic area. This allows maximisation of any resource effort for work in a geographically similar location.

Work Management Governance

We have a work management governance framework that provides a consistent approach to delivering maintenance and capital projects. The framework includes:

- Roles and responsibilities – Staff work as a team and know what to do
- Identifying work – Trained staff in the field and asset analytics to predict asset health
- Planning work – Project delivery and resource utilisation
- Scheduling work – Maximising staff and contractor effectiveness on task
- Executing work – Undertaking the work safely and effectively with skilled teams
- Follow up work – Review of delivered work for required quality standards and any corrective actions

Auditing is a key control on the safety and quality of the work. The following audit processes are utilized:

- A WEL quality assurance auditor may be assigned to undertake an audit of completed electrical work on a defined sample basis
- A WEL quality assurance auditor will be assigned for work involving underground cable systems as frequently as practicable to ensure quality is maintained on buried assets
- Contract managers complete audits of works in progress. Other site observations are also completed by WEL staff
- Outsourced contracting service providers are required to have an internal audit process as part of their quality management system

We use an audit tracking system that scores timeliness, rework minimisation and cost. This system inputs to contractual key performance indicators which are tracked over time, and rework performance is monitored by WEL management and reported to the Board.

Performance Reporting

Performance evaluation deals with three key aspects of the asset management system:

1. Monitoring, measurement, analysis, and evaluation
2. Internal audit
3. Management review

We report on lag and lead indicators to determine improvement actions and ensure the network remains safe and reliable. We act on performance trends that fall below benchmarks set by the regulators and our business objectives.

At the start of each month, the anticipated budget to deliver the schedule of work is confirmed. This is aligned to the AWP and estimates for customer work and reactive maintenance. Estimation is refined through detailed planning so that costs are based on a precise scope of works, current labour rates and where necessary, quotations from third parties

Variance analysis is competed at the end of each period and compared to the original budget. Variance targets are expected to be within ±5% for actual total expenditure. This is further broken down into more detailed types of work to understand issues with over or under expenditure.

Monthly schedule compliance is tracked. Fault responses and other reactive work, which impact the monthly schedule, are assessed to ensure that resources are not unnecessarily committed, to the detriment of achieving the monthly schedule.

Continuous Improvement

WEL's continuous improvement process starts with registering improvement opportunities and prioritising them based on a range of criteria. The criteria include the impact it will have on the organisation or customers. We identify improvement opportunities through:

- Consultation within teams
- Asset performance indicators
- Asset health indicators
- Incident reporting and feedback
- Public feedback

Each month a formal review of completed work is undertaken to ensure the quality of work delivered, all requisite information has been received and projects can be closed out. Financial reviews of the costs for work assess delivery against budget.

Technical information is collated each month and data regarding the health of the network assets is compiled. This is combined with Fault - Root Cause Analysis following events, when the asset maintenance strategy may be adjusted to improve preventative maintenance (through Standard Maintenance Procedures) or change the rate at which we replace assets at the end of their useful life. This feedback and tracking is used to calibrate the CBRM model.

4.3.1 Works Delivery Model

Our Works Delivery Model aims 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 AWP 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 to establish delivery timelines across design, planning, scheduling and construction
- **Detailed Design:** We have a library of standard designs and construction techniques in WEL's Design and Construction manual, to maintain quality, standardisation, and cost efficiency. Asset categories, which have standardised designs, include subtransmission lines, zone substation equipment and switchgear. All designs incorporate SiD concepts ensuring assets can be safely accessed, operated, and maintained. Opportunities to develop standardised designs are typically identified during asset renewal processes and development of asset maintenance strategies. Specialist independent design support is utilised to manage time constraints and capability gaps
- **Scheduling Plan:** A detailed monthly schedule for the delivery of all work types. Delivery is monitored against the plan to improve resources coordination
- **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 projects require a closeout report to be completed and meetings held to capture and discuss lessons learned

Design and Construction Resourcing

The AWP establishes resourcing requirements across design and construction. The AWP determines the projects for delivery prior to the commencement of the financial year, with appropriate resource availability for delivery of the projects. This ensures performance criteria are established and secures both design and construction resources to meet the forecast workload for the year. WEL has delivery contracts with two Tier One contractors to enhance works delivery with the primary focus in CIW work. Having the additional contractors reduces resource risk and increases our ability to deliver works in a timely manner. Planned work is assigned and communicated to delivery partners in December for design and pricing, with delivery programmed in the financial year. We have additional sub-contractors who supplement the internal and external service partners.

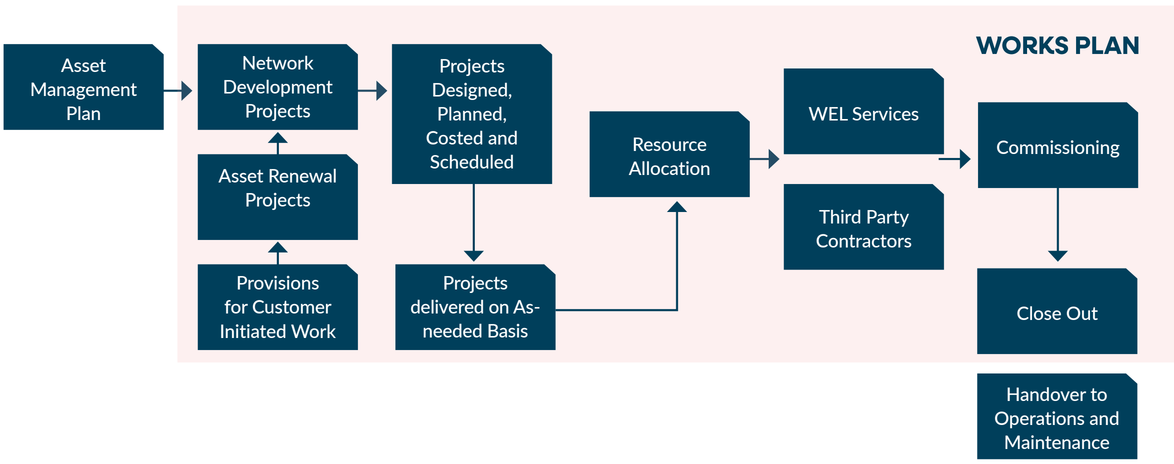


Figure 4.3.1.1: Works Plan

4.4 Materials Procurement

The objective of our materials procurement activity is to efficiently acquire the materials specified by asset management and WEL Services adhering to a core set of principles:

- Lawfulness - act within the law and meet its legal obligations
- Fairness - act fairly and reasonably in its undertaking of procurement activities and apply ethical principles and equitable opportunities to its procurement
- Value - will consider the total cost of ownership and whole of life cost when sourcing goods and services to ensure value for money
- Transparency –will be open and transparent, free from unmanaged conflicts of interest to ensure the quality and integrity of the decision-making process
- Sustainability –consideration of environmental, social, and economic factors when sourcing goods and services for the network
- Ethics –meet its legal or moral obligations towards freedom, fairness and dignity in operations and supply chains, i.e. modern slavery and work exploitation
- Safety - procurement for the network will consider all aspects of the safety of staff, contractors and the community

The stages of the procurement process are:

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

This procurement model is a documented and effective means of procuring items e.g. inventory, equipment, and vehicles. The benefits are measurable and responsibilities are defined and supported by senior management. The processes and business rules for procurement activities have been captured in WEL's systems.

Tendering

WEL tenders all major equipment purchases 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 submission of a formal written recommendation.

For purchases up to $2M, written approval is sought from the WEL Tenders Committee. Purchases over $2M require Board approval following a recommendation from the Tenders Committee.

Preferred Suppliers

We have established several preferred suppliers. The benefits of a preferred supplier arrangement are consistency and certainty of supply, optimal and stable pricing, which reflect current market conditions, quality assurance and volume rebate options.

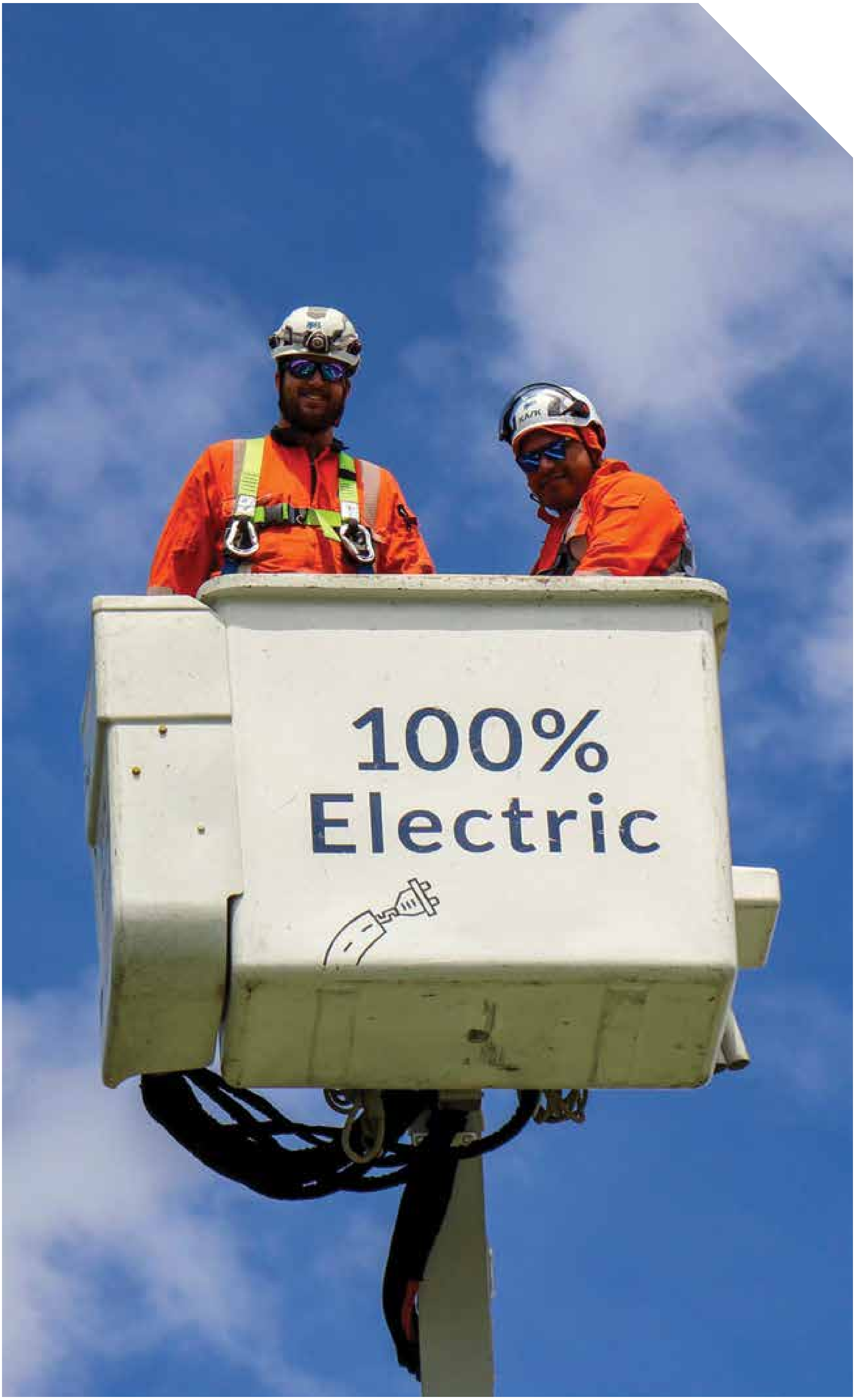
Monitoring Supplier Performance

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

4.5 Document Control and Review

WEL uses proprietary software for the control and review of its asset management documentation. This software allows us to clearly define processes and set review periods. Each process describes actions that are required and links to controlled documents. Processes and documents are assigned an owner and it is the owner's responsibility to ensure that a review of the processes and documentation is undertaken prior to its review date.

We are certified to ISO 9001:2015 - Requirements and have regular internal and external audits against the document control standard.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5 Asset Management Performance

Hua Whakahaere Rawa

WEL NETWORKS AMP 2023

5. Asset Management Performance

This chapter describes our performance objectives, initiatives, indicators and targets for the AMP covering 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 directly linked to our business plan, strategic plan and ultimately support our corporate vision.

The objectives focus areas are summarised as follows:

- **Safety:** Safety is our priority. We strive for a strong safety culture with a focus on continuous improvement where strong safety practices are firmly embedded as part of the way we work every day: they are an outcome of "Good Work". 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 quality, reliability of supply and the quality of service we deliver, such as the time taken to resolve a complaint
- **Cost Efficiency:** Cost efficiency is making the right investment choices at the right time, and delivering our works programme for the lowest whole of life cost, while achieving the quality and safety objectives
- **Asset Performance:** The performance of our assets determines the quality and cost of services provided to our customers. This is a consequence of the asset management decisions made on a daily basis. We improve our asset performance by increasing our asset management capability

5.2 Safety

WEL aspires to being 'Best in Safety'. This underpins our commitment to ensuring the health and safety of our staff, contractors, and the communities we operate in. We are also working towards embedding the concept of "Good Work" whereby good safety is an outcome of the way we work every day.

5.2.1 Safety Objectives

Our safety objectives are:

- **Bring 'Best in Safety' to life** - Our people are fully engaged in health and safety and understand our health and safety strategy, objectives and accountabilities
- **Build Capability** - We have strong and sustainable leadership in health and safety. We have the competence to identify hazards, ensure risks are appropriately controlled and make sound safety- based decisions
- **Risk Management** - We focus on our critical risks, ensuring they have critical controls in place. We will measure and monitor controls to ensure they actively manage critical risks
- **Systems and Structure** - We aim to raise the standard and continually improve our health and safety performance, systems and structure. We effectively communicate health and safety issues and performance
- **Contractor Management –** We ensure our strategic contractors are engaged, competent and capable in achieving our desired objectives
- **Learning Approach** – we learn from incidents and from everyday work and share those learnings with our people and our contractors

5.2.2 Safety Initiatives

Health and Safety Roadmap 2022- 2025

We have implemented continuous improvement programmes based on current innovative approaches to health and safety that will build foundations for "Good Work" to deliver better safety outcomes. Our focus over the past year has been on the first two workstreams; Enabled and Capable Workers and Learning from Incidents. In 2023 our work will centre on critical risk management and the implementation of critical controls. Our workstreams are:

- Enabled and capable workers
- Learning from incidents
- Critical risk reduced as far as is reasonably practicable
- Aligning Work as Intended (WAI) with Work as Done (WAD)
- Systems that enable the safety of work

Public Safety

To increase public understanding of the potential safety risks associated with our assets and work sites, WEL has run several public safety campaigns. The most recent being awareness about the risks of scaffolding near our electricity assets. This is now being supported by running awareness talks to scaffolding businesses.

Other campaigns have focused on; working on the roadside, asset safety including pillar boxes and transformers, and we encourage the public to use the "before you dig" site before commencing any work. 'Down Means Danger' draws public attention to the dangers associated with not treating all fallen power lines as live, particularly as a result of a car accident such as car vs pole. These campaigns are rotated via digital billboards, social media channels, print and radio advertising within our network boundary. We also deliver specific sessions with emergency services to educate them about the risks associated with car vs pole downed lines.

We have a PSMS. The scope of the system is:

- The WEL electricity distribution network and distribution assets
- WEL's responsibility ends at the point of connection to privately owned assets e.g. service mains are excluded
- Harm to members of the public - WEL staff and contractors are excluded from the PSMS and managed separately
- Significant damage to non-WEL owned property

The PSMS does not cover damage to WEL's assets and worksites as these are covered by the Health and Safety at Work Act requirements. The management of public safety is guided by a series of hazard/risk assessments for all asset types. Any assets rated as having a high level of potential risk are put through exposure rate analysis. This involves assessing the potential exposure of the public or third-party should an asset fail.

Risk is mitigated through sound procedures in relation to the asset, including its introduction to the network, maintenance, monitoring, repair, replacement and ongoing operation. The PSMS is concerned with assets for their entire lifespan. Risk is mitigated by having appropriately qualified and trained staff, keeping comprehensive records that relate to the inspection and maintenance of the assets and a programme of network-based audits.

Employee Wellbeing Initiatives

While there were some challenges in providing wellbeing initiatives during the last 24 months due to Covid 19 restrictions we have provided programmes for flu vaccinations, mole mapping, bowel cancer screening and moving safely to reduce strains. WEL has a programme to support the mental wellbeing of staff ensuring they are fit for their work every day. We have introduced several flexible working options as part of our overall wellbeing programme, including a nine-day fortnight which is available to office and field staff.

People leaders in the business participated in the 'Wellbeing Leadership Programme' facilitated by an external contractor in 2022. Through this programme, employees were taught techniques to create a positive, energised, high-performance team culture including:

- A motivating force to create a culture shift
- Education and inspiration to create buy in
- Visual and environmental changes
- Follow-up and reinforcement

5.2.3 Safety Measures and Targets

Our measures for safety performance include a range of lead and lag indicators including; injury severity rate, number of public safety incidents causing harm, average time to address safety issues raised by the public and number of site safety visits completed by team leaders and management. The following tables show our safety performance against targets.

Lag indicators	2023-24 Targets	Actual Performance FY 2022
Injury Severity Rate (Rolling monthly average number of recovery days following a workplace injury/illness)	< 5	6.6 (Against the 2022 target of <7)
Public Safety Incidents Causing Harm	0	1
Number of incidents of faulty neutral causing harm where a WEL smart meter could have detected the fault	0	0

Table 5.2.3.1: Safety lag indicator and targets

Lead Indicators	
Near misses reported	Measure – Investigation type decided and launched within three working days of receiving the report. Report completed 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.

Table 5.2.3.2: Safety lead indicator measures

Other Measures			
Category	**Target**	**Number FY21**	**Number FY22**
Lag Indicators:			
Notifiable Incidents	0	2	1
Lost Time Injuries	0	6	5
Medical Treatment Injuries	0	4	5
Restricted Work Injuries	0	3	5
First Aid Injuries	0	17	8
Motor Vehicle Incidents	0	18	22
Environmental Release	0	1	2
Lead Indicators:			
Near Misses Reported	-	105	123
Director Site Visits	1 per year		3
Executive Site Visits	1 per month	61	33
Management and other site visits	905	666	521
Health and Safety Meetings (WEL staff and Service Partner committees)	N/A	17	17

Table 5.2.3.3: Other safety measures and targets

5.3 Customer Experience

We aspire to being 'Best in Service'. Our objective is to provide excellent customer service and network performance. We believe that relationships in our community, with businesses, councils and community groups are vital to our success.

5.3.1 Customer Experience Objectives

Customer experience is the measure of how customers feel about the service received. 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 about our network.

The objectives for achieving 'Best in Service' 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 'partner of choice' within the community and within the industry

5.3.2 Customer Experience Initiatives

Customer Experience Initiatives have been categorised as network performance and customer service.

Network Performance Initiatives

The following are the network reliability initiatives for the AMP period:

- Using data from Failure Modes Effects Criticality Analysis (FMECA), Root Cause Analysis (RCA) outcomes and notifications to develop improved asset strategies. This includes network reconfiguration and the installation of automated devices to provide thorough fault information. This reduces the number of customers affected by an outage and allows remote fault diagnosis and restoration of some customers within reduced timeframes
- This analysis enables initiatives to target our most common equipment failure modes including the early identification of cracked ceramic insulators through acoustic and corona-based inspections. This allows the failing insulators to be identified and replaced. The analysis generated a second initiative to strengthen or replace twist sleeve joints on copper overhead lines. The failure of these joints is the most common cause of downed lines. The strengthening of these joints enables 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 such as cable PD testing, UAV inspection of pole top equipment, thermal hotspot detection and ultrasonic/acoustic detection on overhead line insulators
- Detailed pole top line inspection by helicopter for rural lines to determine condition and emerging failures that need to be addressed more urgently
- The inclusion of automation as appropriate when replacing distribution switches or ring main units
- Investment in network capacity and security. This investment addresses localised areas of forecast growth and is described further in Chapter 6
- Introduction of new monitoring technology. The Energy Services team actively monitors, assesses, and trials new technology to maximise the opportunities available from these emerging technologies such as PV, battery systems and EV chargers
- Leveraging the data from Smart Meters to support investment decision making and to 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 such as:
  - 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:

- Customer Initiated Works satisfaction surveys enable customer feedback on works completed and we utilise this data to improve our service offerings. These results are reviewed on a quarterly basis
- Continuous improvement in our internal processes, so that customer interactions and broader relationship management are centrally supported and coordinated
- The realignment of delivery of work with the introduction of two Tier One delivery partners. This aids the implementation of the Customer Initiated Works programme and minimises the impact of faults on delivery
- Rolling out new delivery partner contracts that are fit for purpose
- Measure and benchmark delivery times for services and set targets for improvement
- Ensure that customer needs are understood and integrated into 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
- Making surveyor meetings an annual engagement
- Reinforce our vision and values with our staff, particularly the 'Best in Service' objective by providing additional training
- Review our customer feedback processes to ensure that the customers' concerns and opinions are clearly identified
- Building closer alignment and relationships with key stakeholders such as Survey and Spatial New Zealand - Waikato branch to improve processes to alleviate delays in final approvals for works completion

5.3.3 Customer Experience Measures and Targets

Our customer experience measures are categorised into network performance and customer service.

Network Performance Measures

Network Performance measures reflect the average reliability a customer can expect to receive. These measures account for outages on the high voltage (HV) network and do not include outages that are solely on the low voltage (LV) network. System measurement and control improvements that enable accurate recording of all LV outages will be delivered as 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

Starting in this financial year we have fully aligned SAIDI and SAIFI targets with the Commerce Commission's Electricity Distribution Services Default Price-Quality Path Determination 2020. The primary impact of this change is splitting out planned and unplanned outages and reporting each separately. WEL's planned and unplanned reliability targets for the next 10 years are outlined in the following tables. Planned SAIDI is forecast to increase over the planning period aligned with the increase in work outlined in Chapter 6. Due to the nature of network faults, greater certainty for SAIDI is unable to be accurately forecast further into the future.

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Planned SAIDI	35.6	36.4	36.5	36.8	36.8	36.8	36.8	36.8	36.8	36.8
Unplanned SAIDI	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5

Table 5.3.3.1: Planned and Unplanned SAIDI Targets

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Planned SAIFI	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Unplanned SAIFI	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

Table 5.3.3.2: Planned and Unplanned SAIFI Targets

Network Performance Results

The following table shows our SAIDI and SAIFI performance against our targets for FY22. SAIDI performance exceeded our target by 31 SAIDI minutes and was the highest result recorded over the past 10 years.

Contributing factors are:

- 62 car accidents involving poles (45 average per annum) – 9.3 SAIDI minutes above the historic average
- significant outages from three overhead line failures, two air break switch failures and a transformer cable termination failure
- the high number of outages from Cyclone Dovi, totalling 13.7 SAIDI minutes.

This storm event was the largest event to affect the WEL network since Cyclone Bola in 1988.

	FY2022		
	Target	Actual	Variance
Total SAIDI	86.27	117.27	-31.0
Total SAIFI	1.52	1.64	-0.12

Table 5.3.3.3: FY2022 SAIDI and SAIFI Performance against Targets

WEL's approach to communicating outages with customers

Planned Outages

To undertake maintenance or network upgrades that require customer shutdowns, a network request system is utilised to apply for the outage within the Advanced Distribution Management System (ADMS). The date, time, customer impact, and mitigation methods are assessed and approved.

An EIEP5A file identifying the affected transformers, date, shutdown start and end time is auto generated and sent to the Electricity Authority (EA) Outage Portal a minimum of 10 days prior to the outage date, which retailers access to produce individual customer outage notifications. The notification process automatically generates a scheduled outage within the outage page on the WEL website in both list and graphical overlay format.

Cancellations, time and date changes greater than 24 hours prior to the notified outage will be communicated to the retailer. A new EIEP5A file will be sent to the EA Outage Portal and the outage map will also be updated automatically.

Overruns, cancellations, time and date changes within 24 hours prior to the notified outage will be updated in the outage map and as a courtesy the EIEP5A file will be generated and sent to the EA Portal.

Unplanned Outages

An unplanned outage caused by a fault or emergency switching will automatically generate an EIEP5B file and update the current outages on the outage map. An Estimated Time to Restoration (ETR) is automatically applied and can be updated as the fault cause and remedial actions are identified.

Call Centre

WEL has a Customer Call Centre during business hours and utilises a third-party call centre outside of business hours. The ADMS generates outage notifications to selected groups and people including the third-party call centre who generate automated outage messaging which is played to incoming calls.

Table 5.3.3.4 shows the number of Planned Outages, together with the outages where the duration was longer or shorter than the agreed outage time with the consequential SAIDI impact. This is broken down in alignment with the Commerce Commission's Electricity Distribution Services Default Price-Quality Path Determination 2020. Overrun and underrun outages are tracked as they can increase the impact of the planned outages to customers. For overruns the impact is related to the additional outage duration. For underruns the impact is positive for some customers being restored early but can be negative if a customer has planned around a longer outage. For example, a customer could have arranged a generator to maintain supply during the planned outage. If the outage is much shorter than planned, then the generator may not have been needed. As a result both events are recorded.

FY2022			
Month	**Planned Outages**	**Overrun / Underrun**	**SAIDI Impact**
1	27	7	0.008104
2	22	8	0.06995
3	49	11	0.18025
4	37	14	0.66191
5	26	8	0.01295
6	37	4	0.01414
7	28	6	0.07945
8	29	4	0.01191
9	39	8	0.01656
10	17	2	0.00466
11	45	13	0.49884
12	36	10	0.7843

Table 5.3.3.4: FY22 Planned Outages with Overrun or Underrun and total SAIDI-minute impact.

Worst Performing Feeders

We use PowerBI dashboards to show 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 2022 are:

Based on outages/ 100km /year				Based on SAIDI			
Feeder	**Total Outages**	**Total SAIDI**	**Outages /100km / year**	**Feeder**	**Total Outages**	**Total SAIDI**	**Outages /100km / year**
TEKCB5	160	7.93	74.3	WEACB6	200	24.60	27.8
WEACB4	89	4.34	56.3	TEUCB1	162	22.81	24.2
GLACB1	47	4.08	55.1	PEACB16	22	12.95	28.1
TEKCB3	90	5.80	52.7	WEACB2	147	12.89	39.1
CLACB16	25	6.58	46.3	WALCB6	69	12.24	21.4

Table 5.3.3.5: Worst performing feeders

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

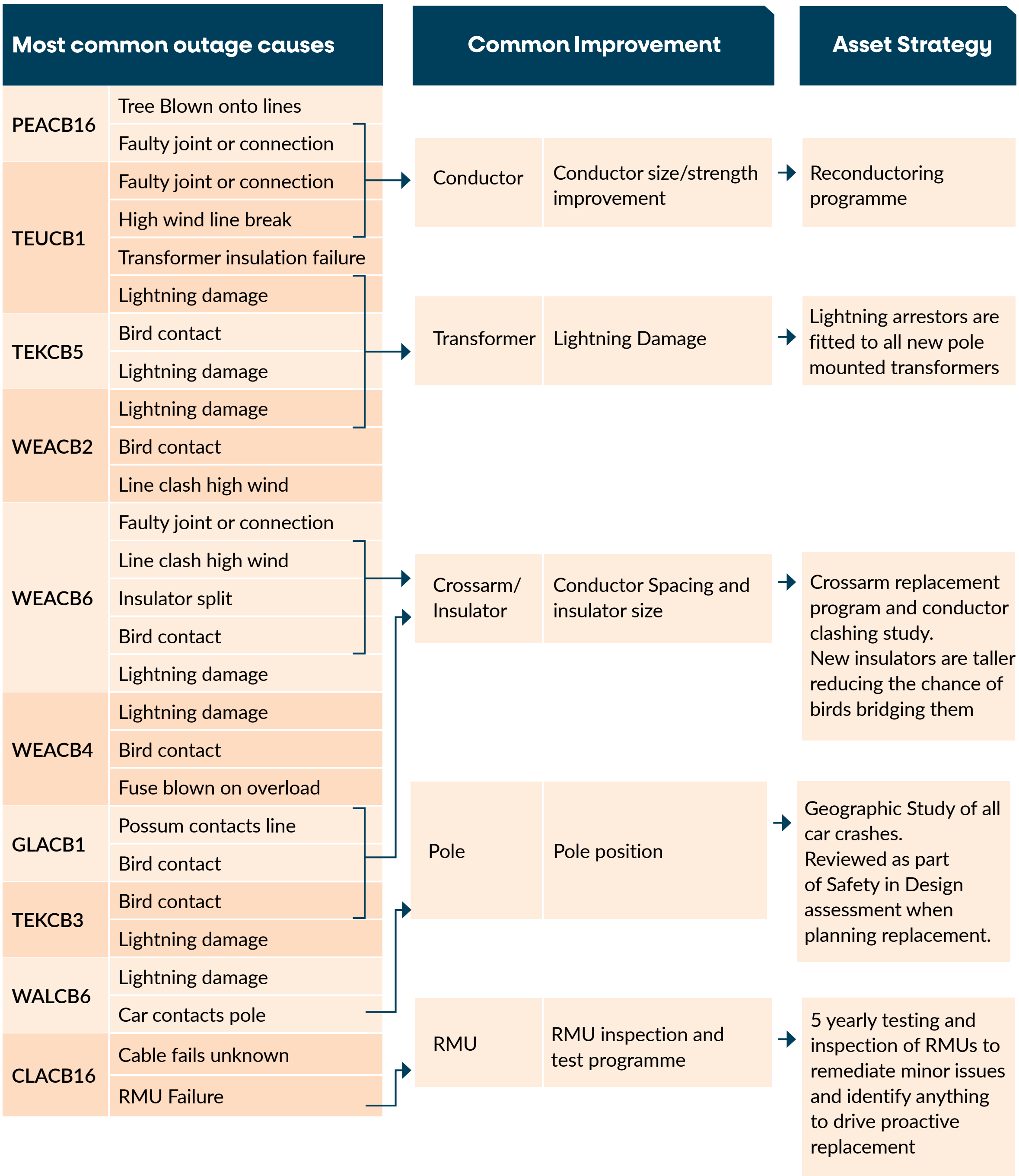


Figure 5.3.3.6: Most common failure causes and aligning strategy

Feeders that have high SAIDI, but low failures per 100km, indicate that the line equipment is relatively reliable. However, due to the line length we experience a significant number of outages. To reduce SAIDI on these lines our approach is to reduce the number of customers for each outage or the duration of each outage. This is achieved through a range of network configuration upgrades, back-feeds and ties to other networks. We are investigating the use of new technologies such as batteries and distributed generation as alternatives.

Feeders with low SAIDI, but high numbers of outages per 100km, show feeders that have effective automatic interconnection and segmentation. These are addressed under the asset renewal programme. They are used to identify improvement opportunities within our design and maintenance strategies.

Customer Service Measures

Our customer service performance measures are:

- **Customer Satisfaction** – Regular surveys of a sample of customers to gauge their performance expectations, the price they are prepared to pay and their satisfaction with our service
- **Customer Satisfaction (Customer Initiated Works)** - Monthly surveys of all customers who have had a new connection or similar customer work-type completed. The survey is conducted by an external research contractor and measures customer satisfaction across Value, Efficiency, Communication, Performance and Outcome. A quarterly report is provided to us for analysis to drive improvements in customer satisfaction. The target is reviewed annually to ensure a customer focus is retained
- **Standard New Connection Quote Time** – Measures the average number of working days it takes to provide a quote for upgrades and new connections to our network
- **Complaint Response Time** – The average number of working days to provide a resolution to any complaint.

This table shows the targets for each measure over the AMP period.

Measure	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Customer Satisfaction	88%	89%	90%	90%	90%	90%	90%	90%	90%	90%
CIW Satisfaction Performance (Annual weighted average)	7.4	7.5	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7
CIW Satisfaction Efficiency (Annual weighted average)	6.4	6.5	6.5	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)	20	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 2024 – 2033

Customer Feedback - In-house Complaints Process - We offer a free in-house complaints service. If a formal complaint is received, it is investigated, and we endeavour to resolve the problem with the customer.

If we receive a complaint, we will:

- Acknowledge the complaint within two working days either in writing or verbally
- Provide the customer with an update on progress within seven working days if the complaint has not already been resolved
- Endeavour to resolve the complaint within 20 working days. If not, we provide customers with an explanation in order to extend the investigation by a further 20 working days
- If the customer complaint is more appropriately dealt with by another party such as an electricity retailer, we may refer the complaint to that company on behalf of the customer. We will notify the customer that we have referred their complaint on and provide the relevant party, name and contact details

Customer Complaints Resolution - Complaints are received by the Customer Services team and reviewed and assigned to the appropriate person to follow to resolution as per our Complaints Management Policy. Customer complaints and compliments are managed by using the WEL customer service portal. If it is because of a third party or natural event out of our control, we refer the customer to their insurance company. If it is a complaint for damage because of WEL activity or equipment failure, we will adopt a fair and reasonable approach on a case-by-case basis. In cases where resolution is not able to be achieved using internal resources, the customer is informed that the Utilities Disputes resolution process is available to them.

WEL's approach to planning and management of new or altered connections

If the connection meets criteria for a point of connection in the road reserve and there is Low Voltage (LV) supply available, the work scope is quoted at standard rates in accordance with our Capital Contribution Policy. If the work scope is deemed to be non-standard, a design is completed and commercially modelled to determine the required customer contribution.

For Distributed Energy Resources (DER) applications, the Asset Strategy and Engineering team participate in the design and approval process. Upon payment, the work is processed through the required activities to delivery.

Our approach to managing communications with customers about new or altered connections is through a portal on the public website called WELConnect. Customers can log into WELConnect and see the status of their projects with information on their projects. Additional queries can be communicated by email or phone to staff.

Presently we are not achieving the target days outlined in the performance metrics. To correct this anomaly, the two Tier One contractors have been bought on board to focus on CIW delivery. The capacity they bring will ensure that we will trend towards our target figures. The current average time to provide a quote for a new ICP and alterations to an existing ICP is 27 days. The average time to construct a new ICP or alterations to an existing ICP is 67 days, across all customer work types.

The consumer classes are broken down into the following types:

- Non-standard new connection <110kVA
- Standard new connection <110kVA
- Non-standard new connection >110kVA
- Subdivisions
- Streetlights
- Temporary supplies
- Distributed Generation

Customer Satisfaction

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.

Customer Satisfaction is gauged by:

- Bi-annual Customer Price Quality Survey
- Feedback card metrics
- Time to resolution KPIs

Global supply chain shortages in the infrastructure industry have impacted WEL. During the past year, we have seen supply chain constraints affect our ability to deliver on customer expectations as lead times have trebled for some key equipment. Supply chain issues combined to be part of a "perfect storm" as customer spend increased by 27% since 2020, compounded by a tight labour market. This made it challenging to fully meet customer needs. Consequently we have recently engaged two Tier One contractors to increase capacity.

To ensure we fully meet customer requests, we have increased our stock levels to ensure we have frequently used equipment on hand. We have partnered with local contractors for delivery to ensure we are responsive to customer requests.

The average time for customer complaints to be resolved in 2022 was three days.

The customer satisfaction when delivering these works is shown below:

Measure	Target	2022	2023 As at 1 December 2022
CIW Satisfaction Performance (Annual weighted average)	7.0	6.7	6.4
CIW Satisfaction Efficiency (Annual weighted average)	6.0	5.6	5.1

Table 5.3.3.8: CIW Customer Service Measures

5.4 Cost Efficiency

Our cost efficiency objective is to implement the Works Plan (see Section 4.3). This is optimised for risk and impact without compromising safety, at a feasible cost to customers. Our cost efficiency objectives are 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
- Our systems enable and support efficient delivery
- Investment and repairs are optimised using robust methodology to achieve operational targets
- We measure and monitor delivery performance (safety, quality, time and cost) and 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 3.4.4 included several initiatives that impact cost efficiency, outlined below:

- the automation of processes
- data improvement
- monitored performance indicators
- gap analysis to drive action towards the certification to ISO 55001:2014

5.4.3 Cost Efficiency Measures and Targets

The measures established for cost efficiency are:

Cost Per Customer – operating costs that are allocated to electricity distribution services (in accordance with Information Disclosure requirements), divided by the number of connections. It excludes capital expenditure, 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) is 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. The following table shows the targets for each measure over the AMP period.

Cost Efficiency	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Cost per customer ($ Opex)	343	340	336	331	328	324	320	315	311	306
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.

Cost Efficiency	2022		
	Target	Actual	Variance %
Cost per Customer ($)	321	334	3.9%
Capital Work Delivery ($M)	20.1	22.2	10.4%

Table 5.4.4.1: Cost Efficiency Performance

The global pandemic and inflationary pressures from recent local and world events have significantly impacted the cost and availability of materials and labour. As a result, cost efficiency targets for 2022 were not met.

Faults were significantly higher than the historical monthly average in February and March 2022 due to Cyclone Dovi and again more recently with Cyclone Gabrielle. This led to a significant increase in operational expenditure on faults resulting in higher overall cost per customer for the year.

The high variance for capital work delivery was due to purchase of land for a future zone substation at the end of FY22 that was not forecast. This accounts for the $2M difference between the target and actual.

5.4.5 Evaluation of Performance against FY23 AMP

The global inflationary pressures from recent local and world events have significantly impacted the cost and availability of materials and labour. As a result, the operational costs in FY23 were higher than anticipated. Furthermore, Cyclone Gabrielle in February 2023 led to higher fault costs. Expenditure on renewals and corrective maintenance was lower than forecast due to resource constraints. Two Tier 1 contractors are being introduced to mitigate these constraints in the future.

Total capital expenditure forecast is largely in alignment with budget. The two major variations were due to; deferral of the proposed Fairfield zone substation due to a major load connecting directly to Transpower and non-network expenditure was higher predominantly due to the strategic decision to bring the headend project in-house.

Expenditure on Assets)	*Budget FY23 ($000)*	*Forecast ($000)*	
Consumer connection	28,349	33,067	Post Covid economic activity was higher than anticipated
System growth	11,637	6,610	Fairfield zone substation build deferred
Asset replacement and renewal	15,171	14,568	Priortisation for customer connections and resource availability
Asset relocations	5,023	3,512	Relocation requests lower than expected
Total reliability, safety and environment	6,898	8,302	Carryover costs for Gordonton switch room rebuild from FY 22
Expenditure on network assets	**67,079**	**66,059**	
Expenditure on non-network assets	6,845	10,116	The headend project was introduced during the year
Expenditure on assets	**73,924**	**76,175**	

Operational Expenditure	*Budget FY23 ($000)*	*Forecast ($000)*	
Service interruptions and emergencies	3,330	4,570	Cyclone related faults are the main driver for cost over run.
Vegetation management	1,691	1,659	
Routine and corrective maintenance and inspection	2,224	1,577	Corrective works lower than forecast due to resource constraint
Asset replacement and renewal	2,661	2,366	
Network opex	**9,906**	**10,172**	
System operations and network support	9,581	9,957	
Business support	14,170	16,254	Additional staff in business support functions and inflation
Non-network opex	**23,751**	**26,211**	
Operational expenditure	**33,657**	**36,383**	Operational cost overrun predominantly driven by business support costs.

Table 5.4.5.1: Evaluation of Performance Against FY22 AMP

5.5 Asset Performance

Asset performance directly reflects our asset management decisions and processes. Changes to the strategy will take many years before measurable changes in the outcome are seen. 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 ensure:

- Asset management investment decisions are optimised and are based on appropriate trade-offs betweencapital and operational expenditure, risk and reliability
- Preventive and corrective maintenance decisions are made using quantitative analytical techniques such as Failure Mode Effects Criticality Analysis (FMECA) and WLCC analysis. These techniques support quantifiable trade-offs between operational expenditure, asset condition and reliability
- How we deliver our Works Plan, as this is a key input in investment decisions
- We continue to develop new tools and systems for data analytics using smart meter data to improve our service to our customers (discussed further in Chapter 7)

5.5.2 Asset Performance Initiatives

The initiatives we undertake to achieve our asset performance objectives include:

- A review of the asset renewal and works prioritisation programme to manage the work will support works planning and delivery, while maintaining an acceptable level of risk
- Improvements to our maintenance planning 'end-to-end' process to achieve cost effective maintenance was completed via the Operational Excellence workstream over the last two years. This was achieved by targeting equipment with common modes of failure and improving the quality of condition data obtained from maintenance activities, as discussed in Section 5.3.2
- Assessing opportunities to integrate emerging technologies such as PV and battery, to improve the performance of network assets

5.5.3 Asset Performance Measures and Targets

We reviewed our asset performance measures. These measures form a feedback loop from WLCC to Maintenance Planning. Failure rates and notifications are tracked for each asset class in Power BI dashboards. Changes in these parameters influence changes in asset replacement and preventative maintenance strategies.

In the short term, asset performance measures focus on network utilisation. We track and improve GXP load factors which are a measure of the efficiency of assets we contract from Transpower.

The basis of the targets is maintaining our historical performance. This table shows the targets for this measure over the AMP period.

Measure	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Load Factor at GXPs	>60%	>60%	>60%	>60%	>60%	>60%	>60%	>60%	>60%	>60%

Table 5.5.3.1: Asset Performance Targets 2024 – 2033

5.5.4 Asset Performance Evaluation

WEL's asset performance for 2022 is shown below.

Asset Performance Measures	Target	Actual	Variance %
GXP Load Factor (%)	60%	52%	-8%

Table 5.5.4.1: Asset Performance 2022

Since 2021, WEL has seen an increase in peak demand to 308MW. Energy consumed throughout the network has increased by 3.7% with a resulting decrease in GXP load factor. However, with the greater proliferation of PV across the network reducing energy consumption, and an upwards pressure on peak load from EV charging, further measures will be required to maintain the load factor in the future.


ELECTRIC VEHICLE FAST CHARGER
ELECTRIC VEHICLE CHARGING ONLY
P60

6 Network Development

Puna Whakawhanake

WEL NETWORKS AMP 2023

6. Network Development

WEL's approach to network development is detailed in the following sections and describes the plans in place for the AMP period.

6.1 Overview

The network development plan has been reviewed and aligned to customer needs and the performance objectives as described in Chapter 5. This enables targeted investment, driven by need in each area of the network.

Our network development investment is driven by three main factors: strong customer growth, climate change driven resilience, and forecast load increases due to the electrification of heat and transport. The key aspects of network planning that are impacted by these factors are:

1. Capacity and Quality of Supply (power quality, reliability), and constraints arising from peak demand growth in specific areas within the network
2. Security of Supply issues from reduced back-up capacity due to growth in peak demand
3. Network Resilience

The projects identified in this chapter represent our view of what is required to mitigate identified constraints. Currently there is high uncertainty in the forward projections. We will continue to monitor and adjust our plan accordingly.

6.1.1 WEL's Approach

Chapter 4 describes our three-stage process and approach for all investment projects, including network development and non- network investment, outlined below

1. **Demand Forecasts**
   Demand forecast scenarios are created from local council plans, economic trends, local developer engagement and technological trends.
2. **Needs identification**
   The needs considered fall under the following categories:
   - Safety
   - Reliability performance
   - Growth and security
   - Resilience
   - Customer requests
   - Technology change
   - Legal, regulatory and environmental requirements
   - Environmental sustainability
3. **Options analysis**
   Following need identification, potential options that meet the requirements are formulated. Options vary depending on the type and complexity of need(s). Emergent solutions including demand management are considered as potential options and undertaken if practicable and cost effective.

   The investment option selected should optimise the cost-benefit ratio, deliver on safety, and meet identified need(s). All investments are subject to the governance framework and processes described in Chapter 4.

6.1.2 Key Planning Assumptions and Inputs

Key assumptions informing network development planning are:

- Future peak demand growth based on customer initiated works and forecast in Section 6.2;
- Residential subdivisions impact of a potential short recession
- The 44MW embedded co-generation plant at Te Rapa to be decommissioned in June 2023
- The 64MW embedded wind farm generation at Te Uku will not be available to meet demand following a major power outage
- The current level of load control (primarily domestic hot water) will continue through the AMP period, including renewal and maintenance of load management systems.
- Increasing uptake of light passenger, slow charging EVs, including:
  - Customer uptake of network managed charging
  - Customer demand elasticity to pricing
- Industrial development of:
  - Ruakura Inland Port (TGH SuperHub) will be directly connected to Transpower HAM33 GXP
  - Ohinewai Sleepyhead Industrial & Residential Estate will start development in 2026
  - Northgate Industrial Park will populate in 2028
  - Airport industrial zone will commence in 2027
  - Horotiu industrial zone will commence in 2027
- Large electrification of industrial plant will be implemented only towards the end of the AMP period
- Dampened demand forecast in the initial two years of the AMP period due to a possible recession.

Many inputs are utilised in the planning process, including:

- Customer Initiated Works forecast
- The reliability performance sought by WEL's customers and stakeholders; as detailed in Chapter 3, and the corresponding performance objectives discussed in Chapter 5
- Specific individual customer and stakeholder requirements
- Inputs required to forecast electricity consumption and demand, as set out in Section 6.4;
  - Local authority plans (HCC, WDC, Waipa DC, WRC, NZTA, Transpower etc.)
  - Economic indicators, official census, customer surveys, appliance sales
  - Customer enquiries and network connection applications
  - Future weather extremes[1]
- Regulated supply quality limits
- Equipment types and ratings (both customer and network)

1 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 WEL's contingency planning.

The following figure shows an overview of the WEL network system from GXP to zone substation (excludes 11kV and LV distribution level).

Figure 6.1.2.1: Overview of the WEL Network System

6.2 Demand

Our network delivered 1,331 GWh of electricity for the 2022 financial year with absolute peak demand of 308MW. Peak demand is one of the primary drivers of network development investment. Forecast peak demand is a key input and informs the expected timing for growth driven investment during the AMP period.

The sustained peak demand at the start of the planning period is 278MW. This value is the estimated sustained peak, or 99.5th percentile on the yearly period which is lower than the absolute maximum peak demand value for the year. Sustained peak values are used, as they give a better indication of constraints in relation to network capacity (refer to Section 6.5).

6.2.1 Demand Growth

Electricity demand is expected to significantly increase over the AMP period. Long-run historic organic growth in system sustained peak demand is approximately 1.4% p.a. Included in the forecast are a range of electrification, EV uptake, and economic growth scenarios, with consideration to the underlying factors as outlined in the following sections.

We have refined our demand forecasts and the updated total demand forecast is shown below, with comparisons to:

- Transpower's Net Zero Grid Pathways – Phase One (NZGP1) grid planning scenario update[2]
- A comparable EDB with similar composition of customer types (Range shown in the shaded section)

The graph shows WEL's growth scenarios compared to that of the other EDB, normalised to our network.

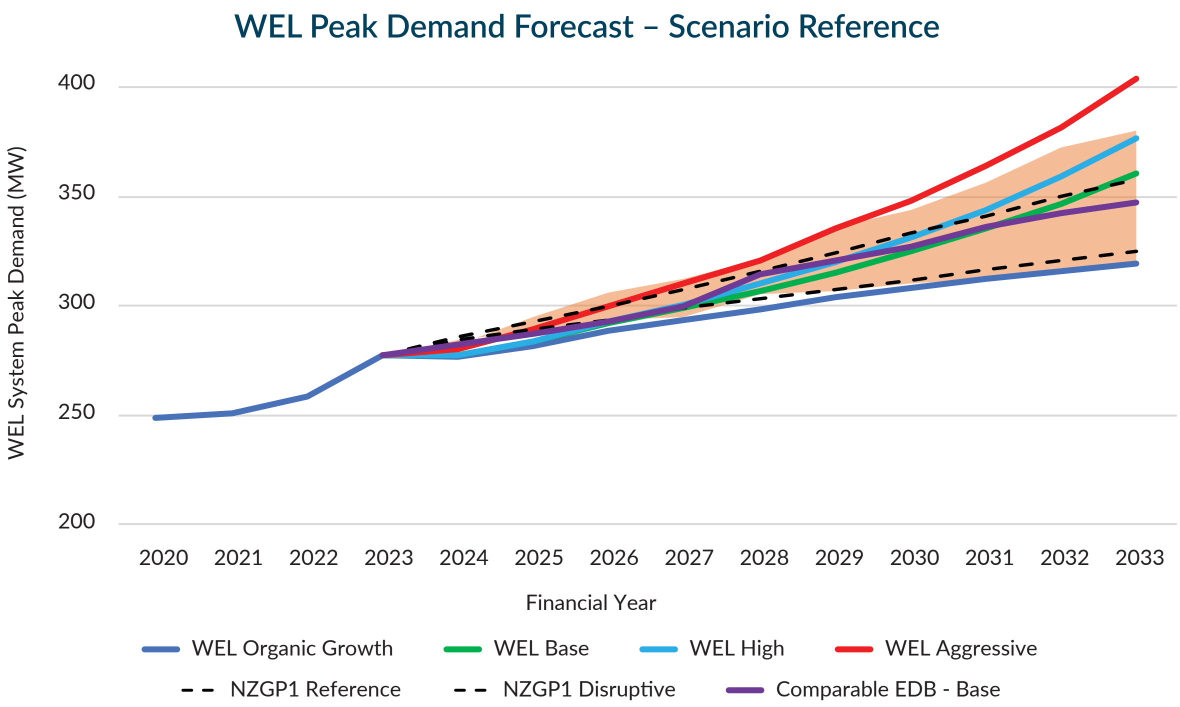


Figure 6.2.1.1: WEL Demand Forecast Scenarios – Compared with other NZ networks

2 Published December 2021 - an update of MBIE Electricity Demand and Generation Scenarios EDGS 2019

N.B. Transpower assumes a substantially lower organic growth rate of 0.3% p.a. compared to WEL, as their forecasts include:

- All New Zealand population base
- Both high and low growth areas across all New Zealand
- Greater diversity factor at the transmission level

Longer term forecasts are highly sensitive to near term and medium-term developments, with increased uncertainty due to the future trends described above. The range of forecasts also widens at lower voltage levels due to lower effective populations served.

The Base Case scenario projections are based on long term national and international trends, calibrated to local Waikato factors and near-term economic conditions, using our customer survey results and business intelligence. The WEL base case has been selected as the preferred scenario for this AMP.

6.2.2 Drivers of Demand

Traditional drivers of demand growth are:

- Expanding population, associated land re-zoning and dwelling growth
- New and expanding industrial and commercial enterprise activity

These are described for each of the network areas in Section 6.9.

In addition to the traditional drivers of demand growth is emerging demand growth from:

- Electrification of transport (private, commercial, heavy)
- Electrification of existing industrial processes (automation, process heat)
- Intensification of electricity use for space and water heating, and other appliances
- Uptake of DER solutions, such as solar and batteries

Recent global conflict has highlighted the vulnerability of New Zealand's dependence on importation of petroleum, coal, gas, and the underlying volatility in those markets. New Zealand has the potential for low-cost renewable electricity resources and a drive to convert demand to electricity. The Climate Change Commission report proposes a plan to be 100% renewable generation by 2030 and carbon neutral by 2050.

The carbon neutral journey will drive electricity's share of total energy demand from 25% (2016) to 61% (2050) according to Transpower's "Te Mauri Hiko" study base case projections. We engaged two independent international consultants to produce network impact assessments of EVs on the network and these projections are used in the underlying assumptions for network development.

6.2.3 Emergent Demand

The New Zealand electricity industry is entering a period of unprecedented change and growth driven by Government policy, environmental objectives, and the need to access cost effective renewable energy.

Electric vehicles, electrification of industrial processes, distributed generation, battery storage systems, and demand management services are examples of emerging technologies with the potential to significantly impact the design, construction and operation of the network.

Currently WEL is experiencing the impact of additional solar PV and EV charging. A deferred uptake scenario, based on a forecast recession over 2023-2024, is accounted for in our planning. Additional network monitoring, review of industry trends, and ongoing analysis will be used to manage the risk of emergent demand.

Section 6.7 describes our initial plans for these technologies.

6.2.4 Residential load patterns

Residential load patterns have shifted as consumers seek improved cost effectiveness and convenience from upgrades to existing appliances, and the increasing use of electrical technology in new appliances.

In the next 10 years, it is forecast that load will increase from conversion of non-electric air and water heating appliances, and uptake of electric vehicles and associated charging. Other sources of residential demand profile change will come from appliances that are gaining popularity in the NZ market including heat pump and air conditioning technology, mechanical ventilation, induction cooktops, instant hot water, electric power tools and home automation.

Counterbalancing forces include insulation improvements, smaller dwellings, efficient appliances, fuel substitution, and energy reduction due to affordability. However, it is expected that aggregate residential electricity demand will increase as consumers seek greater convenience and lower overall energy cost.

With the increasing adoption of new technology, customers are becoming aware of their behaviour with respect to energy consumption and impact on the environment, wanting more control and visibility of their energy consumption.

In residential and small commercial sectors, increased demand is likely to occur behind the meter without notification to WEL.

The level of visibility of 'behind-the-meter' changes in appliance type and use is limited, and demand can increase where no distinct new customer or customer application for new load has been made, and little demand flexibility has been made available. Additional demand may occur, causing reactive upgrades on the network, starting at the LV and distribution transformer level. WEL's access to smart meter data and data intelligence workstreams will provide insights for asset investment decisions.

Preliminary studies show there are a small but growing number of distribution transformers on the threshold of overload. This phenomenon is particularly clustered around affluent rural lifestyle areas with little densification and load diversity. The number of overloaded LV lines and distribution transformers will increase with the conversion from other energy sources to electricity.

6.2.5 Electrification of Transport (EV)

Central government has supported the uptake of electric vehicles (EV) in the private sector through incentives such as the Clean Car Discount, and disincentives to purchase new internal combustion engine (ICE) vehicles.

Regardless of subsidies, global factors mean that the offerings into the NZ market will likely be weighted towards Battery Electric Vehicles (BEV) in the future. In the light passenger vehicle segment, major vehicle manufacturers have committed to have a high proportion of their sales be EV or plug-in hybrid.

The forecast growth of EV charging will increase peak demand and voltage regulation issues on network infrastructure, with initial impacts felt at the LV level. Peak demand will be exacerbated if charging is unmanaged, and current pricing signals continue to be diluted.

Uncontrolled EV charging will require capacity upgrades of upstream network assets to resolve overloaded assets and substandard power quality. The additional network expenditure for new commercial fleet or fast charging stations falls under the Customer Connection category. Upstream and other upgrades for which there is no formal application to the network will be managed under the System Growth category.

6.2.6 Industrial Development and Electrification of Process Heat

With industrial activity expansion, there will be new demand driven by automation, upcoming regulation, carbon pricing, and fuel switching. Examples of this emergent electricity demand are:

- Conversion of existing industrial thermal processes
- Conversion of industrial/primary sector functions.
- Space and water heating previously supplied by gas/wood/coal
- New businesses with load requirements previously not seen in the Waikato e.g. vertical indoor farming

Previous surveys[3] for potential industrial plant conversion have had sparse responses. We are partnering with EECA and Transpower to undertake a new study of Waikato industrial customer electrification intentions, to be completed by July 2023.

The latest feedback from industrial customers indicates a conservative pathway to decarbonising their operations, with few confirming plans to change fuel sources. By 2025, any electrification impact will be small, based on the number of known committed projects. We will continue to request and evaluate customer intentions as fuel availability scenarios unfold over the AMP period.

Signalling anticipated increases in network investment from new demand, forecast small to medium heat process electrification has been included at a smoothed average rate, with an allowance for a large factory electrification in the latter years of the AMP.

6.3 Distributed Generation (DG) and other Distributed Energy Resources (DER)

The uptake of de-centralised renewable distributed energy resources embedded within local distribution networks is increasing, including those added to dwellings within the low voltage network. The number of DG connections to the network is growing with the total nameplate capacity of DG connections growing by more than 30% year-on-year.

Recently, there has also been a step increase in enquiries for large-scale connections. We have five DG customers with nameplate capacity of over 10MW seeking to connect to the distribution network over the next few years.

At 1 April 2022, we have over 1800 distributed generation customers, predominantly photovoltaic panels, with close to 10MW of total installed capacity. The graph below illustrates the historical growth of solar connection and capacity.

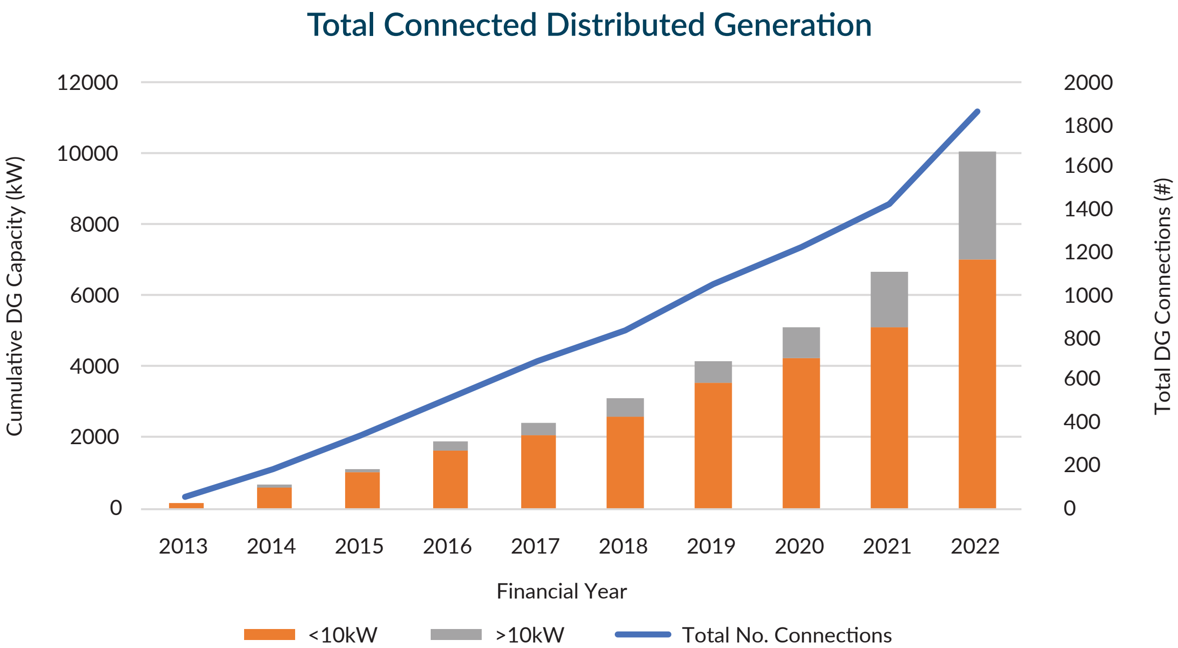


Figure 6.3.1: Total Connected Distribution Generation

Prior conventions of one-way power flow and coarse demand response solutions will be increasingly challenged as consumer choices drive demand and generation profiles. Increasing DER, quantum of individual connections and demand, bring new challenges and opportunities to network planning and system operation for WEL and its existing customers.

3 2013 and 2018 Census. 2011 EECA survey

Challenges include:

- Reverse power flows and associated voltage rise may cause damage to nearby customers' equipment
- Intermittency of generation may increase power quality issues
- Workforce safety, particularly for unlicensed practitioners
- Workforce capability
- Incompatibility with existing network protection coordination
- Complexity and uncertainty of forecasts at the distribution level
- Mismatch of localised demand to generation time profiles can increase network investment to mitigate constraints.

Opportunities include:

- Flexible controllable demand allows better matching to local DG and network capacity to reduce network investment
- Controllable energy storage and generation can offset network capacity constraints and defer investment into wires
- Greater load management
- De-centralised micro-grids diversify supply risks and can increase resiliency to local communities

We are undertaking a range of DER trial projects, to study and understand the future opportunities and impacts. Our guides and standards regarding DG connection can be found on the WEL Website, **www.wel.co.nz/innovation/solar-distributed-generation**

6.4 Demand Forecast

WEL's approach to developing demand forecasts is discussed in this section, including assumptions and the uncertainty involved. All published demand forecasts are based on the Base Case discussed in Section 6.2.

6.4.1 Forecasting Methodology

Forecasting methodology involves several components that are assessed and combined to produce a credible range of estimates of peak demands on various network levels during the AMP period.

6.4.2 Establishing Base Demand

Half-hourly data is measured and collected at zone substations, GXPs and across the network. Multiple years' data is analysed, removing one-off events and abnormal system states. The peaks between zone substations and their respective GXP are generally not coincident, due to diversification in customer energy use. Calibration with weather records is used to establish a baseline demand level for our forecasts.

Smart meter data is used to determine load estimations for distribution transformers which are aggregated up to the 11kV distribution network, enabling load estimates for sections of the distribution network not fitted with telemetered devices. The effect of planned network reconfigurations can then be accurately forecasted.

6.4.3 Forecasting Conventional Residential, Industrial, and Commercial Demand Growth

Changing land use is identified from local authority planning documents, including greenfield and densification of existing areas from local council plans, and new roading infrastructure from roading authorities.

Potential demand scenarios are then formulated based on various indicators, including:

- Customer enquiries and applications
- Discussions with developers
- Census and survey information
- Local and global economic indicators
- Current intensity of demand by land area
- Demand trends

Customer group demand characteristics and future demand scenarios are used to provide fine loading and constraints forecasts.

6.4.4 Forecasting Emergent EV Demand

The uptake rate of battery EVs and plug-in hybrid EVs is based on two independents studies commissioned by WEL in 2021/22. The findings localise the uptake rate and fleet composition to the Waikato and WEL Networks area. This is indexed to local and national fleet statistics, including new sales and used imports.

The energy demand is estimated from local and national statistical estimates of Waikato daily, weekly, seasonal driving distance and speed, indexed to vehicle battery capacity and electrical motor efficiency.

The power demand and load profile impact are tested with a range of probabilistic scenarios for various ranges and combinations of network and charger visibility, acceptance of EV demand flexibility, and various physical charging equipment configurations and a mix of consumer charging behaviour.

We are undertaking technology and customer engagement trials to refine the range of impacts, extend studies to the LV level, guide WEL's innovation efforts and inform its least regrets investment path.

6.4.5 Forecasting Emergent Industrial and Other Electrification Demand

Forecasts of electrification of domestic heating appliances use national and regional census data to gauge the new demand. We are observing developments in other countries and impacts of appliances new to the NZ market.

Forecasts of electrification of industrial processes use various industry surveys and studies[4], along with WEL Group customer enquiries. Collaboration with customers, local and central government, NZ, Australian and international industry groups, form an important part of business intelligence. There is uncertainty due to evolving technology, uncertain economic outlook, and low visibility of customer intentions, as discussed in the following section. To improve our understanding of electrification demand within the Waikato, we are undertaking a joint study with EECA and Transpower, due to be completed by July 2023.

4 Te Mauri Hiko report by Transpower and various other publications

6.4.6 Uncertainty

Forecasts involve a degree of uncertainty particularly over longer periods and where there are changing circumstances or the potential for new activities. In the medium-to-long term, emerging technologies, demand, generation, evolving policy and markets increase the uncertainty of our demand forecasts. Other factors, including short-notice commercial customer applications, result in substantial step changes in demand that are difficult to predict. On the supply and delivery side, there is uncertainty driven by the ongoing economic impact of the COVID pandemic and global conflicts.

Global macro-economic and policy developments to decarbonise the NZ economy indicate electricity usage and loading on distribution networks will increase[5]. There is less certainty around timing, as users' decisions are critical and less well signalled. WEL is continually scanning the local and global markets, developing data analytics, gauging customer intentions, for trends and triggers for development. Various technology/customer uptake scenarios are created to represent the range of possibilities and the most appropriate ones are selected, reviewed and regularly updated.

To manage the network of the future and to understand investment requirements a clear understanding of the LV network is critical, and we are investing in LV visibility and management projects. There are limited mechanisms for network control of these new loads, beyond pricing signals. The potential demand flexibility and responsiveness to price of existing and new loads is highly uncertain as distribution pricing signals can be diluted or exacerbated by retail offerings.

The size and timing of our distribution investment is based on net cost-benefit to customers over the lifecycle of customer demand and network assets. Early investment or large step increments are more efficient overall, due to the asymmetric risk of late or reactive network capacity expansion. Smoothing of network investment ensures that network expansion occurs within finite financial and workforce capacity and overall risks are minimised.

Our development plans and corresponding investments may be amended in subsequent revisions of the AMP reflecting the emerging needs of our customers, stakeholders and changing circumstances on the network. We evolve our planning approach to balance a growing number of priorities.

6.5 Needs Identification

Demand forecast and contingency scenarios for different areas of the network are input into network models to forecast loading on individual assets and identify constraints that may prevent the system from consistently working to transmit electricity.

Potential constraints are:

- Asset's thermal capacity issues
- Quality of Supply (or Power Quality)
- Security issues including other reliability concepts such as availability, durability, resilience
- Legislative and regulatory requirements
- Safety and environmental requirements

6.5.1 Capacity

Equipment thermal capacity is factored into WEL's planning based on the capacity rating stated on the nameplate. The exceptions are power and distribution transformers, and major subtransmission cables and overhead lines where thermal dissipation factors are considered.

5 Boston Consulting Group recently estimated that NZ lines companies will need to spend $46 billion by 2040.

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

Underground cables have a reduced thermal operating envelope and loading needs to be managed to avoid causing thermal runaway or cascading failures.

It is rare for load to increase at a rate which exceeds normal equipment operation conditions. This will be increasingly challenged by the proliferation of intermittent generation, however will be supported by a wider range of demand flexibility profiles.

6.5.2 Power Quality

Power quality describes the stability and conformity of the power supply in terms of voltage magnitude, frequency, and waveform required for the safe, and continuous operation of network and customer electrical equipment. Power quality issues include transient disturbances, harmonics, steady-state deviations, and equipment compatibility.

As an electricity distribution business we are required to comply with NZ regulations. The evolving topology of distribution networks, nature, characteristics and profiles of loads and DER means that power quality may need increased monitoring than has historically occurred.

We monitor power quality at various points in the distribution network:

- Grid Exit Points (GXP) through installed monitoring devices, as well as market information
- Selected zone substations
- Selected 11kV feeders
- Selected distribution transformers
- At the customer end through the smart meter (predominantly residential customers)

WEL is planning to improve the accuracy of power quality monitoring by increasing the number of monitoring devices and proportion of the network being monitored (see Section 6.7).

6.5.3 Security of Supply

The security of supply standard sets the high-level guidelines for achieving a reliable and resilient network. The security level determines the ability of the network to maintain supply following the failure of an asset. WEL's security standards are specified to achieve our performance objectives, and the reliability performance sought by customers and stakeholders. The security of supply standard is one of the criteria thresholds by which forecast gaps are identified and categorised.

The security of supply standard is based on economic mitigation of probabilistic risks. This includes current valuation of economic loss to the community in the event of interruption to supply. As use of electricity is expanded to more private consumer and commercial applications, customer value of reliability and system availability will increase, requiring security of supply standards to evolve.

The security criteria currently used are set out 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	>5000	N-1	Maintain 100% of PCD[1]	100% restored within one hour
10 to 25 MVA CBD zone and switching substations	>2000	N-1	Maintain 100% of PCD	Majority restored within two hours, 100% in repair time
10 to 25 MVA Large urban zone substations	>5000	N-1	Maintain 100% of PCD	Within three hours restore 90%, repair time 100%
5 to 10 MVA Medium urban zone substations	>2000	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	>1000	N	Within 15 minutes restore 50%, within three hours 90%, repair time 100%	Restore 100% in repair time

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

Table 6.5.3.1: WEL's Security of Supply Standards – Sub transmission

Range of Post Contingent Demand (PCD) MVA	Customer Impact	Security Level	Time to Restore after 1st interruption	Time to Restore after 2nd interruption
2.5 to 5 MVA Urban interconnected feeders	>1000	N	Within 15 minutes restore 50%, within three hours 90%, repair time 100%	Restore 100% in repair time
1 to 2.5 MVA Urban & 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, LV[2]	<300	N	Restore 100% in repair time	Restore 100% in repair time

[2]Full load back feeds are not provided as standard for LV circuits. Where practicable LV interconnections may be available between transformers in urban areas. New ground mounted transformers may include facilities to connect emergency LV generation where space permits.

Table 6.5.3.2: WEL's Security of Supply Standards – Distribution

"N-1" means the ability for the network to maintain supply to downstream customers in the event of an outage to a single component, e.g. transmission line, cable, transformer or generator without interruption.

Transfer capacity of the adjacent distribution or subtransmission network to receive transfer of load from the subject substation is considered in the evaluation of constraints during contingency events.

6.5.4 Resilience

With global decarbonisation plans, a heavier reliance on electricity will be required. This comes at a time when the probability of significant events such as natural disasters, cyber-attack and pandemic is increasing. Recent events in NZ have evidenced the need for distribution networks to be more resilient.

As a lifeline utility, the Civil Defence Emergency Management (CDEM) Act 2002, requires WEL to be able to function to the fullest possible extent during and after an emergency, even though this may be at a reduced capacity. To align with industry practice, we will conduct an assessment against the framework in the EEA Resilience Guide 2022. This describes NZ EDBs' optimal approach to hazard management using the four areas of activity known as the 4Rs (Reduction, Readiness, Response and Recovery). These activities are interrelated and together form a continuous improvement process as shown in the Figure below. Utilising this process greatly contributes to the overall level of resilience that a Lifeline Utility can achieve both in preparation for and in response to a major event.

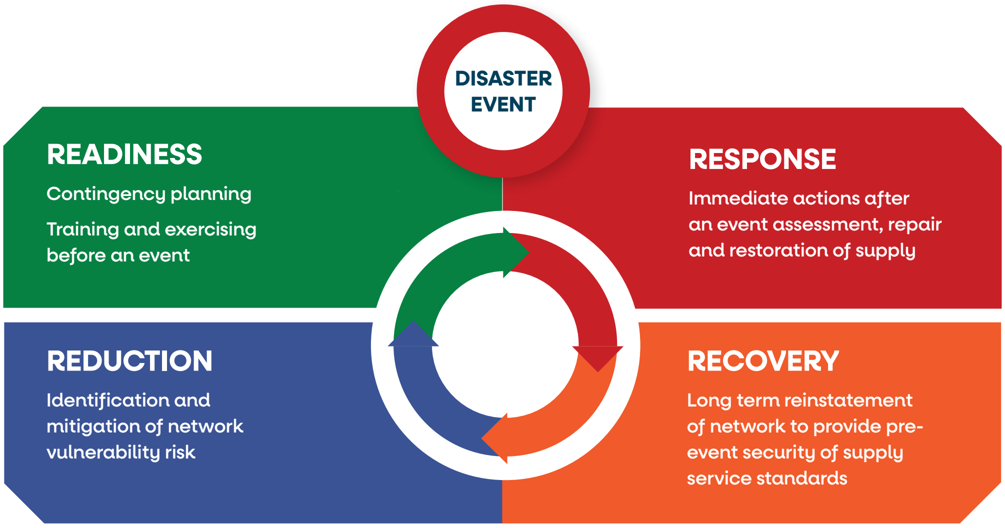


Figure 6.5.4.1 DR 4R's Actions

As a mature lifeline utility we have well developed plans in place for storm, cyber, earthquake and pandemic contingency. WEL holds a supply of emergency spares, mutual aid support relationships with other North Island EDBs and support arrangements with network service partners. WEL ensures new and replacement assets consider and mitigate resiliency risks.

We are also an active member of the International Community for Local Smart Grids (ICLSG), this group of electricity distributors, under the guidance of Oxford University, has a workstream drawing on international experience to further network resilience. This ensures WEL is aligned to the best of international thinking.

Significant resilience improvements planned for the next 10 years are shown in the following table.

	Existing Processes	Planned within the AMP	Under Review for future planning periods
Readiness	▶ Contingency Plans to determine the offloading of circuits should equipment failure occur ▶ Dedicated response room and offsite disaster recovery site ▶ Major Incident policies and procedures - that detail the roles, responsibilities and tasks undertaken during a major event ▶ Documented pre-event preparation meetings ▶ Major event exercises ▶ Post storm reviews ▶ Communication plans ▶ Staff trained in CIMS ▶ Cyber security systems and reviews ▶ LiDAR surveys of the network to identify high risk lines ▶ Trunk radio and satellite phones ▶ Additional network control capability (staffing)	▶ Ongoing event exercises ▶ Continuous improvement of contingency plans ▶ Ongoing and refresher training in event management (CIMS)	Assessment against EEA Resilience Guide 2022
Response	▶ Outage Management System ▶ Relationships with other EDBs and service providers ▶ Priority access to aerial support	▶ Two tier one contractors onboarded ▶ DSO implementation ▶ Improved outage maps ▶ Improved outage management tools ▶ Cyber security ▶ Automated Under Frequency Load Shedding – system upgrade	
Recovery	▶ Critical storm spares holding - this includes materials to construct a 4km 33kV line including a river crossing, and other items critical to ensuring the resilience of the network during the recovery phase ▶ Fault stock holding - a minimum reorder level that ensures we maintain adequate stock of regularly used equipment to manage storm events ▶ DR site which provides backup control room and redundancy of equipment		
Reduction	▶ Substation and substation seismic upgrades ▶ Network security standard ▶ Line spacers ▶ Strategic tree pruning by dedicated vegetation management team ▶ Pole tilt rectification	▶ Huntly area resilience projects to address potential liquefaction issues ▶ Raglan and Te Uku area resilience ▶ Seismic upgrade of substations ▶ Network reliability projects ▶ Security of supply projects (including a GXP review)	Study has been undertaken to understand the impacts of climate change- this has highlighted areas within the Huntly region that require detailed investigation and planning

Table 6.5.4.2: Resilience Improvements

The balance between additional resilience and adding cost must be considered as this may entail a change in overall service being provided to customers. WEL wants feedback on this balance from our stakeholders to ensure we continue to provide the service at a cost that customers are comfortable with.

6.5.5 Sustainability

Sustainability regarding energy supply speaks to compatibility with human health, the environment, risk and continuance. In the electricity industry, sustainable energy use calls for transition to a system that allows homes, communities, and businesses to access and utilise the most reliable and least polluting forms of energy. We are positioned to support our customers to achieve their de-carbonisation and sustainability goals through connection to local renewable energy, and electrification of existing non- renewable energy consumption. We will deliver our energy transition through economic investment in electricity distribution capacity, reliability, and operational capability, so customers may generate renewable energy and flex distributed energy resources.

Services from WEL Group subsidiaries offer customers opportunities to improve their sustainability through deployment of EV chargers, solar connection, Battery Energy Storage Systems (BESS) and other DERs.

WEL has invested in improving the direct sustainability of its operations through:

- Solar, generation, and BESS at WEL's Maui St Office Depot and DR site
- Electric and hybrid corporate vehicles
- Electric EWP truck and other diesel consumption reduction efforts

6.5.6 Affordability

In the context of this AMP, affordability is the measure of consumers' ability to access the energy they require to meet basic household needs and maintain a reasonable standard of living.

As a network owner, the main way we can improve affordability is by reducing our long-term cost-to-serve. As a monopoly operating in a regulated environment, we take a long-term approach to cost recovery. Investments made now will be recovered over many decades. The least-regrets ways of achieving this is to increase utilisation of our network's existing capacity. Shifting even small amounts of load into times of the day when the network has spare capacity may allow us to delay, or even entirely forgo, costly network reinforcement projects.

To enable us to deliver the long-term best outcomes for our customers, all of the projects and initiatives we have outlined throughout this plan are evaluated against their ability to increase network utilisation and/or decrease our long-term cost-to-serve. Increasing network utilisation can be achieved in one of two primary ways, the first is to implement solutions which allow us to manage network utilisation, the second is encourage load to be shifted with cost- reflective pricing.

Two of the key solutions which will allow us to better manage network utilisation are:

- Greater procurement of demand response
- Integration of flexible DER into our network management toolkit

Our approaches to procurement of demand response and integration of flexible DER are discussed further in Section 6.6 and 6.7.

The other way we can support affordability is to set equitable and cost-reflective pricing for distribution lines services. As many of our input costs are fixed or fixed-like (that is, they don't change with usage), we have embarked on a journey towards recovering more of our costs from fixed or fixed-like charges. This approach supports affordability as customers will no longer incur charges that increase with usage at times when the network is not constrained. However, periods of high network congestion could be signalled with a limited peak demand price to encourage load to be shifted into alternative periods where there is ample capacity. In doing so, this methodology promotes better utilisation of network capacity, which as already highlighted, reduces our long-term cost-to-serve.

More information can be found regarding our approach to network pricing, including how it aligns with the guidance published by the Electricity Authority, in our Pricing Methodology disclosure, available at **www.wel.co.nz/about- us/regulatory-disclosures/pricing/**

6.6 Solution Options

6.6.1 Conventional Solutions

Conventional solutions involve providing:

- Additional capacity through upgraded or new lines, cables, transformers, and switchgear to service the increasing level and value of load
- Greater security and reliability through back-feed connections and capacity for transferrable load
- Price settings to incentivise efficient use of the network and recover costs for upgrades
- Curtailing peak demand to provide the security of supply required through load management systems

Sections of the network can be offloaded to neighbouring zone substations and feeders providing alternate supply in a fault scenario. Offloading can also be used to mitigate short term planning risk by providing additional capacity. If the neighbouring zone substation or feeder is lightly loaded it may be used to reduce capital investment.

With the use of electricity for transportation and process heat, and the shift to working from home, customer expectation is likely to require N-1 security closer to the point of connection, for increased security and reliability. Practical implementation may result in a greater density of high and medium voltage transformers, shortening length of distribution and LV feeders providing improved power quality, increased distribution security and reliability.

6.6.2 Emergent Non-Wire (Non-Network) Solutions

Technological developments and changing policies and regulations (global and national) create new opportunities for reliable, cost-effective, and sustainable distribution of electricity.

New developments include:

- Distributed Energy Resources (DER) have seen improvements in cost effectiveness, scale, and controllability, including developments in:
    - Energy storage deployed by the network at neighbourhood and street level
    - Customer owned electrical and thermal energy storage systems and potential offerings into future markets
    - Electric vehicle storage, demand flexibility, and potential re-injection into the network (V2G)
    - Dispatchable and non-dispatchable distributed generation contracted from future markets
- Demand flexibility services in conjunction with DERs allow:
    - Localised demand side response solutions resulting in greater flexibility to respond to supply disruptions
    - Matching of load to non-dispatchable generation profiles to maximise local renewable energy utilisation
    - Flexibility in real and reactive power offering more cost effective and stable power quality management compared to current technology
    - Capital investment deferral through contracted third-party DER and load side management
- Cost effective network metering and power quality devices allowing:
    - Greater visibility of the LV network
    - Customer demand data that can be transformed into operational and planning insights
    - Pricing and incentivisation to reflect distribution level constraints
    - Granular forecasting of demand, distributed energy resources, and generation
    - Near-real time detection and reporting of abnormal system conditions, faults
    - Prediction of certain incipient faults

Non-wire solutions[6] can apply as deferral or full alternative to supply increases in electricity demand with additional conventional solutions.

We are investigating emergent non-wire alternatives and impacts on the network and customers, investing in systems capability. This allows emergent solutions to be deployed, integrated, and operated, when they prove to offer cost-effective alternatives to conventional solutions. We are developing critical end systems to tender for and evaluate third party non-wire solutions.

Section 6.7 provides an overview of our preparation to become a Distributed System Operator, and to be operationally ready to integrate these non-wire solutions and optimise customers' energy security, sustainability and affordability for the changing landscape.

6.6.3 Selection of Options

Selection of solutions is based on:

- Whole of lifecycle cost and benefit
- Cost efficiency of capacity provided or deferred
- Technical feasibility
- Availability and reliability
- Risks mitigated and risks introduced (technical, safety, financial etc.)
- Ease of integration and inter-operability with network and asset management systems
- Continued long term support
- Relative economic value of the above factors for alternatives

WEL seeks to ensure that local DER (solar/battery) solutions are considered as part of the solution options. The cost-benefit of these emergent solutions is considered against the same economic and technical criteria as conventional solutions e.g. lifecycle cost per 1MW and 1MWh, regardless of form. This is to prevent over investment and pass-through costs of a more expensive solution, or selection of a high-risk endeavour.

We are preparing for emergent solutions to be a pillar of future electricity system security, sustainability, and affordability. Our innovation development path includes improvements to network visibility, and new inter- operability infrastructure and platforms, which will be integrated when they are ready. We continue to trial and test emergent solutions so that optimal economic and technical solutions are deployed for the community.

6.7 Strategic Themes & Innovation Practices

6.7.1 Flexible Open Networks

New Zealand's energy future will be shaped by many factors, most of all by the way our customers use, generate, and manage energy. Electricity distribution networks are the closest interface with the grid for most customers, and where the greatest impact from these changes in customer behaviour will be felt. WEL as an owner and operator of a distribution network, has a responsibility to evolve our operating model and services to adapt to future operating environments and enable customers changing use of the network to service their future energy needs.

6 These are termed as "non-network solutions" in NZ regulations. Also known as "non-wire alternatives" or "non-pole and wire" alternatives. N.B. this is distinct from "non-network assets" and "non-network expenditure", which is expenditure that does not correlate directly to on-ground assets or the systems that allow their operation, but are indirectly required for continued operation of the network. E.g. corporate computer systems and vehicles.

WEL is developing our operating and service model to support the changes in energy flows, data, flexibility, towards an open access model. An open access network will allow existing and new consumers greater and more equitable participation to the distribution network as a vital platform for delivery of energy and capacity to and by consumers. WEL's investments seek to enable this by developing:

- Standards and processes for greater access to connect and operate any compatible equipment[7]
- Operational technology to support distribution level DER and flexible demand

We call this the transition from distribution network owner (DNO) to Distribution System Operator (DSO).

We have published our innovation path in the DSO strategy roadmap, shared with industry at the EEA 2022 conference. This strategy outlines how we are going to integrate the traditional network management practice with an innovative DSO service model.

Highlights of WEL's DSO innovation programme:

- Build DSO systems to enable network and device visibility, operational control and optimisation of both customer and utility owned assets via direct and indirect coordination
- Build DSO processes to enable the advanced planning, engineering, project delivery and operation support
- Build DSO people resource with skills from different disciplines to support the DSO transition
- In FY22 and FY23 we have completed a series of foundation projects so we can embark on our transition journey
- In FY24 our primary focus on the DSO tactical plan and deliverables are implementation of new applications in LV network visibility, adaptive EV charging coordination and BESS integrations at various network hierarchical levels.

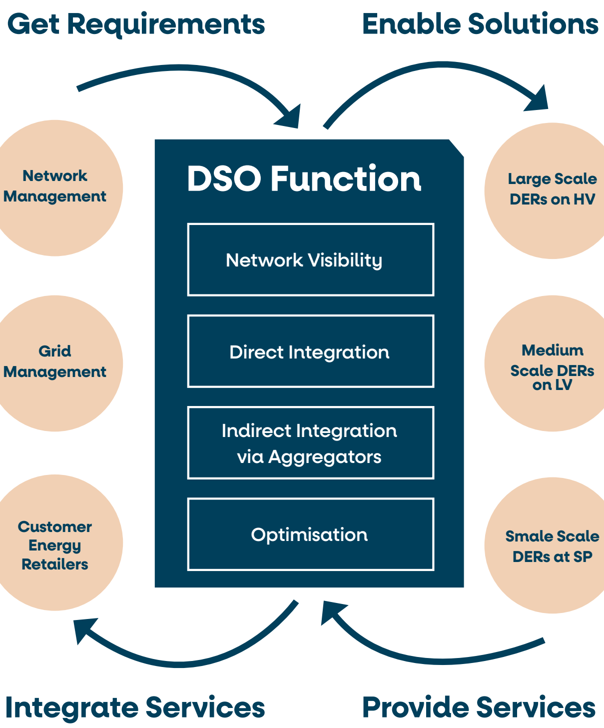


Figure 6.7.1.1: DSO Function

7 With appropriate consideration of cost of access, network operation and system safety and security, standard equipment, standard access arrangements

Ultimately, the network will enable open access transactions so that customers and service providers can connect devices and conduct energy transactions with minimal restrictions. The evolution of open-access networks will follow technological, market, and skills developments, and its final form is yet to be determined. Regardless of its final form, WEL are committed to providing an open-access network, which will be an essential enabler for more renewable distributed generation and demand flexibility, and a sustainable, affordable, reliable, resilient energy future.

The challenge of transitioning to an open-access network cannot be underestimated. This evolution will require considerable effort and investment to provide the required visibility, controllability, flexibility, stability, and accessibility of all parts of the network. WEL has achieved great progress towards an open- access network, however, many factors could accelerate uptake rates, and if this occurs, we will need to amend our anticipated timeframes and future AMPs.

6.7.2 LV Visibility, Data Analytics and Load Profiles

A foundational element of enabling flexible networks and non-wire solutions is statistical and time-based information on load and generation profiles at all levels of the network. To increase the resolution of information, WEL is investing in network monitoring equipment at the LV level.

Data analytics are applied to the load and power quality information from smart meter and Power Quality (PQ) analysers to create statistical demand profiles for each customer group. This establishes a baseline for current customer behaviour, used to locate potential flexible demand, and for increasing the certainty of large customer connection requests.

Information from smart meters and PQ analysers upstream of groups of customers (e.g. at distribution transformers) is used to validate finer customer load profiles and estimate load profiles for customers on parts of the network without meters.

WEL is developing phase 1 of this DSO roadmap (visibility) using smart meters. The smart meters enable innovative practices and are already used to manage 12 issue types across the LV network including broken neutral connections. This visibility has enabled further innovation in trials for DER interfacing and DERMS.

Examples are detailed below:

Application area 1 – Coordinated voltage profile study

This study was designed to investigate using voltage data to plot aggregated distribution transformer level voltage to support a voltage compliance study at both distribution transformer and ICP levels. Non-compliance locations are further investigated by assessing the individual ICP level profile, loading data, phase imbalance, etc.

The Compliance study was extended to consider all distribution transformers under the same HV feeder and zone substation power transformer so that end-to-end coordination can be delivered. These are ranked and assessed to upgrade using the budget detailed in section 6.10.1.

Application area 2 – Loop impedance / high neutral impedance detection and study

Supply quality data and voltage events are used for the ICP connection high loop impedance study. The WEL approach is considering both voltage patterns and calculated impedance pattens to detect potential connection issues, the result is compared against upstream level connection levels, e.g. LV circuit and distribution level to narrow down potential fault locations. This is actively monitored and when a defect is detected a fault technician is dispatched to repair this issue. Once complete the results are analysis to confirm the correction of the issue. WEL is working on automation of the process.

Information from surveys, census, local and global macro trends, engagement with various territorial authorities, industry groups, and customers is used to gauge the scope, potential, and rate of new technology development and consequent emergent demand and solution adoption.

Engineering analytics are then applied in combination with load profiles to estimate potential impact of emergent demand on all levels of the network.

6.7.3 Distributed Energy Resource Investigations

WEL's investment in DER increases the flexibility and cost effectiveness of providing network capacity, ensuring value for consumers, and opportunities for communities. We are investigating and testing DER and supporting technologies to understand capabilities, impacts and influence on the network through participation in practical trials.

A grid-tied microgrid has been built, including solar PV generation, battery energy storage, diesel generation and integrated control system. Stand-alone BESS trials are planned for different levels of the network, including subtransmission, distribution, LV, domestic or "behind-the-meter".

WEL is engaging with large industrial customers to ascertain their interruptible load and other demand flexibility, then developing programmes to maximise value for these customers and the network. These trials provide data on operating several DERs together and the impact on the network. The findings provide insight for future capital investment into the traditional network to provide customers with sustainable and low-cost options to meet their energy requirements.

Key performance indicators include:

- Lifecycle cost for capacity
- Technical feasibility, including physical power and energy density
- Ease of deployment and integration with network systems
- Public and workforce safety
- Flexibility
- Risk factors and share or diversification of risk in relation to central source solutions

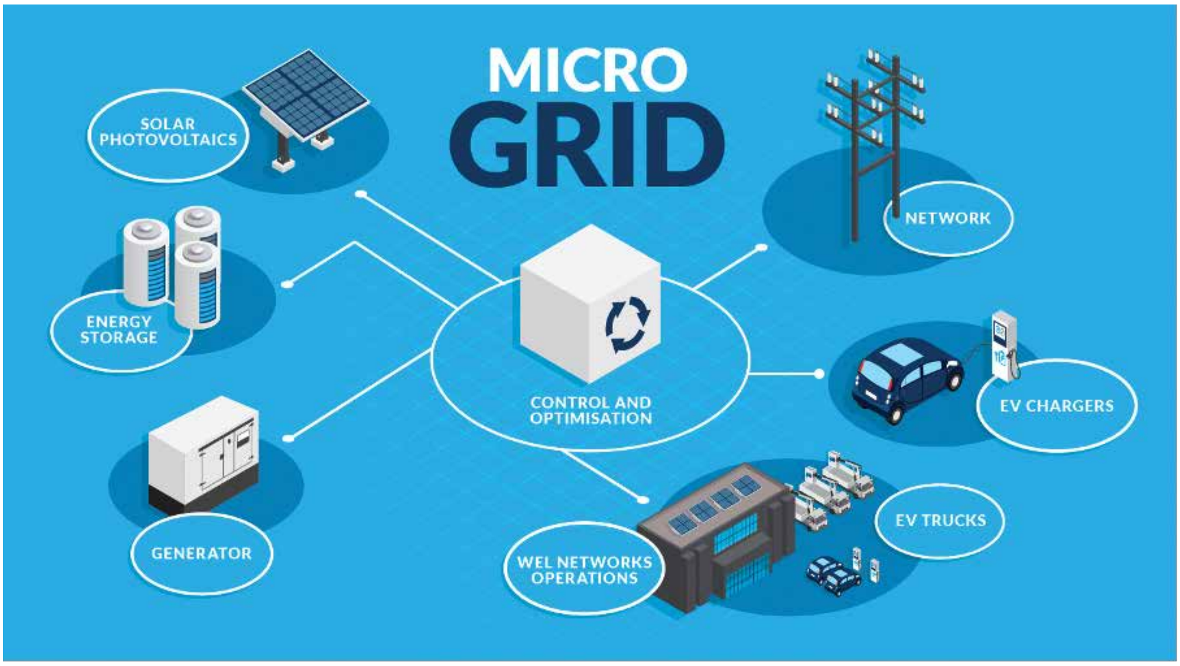


Figure 6.7.3.1: Distributed Energy Resource Micro-Grid

6.7.4 Electric Vehicles and Charging Management

Through We.EV, we have established a network of public chargers throughout the Waikato to support EVs in the community and understand the impact of different deployment of EVs and public/commercial chargers.

Sites that have been established include:

- 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

We initiated a trial home charger engagement management programme that interfaces customer chargers to an automated device management platform. It allows us to understand customer needs on domestic EV charging and provides the ability to accommodate more charging flexibility without triggering upstream asset replacement.

We are investigating the impacts of vehicle-to-grid power injection technology and are continuing to observe global macro and technological trends for potential uptake in New Zealand.

WEL are partnering with local businesses to install EV charging stations at multiple sites across the region.

6.8 Consumer Connections

6.8.1 Context

Over the past three years we have seen the number of building consents increase at a significant rate. The number of new dwellings consented in the year ended June 2022 was up 9.4% in the Waikato[8]. WEL's customer-initiated work schedule has grown significantly in-line with NZ and regional economic growth. In the last financial year, we produced over 1,000 quotes for potential new load on the network.

Modelling suggests that consents will decline through FY24 and continue to through FY25. An MBIE report released in August 2022 forecasts national residential building consents may slip 33% over the coming years. The Building Research Association (BRANZ) sees the value of residential activity falling 5% to $29b this year and continuing its slide into 2026 and possibly longer. This decline is driven by unfavourable global economic conditions, increasing interest rates, and supply chain constraints. Infometrics data indicates that it is taking longer to build residential buildings.

The Waikato won't feel the full force of this decline due to underlying net growth in the Waikato population (expected to grow at 1% per annum up to mid-2040, the fastest of all NZ regions). Hamilton City Council (HCC) predictions suggest that residential consenting is expected to drop off in 2023 representing a decline of about 20% and short-term forecasts indicate reduced activity on customer driven projects. However, the HCC data suggests a faster recovery with 2% GDP growth predicted from 2023 and beyond with building consents recovering in FY25. Within two years they forecast a return to 2023 levels.

8 Statistics NZ

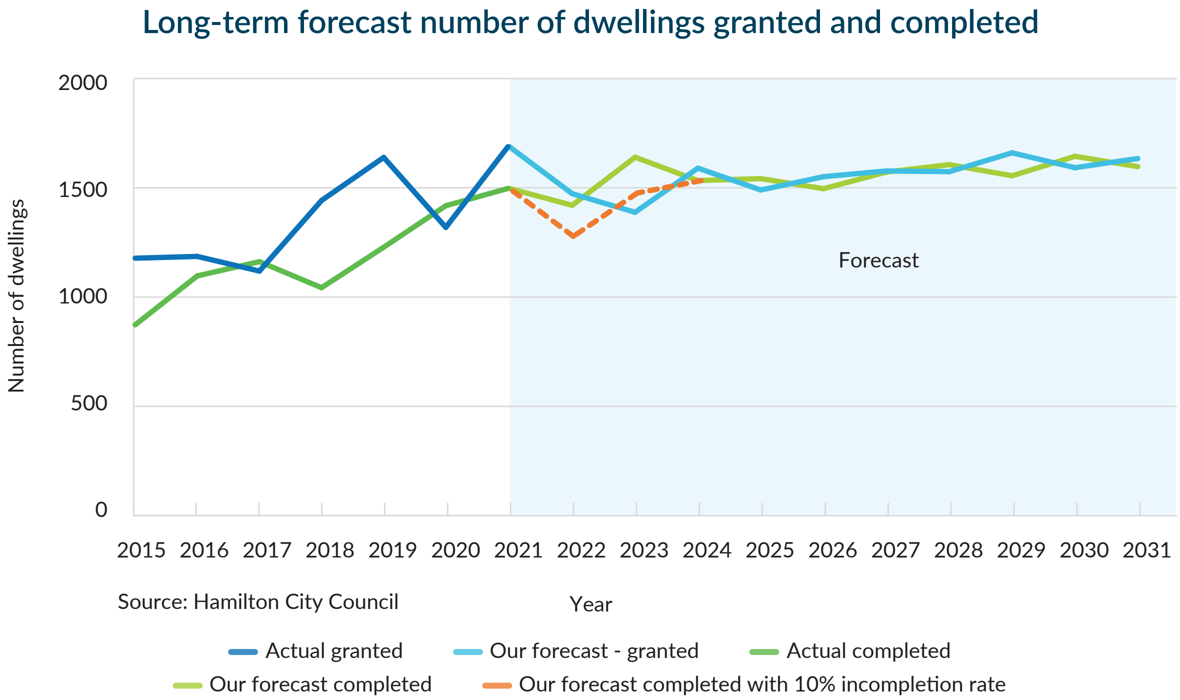


Figure 6.8.1.1 Hamilton City Dwelling Forecasts

6.8.2 Approach

WEL's base case forecast of customer connections, includes that NZ will enter a recession in FY24. This may result in a reduction in new connections in FY24 and through FY25. The impact of the global financial crisis (GFC) in 2008 was a 50% reduction in new connections in 2009, with connections slowly building back up to normal over a four year period. Current indicators are that this recession will be for a shorter duration.

Further signs of an upcoming recession are the economic impacts of monetary policy with the RBNZ increasing the official cash rate (OCR) to reduce spending to ease inflation.

The impacts of Cyclone Gabrielle and the January 2023 floods mean further increases to the OCR are likely. We have forecast that uptake of EVs will slow for the next two years due to the impacts of recession and inflation on disposable incomes. We will monitor economic conditions and reforecast spending as appropriate in future AMPs.

The following table summarises CIW projects across several different connection types.

Project / Programme	Investment Need	Estimated cost ($'000)
New Connections, subdivisions and upgrades	Network existing capacity is compromised with the additional demand	$196M

Table 6.8.2.1: CIW Total Expenditure (excluding relocations)

6.8.3 Customer Initiated Works Schedule

Customer Initiated Works ($'000's)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Non Std Connections	2,157	2,160	2,091	2,149	2,246	2,257	2,382	2,514	2,564	2,625
New Connections <110kVA	2,881	2,797	2,813	2,719	2,847	2,891	2,915	2,966	3,089	3,229
New Connections >110kVA	3,117	3,130	3,004	3,125	3,346	3,431	3,484	3,636	3,754	3,879
Upgrade Existing Small	457	430	442	458	475	500	539	554	570	641
Upgrade Existing Large	1,739	1,776	1,783	1,744	1,898	1,982	2,102	2,161	2,235	2,349
Subdivisions	5,868	6,013	6,242	6,108	6,161	6,314	6,551	6,941	7,236	7,639
Network Upgrade due DG Applications	26	22	25	26	27	28	29	30	31	32
EV & Process Electrification	338	453	678	1,017	1,129	2,358	2,914	3,352	3,798	3,792
Total	16,582	16,781	17,077	17,346	18,129	19,760	20,916	22,156	23,277	24,185

Table 6.8.3.1: Customer Initiated Works projected capital expenditure (excluding relocations)

6.9 System Growth

6.9.1 Overview

Residential Growth

The Hamilton urban area hosts a significant portion of residential customers and residential growth within our network. HCC forecast the number of dwellings consented and completed within the Hamilton territorial boundary to fall from the 2019 and 2021 record highs to just below 1500 for the next two years, before settling within a narrower range around the 1500 dwellings per annum level. The number of new homes under construction is falling just as the pandemic induced material shortages and supply chain issues improve.

Infill residential densification has comprised >60% of residential growth, with a longer lag in consent-to-completion rate compared to greenfield subdivisions. Our base case projections include a conservative 800-1000 dwellings growth per annum for the initial two years of the AMP period, with a recovery to 1400-1500 dwellings growth per annum across the whole network. We align our network investments to support the growth strategies of the Hamilton City Council, Waipa District Council, and Waikato District Council.

Commercial and Industrial Growth

Industrial consenting has been particularly strong in the Ruakura area, in and around the new Inland Port, and in the Burbush, Pukete, Te Rapa areas in the North-West of Hamilton.

The base case includes industrial customers with committed connection contracts in the short-medium term projections. In the longer term, the historic average growth rate is used, noting that recent connection capacity requests from larger customers have grown in size. Forecasts in this area are guided by council land zoning and commercial readiness and availability, and customer connection applications.

EV & Process Electrification

EV uptake in the Waikato has been growing, driven by volatile oil prices, favourable subsidies and lending. Figure 6.9.1.1 shows the recent growth in number of EVs within the network area. As of December 2022, the number of EVs comprise 1% of the total number of vehicles domiciled within WEL's network service area. Projections are informed by two commissioned studies, calibrated to regional statistics.

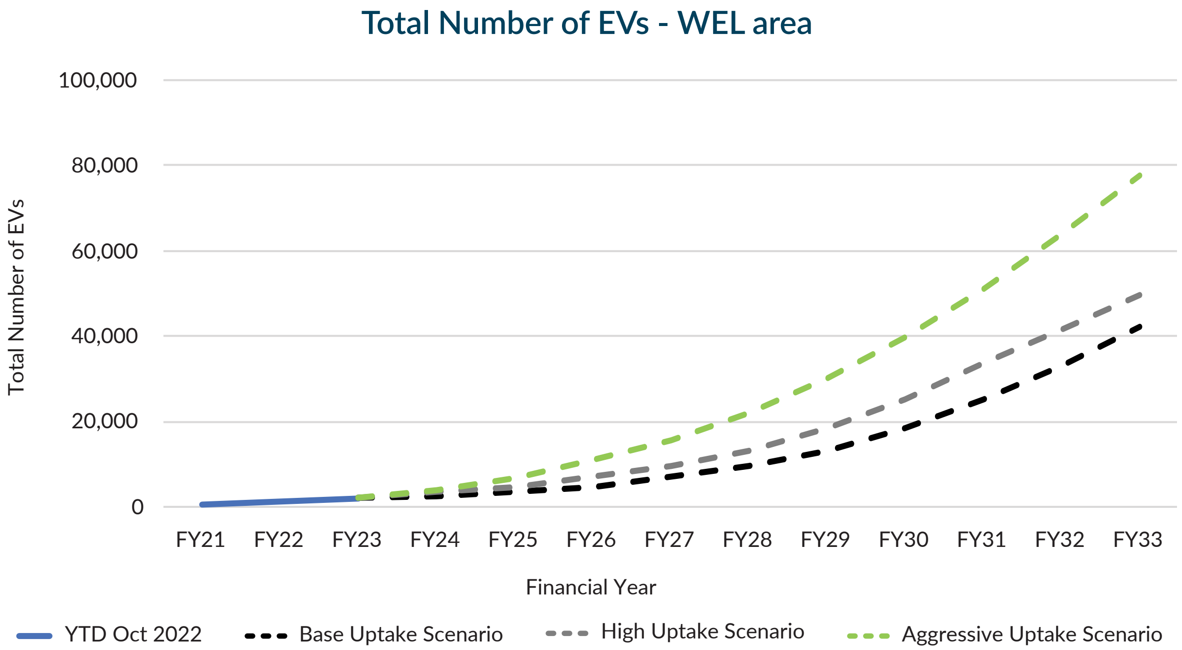


Figure 6.9.1.1: Estimated Number EVs - WEL area[9]

9 Historical statistics from Waka Kotahi regional https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/sheet/monthly-mv-fleet

The base case includes an economic recession induced slowdown in EV uptake due to lower disposable income and less favourable financing conditions.

Supplying emergent demand from EV and industrial process electrification requires provisions for likely demand scenarios. This must be developed before specific timing, location, types of demand and flexibility is firmed up. The provision has been allocated to each region based on current demand and probability of uptake. This will need to be reviewed annually and forecasts adjusted. WEL's approach to forecasting emergent demand is outlined in Section 6.4

Emergent demand at the residential and small commercial scale will likely occur behind the meter without notification to WEL. This new electrical usage behaviour can add significant peak demand (depending on availability and acceptance of load control and responsiveness to pricing signals). Within the AMP period, it is anticipated loading on some WEL network assets will increase beyond their voltage and thermal ratings.

The EV and Process Electrification capital expenditure forecast is significant across the 10 years at $54M. The increased load has been added to the load forecasts and resulting 33kV, zone sub and main 11kV feeder constraints and mitigations have been included in the system growth category.

This forecast of $54M includes 400V network upgrades, distribution transformer upgrades and tactical 11kV upgrades.

We use smart meter data to identify areas for investment. An example is an analysis of transformer loading showing that 10% of the fleet may need to be upgraded or managed within 10 years, refer to Figure 6.9.1.2.

The $54M provision was estimated using high level modelling and includes the following solutions:

- Replacing existing transformers with larger units to address transformer loading issues
- Additional transformers to address transformer loading issues, and LV loading or voltage issues
- LV conductor upgrades
- Voltage regulators to address localized voltage issues
- Tactical 11kV network upgrades or extensions

Non-network options may be part of the solution and are discussed in Emergent Non-Wire Solutions Section 6.6.2

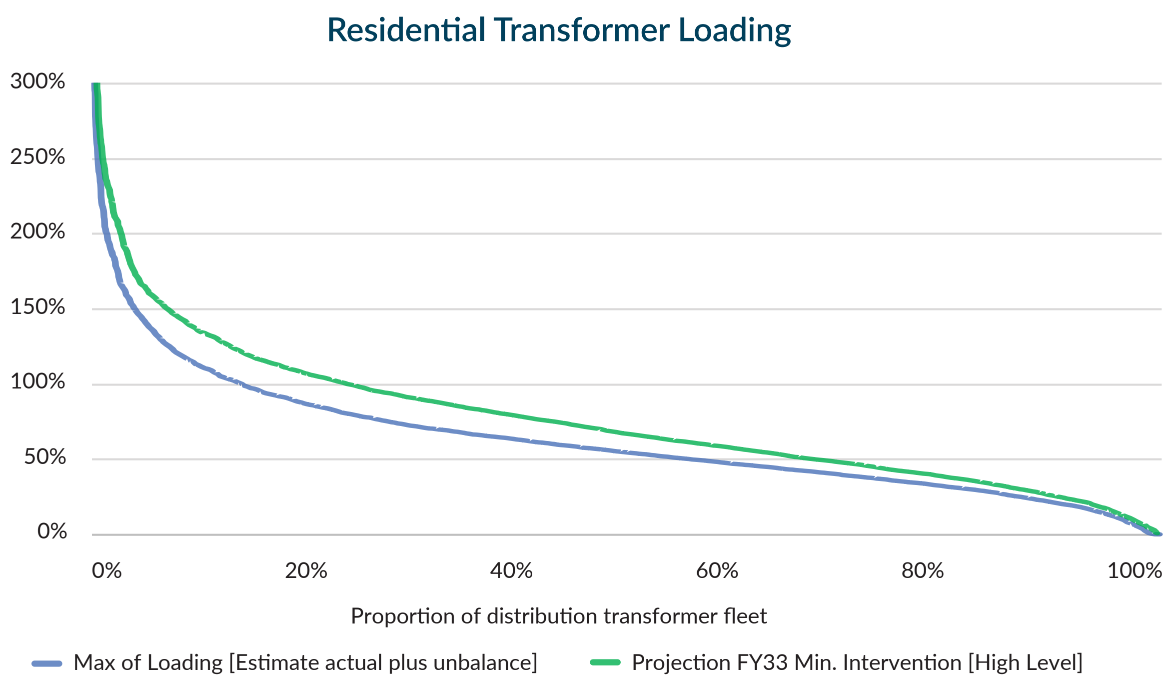


Figure 6.9.1.2: Peak distribution transformer loading (Winter 2022) and FY33 projected loading

Figure 6.9.1.2 shows that a small number of transformers are exceeding their overload rating. However, by FY33 up to 10% may exceed their overload rating at times. The peak loading at most sites occurs in winter when cyclic loadings are higher and able to sustain this load[10]. We routinely analyse transformers with high loading to ensure these are within cyclic limits and to develop controls as the loading increases in the future across the fleet.

Due to uncertainty in demand, we will maintain a flexible approach to managing transformer loads, monitoring and investing in the network where required.

The growth in each of the Hamilton, Te Kowhai, and Huntly network areas is detailed in the following sections, separated by the individual Grid Exit Point (GXP) that supplies each area. Forecast demand on each GXP is for WEL's contribution only and does not include any third-party demand on the same GXP.

6.9.2 Hamilton Area Network Development Plan

The Hamilton area network supplies most of the area within the Hamilton city boundary, excluding the west and north-west of the city, the Puketaha Matangi areas east of the city, and parts of the Ngahinapouri area south and Rukuhia and Hamilton Airport south-east of the city boundary (under Waipa District Council jurisdiction).

The area is predominantly residential, with substantial greenfield developments as outlined in the HCC Structure Plans for Rototuna, Ruakura, Peacockes, and Temple View.

Major commercial and industrial areas include the Waikato University, Avalon, Waikato Innovation Park, Hamilton Airport, Frankton, and Waikato Hospital.

Customer distribution as at end of Financial Year 2022

Customer Group	Number of Active ICP	Electricity Delivered (GWh)
Domestic	54,557	368
Non-Domestic	5,481	100
Streetlights and Unmetered	217	5
Large Commercial	416	261

Table 6.9.2.1: Hamilton Network Customer Breakdown

10 The transformer overload rating factors from IEC 60076-7 are used for planning purposes. Emergency ratings are based on ambient temperatures, other cooling factors, and load profile.

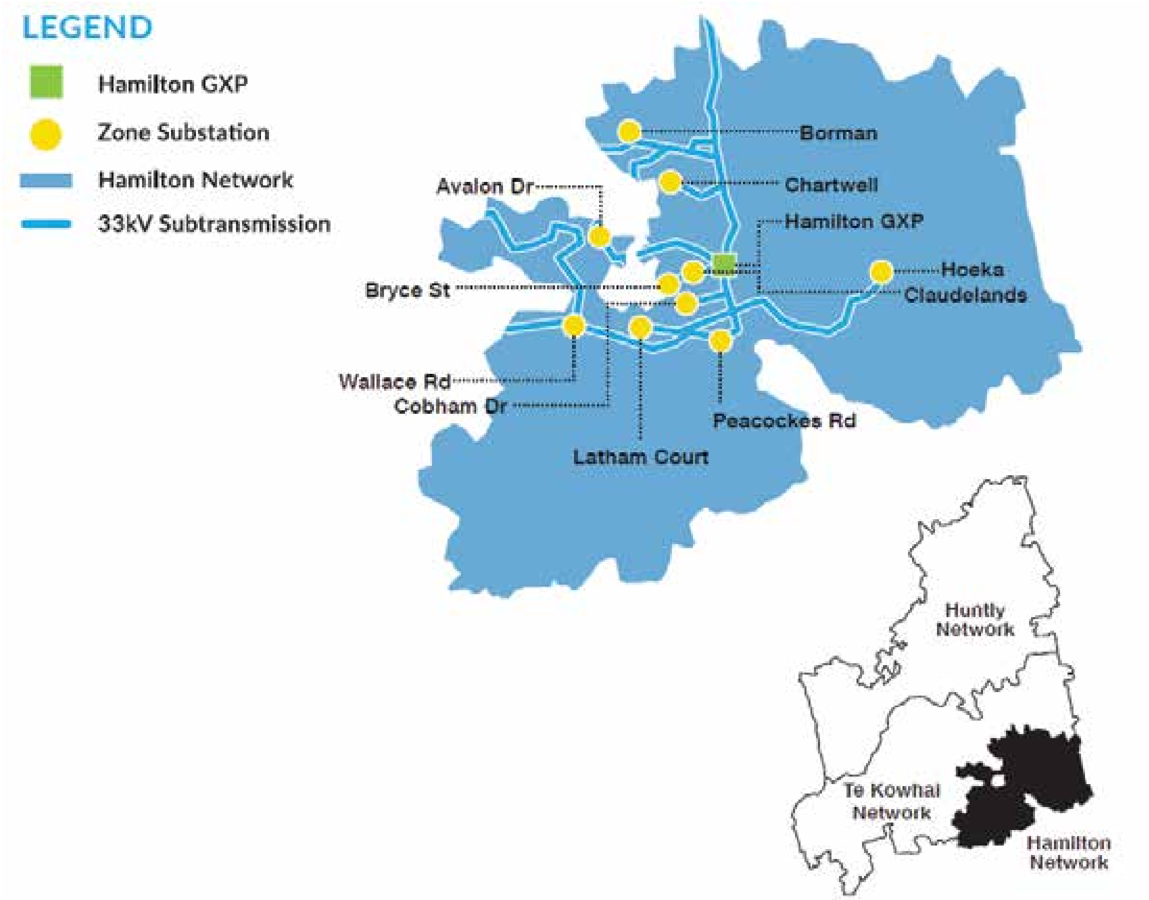


Figure 6.9.2.2: Hamilton Network Area

Hamilton Area Growth

Residential growth forecasts are based on HCC Plans, which outline the proposed layout of greenfield development areas, as well as indicating densification cells within existing areas. There are ongoing residential subdivision developments in the Hamilton network area:

- Rototuna Structure Plan area will continue to be supplied from Borman zone substation
- Ruakura Structure Plan (northern portion) will be supplied from Chartwell zone substation, Hamilton 11kV feeders, and the new Crosby zone substation
- Peacockes Structure Plan area will be supplied from Peacockes substation and a new Airport zone substation.
- Temple View greenfield cell is supplied from Wallace zone substation
- Infill densification of urban areas around the central city and Hamilton East will be supplied from a new zone substation in Fairfield, with 11kV feeder reinforcements to existing Bryce, Kent, Cobham and Claudelands substations
- Infill densification of the Hospital, Dinsdale, Nawton urban areas will be supplied from existing Cobham, Peacockes, Latham, Wallace, Avalon zone substations, with transfers to these zone substations and 11kV inter-substation capacity reinforcements to maintain security of supply to these areas

Commercial growth is expected to continue in the CBD with increasing densification. This is primarily supplied by Bryce St Substation.

Industrial growth in the Hamilton network area, is expected from expansion of the Airport industrial zone (see Waipa District Plan).

Increasing densification and forecast installation of EV chargers drives the need for upgrading the 11kV and low voltage distribution network across the region. Commercial fast chargers necessitate the upgrade of 11kV distribution feeders. The impact of EV charging is expected to be primarily felt in residential areas.

The following table outlines the forecast unmitigated growth at substations in the Hamilton area.

GXP	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Constraint ID
Hamilton 110kV / 11kV	HAM11	44	37	38	39	40	40	41	42	42	43	44	101
Hamilton 220kV / 33kV	HAM33	132	132	134	138	141	144	148	153	158	165	174	102

Zone Substations	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Constraint ID
Avalon Dr	AVA	23.8	19.9	20.2	20.4	20.8	21.2	21.7	22.3	23.0	23.9	25.1	104
Borman	BOR	20.6	21.0	21.3	21.6	21.9	22.2	22.7	23.1	23.7	24.5	25.5	105
Bryce St	BRY	22.9	13.8	13.9	14.4	14.6	14.8	15.0	15.2	15.5	15.7	16.1	106
Chartwell	CHA	25.9	19.8	20.0	20.4	20.7	21.1	21.5	22.1	22.7	23.6	24.6	107
Claudelands	CLA	22.9	22.8	23.4	24.2	25.0	25.7	26.6	27.6	28.9	30.6	32.6	108
Cobham	COB	25.9	13.3	13.6	14.0	14.3	14.7	15.1	15.4	15.9	16.4	18.3	109
Latham Court	LAT	22.9	20.0	20.1	20.3	20.4	20.6	20.8	21.1	21.4	21.8	22.3	
Hoeka Rd	HOE	-	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	
Peacockes Rd	PEA	25.9	17.5	18.3	19.6	21.2	22.9	25.1	27.8	31.0	35.1	40.0	110
Wallace Rd	WAL	15.4	12.1	12.3	12.6	12.9	13.2	13.3	13.4	13.5	13.7	13.8	

Table 6.9.2.3: Hamilton Network Zone Substation Demand Forecasts (MVA) – Pre-Intervention Asset Relocation

*Hamilton 33kV and Hamilton 11kV networks are separated by a phase shift of 30° or 90° depending on the adjacent Hamilton 33kV zone substations. This means that WEL cannot easily transfer Hamilton 11kV load to the Hamilton 33kV network, and vice versa.

N-1 Security	= the ability for the substation to maintain supply to downstream customers, in the event of an outage to a single component (see section 6.3.2 Security of Supply)
Transfer capacity	= the capacity of the adjacent distribution network to receive transfer of customers from the subject zone substation
(green)	= forecast load within firm capacity + transfer capacity
(yellow)	= forecast load nearing firm capacity + transfer capacity. Monitor for acceleration in growth or step change.
(red)	= forecast load exceeds firm capacity + transfer capacity. Project or other intervention to be initiated several years before forecast constraint.

The Constraint ID refers to the specific constraint detailed in the prior Table. It also includes constraints on our sub transmission and distribution network that are not detailed in the forecast tables but have been included in the constraints description below.

Forecast year constrained (FY)	Constraint ID	Constraint description
24	111	11kV feeders BORCB3 and BORCB5 exceeds security of supply criteria
24	112	11kV feeder CHACB9 exceeds security of supply criteria
24	114	11kV feeder AVACB1, AVACB4, AVACB6 and AVACB8 exceeds security of supply criteria
24-33	126	Voltage and thermal constraints at LV and 11kV level assets.
25	105	Sub transmission line to Borman substation exceeds security of supply criteria
25	107	Second order constraint. Chartwell substation exceeds security of supply criteria following 11kV load transfers without intervention.
25	108	Claudelands substation exceeds security of supply criteria
25	113	11kV feeder WALCB2 exceeds security of supply criteria
26	122	Second order constraint. 11kV feeder security of supply exceeded due to load growth.
26	115	11kV feeder CLACB16 exceeds security of supply criteria due to load growth from densification of existing residential areas.
27	103	New Kohia Zone Substation security of supply criteria with single transformer.
27	109	Second order constraint. Cobham substation exceeds security of supply criteria following 11kV load transfers without intervention.
27	116	11kV feeder CHACB12 exceeds security of supply criteria
28	102	Hamilton 33kV GXP exceeds security of supply criteria
28	117	11kV feeder WALCB6 exceeds power quality voltage limits due to load growth
28	118	11kV feeder BORCB4 exceeds security of supply criteria due to load growth
29	106	Bryce St substation exceeds security of supply criteria
29	119	11kV feeder PEACB18 exceeds security of supply criteria due to load growth
30	110	Peacockes substation exceeds security of supply criteria
30	120	11kV feeder HAMCB2762 exceeds security of supply criteria due to load growth
30-33	123	Security of supply and back-feed capability for resilience. The exact location and timing of this constraint will be updated.
31	101	Hamilton 11kV GXP exceeds security of supply criteria
31	104	Avalon Dr substation exceeds security of supply criteria
31	121	WALCB4 exceeds security of supply criteria due to load growth and transfers from adjacent substations.
33	124	Future feeder reinforcement for maintaining security of supply and managing thermal constraints. The exact location and timing of this constraint will be updated.

Table 6.9.2.4: Hamilton Network Forecast Constraints Description

Change from 2022 AMP

In the 2022 AMP update, we included projects to increase sub transmission capacity between the Hamilton and Te Kowhai 33kV networks to alleviate the Hamilton 33kV GXP security of supply constraint. Several developments have occurred between the publication of the 2022 AMP and this AMP, which materially affect the optimal development path. These are:

- The Ruakura Inland Port and Super Hub no longer being supplied by WEL, as the owners and developers have instead opted for direct connection to Transpower HAM33 GXP from FY25 onwards
- The decommissioning of the Te Rapa co-generation plant (44MW generation) and the full-time electrification of the Fonterra plant (18MW load), reducing available subtransmission capacity to support the permanent transfer of the Avalon and Wallace zone substation loads from HAM33 GXP to TWH33 GXP
- Transpower has indicated new interim capacity upgrade options at HAM33 GXP

To manage the HAM33 GXP security constraint we are engaging with Transpower to explore interim GXP capacity upgrade options. The projects to reinforce and reconfigure the subtransmission network to transfer load between GXPs have been deferred until HAM33 GXP interim options are economically exhausted and load that was to be transferred under the previous plan has been retained on HAM33 GXP. During a contingency event, we do have capacity to transfer the load at HAM GXP to Te Kowhai GXP.

Hamilton Area Development Projects

The following table summarises the Hamilton network system growth projected investment and outlines how each addresses the above constraints.

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24	Peacockes spare cable ducts	110	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 construction of new roads (✓) Dig up roadside to install ducts when cables are installed Install grid scale battery Do nothing	544
24	Wallace Protection Upgrade	102	Protection speed Upgrade & margin for increased load growth and security of supply	Upgrade 33kV protection (✓) Do nothing	83
24	Distribution Network Reinforcement - Reconfiguration of Borman Feeder, BORCB3	111	Security of supply	Reconfigure 11kV feeders to balance customer numbers (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV from Borman substation Do nothing	521
24	Distribution Network Reinforcement - New Borman Feeder	111	High Customer Number and load in Rototuna Structure Plan area	New 11kV feeder using existing spare11kV circuit breaker at Borman substation (✓) Do nothing	718

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24	Distribution Network Reinforcement - Reconfiguration of Chartwell feeder, CHACB9	112	Security of supply	Reconfigure 11kV feeder to shift customers to CHACB10 (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder Do nothing	249
25	Borman Rd 33kV Circuit Uprating	105	Continued growth in the Rototuna Structure Plan area	Uprate by re-tensioning 33kV subtransmission line (✓) Install new subtransmission cables Install grid scale battery Do nothing	518
25	Distribution Network Reinforcement - Reconfiguration of Wallace feeder, WALCB2	113	Security of supply	Reconfigure 11kV feeder to shift customers to WALCB3 (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder Do nothing	516
26	Distribution Network Reinforcement - New Avalon Feeder	114	High customer numbers and load growth	New 11kV feeder from substation to shift customers from adjacent feeders (✓) Distributed batteries to manage load Do nothing	1,191
26	Distribution Network Reinforcement - Reconfiguration of Claudelands Feeder, CLACB16	115	Security of supply and load growth due to densification	Reconfigure 11kV eeder to shift customers to adjacent feeders (✓) New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault(✓) Distributed batteries to manage load Do nothing	545
26-27	Distribution Network Reinforcement - 11 kV Transfer Scheme between feeders of CLA, HAM11, CHA	108	Security of supply	Upgrade Claudelands and Chartwell zone substations and HAM11 GXP New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Reinforce network to transfer load (✓) Distributed batteries to manage load Do nothing	510
27	Distribution Network Reinforcement - Reconfiguration of Chartwell Feeder, CHACB12	116	Security of supply	Reconfigure 11kV feeder to shift customers to adjacent feeders (✓) New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Distributed batteries to manage load Do nothing	400
27	Kohia/Second Transformer	103	Security of supply	Purchase new 23MVA transformer (✓) Do nothing	1,095

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
25-28	Fairfield Zone Substation and GXP Transfer	101, 102, 107, 108, 109	Residential densification around Hamilton CBD, Claudelands, Chartwell, Fairfield Hamilton 33kV GXP security of supply	New Zone substation (✓) Reinforce and reconfigure subtransmission network to transfer load (✓) Upgrade Claudelands and Chartwell zone substations Upgrade Hamilton 33kV GXP with 3rd transformer Install grid scale battery Do nothing	8,218
26-28	Distribution Network Reinforcement - 11 kV Transfer Scheme between feeders of BOR, CHA	122	Security of supply	Upgrade zone substations New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Reinforce network to transfer load (✓) Distributed batteries to manage load Do nothing	680
28	Distribution Network Reinforcement - Voltage Regulator Installation and reconductoring, WALCB6	117	Security of supply and voltage constraint on rural area due to load growth in Temple View greenfield residential zone.	Reconfigure11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	270
28	Distribution Network Reinforcement - Reconfiguration of Borman Feeder, BORCB4	118	Security of supply	Reconfigure 11kV feeders to balance customer numbers (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	1,080
29	Distribution Network Reinforcement - Reconfiguration of Peacocks Feeder, PEACB18	119	Capacity	Reconfigure 11kV feeders to balance customer numbers (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	600
27-30	Hamilton GXP upgrade	101	Growth in the Hamilton region. Hamilton 33kV GXP security of supply	Operational Expenditure rerating project (✓) Install 3rd transformer at Hamilton 33kV GXP Install grid scale battery Do nothing	Operational costs passed through the Transmission Pricing Methodology.

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
29-30	Distribution Network Reinforcement - 11 kV Transfer Scheme between feeders of LAT, WAL, KEN	121	Security of supply	Upgrade zone substation capacity New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Reinforce network to transfer load (✓) Distributed batteries to manage load Do nothing	680
30	Distribution Network Reinforcement - Reconfiguration of Hamilton 11 Feeder, HAMCB2762	120	Load growth around Elderly, Chartwell	Reconfigure 11kV feeders to balance customer numbers (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	1,150
24-31	Fairfield Distribution Network	101, 108, 109	Residential densification around Hamilton CBD, Claudelands, Chartwell, Fairfield	Upgrade feeders(✓) Install new 11kV cables (✓) Install automatic switchgear (✓) Network Reconfiguration (✓) Install grid scale battery Do nothing	5,089
28-31	New Airport Industrial Park Zone Substation	110	New industrial area And residential load Growth currently supplied by Peacockes zone substation	Increase 11kV capacity (✓) New Zone substation (✓) Upgrade Peacockes zone substations Install grid scale battery Do nothing	15,605
31	Wallace Permanent GXP Transfer to Te Kowhai	102	Hamilton 33kV GXP security of supply constraint. Driven by ongoing network growth	Reinforce and reconfigure subtransmission network to transfer load (✓) Develop demand flexibility (✓) Install grid scale battery Do nothing	260
31	Distribution Network Reinforcement - 11 kV Transfer Scheme between feeders of LAT, PEA	110, 122	Security of supply	Upgrade zone substation capacity New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Reinforce network to transfer load (✓) Distributed batteries to manage load Do nothing	230
29-32	Reinforcement Kent–Bryce and Kent-Latham	102, 106, 203	Hamilton CBD densification	Increase 11kV transfer capacity (✓) New Zone substation Reinforce and reconfigure subtransmission network to transfer load Upgrade Kent and Bryce zone substations Install grid scale battery Do nothing	1,720

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24-33	EV& Process Electrification-Hamilton	126	Security of supply, loading and voltage constraints	Refer to section 6.2 and 6.9.1 Review constraints triggered by Electric Vehicle load and Process Electrification on a case-by-case basis. Impacts can be from the GXP level down to individual LV circuits.	28,000
29-33	Crosby Distribution Network	105, 107	Load growth in the northern part of Ruakura Structure Plan	Upgrade feeders (✓) Install new 11kV cables(✓) Install automated switchgear (✓) Network Reconfiguration (✓) Install grid scale battery Do nothing	1,675
29-33	Distribution Network Reinforcement - Provision for new VR, switches & reinforcements	123	Security of supply and voltage constraints	Reconfigure11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	450
29-33	Distribution Network Reinforcement– Provision for new feeders	123	Network constraints and load growth	New feeders to address network load growth	293
30-33	Crosby Substation	105, 107	Load growth in the northern part of Ruakura Structure Plan Security of Supply	New Zone substation (✓) Install 3rd transformer at Borman or Chartwell Install grid scale battery Do nothing	6,917
30-33	Peacockes Growth	110	Residential and industrial growth in the development of the Peacockes Structure Plan area. Load growth and security of supply.	New Airport zone substation (✓) Install 3rd transformer at Peacockes Install new 11kV feeders(✓) Do nothing	4,771
24-33	System Growth Engineering, Design and Project Management - Hamilton		All	This is budget for capitalising engineers, design, project management time for capital expenditure projects. Timesheets are going to be introduced in FY24 to ensure costs are journalled accurately. This will also enable a reference point for WEL to allocate this expenditure across all proposed projects in the future.	4,310

6.9.2.5: Hamilton network system growth projects

The following table shows the forecast load on each zone substation after completion of the projects described above.

GXP	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Hamilton 110kV / 11kV	HAM11	44	37	38	39	40	35	36	36	36	37	38
Hamilton 220kV / 33kV	HAM33	132	132	135	138	138	145	149	154	152	158	166

Zone Substations	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Avalon Dr	AVA	23.8	19.9	20.2	20.4	17.3	17.4	17.5	17.7	17.9	18.2	18.5
Borman	BOR	22.9	21.2	21.6	19.0	19.3	19.7	20.1	20.6	21.2	17.8	18.7
Bryce St	BRY	22.9	13.8	13.9	14.4	13.8	14.0	14.2	14.4	14.7	15.0	15.3
Chartwell	CHA	25.9	19.6	19.8	24.1	19.3	19.6	14.4	14.4	14.5	14.5	14.6
Claudelands	CLA	22.9	22.8	23.4	22.7	23.5	23.5	22.4	23.3	24.4	22.7	24.2
Cobham	COB	25.9	13.3	13.6	14.0	14.3	14.7	15.1	15.4	15.9	16.4	17.1
Latham Court	LAT	22.9	20.0	21.1	21.3	21.5	21.7	22.7	23.0	23.3	23.6	24.1
Hoeka Rd	HOE	-	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Peacockes Rd	PEA	25.9	17.5	18.3	19.6	21.2	22.9	14.0	15.2	16.8	18.6	20.9
Wallace Rd	WAL	15.4	12.1	12.3	12.6	12.9	13.2	8.9	9.0	9.2	9.3	9.5
Fairfield	FAI	23	0.0	0.0	0.0	6.0	12.4	20.5	21.2	22.0	23.1	24.4
Airport	AIR	23	0.0	0.0	0.0	0.0	0.0	16.0	17.7	19.7	22.3	25.5
Crosby	CRO	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	6.7

Table 6.9.2.6: Hamilton Network Zone Substation Demand Forecasts (MVA) – Post-Intervention

N-1 Security	= the ability for the substation to maintain supply to downstream customers, in the event of an outage to a single component (see section 6.3.2 Security of Supply)
Transfer capacity	= the capacity of the adjacent distribution network to receive transfer of customers from the subject zone substation
(green)	= forecast load within firm capacity + transfer capacity
(yellow)	= forecast load nearing firm capacity + transfer capacity. Monitor for acceleration in growth or step change.
(red)	= forecast load exceeds firm capacity + transfer capacity. Project or other intervention to be initiated several years before forecast constraint.

Hamilton Network Development Schedule

The following table shows the timing of the expenditure of each of the projects described above:

Hamilton Network System Growth ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Distribution Network Reinforcement - Hamilton	1,488	258	1,799	1,570	1,110	1,258	1,205	905	207	283
EV & Process Electrification - Hamilton	156	208	572	1,248	1,508	2,548	3,598	4,794	5,990	7,377
System Growth Engineering, Design and Project Management - Hamilton	499	436	349	419	420	422	447	421	431	467
Crosby Substation	-	-	-	-	-	-	330	482	3,035	3,070
Crosby Distribution Network	-	-	-	-	-	335	335	335	335	335
Peacockes Cable Ducts	544	-	-	-	-	-	-	-	-	-
Peacockes Growth	-	424	-	-	-	-	1,581	922	922	922
Fairfield Distribution Network	409	850	580	650	650	650	650	650	-	-
Wallace Protection Upgrade	83	-	-	-	-	-	-	-	-	-
BOR 33kV circuit uprating	-	518	-	-	-	-	-	-	-	-
WAL permanent transfer	-	-	-	-	-	-	-	260	-	-
11kV Reinforcement - KEN-LAT & KEN-BRY	-	-	-	-	-	430	430	430	430	-
Airport Industrial Park	-	-	-	-	3,250	3,275	4,880	4,200	-	-
Kohia Second Transformer	-	-	-	1,095	-	-	-	-	-	-
Fairfield Zone Substation & GXP Transfer	-	513	1,565	3,070	3,070	-	-	-	-	-
Total	**3,179**	**3,207**	**4,865**	**8,052**	**10,008**	**8,919**	**13,456**	**13,400**	**11,350**	**12,455**

Table 6.9.2.7: Hamilton network system growth projected capital expenditure

6.9.3 Te Kowhai Network Development Plan

The Te Kowhai network is supplied by Te Kowhai GXP. The Te Kowhai network supplies the Hamilton City Council Rotokauri Structure Plan and Te Awa Lakes Structure Plan areas, as well as the established areas of Hamilton West, Horotiu, and the rural network from Te Kowhai to Whatawhata and Raglan, as covered by Waikato District Council Plans. A large portion of greenfield areas are zoned for residential and industrial development.

The area has a large existing industrial and commercial base in Frankton, Burbush, Te Rapa, Horotiu, and Pukete.

Except for 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.

There are two large, embedded generators in this network: the 44MW Te Rapa cogeneration and 64MW Te Uku Windfarm plus a 1MW cogeneration unit at Hamilton City Council's Wastewater Plant. The imminent decommissioning of the Te Rapa cogeneration plant in 2023 has a material impact on the security of supply for the area.

Customer distribution as at end of Financial Year 2022:

Customer Group	Number of Active ICP	Electricity Delivered (GWh)
Domestic	20,397	144
Non-Domestic	4,760	83
Streetlights and Unmetered	68	0
Large Commercial	373	227

Table 6.9.3.1: Te Kowhai Network Customer Breakdown

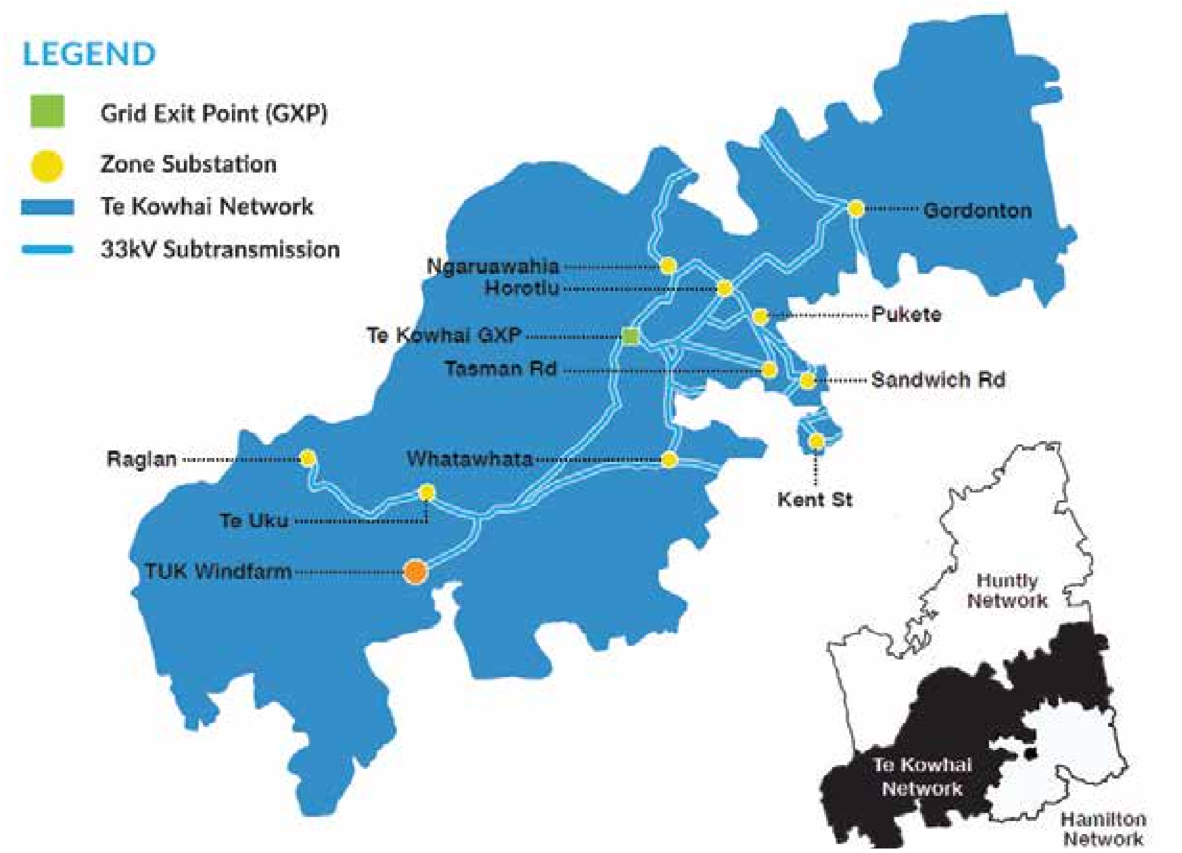


Figure 6.9.3.2: Te Kowhai Network

Te Kowhai Area Growth

Residential growth forecasts are based on HCC and Waikato District Council Plans, which outline the proposed layout of greenfield development areas, as well as indicating densification cells within existing areas. There are ongoing residential subdivision developments within the Te Kowhai network area:

- Rotokauri Structure Plan area will be supplied from Tasman, Avalon zone substations and a new Exelby zone substation
- Te Awa Lakes Structure Plan area will be supplied from Horotiu, Pukete zone substations and a new Kohia zone substation
- Raglan Rangitahi Peninsula supplied from Raglan zone substation
- Infill densification of urban areas around the western edge of the Hamilton central city, Te Rapa, Pukete, Baverstock will be supplied from existing Kent and Sandwich Rd zone substations, with transfers to these zone substations and 11kV inter-substation capacity reinforcements to maintain security of supply

Industrial and commercial growth is based on expansion of greenfield industrial areas zoned in Council Structure Plans, including Horotiu, Pukete, and Rotokauri. This includes major developments in the Horotiu and Northgate Industrial Parks and Burbush / Te Rapa industrial zones. The Northgate Industrial Park will be supplied from Horotiu substation and the under construction Kohia substation. The Burbush / Te Rapa industrial zone will be supplied from Tasman, Pukete and the planned Exelby substations.

Like the Hamilton area network, increasing densification and forecast uptake of electric vehicles drive the need for upgrading the 11kV and low voltage distribution network across the region. Commercial fast chargers installed at industrial and commercial customer premises in the long term will drive 11kV distribution network upgrades.

Commercial growth is expected to continue in the CBD with increasing densification with spill over into the Kent and Sandwich Rd zone substation supply areas.

The following table outlines the forecast unmitigated growth at substations in the Te Kowhai area.

GXP	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Constraint ID
Te Kowhai 220kV / 33kV	TWH33	138	91	93	95	98	100	102	104	107	109	113	201

Zone Substations	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Constraint ID
Gordonton	GOR	5	7.8[11]	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	
Horotiu	HOR	18	19.4	20.2	21.0	21.8	22.5	23.4	24.1	24.9	25.0	25.0	202
Kent St	KEN	22.9	17.9	18.2	18.5	18.8	19.3	19.7	20.2	20.8	21.6	22.5	203
Pukete - Anchor	ANC	30	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	204
Pukete - 11kV	PUK	15	9.7	10.3	11.2	11.8	12.4	13.1	14.0	15.0	16.3	17.8	204
Raglan	RAG	-	5.2	5.4	5.6	5.9	6.2	6.5	7.0	7.6	8.3	9.1	299
Sandwich Rd	SAN	23.8	23.8	23.9	24.1	24.3	24.5	24.7	24.9	25.3	25.7	26.2	205
Tasman	TAS	25.9	22.4	23.6	24.4	25.7	26.2	26.8	27.4	28.0	28.8	29.7	206
Te Uku	TEU	5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Whatawhata	WHA	-	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	

Table 6.9.3.3: Te Kowhai Network Zone Substation Demand Forecasts (MVA)

N-1 Security	= the ability for the substation to maintain supply to downstream customers, in the event of an outage to a single component (see section 6.5.3 Security of Supply)
Transfer capacity	= the capacity of the adjacent distribution network to receive transfer of customers from the subject zone substation
(green)	= forecast load within firm capacity + transfer capacity
(yellow)	= forecast load nearing firm capacity + transfer capacity. Monitor for acceleration in growth or step change.
(red)	= forecast load exceeds firm capacity + transfer capacity. Project or other intervention to be initiated several years before forecast constraint.

11 Sufficient transfer capacity at 11kV. Refer to Legend below Table 6.9.3.3

The constraint ID refers to the specific constraint detailed in the table below. It also includes constraints on our subtransmission and distribution network that are not detailed in the tables above.

Forecast year constrained (FY)	Constraint ID	Constraint description
24	202	Horotiu substation exceeds security of supply criteria
24	207	Overhead section of TWH-RMZ903 33kV subtransmission circuit exceed 'N-1' security of supply criteria loading.
24-33	225	Voltage and thermal constraints at LV and 11kV level assets
25	204	Pukete substation exceeds security of supply criteria. This is constrained by the 30MVA primary winding of the three winding transformer that supplies Fonterra and the Pukete 11kV.
25	208	33kV subtransmission to Avalon substation is constrained under contingent events
25	209	Overhead section of RMZ900-SAN 33kV subtransmission circuit exceed 'N-1' security of supply criteria loading.
25	212	11kV feeder RAGCB4 exceeds security of supply criteria and experiences voltage constraints
26	210	Te Kowhai GXP to Kohia substation 33kV subtransmission circuits exceed 'N-1' security of supply criteria loading.
26	213	11kV feeder KENCB7 exceeds security of supply criteria and experiences voltage constraints
26	299	Subtransmission overhead line circuits in difficult access areas makes restoration time criteria difficult to achieve for faults on certain sections
27	214	Voltage constraints on GORCB3
27	215	11kV feeder TASCB4 exceeds security of supply criteria and experiences voltage constraints
28	206	Tasman substation exceeds security of supply criteria
28	216	11kV feeder SANCB3 exceeds security of supply criteria and experiences voltage constraints
29	201	Te Kowhai GXP exceeds security of supply criteria. This is exceeded if there is no intervention following the transfer of load from the Hamilton 33 GXP.
29	217	Voltage constraints on HORCB5
29	218	Voltage constraints on NGACB2
29	220	Voltage constraints on TEUCB1
30	219	Voltage constraints on HORCB4
30	221	11kV feeder SANCB4 exceeds security of supply criteria and experiences voltage constraints
30-33	222	Future feeder reinforcement for maintaining security of supply and back-feed capability for resilience. The exact location and timing of this constraint will be updated.
33	211	33kV subtransmission to Avalon substation is constrained under contingent events following the permanent shift of load from the Hamilton 33 network.
33	223	Future feeder reinforcement for maintaining security of supply and managing thermal constraints. The exact location and timing of this constraint will be updated.
33	203	Second order constraint. Kent St substation and 11kV feeder loading exceeds security of supply criteria following permanent transfers without intervention.
33	205	Second order constraint. Sandwich Rd substation and 11kV feeder loading exceeds security of supply criteria following permanent transfers without intervention.

Table 6.9.3.4: Te Kowhai Network Forecast Constraints Description

Change from 2022 AMP

For the Te Kowhai network area, the loss of the Te Rapa co-generation plant reduces available subtransmission capacity and necessitates an acceleration of the Kohia zone substation. This maintains service levels to existing customers, and supports the full-time electrification of the Fonterra plant (18MW load).

As mentioned in the Hamilton area development changes, the projects to reinforce and reconfigure WEL's subtransmission network to transfer load between Hamilton and Te Kowhai GXPs have been deferred.

Te Kowhai Area Development Projects

The following table summarises the Te Kowhai network system growth projected investment and outlines how each addresses the above constraints.es the above constraints.

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24	TWH-RMZ903 circuit uprating	207	Security of supply Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Install new subtransmission circuit Reconductor circuit Reconfigure to increase thermal rating (✓) Install grid scale battery Do nothing	270
24	33kV Reinforcement - TAS-AVA	208	Security of supply TWH-AVA circuits constraint	Install new subtransmission circuit from Tasman to Avalon substations (✓) Install new subtransmission circuit from Te Kowhai GXP Install grid scale battery Do nothing	396
24-25	Kohia Substation[12]	202, 204	Demand growth of Northgate Industrial development. Capacity and security of Pukete, Horotiu, Tasman zone substations Security of Supply	New Zone substation – use of network spare power transformer until load grows to N-1 security threshold (est. FY27) (✓) Install 3rd transformer at Tasman and Horotiu Install grid scale battery Do nothing	8,657
24-25	Distribution Network Reinforcement - New Raglan Feeder	212	High customer numbers and load growth	New 11kV feeder from substation to shift customers from adjacent feeders (✓) Distributed batteries to manage load Do nothing	1,226
24-25	Raglan Area Resilience	299	(refer to section 6.10.3)	(refer to section 6.10.3)	(refer to section 6.10.3)
25	RMZ900-SAN circuit uprating	209	Security of supply Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Install new subtransmission circuit Reconductor circuit Reconfigure to increase thermal rating (✓) Install grid scale battery Do nothing	285

12 Previously disclosed as Te Rapa North zone substation.

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
25	KOH-PUK cross bonding reconfiguration	210	Security of supply Decommissioning of Te Rapa Cogeneration greatly increases load on TWH-KOH-PUK cables. Bonding arrangement constrains thermal capacity.	Re-configure 33kV cable cross bonding to increase cable capacity (✓) Install new cable between KOH and PUK Do nothing	250
25	Distribution Network Reinforcement Reinforcement of Kent feeder, KENCB7	213	Security of supply	Upgrade feeders (✓) Install new 11kV feeder Install automated switchgear Network Reconfiguration (✓) Install grid scale battery Do nothing	220
25-26	Distribution Network Reinforcement - Voltage Regulator and network upgrades on Gordonton feeders	214	Security of supply. Voltage constraints	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	1,844
25-26	Distribution Network Reinforcement - Reconfigure Pukete feeder, PUKCB5	215	Security of supply	Reconfigure 11kV feeder to shift customers to adjacent feeders (✓) New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Distributed batteries to manage load Do nothing	440
26-27	Distribution Network Reinforcement - Reconfiguration and Reinforcement between Sandwich Feeders	216	Security of supply	Reconfigure 11kV feeder to shift customers to adjacent feeders (✓)New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Distributed batteries to manage load Do nothing	1,055
24-28	Kohia Distribution Network	202, 204	Demand growth due to the Te Rapa North industrial development	Upgrade feeders (✓) Install new 11kV cables (✓) Install automated switchgear (✓) Network Reconfiguration (✓) Install grid scale battery Do nothing	2,045
24-28	Exelby Substation	204, 206	Demand growth of Rotokauri Structure Plan development. Capacity and security of Tasman, Pukete, Avalon zone substations. Security of Supply	New Zone substation twin (✓) Install 3rd transformer at Tasman Install grid scale battery Do nothing	10,325

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
27-28	Distribution Network Reinforcement - New Voltage Regulator and reinforcement of Horotiu Feeder, HORCB5	217	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	460
27-28	Distribution Network Reinforcement - New voltage Regulator installation and reconductoring on Ngaruawhahia Feeder, NGACB2	218	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	270
28	GXP Transfer: Gordonton to Huntly	201	Te Kowhai 33kV GXP security of supply constraint. Driven by ongoing network growth and transfers from Hamilton 33kV GXP.	Reinforce and reconfigure subtransmission network to transfer load (✓) Upgrade Hamilton 33kV GXP Install grid scale battery Do nothing	915
28	Distribution Network Reinforcement - Reconductoring and relocation of voltage regulator on Te Uku Feeder, TEUCB1	220	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) Move existing voltage regulator to bring voltage within statutory requirements (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	100
28-29	Distribution Network Reinforcement - Reconductoring and automation of Horotiu Feeder, HORCB4	219	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements New automated tie-point switchgear to transfer customers in event of fault (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	240

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24-30	Exelby Distribution Network	204, 206	Demand growth of Rotokauri Structure Plan development	Upgrade feeders (✓) Install new 11kV cables (✓) Install automated switchgear (✓) Network Reconfiguration (✓) Install grid scale battery Do nothing	2,219
29-30	Distribution Network Reinforcement - Reinforcement and reconfiguration of Sandwich Feeder, SANCB4	221	Network resilience and voltage constraints	Reconfigure 11kV feeder to shift customers to adjacent feeders (✓) Upgrade 11kV conductor (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) Distributed batteries to manage load Do nothing	300
29-32	Distribution Network Reinforcement -11kV Fast Transfer Scheme among feeders of zone substations SAN, PUK, TAS, KOH	204, 205, 206	Security of supply	Upgrade zone substation capacity New 11kV feeder New automated tie-point switchgear to transfer customers in event of fault (✓) Reinforce network to transfer load (✓) Distributed batteries to manage load Do nothing	690
24-33	EV & Process Electrification - Te Kowhai	225	Network resilience, loading and voltage constraints	Refer to section 6.2 and 6.9.1 Review constraints triggered by Electric Vehicle load and Process Electrification on a case-by- case basis. Impacts can be from the GXP leave down to individual LV circuits.	21,000
29-33	Distribution Network Reinforcement - Provision for new VR, switches & reinforcements	222	Security of supply and voltage constraints	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	453
32-33	33kV Reinforcement - EXE-AVA-WAL	211	Security of supply Demand growth due to Rotokauri greenfield, Nawton & Dinsdale & Frankton densification. Future constraint on TWH-PUK & TWH-AVA circuits, TWH-TAS circuit is underutilised.	Install new subtransmission circuits from new Exelby substation to TWH-TAS (✓) Install new subtransmission circuit from Te Kowhai GXP Install grid scale battery Do nothing	3,750
32-33	Distribution Network Reinforcement - Provision for New Feeders'	223	Network constraints and load growth	New feeders to address network load growth.	290

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24-33	System Growth Engineering, Design and Project Management - Te Kowhai		ALL	This is budget for capitalising engineers, design, project management time for capital expenditure projects. Timesheets are going to be introduced in FY24 to ensure costs are journalled accurately. This will also enable a reference point for WEL to allocate this expenditure across all proposed projects in the future.	3,232

Table 6.9.3.5: Te Kowhai network system growth projects

The following table shows the forecast load on each zone substation after completion of the projects described above.

GXP	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Te Kowhai 220kV / 33kV	TWH33	138	91	93	95	100	103	105	108	118	115	119

Zone Substations	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gordonton	GOR	15[13]	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Horotiu	HOR	18	15.3	15.3	15.3	15.3	15.4	13.2	13.2	13.2	13.2	13.2
Kent St	KEN	22.9	17.9	17.3	17.6	18.0	18.4	18.8	19.3	19.9	20.7	21.6
Pukete - Anchor	ANC	30	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8
Pukete - 11kV	PUK	15	8.9	8.9	8.9	9.0	9.0	9.0	9.1	9.1	9.2	9.3
Raglan	RAG	5	5.2	5.4	5.6	5.9	6.2	6.5	7.0	7.6	8.3	9.1
Sandwich Rd	SAN	28.2	23.8	23.9	24.1	24.3	20.4	20.6	20.8	21.1	21.5	21.9
Tasman	TAS	25.9	22.4	23.6	24.4	25.6	19.5	21.6	21.6	21.8	21.8	21.9
Te Uku	TEU	15[14]	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Whatawhata	WHA	-	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Kohia*	KOH	23	4.9	6.4	8.3	9.8	11.3	13.0	14.8	16.8	18.5	20.5
Exelby*	EXE	23	0.0	0.0	0.0	3.7	15.1	16.0	17.1	18.2	19.7	21.5

Table 6.9.3.6: Te Kowhai Network Zone Substation Demand Forecasts (MVA) – Post-Intervention

N-1 Security	= the ability for the substation to maintain supply to downstream customers, in the event of an outage to a single component (see section 6.3.2 Security of Supply)
Transfer capacity	= the capacity of the adjacent distribution network to receive transfer of customers from the subject zone substation
(green)	= forecast load within firm capacity + transfer capacity
(yellow)	= forecast load nearing firm capacity + transfer capacity. Monitor for acceleration in growth or step change.
(red)	= forecast load exceeds firm capacity + transfer capacity. Project or other intervention to be initiated several years before forecast constraint.

13 Transformers being replaced with WEL standard transformers under Asset Replacement and Renewal.
14 Transformers being replaced with WEL standard transformers under Asset Replacement and Renewal.

Te Kowhai Network Development Schedule

Hamilton Network System Growth ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Distribution Network Reinforcement - Te Kowhai	955	1,537	1,753	905	585	553	250	330	437	283
EV & Process Electrification - Te Kowhai	117	156	429	936	1,131	1,911	2,699	3,596	4,493	5,533
System Growth Engineering, Design and Project Management - Te Kowhai	374	327	262	314	315	317	335	316	323	351
Exelby Distribution Network	239	330	330	330	330	330	330	-	-	-
Exelby Substation	100	610	1,565	2,965	2,015	3,070	-	-	-	-
RMZ900-SAN Circuit Uprating	-	285	-	-	-	-	-	-	-	-
GXP Transfer: Gordonton to Huntly	-	-	-	-	305	-	610	-	-	-
KOH-PUK 33kV cross bonding fix to improve capacity by 20%	-	250	-	-	-	-	-	-	-	-
KOH Distribution network	637	545	273	305	285	-	-	-	-	-
Kohia zone substation	6,661	1,996	-	-	-	-	-	-	-	-
TWH-RMZ903 Circuit Uprating	270	-	-	-	-	-	-	-	-	-
33kV Reinforcement - TAS-AVA	396	-	-	-	-	-	-	-	-	-
33kV Reinforcement - EXE-AVA-WAL	-	-	-	-	-	-	-	-	1,875	1,875
Total	9,749	6,036	4,612	5,755	4,966	6,181	4,224	4,241	7,127	8,042

Table 6.9.3.7: Te Kowhai network system growth projected capital expenditure

6.9.4 Huntly Network Development Plan

Huntly network is supplied by Huntly GXP. The major load centres are:

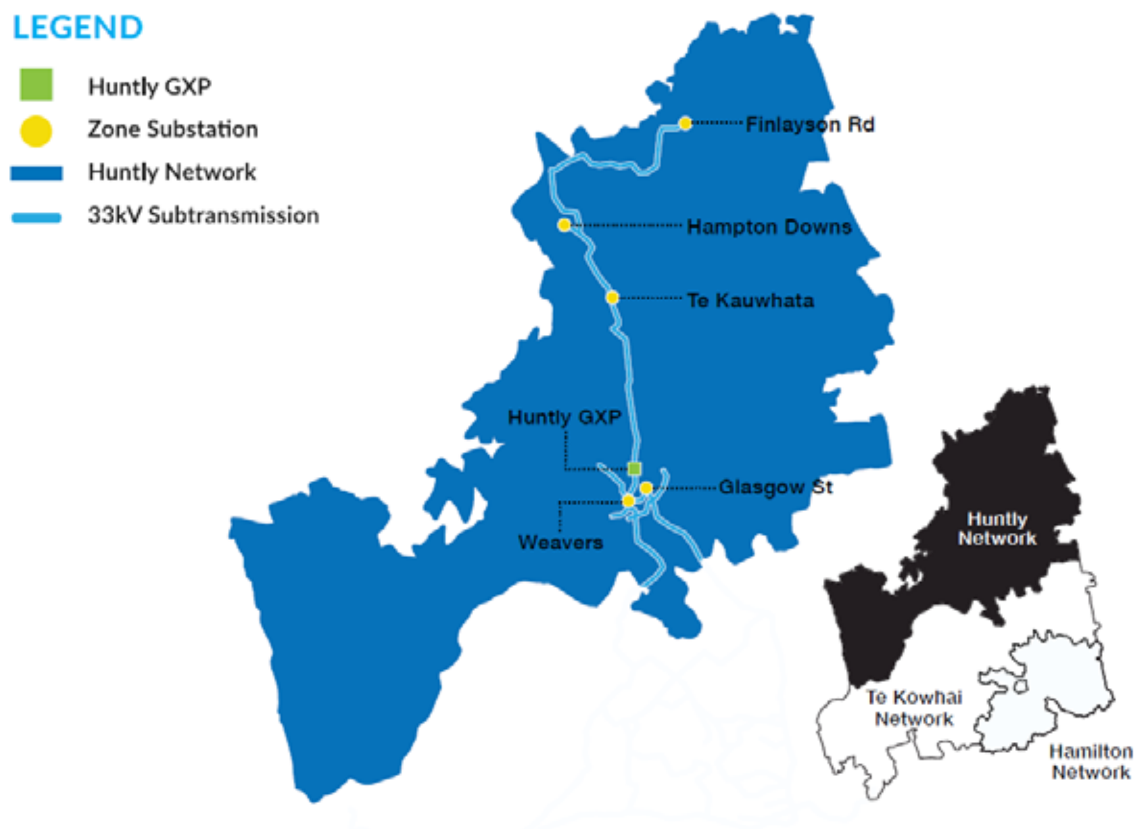
- Huntly township which is supplied from the Weavers and Glasgow zone substations
- Ngaruawahia township which is supplied from the Ngaruawahia zone substation
- Te Kauwhata township, a rapidly growing residential area supplied from Te Kauwhata zone substation

Customer distribution as at end of Financial Year 2022 is shown in the table below:

Customer Group	Number of Active ICP	Electricity Delivered GWh
Domestic	6,998	55
Non-Domestic	2,307	35
Small Scale Distributed Generation	123	1
Streetlights and Unmetered	52	2
Large Commercial	89	34

Table 6.9.4.1: Huntly network customer breakdown

Figure 6.9.4.2: Huntly Network



Huntly Area Growth

General residential and agricultural growth in the Waikato District is forecast to be modest and is assumed to be a continuation of the historical trend. The Te Kauwhata Structure Plan is the exception to this and is forecast to see a higher residential growth. This area is supplied by the Te Kauwhata substation. This substation will also initially supply the Ohinewai Sleepyhead Industrial & Residential Estate until the load necessitates a dedicated substation.

The area is host to some of the longest 11kV feeders on the WEL network, and hence many of the constraints and mitigations will be at the 11kV distribution level.

Destination fast chargers are also expected in the region. These have the potential to require significant network upgrades to accommodate the high network demand that fast chargers require.

The following table outlines the forecast unmitigated growth at substations in the Huntly area.

GXP	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Constraint ID
Huntly 220kV / 33kV	HUN33	82	31	32	32	33	34	35	36	37	38	40	

Zone Substations	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Constraint ID
Finlayson Rd	FIN	-	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	
Glasgow St	GLA	-	9.2	9.2	9.3	9.3	9.3	9.4	9.4	9.5	9.5	9.5	
Hampton Downs	HPT	-	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.5	2.5	
Ngaruawahia	NGA	9	6.0	6.0	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.2	
Te Kauwhata	TEK	10	8.2	8.9	9.8	10.7	11.5	12.8	14.2	15.6	17.1	19.0	302
Weavers	WEA	9	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	301

Table 6.9.4.3: Huntly zone substation demand forecast (MVA) – Pre-Intervention

N-1 Security	= the ability for the substation to maintain supply to downstream customers, in the event of an outage to a single component (see section 6.5.3 Security of Supply)
Transfer capacity	= the capacity of the adjacent distribution network to receive transfer of customers from the subject zone substation
	= forecast load within firm capacity + transfer capacity
	= forecast load nearing firm capacity + transfer capacity. Monitor for acceleration in growth or step change.
	= forecast load exceeds firm capacity + transfer capacity. Project or other intervention to be initiated several years before forecast constraint.

The included constraint ID refers to the specific constraint detailed in the table below. It also includes constraints on our subtransmission and distribution network that are not detailed in the tables above.

Forecast year constrained (FY)	Constraint ID	Constraint description
24-33	317	Voltage and thermal constraints at LV and 11kV level assets.
25	303	11kV feeder TEKCB3 exceeds security of supply criteria. Load growth from Te Kauwhata structure plan area development.
26	302	Te Kauwhata substation exceeds security of supply criteria. Driven by Sleepyhead Ohinewai development and Te Kauwhata structure plan area development.
26	304	Voltage constraints on 11kV feeder GLACB2
26	305	Back-feed constraints on 11kV feeder FINCB2 due to load increase exceeds security of supply criteria for Finlayson substation.
27	306	Voltage constraints on 11kV feeder WEACB2 causing security of supply criteria to be exceeded. Driven by rural load growth.
27	307	Voltage constraints on 11kV feeder WEACB3 causing security of supply criteria to be exceeded. Driven by rural load growth.
27	308	Voltage constraints on 11kV feeder WEACB5 causing security of supply criteria to be exceeded. Driven by rural load growth.
28	309	Forecast large industrial customer connection. Sleepyhead Ohinewai development.
29	310	11kV feeder FINCB4 exceeds power quality voltage limits due to load growth
29-33	313	Future feeder reinforcement for maintaining security of supply and back-feed capability for resilience. The exact location and timing of this constraint will be updated.
30	311	11kV feeder WEACB6 exceeds power quality voltage limits due to load growth
30-33	314	Future feeder reinforcement for maintaining security of supply and back-feed capability for resilience. The exact location and timing of this constraint will be updated.
31	312	11kV feeder TEKCB5 exceeds security of supply criteria. Driven by development from Te Kauwhata structure plan area development.
33	301	Second order constraint. Weavers substation exceeds security of supply once load from Te Kauwhata is transferred at 11kV.
33	315	Future feeder reinforcement for maintaining security of supply and managing thermal constraints. The exact location and timing of this constraint will be updated.

Table 6.9.4.4: Huntly Network Forecast Constraints Description

Change from 2022 AMP

The approval of Ohinewai zoning and subsequent change to the Waikato District Council Ohinewai Structure Plan to allow the Sleepyhead estate, has spurred other residential and industrial developments in the area.

The new commercial area in Taupiri at the end of the 11kV feeder from Glasgow is equally remote from Gordonton and Ngaruawahia zone substations that could potentially supply it.

The area has several large commercial EV charging stations due to its proximity to the state highway between Auckland and Hamilton, and to meet the central government's goal of an EV charging station every 75km.

A recent major review of the loading and distribution back-feed in the area has identified a number of security of supply improvements that are now included in the 2023 AMP.

Huntly Area Development Projects

The following table summarises the Huntly network system growth projected investment and how it addresses the above constraints.

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24-25	Distribution Network Reinforcement - New Te Kauwhata Feeder for Lakeside, TEKCB3	302, 303	High customer numbers and load growth	New 11kV feeder from substation to shift customers from adjacent feeders (✓) Distributed batteries to manage load Do nothing	1,588
25	Distribution Network Reinforcement - New Voltage Regulator installation on Glasgow Feeder, GLACB2	304	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	230
25	Distribution Network Reinforcement - Reconfiguration and automation on Finlayson Feeder, FINCB2	305	Network resilience and voltage constraints	Reconfigure 11kV feeder to shift customers to adjacent feeders (✓) Upgrade 11kV conductor (✓) New automated tie-point switchgear to transfer customers in event of fault (✓) Distributed batteries to manage load Do nothing	100
26	Distribution Network Reinforcement - New voltage Regulator installation and reconductoring on Weaver Feeder, WEACB2	306	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓)] New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	280
26	Distribution Network Reinforcement - New voltage Regulator installation and reconductoring on Weaver Feeder, WEACB3	307	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	280
26	Distribution Network Reinforcement - New voltage Regulator installation and reconductoring on Weaver Feeder, WEACB5	308	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	265

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
25-27	Sleepyhead	302	Customer driven load growth in Ohinewai	Install 33kV cables between Te Kauwhata zone substation and Sleepyhead Estate. Run at 11kV until load exceeds 5MVA. Build zone substation when required by customer. (✓) Build new zone substation and immediately Install grid scale battery Do nothing	3,186
26-27	Distribution Network Reinforcement - New Feeder for large industrial customer Te Kauwhata	309	Load Growth	New 11kV feeder from substation to supply new load (✓) Distributed batteries to manage load Do nothing	1,190
27-28	Distribution Network Reinforcement - New Finlayson Feeder, FINCB4	310	High customer numbers and load growth	New 11kV feeder from substation to shift customers from adjacent feeders (✓) Distributed batteries to manage load Do nothing	524
27-29	Distribution Network Reinforcement - New voltage Regulator installation and reconductoring on Weaver Feeder, WEACB6	311	Security of supply and voltage constraint	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	405
30	Distribution Network Reinforcement - New Te Kauwhata Feeder, TEKCB5	312	High customer numbers and load growth	New 11kV feeder from substation to shift customers from adjacent feeders(✓) Distributed batteries to manage load Do nothing	290
24-33	EV & Process Electrification - Huntly	317	Network resilience, loading and voltage constraints	Refer to section 6.2 and 6.9.1 Review constraints triggered by Electric Vehicle load and Process Electrification on a case-by- case basis Impacts can be from the GXP level down to individual LV circuits.	4,860
29-33	Distribution Network Reinforcement - Provision for new VR, switches & reinforcements	313	Security of supply and voltage constraints	Reconfigure 11kV feeders to balance load (✓) Upgrade conductor (✓) New voltage regulator to bring voltage within statutory requirements (✓) New 11kV feeder from substation Distributed batteries to manage load Do nothing	453

FY	Project/ Programme	Constraint ID	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
32-33	Distribution Network Reinforcement - Provision for New Feeders	314	Network constraints and load growth	New feeders to address network load growth.	290
33	33kV Protection Upgrade – WEA-GLA & GOR	301	Security of Supply. Network Reliability. Network Resilience	Install new 33kV CB at WEA and reconfigure 33kV circuits and upgrade protection (✓) Install new subtransmission circuit between WEA & GLA Install grid scale battery Do nothing	1,400
24-33	System Growth Engineering, Design and Project Management - Huntly		ALL	This is budget for capitalising engineers, design, project management time for capital expenditure projects. Timesheets are going to be introduced in FY24 to ensure costs are journalled accurately. This will also enable a reference point for WEL to allocate this expenditure across all proposed projects in the future.	746

Table 6.9.4.5: Huntly network system growth projects

The following table shows the forecast load on each zone substation after completion of the projects described above.

GXP	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Huntly 220kV / 33kV	HUN33	82	31	32	32	33	34	35	36	37	45	47

Zone Substations	Abbrev.	N-1 Security	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Finlayson Rd	FIN	-	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Glasgow St	GLA	-	9.2	9.2	9.3	9.3	9.3	9.4	9.4	9.5	9.5	9.5
Hampton Downs	HPT	-	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.5	2.5
Ngaruawahia	NGA	9	6.0	6.0	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.2
Te Kauwhata	TEK	10	8.2	8.9	9.8	10.7	9.9	11.2	12.6	14.0	15.6	17.5
Weavers	WEA	15[15]	9.8	9.8	9.8	9.8	11.2	11.2	11.2	11.2	11.2	11.2

Table 6.9.4.6: Te Kowhai Network Zone Substation Demand Forecasts (MVA) – Post-Intervention

N-1 Security	= the ability for the substation to maintain supply to downstream customers, in the event of an outage to a single component (see section 6.3.2 Security of Supply)
Transfer capacity	= the capacity of the adjacent distribution network to receive transfer of customers from the subject zone substation
(green)	= forecast load within firm capacity + transfer capacity
(yellow)	= forecast load nearing firm capacity + transfer capacity. Monitor for acceleration in growth or step change.
(red)	= forecast load exceeds firm capacity + transfer capacity. Project or other intervention to be initiated several years before forecast constraint.

15 Transformers being replaced with WEL standard transformers under Asset Replacement and Renewal.

Huntly Network Development Schedule

The following table shows the forecast load on each zone substation after completion of the projects described above.

Huntly Network System Growth ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Distribution Network Reinforcement - Huntly	408	880	1,270	1,142	397	818	390	100	207	283
EV & Process Electrification - Huntly	27	36	99	216	261	441	623	830	1,037	1,290
System Growth Engineering, Design and Project Management - Huntly	86	75	60	73	73	73	77	73	75	81
33kV Protection Upgrade - WEA-GLA & GOR	-	-	-	-	-	-	-	-	-	1,400
Sleepyhead Cable	-	1,924	1,132	130	-	-	-	-	-	-
Total	**521**	**2,915**	**2,561**	**1,560**	**731**	**1,332**	**1,090**	**1,003**	**1,318**	**3,054**

Table 6.9.4.7: Huntly network system growth projected capital expenditure

6.9.5 Summary of System Growth Capital Expenditure

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

System Growth ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Hamilton Area System Growth	3,179	3,207	4,865	8,052	10,008	8,919	13,456	13,400	11,350	12,455
Te Kowhai Area System Growth	9,749	6,036	4,612	5,755	4,966	6,181	4,224	4,241	7,127	8,042
Huntly Area System Growth	521	2,915	2,561	1,560	731	1,332	1,090	1,003	1,318	3,054
Total	**13,449**	**12,158**	**12,038**	**15,368**	**15,704**	**16,432**	**18,770**	**18,644**	**19,795**	**23,551**

Table 6.9.5.1: Summary of System Growth Capital Expenditure

6.10 Reliability, Safety and Environment

This section discusses, quality of supply, legislative and regulatory, and other reliability, safety, and environmental investment.

Reliability, safety, and environmental activity is predominantly associated with:

- the improvement of reliability or service standards
- maintaining or improving the safety of the network for consumers, employees and the public
- meeting legislative requirements
- reducing the impact of the network on the environment

6.10.1 Quality of Supply

The following table summarises the quality of supply projected investment:

FY	Project/Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24-33	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 WEL's smart meter data.	Upgrade distribution transformer and LV feeders identified by smart meters to improve power quality (✓) Do nothing	5,963
24-33	Smart Meter Distribution Transformer Monitoring	Large commercial customers and parts of the network without 5-minute data required to achieve smart meter benefits.	Install smart meters at sites without smart metering (✓) Do nothing	5,502
24-33	Power Quality Analyser Installation	Large parts of the network without high-rate sampling meters to measure power quality performance	Install power quality analysers at select sites (✓) Do nothing	2,208
24-33	Quality of supply Engineering, Design and Project Management	ALL	This is budget for capitalising engineer's, design, and project management time for capital expenditure projects. Timesheets are going to be introduced in FY24 to ensure costs are journalled accurately. This will also enable a reference point for WEL to allocate this expenditure across all proposed projects in the future.	768

Table 6.10.1.1: Quality of Supply Projects

Change from 2022 AMP

(Refer section 6.7 Strategic Themes & Innovation Practices). WEL is investing in network monitoring equipment close to customer premises to support service levels and the customer's future energy needs.

Visibility of the LV network enables monitoring of LV power, power quality and power flows close to the customer. In turn we can better target capacity upgrades and preventative maintenance and plan to integrate emergent non-wire alternatives (non-network solutions).

The profile for distribution transformer and LV feeder upgrades has been held to a constant level. In FY21's AMP this was a ramped profile.

Due to the expected load growth and DG uptake discussed earlier in this chapter a provision has been allowed for the upgrade of LV feeders and distribution transformers to mitigate power quality issues. Load growth and capacity upgrades are included in System Growth EV and Process Electrification expenditure. It is therefore forecast that the replacement driven outside of this provision will remain constant.

Quality of Supply Project Schedule

Quality of Supply ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Distribution Transformer and LV feeder upgrade projects identified via smart meters	594	569	600	600	600	600	600	600	600	600
Smart Meter Distribution Transformer Monitoring	552	550	550	550	550	550	550	550	550	550
Power Quality Analyser Installation	508	500	500	100	100	100	100	100	100	100
Quality of supply Engineering, Design and Project Management	127	120	97	69	68	65	60	57	55	50
Total	1,781	1,739	1,747	1,319	1,318	1,315	1,310	1,307	1,305	1,300

Table 6.10.1.2: Quality of Supply Projected Capital Expenditure

6.10.2 Legislative and Regulatory

The following table summarises the legislative and regulatory projected investment:

FY	Project/Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
25	AUFLS scheme change	Compliance to new AUFLS regime	Comply with regulatory requirement (✓)	170
24-25	Te Kowhai 33kV Neutral Earthing Resistor and protection enhancement	Voltage regulation, Insulation coordination, Protection coordination	Install Neutral earthing resistor and upgrade protection (✓)	494
24-27	Line clearance mitigation	Safety and compliance	Re-tension lines (✓) Undergrounding (✓) Relocate third-party owned asset (✓)	1,641
25-27	Seismic strengthening of substations and switching stations	Safety and compliance	Strengthen buildings to comply (✓) Replace buildings	2,627
24-27	Legislative and Regulatory Engineering, Design and Project Management	ALL	This is budget for capitalising engineers, design, project management time for capital expenditure projects. Timesheets are going to be introduced in FY24 to ensure costs are journalled accurately. This will also enable a reference point for WEL to allocate this expenditure across all proposed projects in the future.	326

Table 6.10.2.1: Legislative and Regulatory Projects

Seismic

The "seismic upgrades of switching substation" project completes a programme to reinforce buildings that are seismically "at risk".

Sites with strengthening to be completed within FY23:

- Kent zone substation
- Massey switching station building

Remaining sites requiring seismic strengthening:

- Latham zone substation building
- Ruakura Ripple Plant building
- Barton switching station building
- Civic switching station building
- Whitiora switching station building
- MAF switching station building
- Steele Park switching station building

There is additional funding required to relocate Weavers and Glasgow zone substations discussed in the next section.

Legislative and Regulatory Project Schedule

Legislative and Regulatory ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
AUFLS scheme changes	-	170	-	-	-	-	-	-	-	-
NER protection changes through TWH Network	238	256	-	-	-	-	-	-	-	-
Line clearance mitigation	541	500	300	300	-	-	-	-	-	-
Seismic upgrades of switching stations	-	767	1,070	790	-	-	-	-	-	-
Legislative and Regulatory Engineering, Design and Project Management	60	125	81	60	-	-	-	-	-	-
Total	839	1,818	1,451	1,150	-	-	-	-	-	-

Table 6.10.2.2: Legislative and Regulatory projected capital expenditure

6.10.3 Other Reliability, Safety and Environment

The Other Reliability, Safety and Environment (Other RSE) capital expenditure category includes projects where the primary driver is to improve network reliability or safety, or to mitigate environmental impacts of the network, but is not included in either the Quality of Supply or Legislative and Regulatory categories.

Projects that fall under the Other RSE category include those with primary drivers such as:

- Public safety and staff safety
- Environmental impact mitigation
- Reliability improvement of backbone communications networks
- Reliability improvements due to the configuration of the network (in contrast to reliability improvements due to underlying asset condition as covered in Chapter 8)
- Resilience of the network and its ability to withstand and reduce the magnitude and duration of disruptive events and recover from such events (refer to 6.5.4). This excludes mitigations for higher probability or frequency events (for such expenditure, refer to Security of Supply related projects in section 6.9)

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

FY	Project/Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24	Massey 11kV Switchgear Replacement	Aged equipment with high arc flash risk	Replace switchgear (✓)	535
24	Serial Radio	Incompatibility of existing radio network with replacement options on the market.	Install new radio equipment (✓) Do nothing	126

FY	Project/Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
24	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	400
24-25	IoT Network Measurement	Reliability. Key circuits in Hamilton CBD have no measurement, making fault finding and condition assessment difficult.	Install IoT network measurement (✓) Install automated switchgear Do nothing	100
24-25	Raglan Area Resilience	Restoration time difficult to achieve for faults on particular sections of the 33kV circuit supplying Te Uku / Raglan area, due to distance and terrain. High wind coastal area, highly trafficked narrow windy and hilly roads make overhead circuit prone to damage.	Install new 33kV subtransmission circuit in parallel with existing vulnerable section. Splice in new parallel circuit into existing circuit to Raglan at less vulnerable section with new 33kV switchgear (✓) Install new 11kV back-feed circuits and upgrade capacity of existing back-feed circuits (✓) Install grid scale battery (under investigation) Install distributed batteries (under investigation) Solicit dispatchable energy storage from market (under development) (✓) Do nothing	5,000
24-25	Te Uku Substation upgrade	Improve security of 33kV supply, protection upgrade and asset replacement and safety improvements	Upgrade substation to modern standards (✓) Do nothing	3,157
25	Substation Door Upgrade	Safety improvement for emergency egress	Upgrade substation doors (✓) Do nothing	70
26-28	Weavers Zone Substation Relocation	Seismic and flooding resilience. Security of Supply. Other secondary drivers.	Relocate existing equipment to lower vulnerability site (✓) Do nothing	3,635
24-31	Restricted Space Improvements	Substation confined spaces access restrictions	Remove or mitigate confined space risks (✓) Ongoing access restrictions	1,262
31-33	Glasgow Zone Substation Relocation	Seismic and flooding resilience. ASR as well.	Relocate existing equipment to lower vulnerability site (✓) Do nothing	3,690
25-33	Air-conditioning for Substations	Substation humidity and condensation	Install air conditioning and ventilation (✓) Do nothing	590
30-33	Zone Substation Oil Containment	Environmental and fire risk	Improve transformer bunding (✓) Do nothing	1,320

FY	Project/Programme	Investment Need	Options Considered / Selected (✓)	Estimated cost ($'000)
29-33	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	1,555
24-33	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	660
24-33	DER Management System Infrastructure	Communications and other infrastructure required for visibility and management of DER.	Enhance SCADA, communications and control systems enhancements. Design and Build DERMS and LV Management System Infrastructure (✓) Full deployment DERMS without foundational infrastructure. Do nothing	4,310
24-33	LV Visibility and Data Insights	Provide measuring devices in LV network	Provide measuring devices in LV network (✓) Do nothing	3,020
24-33	Fibre Routes	Install new fibre to provide redundancy and high bandwidth to key sites	Install new fibre (✓) Install new radio links Do nothing	4,563
24-33	Daisy Chain Transformer Unbundling	Reliability and Safety Risks Multiple distribution transformers protected by a common fuse creates protection "blind zones". High customer numbers from single isolation switching points adds significant outage duration time for maintenance or fault response.	Install new isolation equipment (✓) Reconfigure circuits (✓) Install LV feeder ties (✓) Do nothing	1,365
24-33	Network Reliability Projects	Minimise fault duration and the number of customers impacted by outages.	Install new isolation equipment (✓) Reconfigure circuit (✓) Install feeder ties (✓) Do nothing	6,455
24-33	Other Reliability, Safety and Environment Engineering, Design and Project Management	ALL	This is budget for capitalising engineers, design, project management time for capital expenditure projects. Timesheets are going to be introduced in FY24 to ensure costs are journalled accurately. This will also enable a reference point for WEL to allocate this expenditure across all proposed projects in the future.	2,405

Table 6.10.3.1: Other reliability, safety and Environment Projects

Network Reliability Projects

There is an ongoing programme to target network reliability improvements at the worst performing feeders and feeders that present high risk should a fault occur. The Network Reliability Projects reduce the consequence of outages by improving both remote switching options and system visibility. This either reduces the impact of outages or speeds up restoration times. These projects are supplementary to the asset replacement and vegetation management strategies. The projects over the next three years have been identified to address specific feeders and the forecast beyond three years is set at historical averages to target 2-3 improvements per year with the specific sites.

Other Reliability, Safety and Environment Project Schedule

Other reliability, safety and environment ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Air-conditioning for substations	-	120	120	50	50	50	50	50	50	50
IoT Network Measurement	50	50	-	-	-	-	-	-	-	-
Restricted Space Improvements	62	240	240	-	240	240	-	240	-	-
Production DERMS Project – System Infrastructure	325	385	450	450	450	450	450	450	450	450
Fibre installation (Discretionary)	55	60	60	65	70	70	70	70	70	70
Fibre routes	218	285	340	360	360	600	600	600	600	600
Serial radio	126	-	-	-	-	-	-	-	-	-
Garden Place Switching Station Bypass	400	-	-	-	-	-	-	-	-	-
LV visibility and data insights	20	20	35	35	35	35	35	35	35	35
Massey 11kV Switchgear Replacement	535	-	-	-	-	-	-	-	-	-
Multi Circuit Rationalisation	-	-	-	-	-	311	311	311	311	311
Network Reliability Project	927	428	620	640	640	640	640	640	640	640
Substation Door Upgrade	-	70	-	-	-	-	-	-	-	-
Te Uku Zone Substation Upgrade	3,007	150	-	-	-	-	-	-	-	-
Zone substation oil containment	-	-	-	-	-	-	330	330	330	330
Weavers Zone Substation Relocation	-	-	1,175	1,230	1,230	-	-	-	-	-
Glasgow Zone Substation Relocation	-	-	-	-	-	-	-	1,230	1,230	1,230
Daisy Chain Transformer Unbundling	240	125	125	125	125	125	125	125	125	125
Other Reliability, Safety and Environment Engineering, Design and Project Management	514	493	203	179	189	146	139	198	180	164
Raglan Area Resilience	500	4,500	-	-	-	-	-	-	-	-
Total	7,209	7,156	3,648	3,414	3,669	2,947	3,030	4,559	4,301	4,285

Table 6.10.3.2: Other Reliability, Safety, and Environment Projects

6.10.4 Summary of Reliability, Safety and Environment Capital Expenditure Forecast

Other reliability, safety and environment ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Legislative and regulatory	839	1,818	1,451	1,150	-	-	-	-	-	-
Other reliability, safety and environment	7,209	7,156	3,648	3,414	3,669	2,947	3,030	4,559	4,301	4,285
Quality of supply	1,781	1,739	1,747	1,319	1,318	1,315	1,310	1,307	1,305	1,300
Total	**9,829**	**10,713**	**6,846**	**5,883**	**4,987**	**4,262**	**4,340**	**5,866**	**5,606**	**5,585**

Table 6.10.4.1: Summary of Reliability, Safety, and Environment Projected Capital Expenditure

6.11 Asset Relocation

Modelling suggests that these consents will decline through FY24 and continue through FY25. An MBIE report released in August 2022 forecast national residential building consents would reduce by 33% over the coming years, before slowly recovering to normal levels.

6.11.1 Relocations and Undergrounding

Relocations are predominantly the movement of WEL network assets associated with HCC roading projects and other works related to subdivision and land development.

WEL will convert overhead lines to underground cables and may fund up to 50% of the total project cost where there is a community focus. A maximum annual spend inclusive of any 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 ($'000)
Other Relocations	Relocation of assets to support the development of transport corridors	Relocate assets (✓)	29,933
Undergrounding	Undergrounding of overhead lines	Underground overhead lines (✓) Maintain overhead lines	4,669
Peacockes Development	Extensive roading and earthworks in the Peacockes greenfield area under the HCC Peacockes Structure Plan	Relocate assets (✓)	3,673

Table 6.11.1.1: Asset Relocation projects

The bulk of FY24 and FY25 expenditure has been budgeted for the extensive roading and earthworks in the Peacockes greenfield area under the HCC Peacockes Structure Plan.

6.11.2 Summary of Asset Relocation Capital Expenditure

The 10-year capital expenditure forecast is shown below:

Asset Relocation ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Undergrounding	479	370	425	476	435	461	490	475	515	543
Other Relocations	2,589	1,419	2,966	3,154	3,080	3,135	3,241	3,369	3,412	3,567
Peacockes Developement	2,173	1,500	-	-	-	-	-	-	-	-
Total	5,241	3,289	3,391	3,630	3,515	3,596	3,731	3,844	3,927	4,110

Table 6.11.2.1: Asset Relocation Capital Expenditure

6.12 Summary of Network Development Capital Expenditure

The 10-year Network Development Capital Investment forecast is shown in the following figure. As discussed in Section 6.8, capital budget provisions included in Consumer Connection and System Growth enable electrification, EV uptake and economic growth, supporting New Zealand's carbon reduction commitments. This is the primary driver for the expenditure profile.

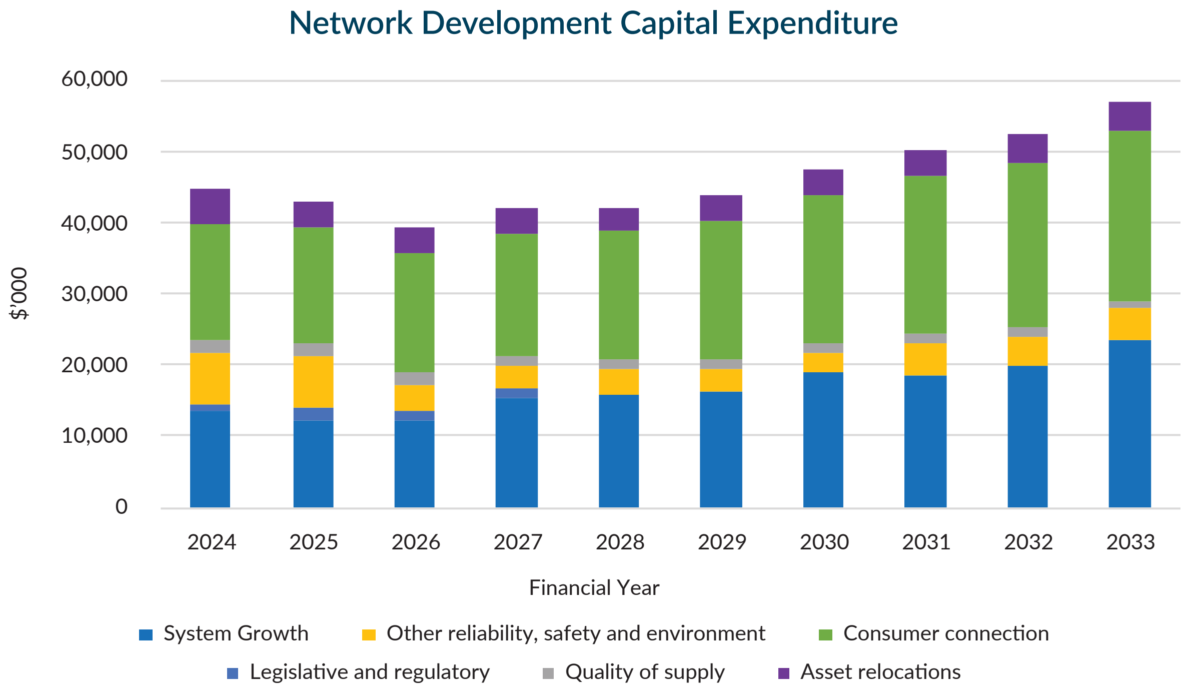


Figure 6.12.1: Network Development Capital Expenditure

7 Non-Network Solutions and Support Systems

Puna Taunaki

WEL NETWORKS AMP 2023

7. Non-Network Support Systems

This chapter details our approach to expenditure on non-network support systems.

WEL has non-network support systems that enable the business to conduct its day-to-day activities in an efficient manner. Systems include the 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, Smart Meter Data System and the Customer Self Service (CSS) web portal.

Most are "off the shelf" products configured to accommodate internal business processes. Internal staff and third-party vendors support these to ensure the systems remain current, secure and fit for purpose. A strategic mobility programme is being established to ensure greater capability in the future. The GIS system is to be replaced with an Esri solution in 2023. These systems interface to ensure consistent datasets are available.

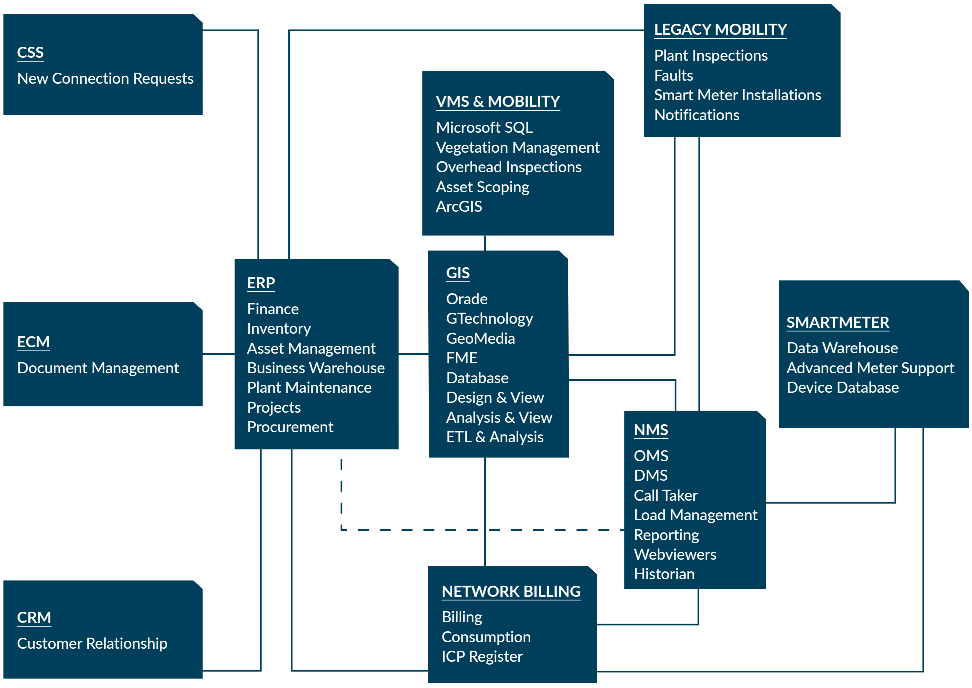


Figure 7.1: Non-Network Support Systems

7.1 Network Operational Technology

This section describes the Network Operational Technology used by WEL to distribute our electricity to customers.

7.1.1 Network Management System (NMS)

The NMS enables fast and efficient control of the electricity network for the operator. It consists of the General Electric (GE) PowerOn Advantage software package, and data storage systems connected to Supervisory Control and Data Acquisition (SCADA) Devices through an IP-based area network. The SCADA network includes Remote Terminal Units (RTUs) that communicate in real time with the control room equipment. Business benefits of the system include safe, reliable, and efficient management of the network and enhanced customer service.

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
- Web viewers
- Historian

These sub-systems are described as follows:

- **Distribution Management System (DMS) and Switching Management**
  The DMS is the core of the NMS collecting real time information and disseminating it to users and other subsystems. The DMS has a connectivity model allowing operators to see the effects of actual and planned switching through animation of the diagram with the current state. It also controls all switching management steps (preparation, validation and execution) and enforces built-in safety logic throughout all stages. This is a powerful aspect of the system, especially from a safety perspective through the enforcement of operational procedures.
- **Outage Management System (OMS)**
  The OMS application is designed to aid in the management, 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. The 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 is 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. All network reliability information (SAIDI, SAIFI etc.) is captured by the NMS and is presented in reports. The annual reliability disclosure reports are automatically generated.
- **Webviewers**
  The PowerOn product provides a web-based view of the operating single line diagram and a linked legacy geographic view (based on Computer Aided Design (CAD) data from GIS). This provides visibility of the system to a wider audience in the business.
- **Historian**
  Analogue points within 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 consists of multiple application servers distributed in the main offices and the disaster recovery site. The system is designed to ensure high availability and resilience of the system. There are separate pre-production and development environments.

Some mobility functionality has been developed to allow the dispatch of fault jobs to field devices and the completion of fault reports from the field. Improvements to cyber security are implemented as part of a wider ongoing IT/OT programme of work or in response to recommendations from external reviews.

7.1.2 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 to meet Metering Equipment Provider (MEP) process and compliance requirements.

Mesh Communications Network and Advanced Meter Management

The metering headend hosts a suite of applications that support the WEL smart meter implementation.

WEL is bringing the smart meter headend system in house to ensure that the information collected is accessible and effectively managed over its lifecycle. It will also ensure that any system changes required to leverage new opportunities can be undertaken in a timely and reliable manner and the IP will be retained by WEL. This project will ensure that we have the systems and processes to collect, store and analyse the information from our smart metering fleet to proactively identify areas of risk within our network.

Smart Meter Database and Data Warehouse

WEL is an MEP currently providing metering services to eight retailers. To support this function, we maintain a Metering Equipment database containing all metering equipment details and associated compliance information.

Five-minute logging of voltage and current is being incorporated into Compass, WEL's Smart Meter Data Management Storage System, to enable a review of power quality issues.

Data Analytics

We have significant expertise in developing tools and analytics for meter data and continue to develop new systems, with the aim of becoming the centre of excellence for smart meter data analytics in New Zealand and providing these services to other companies.

WEL is exploring future ways of measuring, managing, and reporting voltage quality through data analytics platforms.

A system is currently under development for receiving and processing five-minute interval measurement data (including voltage, current and power) from meters and using this data to support several advanced use cases. These are discussed in 6.7.1.

7.1.3 Other Network Operational Systems

Geographic Information Systems (GIS)

WEL's network assets are distributed over a large geographical area. We need to know, visualise and analyse the geographical location of each asset. The 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.

In addition to 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.

Assets recorded in GIS have 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 current. Structured and on-going quality assurance is 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
- Boundaries from Statistics New Zealand

WEL uses 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.

WEL is in the process of transitioning its GIS system to an Esri platform. This will form the basis of our map-based applications. Recent enhancements have included a full LiDAR assessment of the network and mobility applications.

Network modelling software

We use DIgSILENT PowerFactory 2020 for our network models (based on GIS information) to analyse power flows and voltages across the sub-transmission and distribution networks. The analysis is used for asset management, network planning and the connection of new DER.

Protection Setting Database

Settings for all protection devices are summarised in a database which is updated regularly. A new protection calculation and settings summary tool has been developed to enable protection coordination at each individual substation or switching station to be viewed graphically.

Voice Radio system

We use multiple communications channels to communicate between the control room and field resources. The primary method is via cellphone.

A fully compliant digital Radio Telephone trunk radio system was implemented in 2019 as a secondary communication channel, which introduced additional safety features such as "man down" and "open channel" communication to multiple parties simultaneously.

All inbound and outbound calls from the control room, including RT communications, are recorded on a third-party voice recording system. For remote areas of the network where cellphone or RT signal is weak, we have a satellite phone available to ensure effective communication can be achieved.

7.2 Corporate Information Technology

This section describes our corporate information systems.

7.2.1 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, asset management, works management and inventory management functionality for the business. The functionality enabled in SAP includes:

- Finance and Control
- Project Systems
- Plant Maintenance
- Materials Management and Inventory Management
- Quality Management
- Sales and Distribution

Future enhancements include:

- Upgrade of SAP environments to the latest support packs to ensure the system is kept secure and its components are kept in vendor support
- Upgrade of the existing SAP Business Warehouse solution
- SAP Mobility solutions to enable field staff to access better information to improve efficiency

7.2.2 Network Billing System

The billing system supports the requirements of ICP management, the retailer and direct billed consumers invoicing calculations.

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.

7.2.3 Electronic Content Management

Content Server is an OpenText content management system (known to staff as Content Manager). We use the system as a repository for unstructured corporate data. It provides a controlled location for accessing and sharing information such as agreements, policies, guides, emails, presentations and board books.

Version control applies to all content, providing a single controlled source of the truth.

7.2.4 Mobility Systems

The mobility solution provides functionality for electronic data collection from the field. There are four 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:** Breakdown work is assigned to the respective field worker who can view important detail such as address and contact details. 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. Notifications are submitted into a planning queue for rapid analysis and corrective work creation as required
- **Smart Meters:** The certification details are captured electronically with any job information.

A digital road map will be established to consolidate the various mobile platforms currently in use to enhance 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.

7.2.5 Customer Self Service Portal (CSS)

The Customer Self Service Portal is a web application developed in 2020 and caters for Customer Initiated Works, related billing tasks and some customer service team functions. The system centralises 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
- New Connections Works Delivery
- 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 NMS
  - Implementation of the digital roadmap, which provides in-field connectivity to core systems, resulting in significant productivity gains
- **Computer Equipment Capital Expenditure.** This covers the physical computing infrastructure including servers, storage, switches, firewalls and desktops. Expenditure in FY24 is lower than other years due to some critical servers being upgraded under the strategic projects budget. The expenditure in FY25 and FY26 increases to replace equipment identified as being at end of life. The long-term strategy is to spread these upgrades evenly across a four-year period, removing the expenditure peaks, leading to more resilient lifecycle management of these assets. We will continue to monitor and review the use of "on-premises" infrastructure, versus moving hosting into the 'cloud'. Less critical systems (e.g. Office, Teams, Exchange and SAP) could migrate to Microsoft Office 365 and Microsoft Azure over the timeframe of this plan
- **Motor Vehicles**. The forecast reflects the updated policy for non-WEL Services vehicles, which is to replace vehicles at year seven or 200,000km, whichever is earliest. Use of the pool car fleet is being further optimised and the pool fleet has moved from eight to six vehicles, 100% of which are EV or hybrid. The strategy results in no planned small vehicle replacements within the next two years, without compromising safety, availability or vehicle suitability. The move to EV and alternative technologies aligns with our sustainability strategy to maximise fleet emission reductions when suitable technologies become available, and net-zero carbon by 2050
- **Plant and Equipment.** The forecast through FY25-FY27 largely reflects the spend required to refurbish the Maui Street Depot and Head Office to better accommodate the staff, which includes replacing "end of life" fixtures, such as air conditioning, carpets and upgrading amenities.
- **Sustainability focus.** A key consideration when undertaking projects is sustainability. WEL continues to develop a strong sustainability stance and has embarked on a programme of activities in support of this, including electric pool vehicles and trucks with electric power take-off and electric elevated work platforms. A 10-year Sustainable Business Plan has been created that outlines our vision as we move towards 2030. WEL has chosen to align its sustainability activity to four of the United Nations' Sustainability Development Goals (SDGs): SDG3 Our People; SDG7 Our Community; SGD9 Our Network and SGD13 Our Emissions. The programmes are identified in alignment with each SDG area and will assist us in keeping our staff and the public safe and healthy, providing low-cost energy for those in energy hardship in our region, ensuring provision of a resilient infrastructure and reducing our carbon footprint over time.

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

Routine Non-Network Capital Expenditure ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Computer Equipment	164	350	550	550	350	350	350	350	350	350
Computer Software	224	250	250	250	250	250	250	250	250	250
Plant and Equipment	54	400	400	450	500	500	500	500	500	500
Motor Vehicles	-	-	100	270	100	100	100	100	100	100
Total	442	1,000	1,300	1,520	1,200	1,200	1,200	1,200	1,200	1,200

Table 7.3.1.1: Routine Non-Network Capital Expenditure

Strategic non-network capital expenditure includes projects targeting business improvements. These projects have been budgeted at $5M Capex per annum. In FY24 and FY 25 additional projects have been budgeted, including:

- Building and facilities – this expenditure is to increase office and warehousing facilities
- DSO projects – programme of works to increase the visibility of the LV network, provide additional business analytics and trial non-network solutions
- Strategic projects – this is an annual programme of works designed to improve efficiency. Examples include mobility programmes, data management, LV Works management, and reserves market management
- Headend – this project is to take control of the metering headend management, reducing dependency on a third- party provider and ensures data required to enable that DSO capability is available and reliable.

We are investigating the upgrade to SAP S4/HANA in the coming years, with a business case including delivery timelines currently under consideration. The cost of this change is yet to be determined; it has not been included in the AMP numbers.

Strategic Non-Network Capital Expenditure ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Buildings/Facilities	2,361	2,000	-	-	-	-	-	-	-	-
DSO Projects	1,990	-	-	-	-	-	-	-	-	-
Strategic Projects	4,245	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Data Headend	4,229	-	-	-	-	-	-	-	-	-
Total	12,825	7,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000

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

Detailed in Chapter 6, we are developing a framework to evaluate and utilise non-network solutions. Over the ten year period it is likely that a number of constraints will be mitigated using these techniques. This enables us to manage the increased growth in both load and DER at a lower overall cost. This cost, while decreasing network development capital costs, increases our non-network operational expenditure. The full cost of this change is yet to be determined and has not been included in the AMP numbers. The table below summarises the expected non-network operational expenditure.

Non-Network Operational Expenditure	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
System operations and network support	9,784	9,784	9,784	9,784	9,784	9,784	9,784	9,784	9784	9,784
Business support	17,528	17,528	17,528	17,528	17,528	17,528	17,528	17,528	17,528	17,528
Total	27,312	27,312	27,312	27,312	27,312	27,312	27,312	27,312	27,312	27,312

Table 7.3.2.1: Non-Network Operational Expenditure

8 Asset Replacement and Renewal

Te Whakapai me te Whakahōu Rawa

WEL NETWORKS AMP 2023

8. Asset Replacement and Renewal

This chapter describes WEL's renewal and maintenance approach for the AMP period. It details planned renewals and maintenance work, and how WEL has forecast the associated expenditure.

8.1 Overview of Asset Replacement and Renewal

Delivering WEL's performance objectives, as described in Chapter 5, requires the right balance between expenditure on maintenance and investment in renewals. WEL considers the whole of life cost of the assets and required interventions during their lifecycle, to ensure balance between competing drivers of risk, performance and costs.

As part of capability project initiatives, WEL streamlined its end-to-end asset renewal process to improve the decision making when prioritising replacements and enabling work packaging. Introducing work scoping at the early stage of the planning process allows efficient grouping of work. An Annual Work List (AWL) is generated, and risk ranked, using the outcomes of the Condition Based Risk Management (CBRM) tool. The CBRM tool uses system data, including condition information to determine the asset health index (AHI) and asset risks, to develop WEL's capital expenditure in this area. Further details are described in the sections below.

8.1.1 WEL's Approach to Asset Renewal

WEL established the asset management framework, described in Chapter 3, and takes a risk-based approach to renewals with the implementation of CBRM. Key asset classes contained in the CBRM model, are listed 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

Our asset lifecycle strategy is focused on achieving system reliability and meeting regulatory requirements. WEL's reliability performance to date has been good. The objective contained in our Maintenance Manual is to obtain the most cost-effective method of managing network risk and ensure network assets achieve their expected level of service. We achieve this through Failure Mode Effects and Criticality Analysis (FMECA) and whole of life cycle cost analysis. This is then used to develop our individual fleet asset management manuals. This documents our approach to maintenance, inspection, renewal and disposal requirements for each asset class. The information collected in the maintenance and inspection programs is used to inform our Condition-Based Risk Management (CBRM) tool. This tool is used to determine the optimal renewal strategy for each asset class.

For assets, such as HV fuses (DDOs), that do not have a CBRM model, WEL uses information obtained from inspection and reliability tools, such as FMECA to assess the risk of failure and prioritise the renewal programme.

WEL has undertaken analysis on per unit replacement costs. This provides a more detailed understanding of the cost to replace each asset and has been factored into our overall approach.

WEL's investigations into conductor failures have shown that failures tend to be associated with twist joints, jumper failures and damaged conductor due to line clashing. To target areas of potential concern we have invested in a corona camera which allows us to pinpoint the location of PD at the early stages of a fault. We have also undertaken a review of our LiDAR data to identify areas where line clashing may be an issue. Additionally, we have taken samples from different conductor types and sent these for destructive testing to help determine a model for the remaining conductor life. The results will now be fed into our future model development. The LiDAR data has also been used to identify low lines which are at risk of damage from third parties and we have a programme in place to address these.

In FY23 we developed an equipment condition feedback loop into our replacement programmes. This requires the teams replacing the assets to provide information on the condition of the assets being removed. That information is then used to calibrate our CBRM model and asset condition grading. We will use this to ratify our asset replacement programmes, in line with the ISO 55001 requirement for a feedback loop.

While WEL is achieving positive results in SAIDI reductions in the equipment failure category, planned SAIDI has been increased to enable the asset replacement programme to be completed.

Optimised asset management seeks to lower the cost of replacement for each asset class and considers whole of life costs. WEL lowers these costs through continually reviewing opportunities to improve our approach by optimising scoping, grouping and risk-ranking replacements. This approach has significantly reduced the amount of variation in our annual works programme, resulting in far greater certainty of the works to be delivered in a particular year, with greater clarity of work scope. In FY23 we implemented a mobile platform which incorporated; defect notifications, routine inspections, data corrections and works scoping. We expect that by combining these four processes into a single application we can combine tasks which can all be undertaken by a single person, thereby improving efficiency. Additional efficiency driven by this change is the integration directly into SAP removing the need for duplicated data handling, improving both efficiency and the accuracy of data. A full year's worth of asset inspections is now available to our inspectors, giving them greater visibility and flexibility in delivering the annual inspection programme. There are dashboards which provide visibility on progress. Early results show a marked improvement in the delivery of the inspection programme.

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

8.2 WEL's Approach to Asset Maintenance

WEL's maintenance activity is safety focused and ensures compliance with relevant regulations. It is structured to minimise the whole of life costs of the 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
- Where possible improve network availability

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

8.2.1 Assumptions and Inputs

Assumptions and inputs inform the level of maintenance undertaken on WEL's assets. The key assumptions and inputs are described below.

Industry Standards and Analysis Tools

Maintenance tasks are determined using industry maintenance standards, supporting tools and analysis that assist maintenance engineers to optimise and rationalise the maintenance plan. In 2021, WEL completed a programme of creating Standard Maintenance Procedure documents (SMPs). This began with key safety related assets like circuit breakers and protection relays. SMPs outline the maintenance requirements in the Maintenance Manual, in a more detailed and procedural way. This assists in standardising plant maintenance processes and the capture of key asset information, including asset condition.

Asset Inspections

WEL regularly inspects its assets, the surrounding area and vegetation. The inspection or monitoring frequency of an asset 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 CMMS. This information is used by the CBRM tool to produce risk profiles and investment scenarios, with options for capital expenditure projections.

Condition Assessment

Asset condition influences the extent of servicing, any necessary repairs required and provides vital data to inform asset renewal decisions. The 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 aging 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	Less urgent defects - requiring addressing in the specified timeframe
3		3 months	
4		18 months	
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

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. 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. WEL completed a review of equipment that could be used as an alternative to SF_6-filled switchgear in FY19. As a result of that review we have changed our preferred ringmain units to a hybrid model which has lower volumes of SF_6. We are currently reviewing this again, with the intention to move to SF_6 free switchgear, where practical. In the meantime, WEL is required by law to disclose the quantity it has installed in the network. WEL records and monitors the volumes of SF_6 gas installed, disposed, and emitted into the environment. As at 31 December 2022, the volume of SF_6 utilised by WEL's switchgear was 1.54 tonnes. During the 2022 year, WEL was able to reduce stored spare SF_6, however 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 has the potential to interfere with the safe and reliable supply of electricity to customers and network. WEL has increased the inspection frequency and has a vegetation management system to record, predict and manage all vegetation works through a mobility solution platform. This system has a purpose-built vegetation growth model based on all New Zealand species, weather and environment information to aid in proactive targeting of risk areas and future vegetation management requirements. This system has allowed WEL to effectively manage our vegetation.

The current legislation is under review and this may lead to a need for vegetation expenditure to change. The current legislation provides minimal ability to address "fall in" trees. Fall in trees are trees that are outside the growth and notice zones specified in the regulations, however the lines are within the fall radius of the tree. Fall in trees are the predominant contributor to major outages resulting from extreme weather events within the WEL network.

Vegetation expenditure is currently based on WEL's vegetation management requirements to maintain safety compliance and ensure network reliability targets are met. With the introduction of the vegetation management system, future expenditure forecasts will consider the outcomes of the growth modelling. Table 8.2.3.1 shows expected expenditure for the AMP period.

Vegetation Management Operational Expenditure ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Vegetation Management	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712
Total	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712

Table 8.2.3.1: Vegetation Management Operational Expenditure

8.2.4 Service Interruption and Emergency Management

Service interruption and emergency management relate to required faults work under WEL's operational expenditure programme.

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 CBRM model projections. Our history has shown that approximately 70% of faults are low voltage faults, therefore it is expected that as the load in LV increases with electrification that the number of faults experienced will also increase.

Service Interruption and Emergency Management Operational Expenditure ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Service Interruption and Emergency Management	3,371	3,404	3,438	3,473	3,507	3,542	3,578	3,614	3,650	3,686
Total	3,371	3,404	3,438	3,473	3,507	3,542	3,578	3,614	3,650	3,686

Table 8.2.4.1: Service Interruption and Emergency Operational Expenditure

8.2.5 Maintenance Forecasting

WEL's maintenance activities and associated operational 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 the maintenance team to ensure improvements are captured and updated in the plans. The increase across the planning period is to allow for additional 11kV cable PD testing.

The maintenance forecast for each asset category is shown at the end of each section below.

Routine and Corrective Maintenance and Inspection Operational Expenditure ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Routine and Corrective Maintenance and Inspection	1,908	1,884	1,938	1,952	2,058	2,070	2,125	2,148	2,170	2,143
Total	1,908	1,884	1,938	1,952	2,058	2,070	2,125	2,148	2,170	2,143

Table 8.2.5.1: Routine and Corrective Maintenance and Inspection Operational Expenditure

Asset Replacement and renewal operational expenditure encompasses work needed to maintain network asset integrity so as to maintain current security and/or quality of supply standards as well as replacement or renewal of assets were driven by:

- Physical deterioration of the condition of network assets or their immediate surrounds
- Obsolescence of network assets
- Preventative replacement programmes, consistent with asset life-cycle management policies
- Ongoing physical security of network assets

Asset Replacement and Renewal Operational Expenditure ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Asset Replacement and Renewal	2,882	2,852	2,917	2,934	3,061	3,075	3,142	3,168	3,195	3,163
Total	2,882	2,852	2,917	2,934	3,061	3,075	3,142	3,168	3,195	3,163

Table 8.2.5.2: Asset Replacement and Renewal Operational Expenditure

8.2.6 Innovations and Improvements in Maintenance Practices

Innovation and continuous improvement are necessary to meet WEL's cost efficiency objectives. Improvement in the end-to-end Asset Lifecycle Planning Process flow has been implemented which included the alignment of SAP maintenance plans with the analysis from FMECA, and Whole Life Cycle Cost Analysis (WLCC). The process involves master data management, engineering analysis, asset measurement points, maintenance standards development, and reporting. This is intended to drive improved asset reliability, data quality, and works delivery efficiency.

The maintenance related improvements and innovations WEL has recently implemented include:

- Asset Condition Monitoring (ACM) mobile tool. As discussed in 8.1.1 this is expected to drive efficiency in the scoping of works.
- Results from PD online and offline testing have highlighted a number of joints that had the potential to fail and these have been addressed. We have factored into the budget an allowance to fix more of these.
- A PD survey using the acoustic and corona camera has provided early detection of defects associated with insulators and connections. We have factored these findings into a more targeted replacement programme for these assets which commenced in FY22.
- Our leaning pole assessment criteria have been reviewed. This has resulted in an increase in notifications which have been factored into the next two years of the pole replacement budget.
- The data analytics from the LiDAR survey were used to determine low lines and areas where line clashing could be an issue. These findings have been factored into our replacement programmes for poles, conductor and crossarms. It has also been used to identify vegetation issues and these have been incorporated into our vegetation management system and scoped for remediation.
- In FY23 we conducted an inspection via helicopter of poles in rural, remote and difficult to access locations. The inspection identified assets where remedial works were required. This further assists in targeting our asset replacement during the planning period.
- Destructive testing of overhead conductors has involved samples from different conductor types, different ages and different locations. The results have recently been received and they will now be factored into our replacement models. Early indications are that an extension to our conductor life expectancy should be possible.
- Our journey to ISO 55001 certification, has seen the development of smart data collection tools. Our equipment condition feedback tool requires the field staff removing an asset to report its condition at the time of replacement using a mobile form. This is information is then analysed to validate our CBRM models, completing the plan-do-check-act loop which is pivotal to ISO 9001.
- A review of standard equipment replacement costs has been completed. This has provided more accuracy into our forecasts and AWL programme. This will ensure that the budgets assigned are suitably sized for the assets to be replaced.

End to End Lifecycle Planning Process

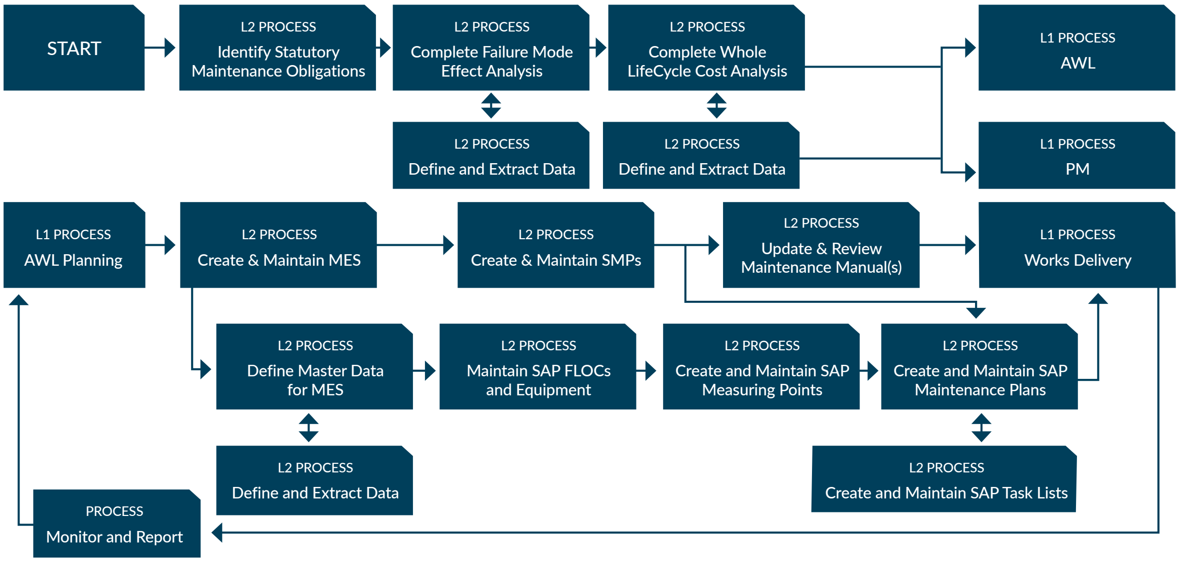


Figure 8.2.6.1: End to end Lifecycle Planning Process

Engineering Analysis (FMECA)

FMECA and asset 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 of 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 programme 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 MES in conjunction with the asset class's 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 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.

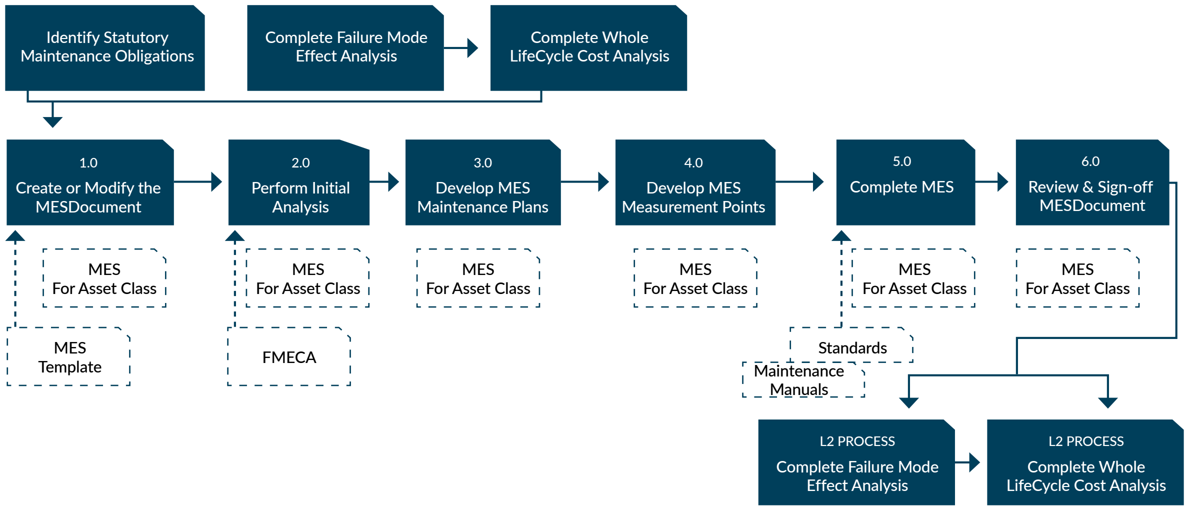


Figure 8.2.6.2: MES process overview

Standard Maintenance Procedures (SMP)

The purpose of the SMP programme is to define the required level of maintenance which will ensure equipment and systems deliver a safe and reliable service at their required duty, considering the environment in which they operate. This approach is a key driver of WEL's asset management strategy which is based on a preventative and predictive approach that considers the capacity of available resources, access to assets and the balance between safe operating assets and life cycle costs.

WEL's Lifecycle Engineering 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 required to perform maintenance to the high standard set out in the SMPs and provide critical measurements and test results back to the Lifecycle Engineering Team who perform reliability analytics and ensure the network remains safe and reliable.

The application of these innovations and improvements is discussed in Section 8.4.

Root Cause Analysis

Root Cause Analysis (RCA) examines failures when they occur and identifies improvements in maintenance and design which is applicable to critical network equipment in the light of the real fault events.

Root cause analysis is a key tool to prevent the recurrence of nonconformity through the identification of appropriate corrective action rather than simple correction. WEL utilises root cause analysis as follows:

- Following an incident (as defined in the WEL BMS) an investigation will be undertaken which follows the ICAM procedure
- Following an asset failure, a root cause analysis may be requested
- Following high customer impact outages
- Following identification of nonconformity in asset management processes, a root cause analysis may be undertaken. This utilises structured problem-solving techniques that WEL staff have been trained in e.g. Five Why's and Cause and Effect Analysis or potentially ICAM

The outcome of a root cause analysis may feed into further analysis (e.g. FMECA) or indicate the need for changes to the asset management system. For example, the root cause of asset failures may be a consequence of insufficient resourcing for asset management.

8.3 Renewals

WEL uses CBRM modelling to develop a risk-based approach to planning 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-based asset management.

CBRM is a tool that combines asset data and information (e.g. age, asset type, working environment, condition, other factors such as number of connected parties), engineering knowledge as well as practical experience to estimate future condition and performance of network assets. Specific risks for each asset category are identified and quantified. WEL has developed CBRM models for all its key asset classes to determine health and risk profiles and used these to develop capital expenditure projections.

Through the asset planning process, WEL manages scope and budget requirements of renewal work. This is outlined in the Project Definition Document (PDD).

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 5 to 10. However, this has been balanced after a review of the overhead line reliability strategy which resulted in a reduced rate at which conductors need to be replaced. Capitalised Faults and Notification work will increase slightly over the 10-year period in response to the reduced but optimised asset replacement strategy.

In addition to the replacement of network distribution equipment, WEL included selected substation equipment in its renewal programme. These include:

- the aged electro-mechanical relays and other secondary devices that are becoming unreliable due to their age and condition
- circuit breakers that have mechanism issues
- aged zone transformers that are in poor condition

8.3.1 Investment Scenarios

To determine the optimal level of planned renewal expenditure across the key asset categories in the AWL, WEL considered four alternative investment scenarios including a baseline of the 2024 AMP approach. The section below shows indicative 10-year risk profiles for each scenario. The scenarios are:

- **Scenario 1 – The Do-Nothin**g 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 – Proposed budget [$12.0M]** scenario is WEL's preferred option. It looks to minimise the combined cost of asset renewal, fault and notification budgets.
- **Scenario 3 – Proposed budget +$1M [$13.0M]** 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.
- **Scenario 4 – $ Proposed budget -$1M [$11.0M]** 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.

The key asset categories included in the scenarios presented above are the following:

- 11kV Overhead Line Conductors
- Crossarms & Insulators
- Ring Main Units [RMU]
- Poles
- Distribution Transformers
- Network Switches
- LV Pillars

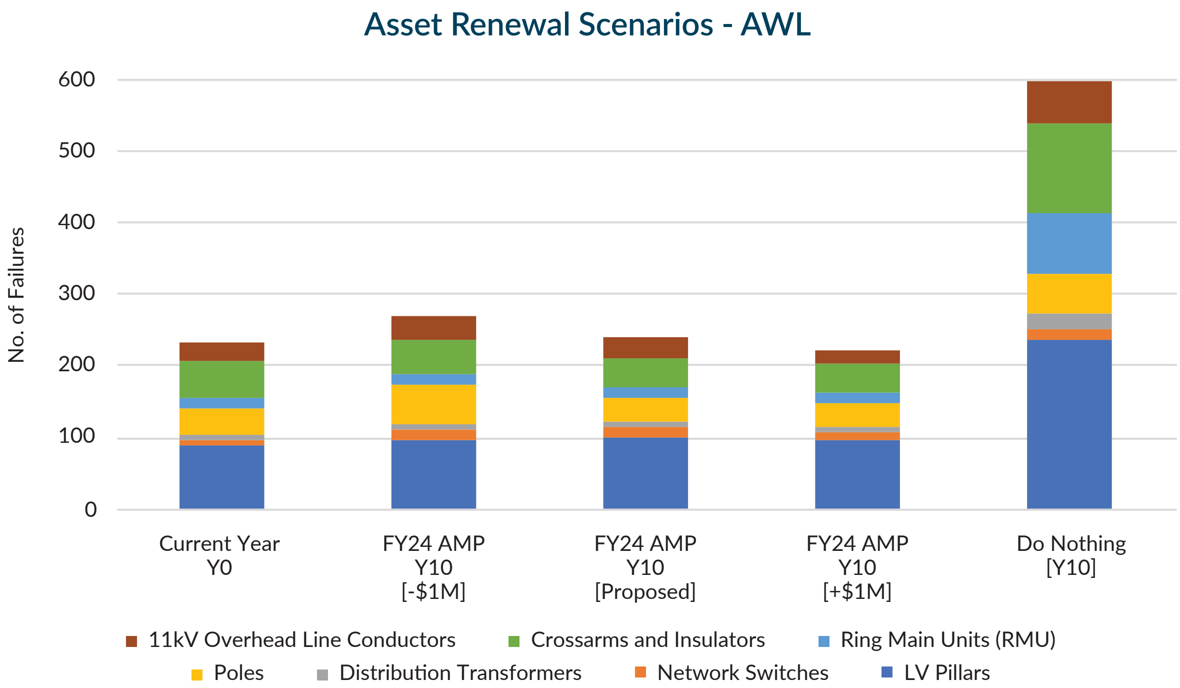


Figure 8.3.1.1: Asset Renewal Scenarios

8.3.2 Assumptions and Inputs

There are a range of assumptions and inputs necessary for establishing WEL's 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 the inspection programmes 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 corona and acoustic 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 in 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 significantly improved 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 by the Engineering Team.

A complete Network LiDAR survey (Light Detection and Ranging) has been completed which provided a laser accurate position of all WEL overhead line assets in relation to ground levels and GPS coordinates. Outcomes are being 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.

WEL has engaged an external contractor to inspect selected overhead lines using a helicopter. This has provided insights and detailed defect notifications on poles and pole-top equipment which are not usually possible during ground inspections.

We have commissioned a new Asset Condition Monitoring (ACM) tool which is used for both field inspection and for scoping. This tool is integrated in WEL's CMMS which enables efficiency in field executions and increase in data accuracy.

These techniques help eliminate failures proactively via the 'network defects' process and early intervention programmes and can also be used to defer premature asset renewals. It also provides WEL with early warning on potential failures that could result in catastrophic consequences.

Design Life Assumptions

The expected design lives of assets are based on manufacturers' guidance and WEL's own practical experience managing assets. WEL seeks to extend the working life of its assets, beyond design life, based on risk assessments, as well as benchmarking asset reliability and the condition of older assets with similar configurations. WEL recently commenced overhead conductor sampling that will provide technical asset life estimation.

8.4 Asset Life Cycle Management

This section describes how WEL manages its assets over the full lifecycle and considers the following asset categories, with details of included asset and expenditure summaries:

- Subtransmission
- Zone Substations
- Distribution and LV Lines
- Distribution and LV Cables
- Distribution Substations and Transformers
- Distribution Switchgear
- Other Network Assets

For each asset category WEL has:

- 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 their approach to addressing these problems
- Identified the replacement programme and drivers
- Described the innovations WEL has made to defer asset replacements
- Listed the projects underway or planned

8.4.1 Capitalised Faults and Notifications

Capitalised faults cover unplanned asset replacement due to network asset failures. The capital expenditure is detailed in Table 8.4.1.1 and shows that the expected capitalised faults to remain constant over the period. 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. Faults can impact public and WEL personnel safety, customer supply and WEL's reputation. The annual quantity of faults is forecast 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.

Defect notifications are asset defects that are identified as needing replacement within the current financial year. Defect notifications give sufficient time to plan the repair within the year however, due to their urgency, provide insufficient time to plan and budget for the repair prior to the start of each financial year. Historical network data shows defect notifications are regularly raised due to several 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's standard design or specific design. The capital expenditure for notifications is outlined in Table 8.4.1.2.

Capitalised Faults ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Capitalised Faults	3,409	3,404	3,404	3,404	3,404	3,404	3,404	3,404	3,404	3,404
Total	3,409	3,404	3,404	3,404	3,404	3,404	3,404	3,404	3,404	3,404

Table 8.4.1.1: Capitalised Faults Expenditure

Notifications ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Notifications	2,940	2,935	2,935	2,935	2,935	2,935	2,935	2,935	2,935	2,935
Total	2,940	2,935	2,935	2,935	2,935	2,935	2,935	2,935	2,935	2,935

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
- Tree debris blown onto the lines during high wind or storm events
- External influences such as possums or birds causing flashovers

Regular Maintenance and Inspection

Inspections on subtransmission lines include:

- Detailed inspections on all line assets every five years
- Six-monthly thermal and corona surveys on critical lines
- A complete network LiDAR survey has been conducted that has taken an accurate snapshot of all overhead assets

During detailed inspections, tests are conducted on all earth banks. Our survey data has been enhanced by the procurement of an acoustic and corona camera which provides early detection of defects. Thermographic, multispectral imaging and acoustic surveys are conducted on selected critical subtransmission feeders annually.

Maintenance tasks are undertaken to correct any defects identified.

Asset Renewal Programme

No major line lengths are due for replacement within the AMP period. Targeted replacements are made based on condition. Approximately 300 subtransmission crossarms are nearing nominal end of life and we have increased our planned renewal spend to address this along with a known insulator failure mode.

Subtransmission Poles

Although our pole assets are predominantly concrete with an expected life of 70 years we have a small number of wood poles nearing end of life which are targeted for replacement. Additionally, we have a number of poles installed in areas with peat soil. The failure mode in peat relates to issues with foundation strength. CBRM does not currently include that specific failure mode, therefore our replacement programme has allowed for a further small number of poles in peat to be replaced each year across the planning period.

As a result of the asset renewal per unit cost analysis undertaken in FY23 we have a clearer understanding of the costs to replace different pole types. Subtransmission poles are more expensive to replace due to the complexity of the replacement work and therefore their asset renewal costs have been increased across the planning period to reflect this.

Subtransmission Crossarms and Insulators

Our older subtransmission crossarms are predominantly wooden and nearing end of life. The rate of deterioration is expected to exponentially increase as they age. We have a known ceramic insulator failure mode which causes the top of the insulator to crack and shear off causing the conductor to drop onto the crossarm. Aging crossarms with these insulator types are targeted for replacement. In our subtransmission network, we are replacing wooden crossarms with steel which has an expected life of 70 years, aligning with the expected pole life.

Subtransmission Conductor

The conductor is in good condition and therefore there is no expected spend in the AMP period for asset replacement.

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
- Cable joint failures

Regular Maintenance and Inspection

WEL has invested in specialised cable testing equipment, and implemented a new strategy of regular cable testing, results tracking and end-of-life prediction. This will further improve cable health assessment.

In FY24 we will complete the first round of scanning of all subtransmission 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 undertakes proactive corrective actions and determines the failure mechanism of the suspected cable joints and terminations. Once the mechanism of failure is understood, this information is used to improve preventative and predictive maintenance routines for cables.

Asset Renewal Programme

The new WEL Networks maintenance strategy includes the development of subtransmission cable insulation and accessories condition and health profile. After completion of the first assessment cycle, the Lifecycle Engineering Team will analyse and recommend a long-term plan for HV cable renewal. A proactive cable joint replacement programme was completed in FY23 for the replacement of identified cable joints between Pukete substation and Te Kowhai GXP. This programme was undertaken in conjunction with the Kohia substation development project. A further programme, driven by PD testing results, has been budgeted for across the 10-year planning period. It is anticipated that cable replacement will need to occur towards the end of the planning period.

Most cable faults are caused through human activity or cable joint failures. These do not require large lengths of cable to be replaced. However, WEL has significant lengths of cable approaching end of design life. WEL's new cable testing regime will deliver better understanding of their health, remaining life and expected replacement timeframe and enable optimal replacement with lower impact on network reliability.

Subtransmission Circuit Breakers (CBs)

Risks and Issues

There have been no significant issues identified with WEL's subtransmission CBs. We only expect to replace one in the planning period.

Regular Maintenance and Inspection

Subtransmission 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

The CBRM model has been implemented to assist in renewal prioritisation and forecasting the required level of investment for subtransmission CBs.

An outdoor 33kV subtransmission circuit breaker at Ruakura switching station is scheduled to be replaced in FY24 due to condition driven risks. Other than this there is no expected asset renewal spend in the AMP period.

Summary of Subtransmission Renewal expenditures

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)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
33kV Circuit Breakers (CB)	53	-	-	-	-	-	-	-	-	-
33kV Subtransmission Cable	117	114	112	112	111	111	165	164	191	244
33kV Poles	104	92	90	90	89	88	83	81	78	75
33kV Crossarms and Insulators	263	262	256	255	254	253	271	281	292	313
Total	**537**	**468**	**459**	**457**	**455**	**452**	**519**	**526**	**561**	**632**

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
- Degradation of the paper windings insulation resulting in failure to withstand forces during a fault on connected circuits. 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 switches

Regular Maintenance and Inspection

Testing and maintenance are specific to the subcomponent of the power transformer as detailed in Table 8.4.3.1

Frequency	Maintenance	OLTC	Vacuum-OLTC
2 Monthly	Inspection	X	X
Yearly	Annual DGA	X	X
3 Yearly	Transformer Minor	X	X
6 Yearly	Transformer Major	X	X
3 Yearly	On-Load Tap Changer (OLTC) Servicing	X	
6 Yearly	On-Load Tap Changer (OLTC) Servicing		X

Table 8.4.3.1: Summary of Power Transformer Maintenance

Minor refurbishment is conducted on transformers that require repainting or rust treatment. Gaskets are replaced as part of the minor refurbishment activity. The remaining life is assessed at this time. WEL expects that properly maintained transformers, with mid-life refurbishment, will have a life exceeding 60 years.

Asset Renewal Programme

Zone transformers at Gordonton, Te Uku and Weavers are reaching the end of their nominal lives. Renewal of these transformers are planned towards the end of the AMP period. WEL continues to track asset health indicators to refine the replacement date.

Zone Substation Switchboards

WEL has Air Insulated (AIS) and Gas Insulated Switchboards (GIS) on its network.

Risks and Issues

The principal risks and issues for zone substation switchboards are:

- Fault flashover causing injury to staff and equipment damage. New boards are fitted with arcflash protection and venting 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
- Operational handling and testing of SF_6 gas in GIS switchboards. WEL is using external service providers for this critical task as they are experts in this field

Regular Maintenance and Inspection

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
- Outdoor switchyard connections, e.g. insulators, busbars

Major maintenance is conducted on AIS equipment every nine years, and every twelve years on GIS equipment

Maintenance 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
- Gas pressure checks and HV withstand tests on GIS.

Asset Renewal Programme

Renewal of indoor switchboards is undertaken in conjunction with CB replacements or as part of network development projects.

CBs scheduled for renewal within the AMP period due to their age and condition include those at Te Uku, Rural Bank, Glasgow and Crawford. CBs at Gordonton are on track for completion by the end of FY23. 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 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
- Damage to earth conductor from external parties - this 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. Newer sites are installed with sump pumps which remove water accumulated in trenches and basements
- Records of earth test results and earthing design are lacking on some older sites

Regular Maintenance and Inspection

Grass cutting, pest control and general cleaning of substation buildings are 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 conducted 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 where practicable or label any remaining identified Asbestos Containing Materials (ACM) from these sites.

The Facilities team have improved specific security issues at substations where third-party damage has occurred. In FY25 they will undertake a risk review of security at all substation and switching station buildings. This will include an assessment of physical security including access and egress, and an assessment of site fencing, taking into account any changes to the surrounding land use. Any requirement for expenditure will be factored into future AMP budgets.

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.

The allowed CB replacement budget per site has increased significantly. This is due to inclusion of all works that will need to be factored into the replacement program e.g. protection relays, site works and inter-panel wiring.

Costs have also increased because two new projects have been introduced:

- Crawford due to a mechanism defect. Unfortunately this is early in its life cycle but remedial steps to address the defects have not been successful.
- Glasgow due to its age has come in at the end of the planning period (FY33)

Due to greater than expected deterioration of the CBs at Kent St substation this work was brought forward into FY23 and therefore falls out of the next planning period.

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)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
11kV Circuit Breaker (Upgrade)	-	-	-	738	734	732	783	998	1,397	1,085
11kV Switching Station/ Zone Sub	117	114	112	112	111	111	110	110	109	109
Zone Substation Transformer	-	-	-	-	1,111	1,108	1,101	1,096	1,091	1,085
Total	117	114	112	850	1,957	1,951	1,994	2,204	2,597	2,279

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 risk to staff, public and public property. The risk of failure is greatest with the remaining hardwood poles and in areas with peat soils
- 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
- Insignificant foundation
- Spalding of concrete in concrete poles

Regular Maintenance and Inspection

WEL's maintenance strategy for poles 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 uses 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 the results. WEL is searching for similar techniques to use on concrete poles.

WEL commenced a programme to inspect selected distribution overhead lines including poles, using a helicopter which performed a "pole top" survey that took high-definition photos. Assessment of the captured data and photos from this inspection programme were used to raise defect notifications accordingly.

Maintenance of poles includes the repair of stay wire and possum guards and strengthening poles that are leaning.

Asset Renewal Programme

We have several wood poles nearing end of life and a number of concrete poles manufactured approximately 50 years ago to a lower manufacturing standard, these poles are targeted for replacement over the AMP period. WEL has changed our requirements for assessing leaning poles in FY23 and reinspected key locations against these new requirements.

We have also improved the quality of our annual inspection programs and completed a pole top survey of a large percentage of our rural locations. These improvement programmes have identified a number of poles that needed to be addressed. To manage this the budget for pole replacement is higher at the start of the AMP period and then tapers off. Approximately 15% of our poles are installed within areas with peat soil and these poles are subject to foundation issues. We are still to develop the CBRM model to address poles in peat soils, therefore the quantity of poles to be replaced has been increased above CBRMs recommendation to address this.

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
- King bolt corrosion

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 most common failure mode is insulator failure (40%), followed by hardware failure (18%) and rotten wood (13%). These failure modes are deterioration based, with the likelihood increasing with age. This type of failure mode is best managed by periodic inspection and preventative maintenance programmes, coupled with a condition-based replacement.

Regular Maintenance and Inspection

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 acoustic diagnostic testing has been introduced as part of the inspection process. This technology is reliable in detecting early signs of insulator cracking or high levels of partial discharge.

WEL has commenced a programme to inspect selected distribution overhead lines including crossarms and insulators, using a helicopter which performed a "pole top" survey that took high-definition photos. Assessment of the captured data and photos from this inspection programme were used to raise defect notifications accordingly.

Asset Renewal Programme

A significant percentage of our overhead lines were constructed in the 1970s. Many of these wooden crossarms have exceeded their nominal life expectancy and the rate of deterioration is expected to exponentially increase. Additionally, the recent helicopter pole top inspection results correlate with our assessment of the deteriorating condition of these assets. Without intervention, crossarm failure rates are forecast to accelerate in the next 10 years. To mitigate this risk, a significant increase in replacement is planned throughout the planning period with an additional step increase from around FY30. The replacement program addresses the higher risk crossarms with poor condition assessment. Our high voltage network crossarms are replaced with those of steel construction, with an expected life of 70 years. This aligns with the expected pole life.

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
- 16mm^2 copper conductors are prone to breaking while handled. Due to higher safety risks, WEL has ceased 'live line' work on or under these conductors. This will increase the number of planned outages to renew this type of conductor over the AMP period
- Line clashing resulting in conductor damage. WEL has undertaken a LiDAR survey of our network. This information has been used to identify areas where line clashing is likely.

Regular Maintenance and Inspection

Inspections for distribution and LV conductors are undertaken as follows:

- Thermal imaging and corona and acoustic testing is completed annually on critical sections of distribution conductors
- The remaining distribution and LV conductors are visually inspected every five years
- 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 programme has commenced to better understand conductor condition
- A LiDAR survey has been conducted 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 WEL's network over time while providing the best value for its customers

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 type of conductor sections will enable WEL to strategically replace the remaining aged conductors in the network and calibrate the 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)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Reconducting	1,426	1,419	1,390	1,386	1,379	1,375	1,366	1,360	1,354	1,347
Distribution and LV Poles	1,977	1,750	1,715	1,709	1,698	1,674	1,574	1,530	1,487	1,424
Distribution and LV Crossarms and Insulators	4,995	4,969	4,869	4,853	4,831	4,816	5,142	5,434	5,540	5,950
Total	**8,397**	**8,138**	**7,974**	**7,948**	**7,907**	**7,865**	**8,082**	**8,233**	**8,380**	**8,720**

Table 8.4.4.1: Distribution and LV Lines Capital Expenditure

8.4.5 Distribution and LV Cables

Distribution Cables

Risks and Issues

The principal risks and issues associated with distribution cables are damage caused by excavations or directional drilling, suspect insulation, and termination failures due to aged dry paper in PILC.

Network outages can be extensive while cable jointing/termination repair work is undertaken although normally customers can be back fed while repairs are completed.

Regular Maintenance and Inspection

FMECA shows that a limited number of distribution and LV cables failures occur at terminations and cable joints. Routine inspections help address these termination failures. At the distribution level WEL has improved fault detection PILC termination inspections by inspecting and measuring PD during periods of high humidity. This has allowed earlier detection of deteriorating terminations and lowered the fault rate. LV cable terminations are routinely inspected.

WEL is implementing a more 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 the most critical cable routes and to allow more informed project planning.

Asset Renewal Programme

In line with previous years WEL has allowed limited cable sections to be replaced following faults. WEL expects that with three years of cable test data it will have a snapshot of the cable network's remaining life. This will allow programming of cable replacements. Given the cable age WEL expect these replacements to start at low levels beyond this AMP 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. Many of the LV cables in are nearing the end of their life.

Regular Maintenance and Inspection

Due to their inaccessibility, there is no routine maintenance performed on LV cables other than termination inspection. However, LV connectivity is monitored in real-time via WEL's smart meter network. WEL is also complementing its current smart meter capabilities with impedance monitoring. It is hoped that this will help to indicate deteriorating sections of cable and enable replacement to be programmed.

Asset Renewal Programme

An investigation is planned to determine the best methodology for monitoring and assessing the health of the aging LV cables. A provision has been made for replacement of the LV cables in the CBD in the later period of the AMP as these are reaching the end of their nominal life. Cables are also replaced as part of other projects such as upgrades or further LV reticulation development. An allowance has also been made to replace sections of cable following a fault, and this expenditure is included under Capitalised Faults (Section 8.4.1).

The cost for the replacement of LV Service Pillars has increased for the next planning period. The increase is driven by the need to relocate these pillars due to safety considerations and also due to a number of higher cost switching pillars needing to be replaced.

Table 8.4.5.1 summarises Distribution and LV Cables capital expenditure for the AMP period.

Distribution and LV Cables Capex ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Distribution 11kV UG cables	117	114	112	112	111	111	165	164	191	244
LV Underground cables	-	-	-	-	278	388	661	877	1,091	1,411
Service and Distribution Pillars	622	619	606	604	601	599	596	593	590	587
Total	739	733	718	716	990	1,098	1,421	1,634	1,872	2,242

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
- External factors such as lightning strikes, birds, possums, vermin, and vegetation

WEL has not identified any systemic problems with any manufacturer or model of transformer.

Most 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). Similarly, an invasive inspection routine will increase life cycle maintenance costs beyond the replacement cost and is not economical.

Damage from external parties on the earthing on WEL's 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 programme.

Regular Maintenance and Inspection

WEL's pole mounted, and pad mounted transformers are inspected every five years. Maintenance and testing include:

- Testing of earth banks
- Security checks
- External panel deterioration or damage
- Vegetation control
- Cleaning of HV and LV cubicles
- Thermal imaging of connections and busbars
- Smart meter demand monitoring

For larger ground-based CBD and industrial distribution transformers the maintenance programme includes:

- Annual inspection
- Thermal imaging and corona and acoustic inspections of all links, bus bars and connections
- Maintenance checks on tank and cubicles
- Cleaning equipment and building internal areas
- 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 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. WEL has developed a tool to aggregate smart meter data relating to their corresponding distribution transformers but will use data loggers where this is not possible.

Asset Renewal Programme

Distribution transformers have an expected life of 50 years. However, dependent on the environment and operating conditions, a life up to 80 years can be safely achieved. We have two main types: pole-mounted and ground-mounted, having various capacity (kVA) ratings from 15kVA to 2MVA. 408 distribution transformers have been identified in moderate condition and 94 in poor condition. The replacement programme for the next two financial years is driven by an increased number of defect notifications targeting condition issues such as oil-leaking and ground-mounted distribution transformers with damage to the tank and/or cubicles. Priority is given to transformers with safety risk (i.e. arc flash). The increase in budget is due to the focus on ground mounted transformers which have higher replacement costs than overhead pole mounted transformers.

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)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Distribution Transformers(11kV/400V)	2,034	1,849	1,706	1,700	1,828	1,822	1,811	1,803	1,795	1,785
Total	2,034	1,849	1,706	1,700	1,828	1,822	1,811	1,803	1,795	1,785

Table 8.4.6.1: Distribution Substations and Transformers Capital Expenditure

8.4.7 Distribution Switchgear

Risks and Issues

Distribution switchgear includes Ring Main Units (RMU), Air Break Switches (ABS), Circuit Breakers (CB), reclosers, sectionalisers, distribution overhead line fuse units and isolating links. 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' issue during operation which poses a significant safety risk. An 'over travel arrestor' tool is being used to operate this model of RMU
- For operation of all oil filled RMUs, a rope and pulley system is used so that these RMUs can be switched at a safe distance
- Failure of old oil filled RMUs, due to oil leaks, moisture ingress or internal component failures

ABS:

- Older, manually operated ABSs 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 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

Isolating Links:

- Corrosion of the moving components. This results in the links either not closing properly or not being able to be opened.

Regular Maintenance and Inspection

Maintenance and testing are undertaken on switchgear as outlined in the sections below.

RMUs

RMUs are inspected and tested every five years. Inspection and testing consist 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 undertaken 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 have partial discharge testing and visual inspection of busbar boxes. RMUs are subject to major maintenance every 10 years and include inspection of internal components, replacement of insulating oil, painting, gasket replacement and lubrication of mechanism.

ABSs

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 conducted on selected switches that are critical to the network (e.g. Open Points). WEL uses UAVs for inspections to gain a bird's eye view of ABSs and other line equipment.

Faulty line connections, contact problems 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 programmes coupled with a condition-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 programme.

Appropriate spares are kept, ensuring faults or defects can be rectified in a timely manner.

CBs

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 and Sectionalisers

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.

Distribution Overhead Line Fuses and isolating links

A visual inspection is undertaken every 5 years.

Asset Renewal Programme

The renewal programme for distribution switchgear is as follows:

RMUs:

Oil-filled Ring Main Units (RMU) have an expected life of 40 years, however if well maintained a life in excess of 65 years can be achieved. Gas-filled (SF_6) type have an expected life of 55 years. The gas-filled units are in good condition. The oil-filled RMUs have poorer condition with a number at end of life.

Our replacement programme for the next two financial years is driven by defect notifications that are validated through the CBRM process. The programme is targeting oil-filled RMUs with particular type issues such as 'Long and Crawford' (L&C) due to a type fault with an internal component and the older English Electric that cannot be operated by the rope and pulley system. The prioritisation of these units is based on condition, safety risk and operational risk.

Our replacement programme is less than the recommended units in CBRM due to our invasive maintenance programme which replaces oil and gaskets, inspects internal components and assesses the condition of the ancillary equipment. This ensures that the units remain in good operational condition and provides a detailed assessment of their condition. The maintenance program targets the refurbishment of approximately 30 units annually and the replacement programme targets around 13 units annually.

The replacement program targets units with the following criteria:

1. known condition issues,
2. units in areas with high public access
3. units that require frequent operation

Targeted replacement of oil filled RMUs, with Vacuum and SF_6 type RMUs, is planned within the AMP period.

ABSs:

An Air Break Switch (ABS) has an expected life of 35 years. We have two types on our network, the true ABS that have a physical air gap between the contacts in the open position and enclosed which use vacuum bottles as the switching mechanism.

The units targeted for replacement include panel switches, which are a vertical mounted fused switch assembly, and older units that are prone to insulator failure and mechanical issues. The panel switches have a corrosion issue with the bolts securing them to the pole and the fuses are no longer available. The programme is prioritised on safety, defect notifications and operational risk.

Reclosers and Sectionalisers:

Sectionalisers and reclosers are newer compared to the other asset classes. Replacement is based on the known asset defect. One unit is proposed to be replaced per annum.

HV Overhead Line Fuses:

There are no planned renewal of these assets. Renewal of these is undertaken as part of pole and crossarm replacement programmes.

Isolating Links:

We have failure type related to corrosion with the S&C links. We have instigated a replacement program to remove these links in conjunction with the pole and crossarm replacement programmes.

Summary of Distribution Switchgear Renewal expenditure

Table 8.4.7.1 summarises Distribution Switchgear capital expenditure for the AMP period.

Distribution Switchgear CAPEX (In Nominal Price $'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
11kV Air Break Switch	439	666	652	650	647	645	641	638	635	632
11kV Reclosers and Sectionalisers	61	60	59	59	59	59	58	58	58	57
11kV Ring Main Unit	2,176	2,165	2,121	2,114	2,104	2,098	2,084	2,076	2,066	2,055
S&C Link replacement	207	206	202	-	-	-	-	-	-	-
Total	2,882	3,096	3,034	2,823	2,810	2,802	2,784	2,772	2,759	2,744

Table 8.4.7.1: Distribution Switchgear Capital Expenditure

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
- 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 WEL's asset classes. This is due to the higher accessibility to the public. Safety risks include electric shock 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.

Regular Maintenance and Inspection

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 subcategories 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 concrete and fibreglass type pillars. The expected life of LV pillars is 45 years. Most of the pillars are in good condition. The replacement programme for the next two financial years is driven by defect notifications targeting poor condition and obsolete pillar types such as concrete and fibreglass.

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.

Protection Relays

Risks and Issues

The principal risks and issues associated with protection relays are:

- Spares for the electromechanical
- The significant cost of maintenance for the electromechanical
- Lack of complex protection functionality and fault analytics in older electromechanical relays

Regular Maintenance and Inspection

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, which require access to the light sensors in the switchgear, are maintained at nine yearly intervals to coincide with bus maintenance
- For all other relays, maintenance is undertaken on a three-year interval to coincide with CB maintenance

Modular Substation

WEL has set up a modular substation to expand 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 substations with integration to WEL's NMS. The installed devices can also be used as spares in an emergency. The modular substation setup is kept and maintained in one of the zone substations.

Asset Renewal Programme

WEL's 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 remote terminal units (RTUs) and batteries, degradation of pilot communication cables and the incompatibility of certain components.

Regular Maintenance and Inspection

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
- 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 across the AMP period.

Smart Meters

Risks and Issues

The principal risks and issues associated with smart meters are:

- Loss of communication
- Electronic failure

Regular Maintenance and Inspection

Maintenance functions on smart meters include:

- Sample testing after seven years
- Recovered meters are refurbished and recertified
- Investigation and repairs on meter “self-reported” issues
- Repairs undertaken on reported failures

Asset Renewal Programme

Smart meters are installed at new installations driven from new connections (e.g. new subdivisions) and where WEL is nominated as the Meter Service Provider (MSP). Meters are replaced when they are reported as not functioning. WEL intends to develop a long-term strategy around WEL meters and how it supports the DSO journey.

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

Regular Maintenance and Inspection

Maintenance on EV chargers includes:

- Service provider scheduled yearly maintenance
- Service provider fault response
- Maintenance repairs 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 load control injection equipment are long lead-times on replacement parts and compatibility issues with the SFU-G type ripple control converter.

Regular Maintenance and Inspection

The load control injection equipment is inspected every six months. Inspections involve plant testing, visual checks, and signal strength tests. Annually 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 completed. The load control injection plant will not be renewed as it is likely this technology will be superseded by smart metering and other gateway technology.

Battery and Charger Systems

Risks and Issues

The principal risks and issues associated with battery and charger systems are:

- Loss of control of primary equipment when battery or charger systems fail
- 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)

Regular Maintenance and Inspection

Due to their criticality, battery and charging systems are inspected six monthly. Tests conducted during these inspections include impedance tests, alarm tests, float voltage and condition. Remote monitoring and load tests are also conducted bi-monthly. WEL has on-line monitoring of RTU connected battery installations. This monitoring will significantly reduce battery test requirements.

Additionally, discharge tests are conducted 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 WEL 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.

Other Network Capex ($'000)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Protection Relays	-	755	741	-	-	-	-	-	-	-
SCADA & Comms	282	283	277	276	275	274	273	271	270	377
Total	282	1,038	1,018	276	275	274	273	271	270	377

Table 8.4.8.1: Other Network Assets Capital Expenditure

8.5 Overall Expenditure summary

8.5.1 Network Operational Expenditure

Operational expenditure is in line with WEL's 2023 AMP forecasts. This forecast is under CPI as efficiencies are expected in the delivery of our maintenance plans. In particular, the cost of providing third party cable locates, utilisation of fault technicians, stand overs and overhead inspections are expected to decrease.

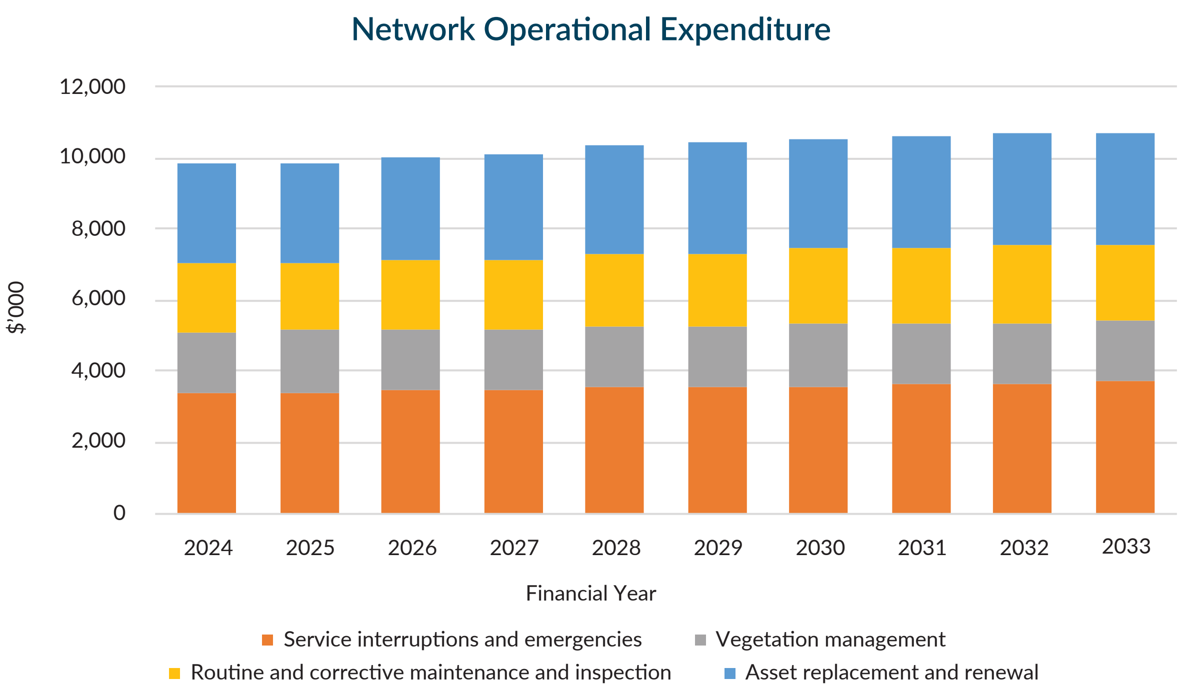


Figure 8.5.1.1: Network operational expenditure

8.5.2 Renewal Expenditure

WEL's asset renewal philosophy remains aligned to the previous AMP with a relatively flat five-year expenditure followed by an increase to address ageing crossarms and air break switches. The proposed spend profile is consistent with the previous AMP.

Capitalised Faults and Notification work will remain unchanged over the 10-year period. Two asset classes where condition data can be improved, are overhead conductors and underground cables. For overhead conductor, WEL's condition modelling shows significant lengths of conductor should be replaced however, this does not match what is experienced and physical inspections.

WEL is embarking on a three-year project where conductor samples will be sent to a materials scientist to assist in assessing the remaining conductor life. Overhead line reliability will be improved through focusing on long span clashing, conductor joints and connections.

Budget to replace cable and cable joints is included in the AMP over the next 10 years. Most cable faults are caused through human activity or joint failures. These do not require large lengths of cable to be replaced. However, WEL has significant lengths of cable approaching end of expected life and there are increasing lengths of cable requiring replacement due to asset condition. We have invested in HV cabling monitoring equipment and are using this to build a solid understanding of the condition. We will also undertake work to understand the condition of the LV conductors.

Good Asset Management seeks to lower the cost of replacement for each asset class. WEL lowers the cost through its continued improvement programmes. This includes risk-ranking of replacements and targeting the highest risk assets and allows WEL to extend asset life while lowering overall risk. The grouping and scoping allow more streamlined replacement planning and execution while lowering the cost and customer outage impact of each replacement.

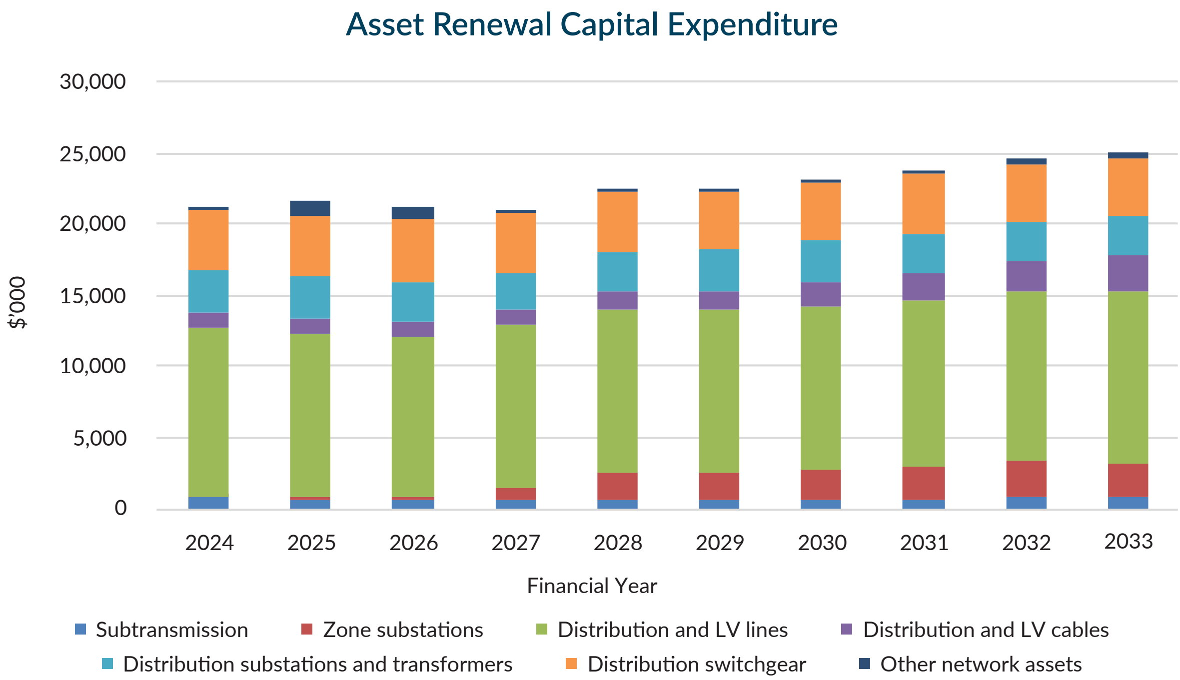


Figure 8.5.2.1: Renewal Capital Expenditure by asset type

9 Summary of Expenditure Forecasts

Rīpoata Ā-Pūtea

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 WEL's expenditure in several categories over the AMP period.

All figures 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 WEL's 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 expenditure across the business. The expenditure profiles cover the 10-year period of the AMP, 1 April 2023 to 31 March 2033.

The notation adopted in each table refers to financial year-end. For example, the 1 April 2023 to 31 March 2024 financial year is referred to as 2024 or FY24.

9.1.2 Forecast Inputs and Assumptions

WEL's forecasts rely on several inputs and assumptions. These include:

- Capital contributions
- Cost of financing (FDC)
- Managing forecast uncertainty

Capital Contributions

The customer works expenditure shown is the gross amount 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 in accordance with the Electricity Distribution Information Disclosure Determination 2012; adjustments for inflation have not been accounted for. Inflation is included in the nominal dollar forecasts in Schedules 11a and 11b in Chapter 10; the inflation forecasts are based on the latest available Treasury forecasts at the date of compilation.

While the assumed inflation rates follow a general historic trend and provide an indicator for future labour rates and material costs, there is always an inherent level of uncertainty. By example, market conditions and pricing can change with relative supply and demand pressures or major economic shocks like the COVID-19 pandemic.

For this AMP, WEL has assumed the change in labour and materials is limited to the assumed inflationary pressures, rather than modelling specific trends in network components or specific labour market rates for trades.

9.2 Network Capital Expenditure

The graph below depicts our total forecast network capital expenditure for the 10-year AMP period, by category. The categories of system growth, consumer connection, asset replacement and renewal are the main drivers of our capital expenditure during the period.

The projected expenditure required for consumer connections is lower in the short-term in line with our current growth forecasts and incorporating the likelihood of a recession. The increasing expenditure from 2026 onwards incorporates the recovery of consumer driven and system growth and to enable anticipated electrification. For a full explanation, refer to sections 6 and 8.

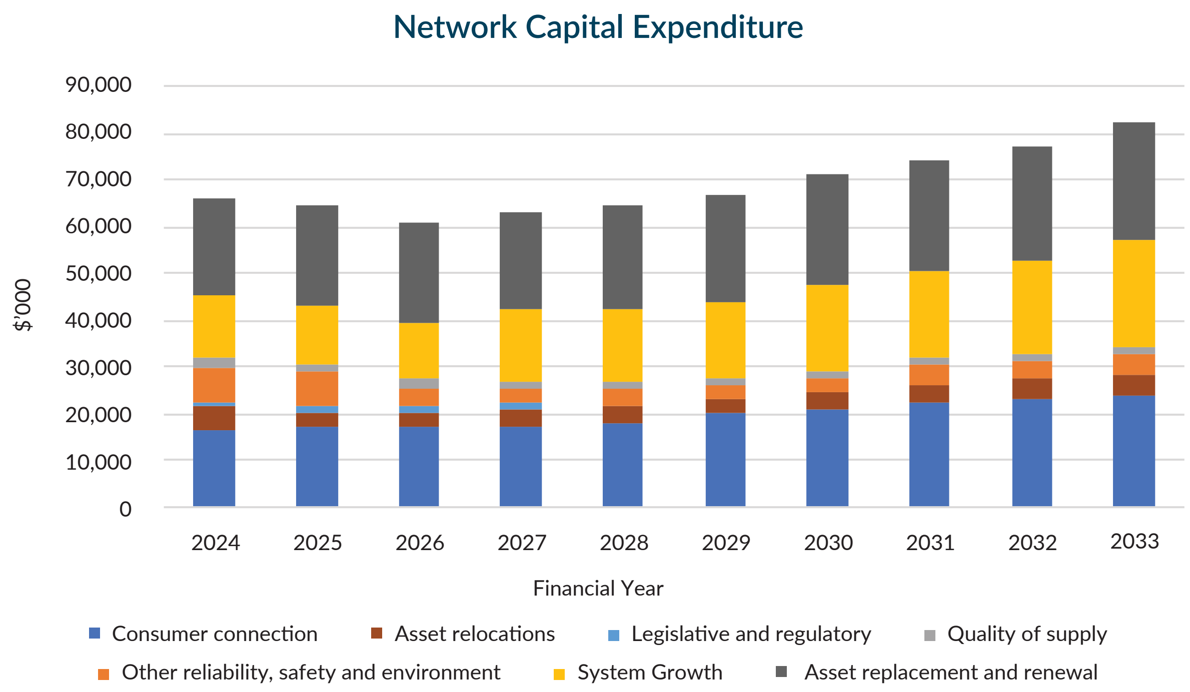


Figure 9.2.1: 10-year Network Capital Expenditure

9.2.1 Consumer Connections

The consumer connection category relates to expenditure on assets in order to establish new, or alter existing, connections as a result of customer requests. It covers expenditure that may be recovered via capital contributions from customers, for both load and generation connections.

Our consumer connection expenditure forecast reflects the increased likelihood of a recession during 2023/24 and the associated slowdown in new connection growth we anticipate. Following the Global Financial Crisis (GFC) in 2008, our network experienced a 50% decline in new connection growth. It took four years for growth to recover to pre-GFC levels. For more details, refer to Section 6.8.

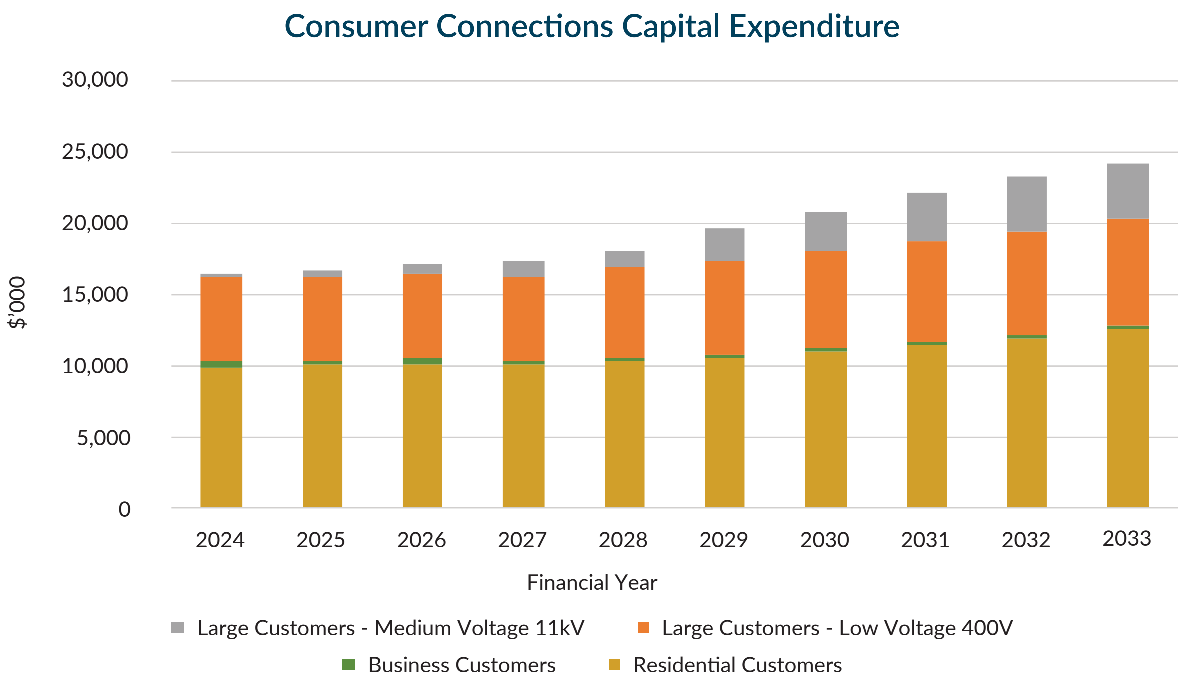


Figure 9.2.1.1: 10-year Consumer Connections Capital Expenditure

9.2.2 System Growth

System growth relates to capital expenditure where the primary driver is either a requirement for additional capacity (which is not directly the result of a customer connection request), or where there is a change in the requirement for electricity distribution services because of new or emerging technologies.

Our system growth expenditure forecast is largely driven by the additional network infrastructure which will be required to allow for long-term population growth in our region and enable the accelerating electrification of transport. The main features of our forecast are near-term reinforcement of subtransmission, followed by the construction of five new zone substations in later years. For more details, refer to section 6.9.

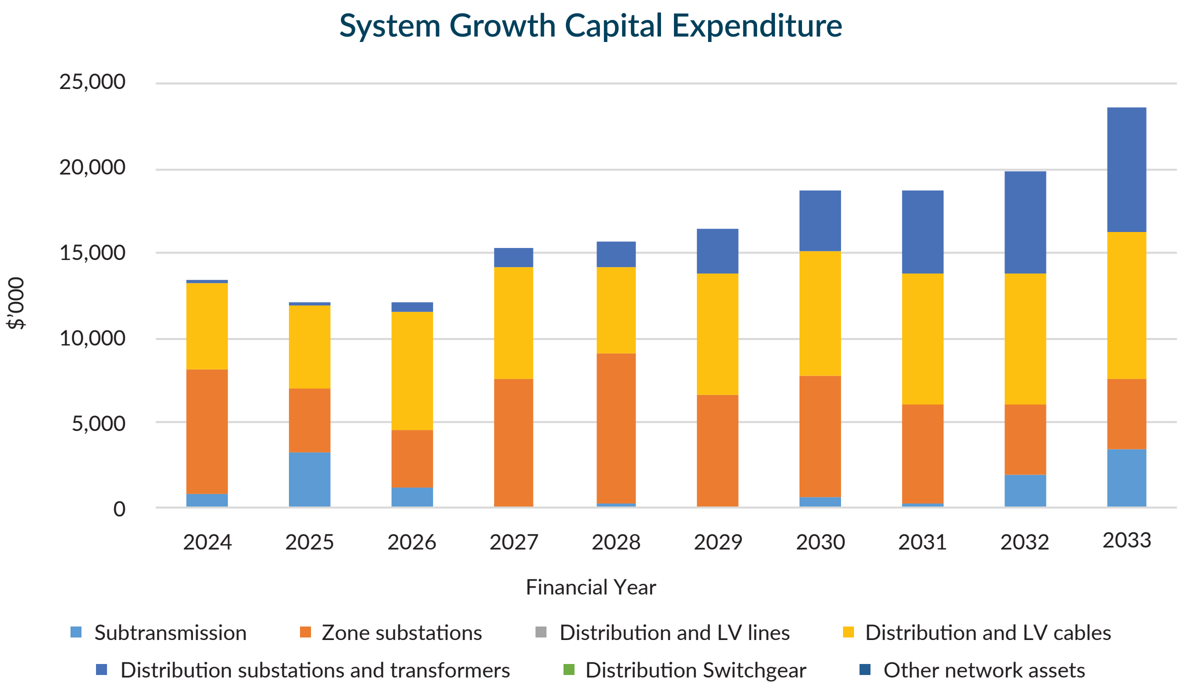


Figure 9.2.2.1: 10-year System Growth Capital Expenditure

9.2.3 Asset Replacement and Renewal

Asset replacement and renewal describes expenditure where the primary driver is maintaining network asset integrity in order to sustain current security and/or quality of supply standards.

A large portion of our network was constructed during the 1970s, wooden crossarms from this era are now nearing their end of life. As we have flattened the replacement profile over many years, this crossarm replacement programme forms the bulk of our asset replacement and renewal expenditure throughout the AMP period. For more details, refer to Chapter 8.

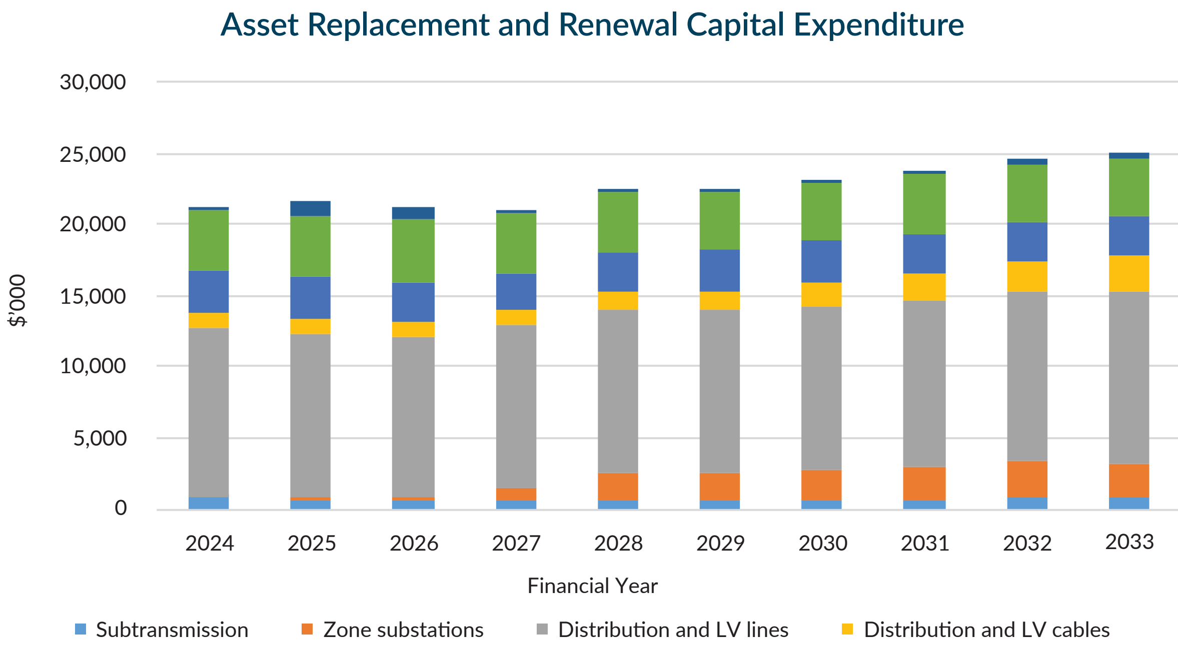


Figure 9.2.3.1: 10-year Asset Replacement and Renewal Capital Expenditure

9.2.4 Asset Relocations

Asset relocations is the category which relates to expenditure on assets which are relocated at the request of a third-party. Usually relocations are requested to allow for a reconfiguration of roading layout but can also include the undergrounding of previously above- ground assets.

Aside from some notable relocation projects in 2024 for various developers and the Hamilton City Council, including the major Peacockes Development, expenditure in this category is forecast to remain relatively stable throughout the AMP period. For more details, refer to section 6.11.

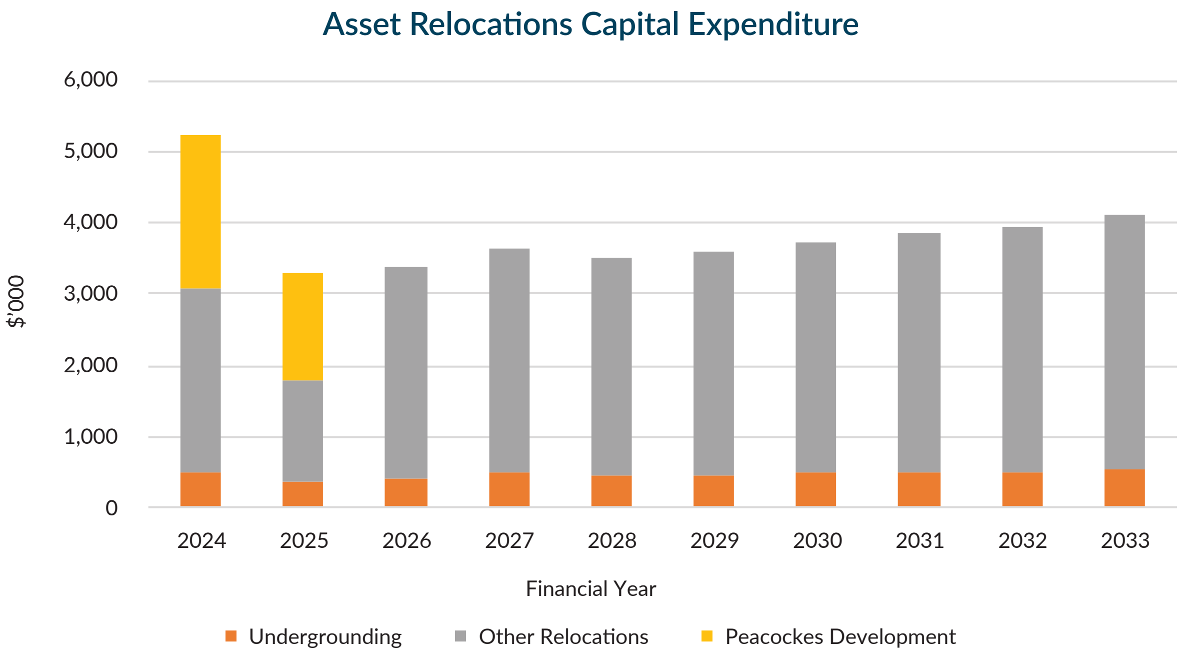


Figure 9.2.4.1: 10-year Asset Relocations Capital Expenditure

9.2.5 Quality of Supply

Quality of Supply covers expenditure required to improve the security and/or quality of supply. Forecast expenditure in this category is intended to reduce the average number, or duration, of interruptions customers experience on our network.

Additional expenditure is forecast in the first three years of the planning period to allow for the installation of power quality analyser infrastructure. After this, our quality of supply expenditure returns to a relatively flat profile for the remainder of the period. The ongoing expenditure throughout the period relates to projects which will address the voltage impacts of photovoltaic cells (solar PV) and electric vehicles, increase the visibility of the LV network, and install smart meters within distribution transformers. For more details, refer to section 6.10.1.

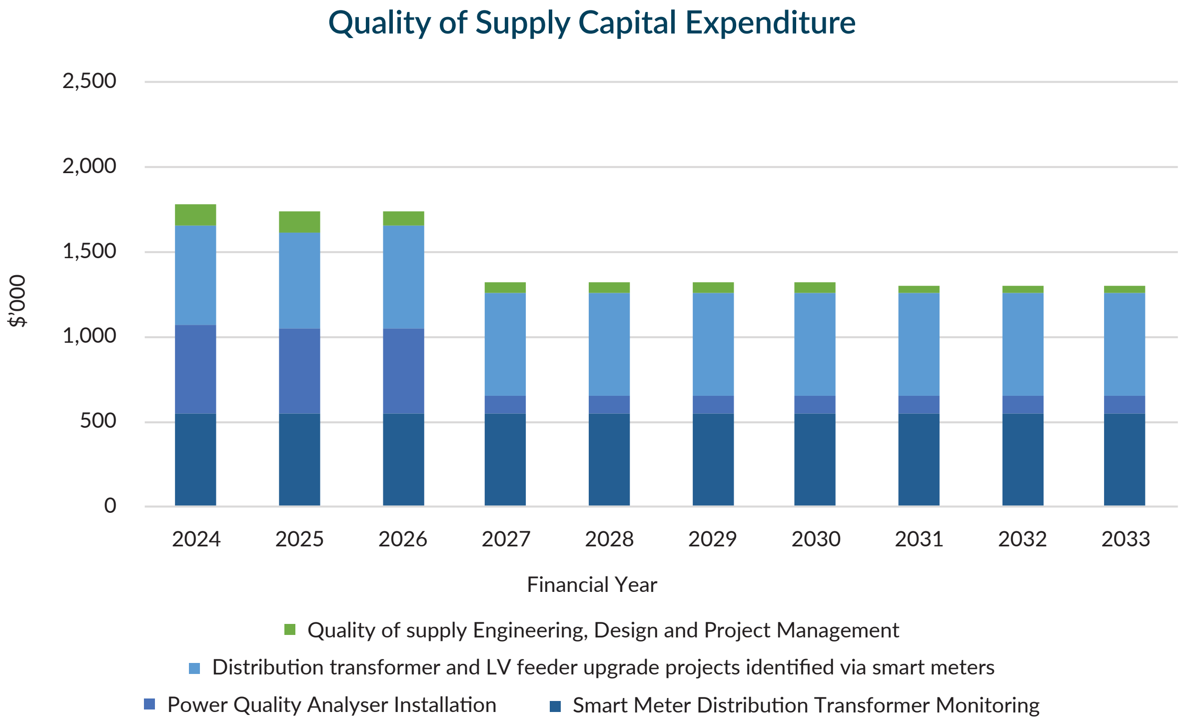


Figure 9.2.5.1: 10-year Quality of Supply Capital Expenditure

9.2.6 Legislative and Regulatory

The legislative and regulatory category outlines expenditure required to ensure that we remain compliant with New Zealand law and regulations.

The known expenditure we have forecast in the first half of the period mainly relates to seismic strengthening of substation buildings and increasing powerline clearances to roads and structures. For more details, refer to section 6.10.2.

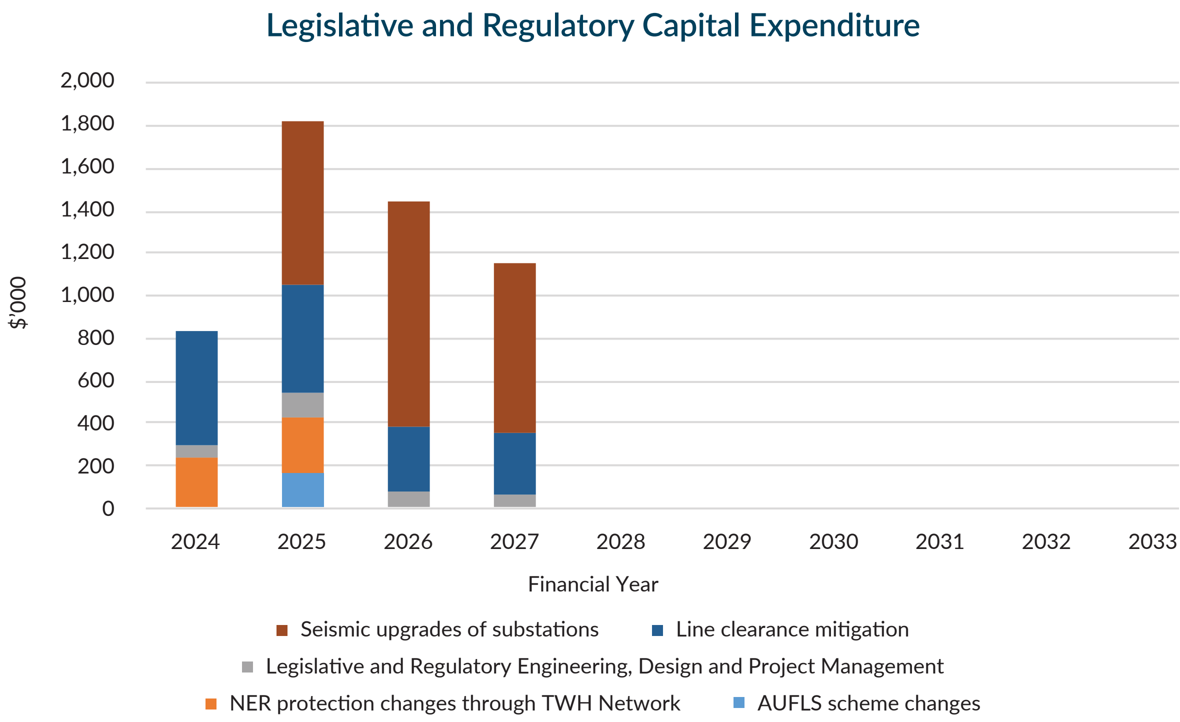


Figure 9.2.6.1: 10-year Legislative and Regulatory Capital Expenditure

9.2.7 Reliability, Safety and Environment

This category describes expenditure required to maintain or improve network reliability or service standards, safety of the network for consumers, employees and the public, and to reduce the impact of the network on the environment.

The majority of forecast expenditure in this category relates to reliability and security of supply improvements. The additional expenditure in the first two years of the plan represent an upgrade of the Te Uku substation and security of supply improvements for Te Uku and Raglan. For more details, refer to section 6.10.3.

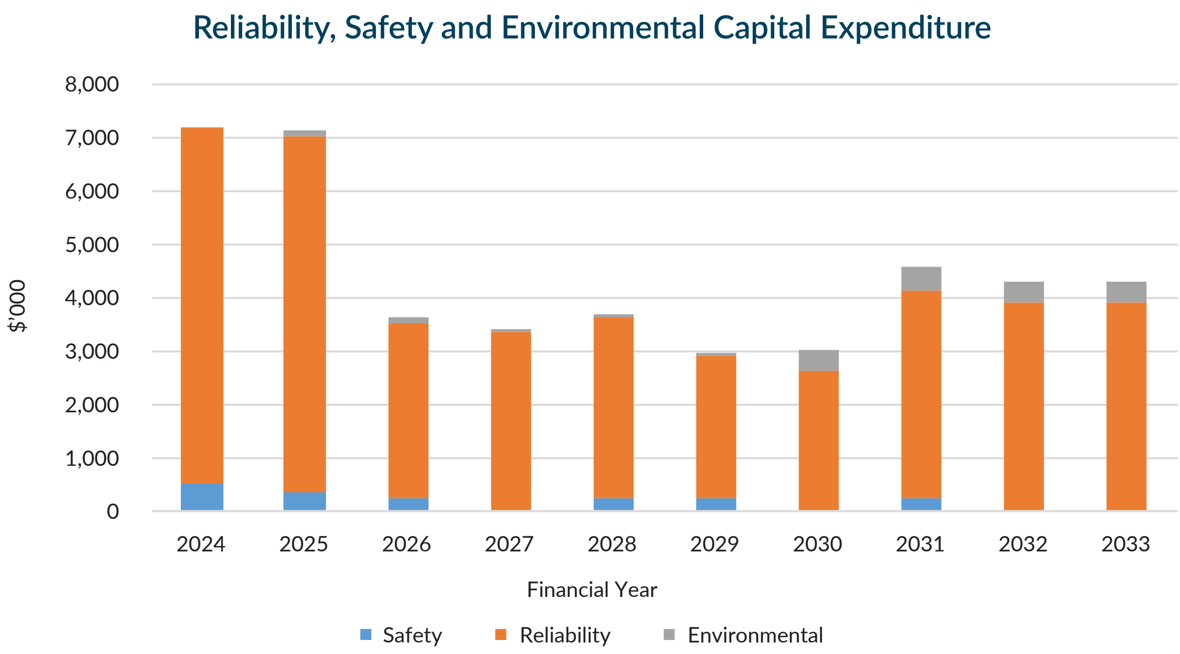


Figure 9.2.7.1: 10-year Reliability, Safety and Environmental Capital Expenditure

9.3 Non-Network Capital Expenditure

The non-network forecast represents expenditure in assets which support and enable our asset management activities, but which are not directly involved in the provision of electricity distribution services. Examples of this type of expenditure include: information technology and asset management systems, tools and machinery, offices and depots, and motor vehicles. Expenditure in this category is further broken down as either 'routine' or 'strategic'.

9.3.1 Routine Non-Network Capital Expenditure

The main drivers of routine non-network capital expenditure are the capital maintenance related to our Maui Street Depot and Head Office, end-of-life computer hardware upgrades, and fleet renewal restarting in 2026 (in line with our fleet replacement strategy). For more details, refer to section 7.3.

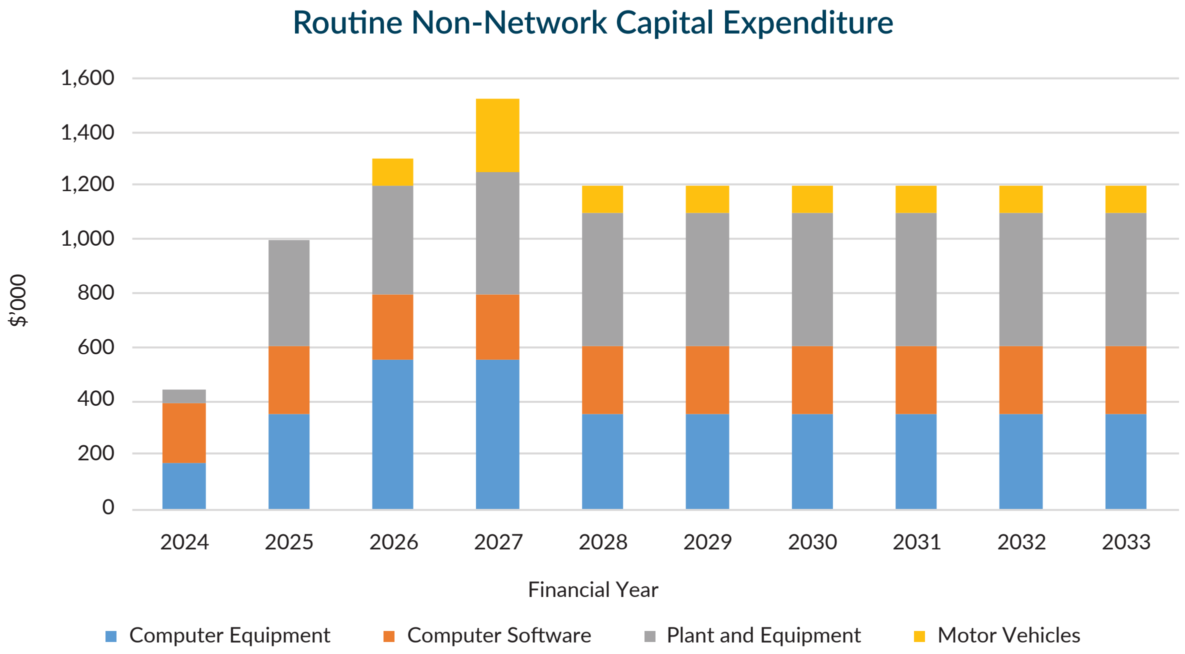


Figure 9.3.1.1: Routine Non-Network Operational Expenditure

9.3.2 Strategic Non-Network Capital Expenditure

Strategic non-network capital expenditure includes projects targeting business improvements. In the first two years of the period, expenditure in this category is largely related to construction of a new office/warehouse, depot expansion, DSO projects, the smart meter data headend project, and other digital transformation projects. From 2026, we expect the expenditure profile to flatten out again. For more details, refer to section 7.3.

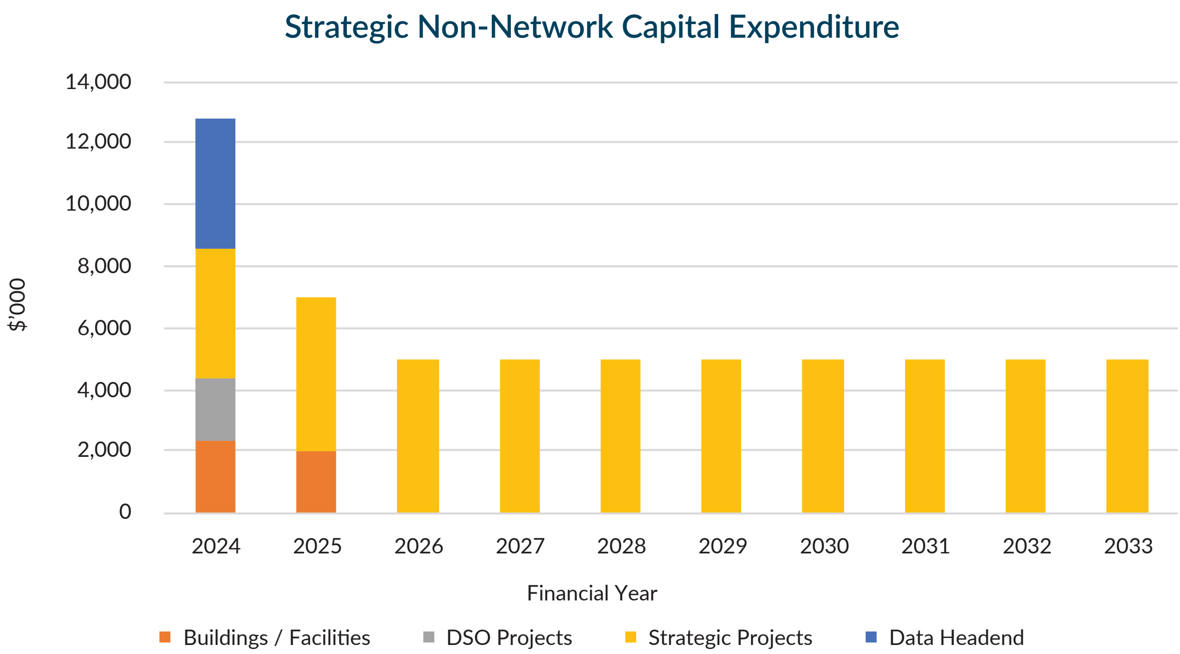


Figure 9.3.2.1: 10-year Strategic (atypical) Non-Network Capital Expenditure

9.4 Operational Expenditure

The graph below depicts our total forecast operational expenditure for the 10-year AMP period, by category. The categories of business support and system operation and network support are the main drivers of our operational expenditure forecast during the period.

The projected expenditure profile for all categories of operational expenditure remains relatively flat over the 10-year period, such that annual operational expenditure is only slightly higher in the last year of the AMP period as compared to the first year.

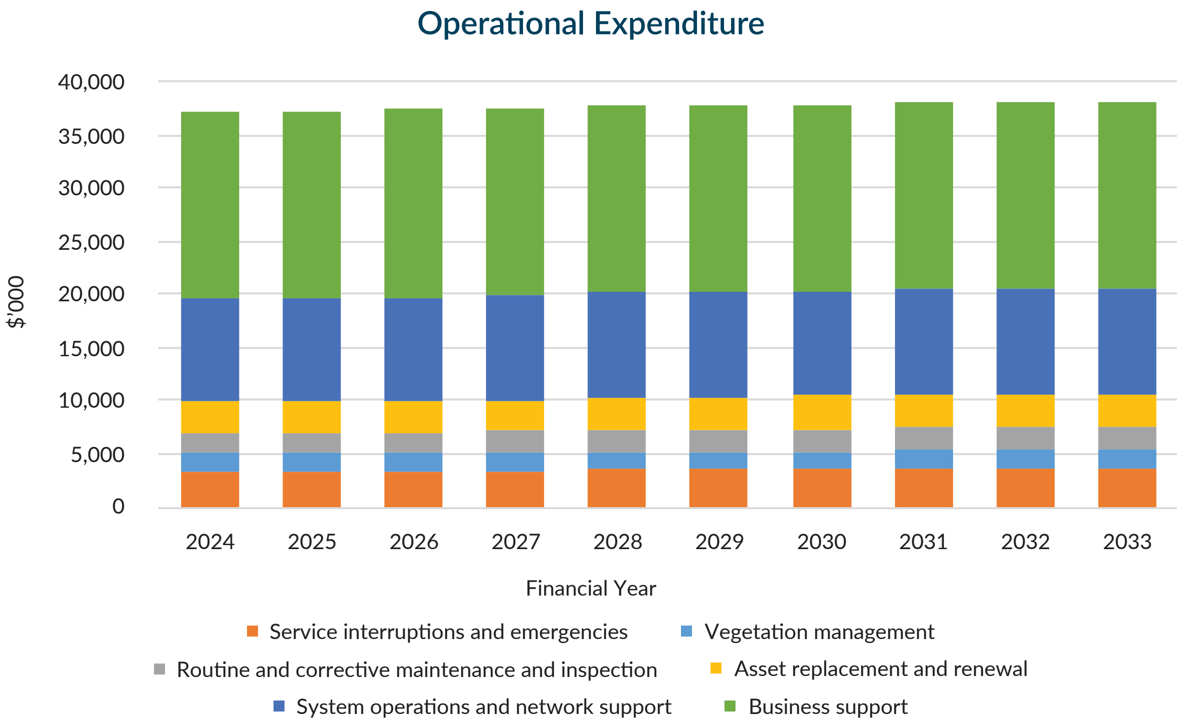


Figure 9.4.1: 10-year Operational Expenditure

9.4.1 Network Operational Expenditure Summary

The network operational expenditure forecast represents expenditure directly related to the provision of electricity distribution services. These categories forecast expenditure relating to such areas as: unplanned instantaneous events that impair the normal operation of network assets, planned inspection, testing, or maintenance, and when there is need to physically fell, remove, or trim vegetation that is in close proximity to network assets. For more details, refer to sections 8.2.3, 8.2.4 and 8.2.5.

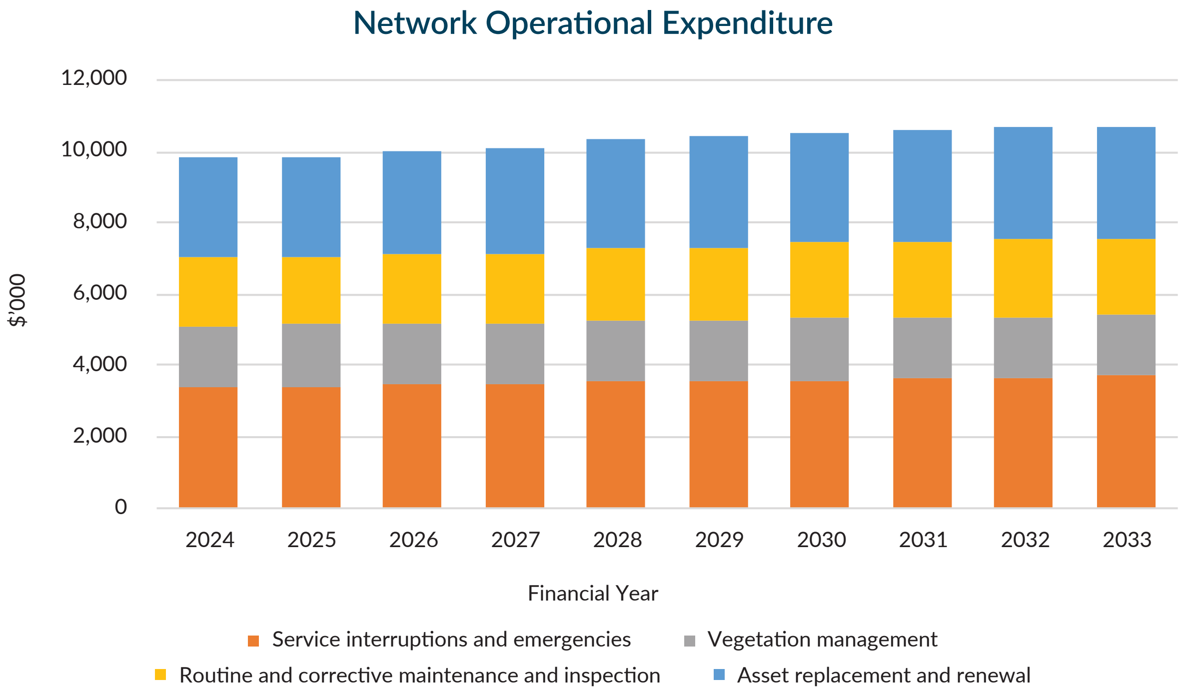


Figure 9.4.1.1: 10-year Network Operational Expenditure

9.4.2 Non-Network Operational Expenditure

The non-network forecast represents operational expenditure which supports and enable our asset management activities, but which are not directly involved in the provision of electricity distribution services.

System operations and network support covers operational expenditure related to asset management, design and planning, and customer support. Business support covers the many other corporate functions of our organisation, including finance, technology, and human resources. For more details, refer to Section 7.3.2.

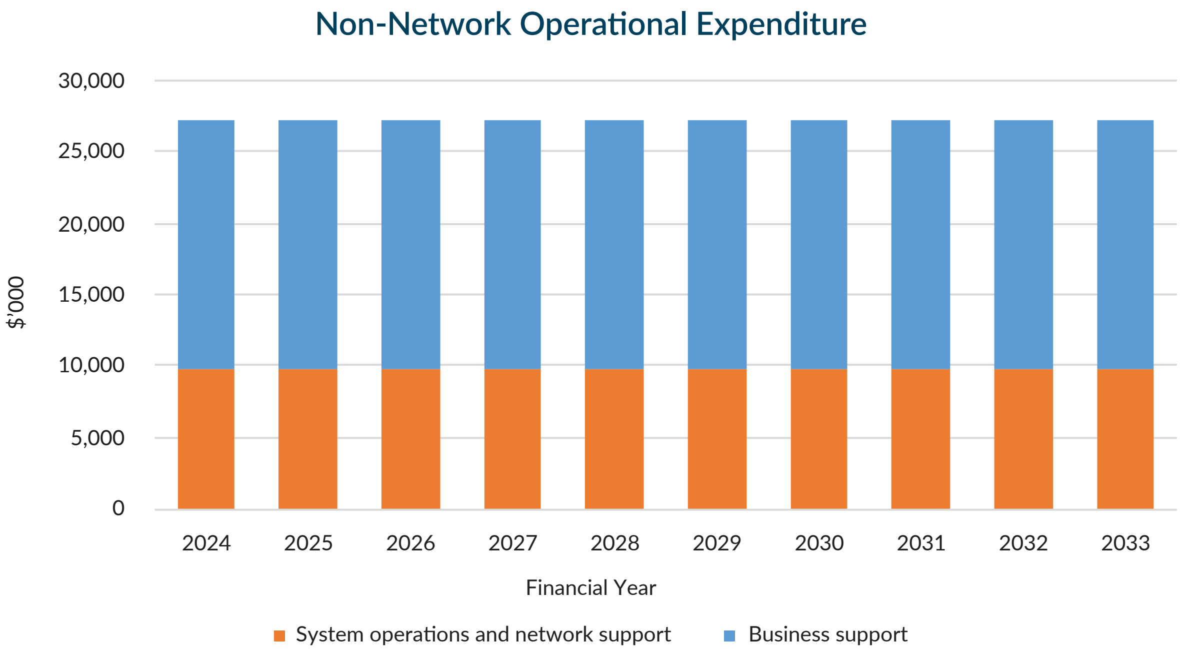
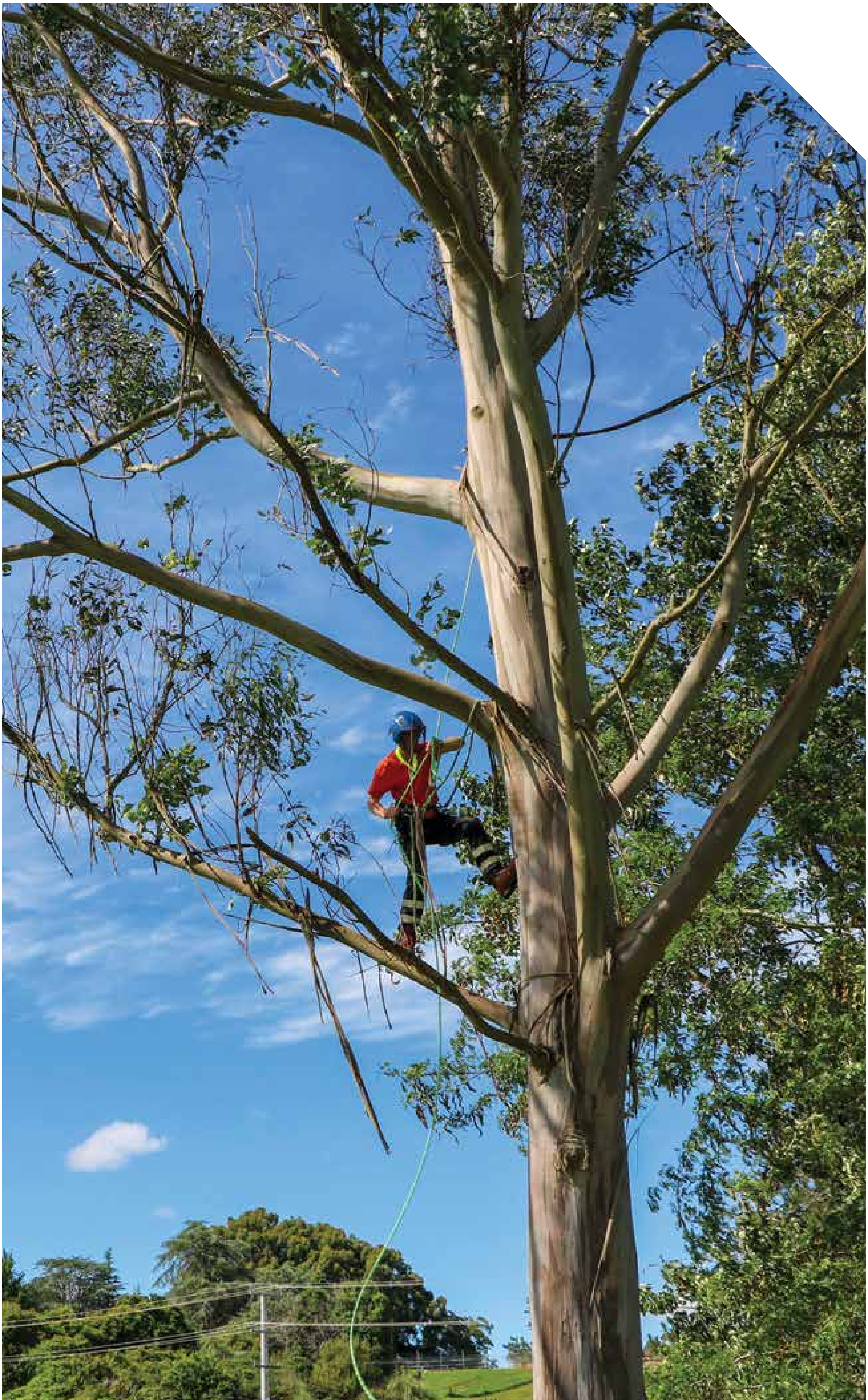


Figure 9.4.2.1: 10-year Non-Network Operational Expenditure



10 Information Disclosure Schedules

Te Whakamōhiohio

WEL NETWORKS AMP 2023

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

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.

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended	**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**	**31 Mar 32**	**31 Mar 33**
11a(i): Expenditure on Assets Forecast	$000 (in nominal dollars)										
Consumer connection	33,067	16,582	17,167	17,819	18,462	19,681	21,881	23,624	25,525	27,353	28,989
System growth	6,610	13,449	12,438	12,561	16,357	17,048	18,196	21,200	21,479	23,261	28,229
Asset replacement and renewal	14,568	21,337	22,276	22,288	22,467	24,493	25,029	26,228	27,400	28,876	30,107
Asset relocations	3,512	5,241	3,365	3,539	3,863	3,816	3,982	4,214	4,429	4,615	4,926
Reliability, safety and environment:											
Quality of supply	1,630	1,781	1,779	1,823	1,404	1,431	1,456	1,480	1,506	1,534	1,558
Legislative and regulatory	474	839	1,860	1,514	1,224	-	-	-	-	-	-
Other reliability, safety and environment	6,198	7,209	7,321	3,807	3,634	3,983	3,263	3,422	5,252	5,054	5,136
Total reliability, safety and environment	**8,302**	**9,829**	**10,959**	**7,144**	**6,261**	**5,414**	**4,719**	**4,902**	**6,758**	**6,588**	**6,694**
Expenditure on network assets	**66,059**	**66,438**	**66,205**	**63,351**	**67,410**	**70,452**	**73,808**	**80,168**	**85,590**	**90,693**	**98,945**
Expenditure on non-network assets	10,116	13,267	8,184	6,574	6,939	6,731	6,865	7,003	7,143	7,286	7,431
Expenditure on assets	**76,175**	**79,705**	**74,389**	**69,924**	**74,350**	**77,183**	**80,674**	**87,170**	**92,732**	**97,978**	**106,376**
plus Cost of financing	-	-	-	-	-	-	-	-	-	-	-
less Value of capital contributions	14,202	10,591	7,497	7,734	7,979	8,215	8,592	9,063	9,608	10,110	10,846
plus Value of vested assets	-	-	-	-	-	-	-	-	-	-	-
Capital expenditure forecast	**61,973**	**69,114**	**66,892**	**62,191**	**66,370**	**68,968**	**72,081**	**78,107**	**83,125**	**87,869**	**95,530**
Assets commissioned	60,617	68,757	67,003	62,426	66,161	68,838	71,926	77,806	82,874	87,631	95,147

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

for year ended	*Current Year CY* 31 Mar 23	CY+1 31 Mar 24	CY+2 31 Mar 25	CY+3 31 Mar 26	CY+4 31 Mar 27	CY+5 31 Mar 28	CY+6 31 Mar 29	CY+7 31 Mar 30	CY+8 31 Mar 31	CY+9 31 Mar 32	CY+10 31 Mar 33
	$000 (in constant prices)										
Consumer connection	33,067	16,582	16,781	17,077	17,346	18,129	19,760	20,916	22,156	23,277	24,185
System growth	6,610	13,449	12,158	12,038	15,368	15,704	16,432	18,770	18,644	19,795	23,551
Asset replacement and renewal	14,568	21,337	21,775	21,359	21,109	22,561	22,603	23,221	23,783	24,573	25,119
Asset relocations	3,512	5,241	3,289	3,391	3,630	3,515	3,596	3,731	3,844	3,927	4,110
Reliability, safety and environment:											
Quality of supply	1,630	1,781	1,739	1,747	1,319	1,318	1,315	1,310	1,307	1,305	1,300
Legislative and regulatory	474	839	1,818	1,451	1,150	-	-	-	-	-	-
Other reliability, safety and environment	6,198	7,209	7,156	3,648	3,414	3,669	2,947	3,030	4,559	4,301	4,285
Total reliability, safety and environment	**8,302**	**9,829**	**10,713**	**6,846**	**5,883**	**4,987**	**4,262**	**4,340**	**5,866**	**5,606**	**5,585**
Expenditure on non-network assets	**66,059**	**66,438**	**64,716**	**60,712**	**63,336**	**64,896**	**66,654**	**70,978**	**74,292**	**77,178**	**82,550**
Expenditure on non-network assets	10,116	13,267	8,000	6,300	6,520	6,200	6,200	6,200	6,200	6,200	6,200
Expenditure on assets	**76,175**	**79,705**	**72,716**	**67,012**	**69,856**	**71,096**	**72,854**	**77,178**	**80,492**	**83,378**	**88,750**

Subcomponents of expenditure on assets (where known)

*EDBs' must disclose both a public version of this Schedule (excluding cybersecurity cost data) and a confidential version of this Schedule (including cybersecurity costs)

Energy efficiency and demand side management, reduction of energy losses		-	-	-	-	-	-	-	-	-	-
Overhead to underground conversion	149	4,649	2,906	3,001	3,212	3,113	3,203	3,329	3,440	3,516	3,685
Research and development	-	-	-	-	-	-	-	-	-	-	-
Cybersecurity (Commission only)											

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended	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	31 Mar 32	31 Mar 33
Difference between nominal and constant price forecasts	$000 (in nominal dollars)										
Consumer connection	-	-	386	742	1,116	1,552	2,121	2,708	3,369	4,076	4,803
System growth	-	-	280	523	989	1,345	1,764	2,430	2,835	3,466	4,677
Asset replacement and renewal	-	-	501	928	1,358	1,932	2,426	3,007	3,617	4,303	4,989
Asset relocations	-	-	76	147	234	301	386	483	585	688	816
Reliability, safety and environment:											
Quality of supply	-	-	40	76	85	113	141	170	199	229	258
Legislative and regulatory	-	-	42	63	74	-	-	-	-	-	-
Other reliability, safety and environment	-	-	165	159	220	314	316	392	693	753	851
Total reliability, safety and environment	-	-	**246**	**298**	**378**	**427**	**457**	**562**	**892**	**982**	**1,109**
Expenditure on network assets	-	-	**1,488**	**2,639**	**4,074**	**5,556**	**7,154**	**9,190**	**11,297**	**13,514**	**16,395**
Expenditure on non-network assets	-	-	184	274	419	531	665	803	943	1,086	1,231
Expenditure on assets	-	-	**1,672**	**2,912**	**4,494**	**6,087**	**7,819**	**9,993**	**12,240**	**14,600**	**17,626**

Commentary on options and considerations made in the assessment of forecast expenditure

EDBs may provide explanatory comment on the options they have considered (including scenarios used) in assessing forecast expenditure on assets for the current disclosure year and a 10 year planning period in Schedule 15

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**
11a(ii): Consumer Connection						
Consumer types defined by EDB*	$000 (in constant prices)					
Residential Customers	25,360	9,984	10,060	10,114	10,112	10,347
Business Customers	496	326	282	453	273	286
Large Customers - Low Voltage 400V	7,211	5,935	5,986	5,833	5,943	6,367
Large Customers - Medium Voltage 11kV	-	338	453	678	1,017	1,129
Large Customers - High Voltage 33kV	-	-	-	-	-	-
*include additional rows if needed						
Consumer connection expenditure	**33,067**	**16,582**	**16,781**	**17,077**	**17,346**	**18,129**
less Capital contributions funding consumer connection	8,232	5,917	4,695	4,730	4,689	4,813
Consumer connection less capital contributions	**24,835**	**10,666**	**12,086**	**12,347**	**12,657**	**13,315**
11a(iii): System Growth						
Subtransmission	4,482	807	3,197	1,199	137	322
Zone substations	301	7,280	3,805	3,315	7,525	8,787
Distribution and LV lines	6	-	-	-	-	-
Distribution and LV cables	1,820	5,201	4,941	6,942	6,440	5,067
Distribution substations and transformers	-	162	215	582	1,266	1,529
Distribution switchgear	1	-	-	-	-	-
Other network assets	-	-	-	-	-	-
System growth expenditure	**6,610**	**13,449**	**12,158**	**12,038**	**15,368**	**15,704**
less Capital contributions funding system growth						
System growth less capital contributions	**6,610**	**13,449**	**12,158**	**12,038**	**15,368**	**15,704**

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

for year ended	*Current Year CY* 31 Mar 23	CY+1 31 Mar 24	CY+2 31 Mar 25	CY+3 31 Mar 26	CY+4 31 Mar 27	CY+5 31 Mar 28
11a(iv): Asset Replacement and Renewal	$000 (in constant prices)					
Subtransmission	235	746	677	668	666	664
Zone substations	368	117	114	112	850	1,957
Distribution and LV lines	8,297	11,877	11,611	11,448	11,422	11,381
Distribution and LV cables	878	1,049	1,042	1,028	1,025	1,300
Distribution substations and transformers	2,152	3,049	2,862	2,719	2,714	2,841
Distribution switchgear	2,534	4,218	4,430	4,367	4,156	4,143
Other network assets	104	282	1,038	1,018	276	275
Asset replacement and renewal expenditure	**14,568**	**21,337**	**21,775**	**21,359**	**21,109**	**22,561**
less Capital contributions funding asset replacement and renewal	342	473	783	783	783	783
Asset replacement and renewal less capital contributions	**14,226**	**20,864**	**20,992**	**20,576**	**20,326**	**21,778**

for year ended	*Current Year CY* 31 Mar 23	CY+1 31 Mar 24	CY+2 31 Mar 25	CY+3 31 Mar 26	CY+4 31 Mar 27	CY+5 31 Mar 28
11a(v): Asset Relocations	$000 (in constant prices)					
Project or programme*						
Undergrounding	149	479	370	425	476	435
Peacockes Development	-	2,173	1,500	-	-	-
*include additional rows if needed						
All other project or programmes - asset relocations	3,363	2,589	1,419	2,966	3,154	3,080
Asset relocations expenditure	**3,512**	**5,241**	**3,289**	**3,391**	**3,630**	**3,515**
less Capital contributions funding asset relocations	5,628	4,201	1,850	1,898	2,025	1,971
Asset relocations less capital contributions	**(2,116)**	**1,040**	**1,439**	**1,493**	**1,605**	**1,544**

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

for year ended	*Current Year CY* 31 Mar 23	CY+1 31 Mar 24	CY+2 31 Mar 25	CY+3 31 Mar 26	CY+4 31 Mar 27	CY+5 31 Mar 28
11a(vi): Quality of Supply	$000 (in constant prices)					
Project or programme*						
Network Work Upgrade Due To DG applications	372	-	-	-	-	-
Distribution Transformer and LV Feeder Upgrade projects Identified via Smart Meters	49	594	569	600	600	600
Power Quality Analyser Installation	-	508	500	500	100	100
Smart Meter Distribution Transformer Monitoring	1,209	552	550	550	550	550
**include additional rows if needed*						
All other projects or programmes - quality of supply	-	127	120	97	69	68
Quality of supply expenditure	**1,630**	**1,781**	**1,739**	**1,747**	**1,319**	**1,318**
less Capital contributions funding quality of supply						
Legislative and regulatory less capital contributions	**1,630**	**1,781**	**1,739**	**1,747**	**1,319**	**1,318**

for year ended	*Current Year CY* 31 Mar 23	CY+1 31 Mar 24	CY+2 31 Mar 25	CY+3 31 Mar 26	CY+4 31 Mar 27	CY+5 31 Mar 28
11a(vii): Legislative and Regulatory	$000 (in constant prices)					
Project or programme*						
AUFLS scheme changes	-	-	170	-	-	-
NER protection changes through TWH Network	-	238	256	-	-	-
Low lines mitigation	195	541	500	300	300	-
Seismic upgrades of substations	279	-	767	1,070	790	-
*include additional rows if needed						
All other projects or programmes - legislative and regulatory	-	60	125	81	60	-
Legislative and regulatory expenditure	**474**	**839**	**1,818**	**1,451**	**1,150**	**-**
less Capital contributions funding legislative and regulatory						
Legislative and regulatory less capital contributions	**474**	**839**	**1,818**	**1,451**	**1,150**	**-**

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28
11a(viii): Other Reliability, Safety and Environment						
Project or programme*	$000 (in constant prices)					
Air-conditioning for substations	-	-	120	120	50	50
IoT Network Measurement	7	50	50	-	-	-
Restricted Space Improvements	168	62	240	240	-	240
Production DERMS Project – System Infrastructure	51	325	385	450	450	450
Fibre installation (Discretionary)	4	55	60	60	65	70
Fibre routes	181	218	285	340	360	360
Serial radio	199	126	-	-	-	-
Garden Place Switching Station Bypass	512	400	-	-	-	-
Gordonton Zone Substation Upgrade	2,316	-	-	-	-	-
LV visibility and data insights	-	250	250	315	315	315
Massey 11kV Switchgear Replacement	1,006	535	-	-	-	-
Multi Circuit Rationalisation	-	-	-	-	-	-
Network Reliability Project	194	927	428	620	640	640
Substation Door Upgrade	-	-	70	-	-	-
Raglan Security of Supply	-	500	4,500	-	-	-
Te Uku Zone Substation Upgrade	1,280	3,007	150	-	-	-
Weavers Zone Substation Relocation	-	-	-	1,175	1,230	1,230
Glasgow Zone Substation Relocation	-	-	-	-	-	-
Daisy Chain Transformer Unbundling	-	240	125	125	125	125
Zone Substation Oil Containment	-	-	-	-	-	-
Repeater Site DC Upgrades	**280**	-	-	-	-	-
*include additional rows if needed						
All other projects or programmes - other reliability, safety and environment	-	514	493	203	179	189
Other reliability, safety and environment expenditure	6,198	7,209	7,156	3,648	3,414	3,669
less Capital contributions funding other reliability, safety and environment						
Other reliability, safety and environment less capital contributions	6,198	7,209	7,156	3,648	3,414	3,669

SCHEDULE 11a: Report On Forecast Capital Expenditure

AMP Planning 1 April 2023 - 31 March 2033

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28
11a(ix): Non-Network Assets						
Routine expenditure						
Project or programme*	$000 (in constant prices)					
Computer Equipment	765	164	350	550	550	350
Computer Software	4,317	224	250	250	250	250
Property, Plant and Equipment	1,170	54	400	400	450	500
Motor Vehicles	47	-	-	100	270	100
Buildings	-					
Easements	220					
*include additional rows if needed						
All other projects or programmes - routine expenditure						
Routine expenditure	**6,519**	**442**	**1,000**	**1,300**	**1,520**	**1,200**
Atypical expenditure						
Project or programme*						
Land	1,287					
Building/Facilities	55	2,361	2,000	-	-	-
DSO Projects	-	1,990	-	-	-	-
Data Headend	2,255	4,229	-	-	-	-
*include additional rows if needed						
All other projects or programmes - atypical expenditure		4,245	5,000	5,000	5,000	5,000
Atypical expenditure	**3,597**	**12,825**	**7,000**	**5,000**	**5,000**	**5,000**
Expenditure on non-network assets	**10,116**	**13,267**	**8,000**	**6,300**	**6,520**	**6,200**

SCHEDULE 11b: Report On Forecast Operational Expenditure

AMP Planning 1 April 2023 - 31 March 2033

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.

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended	**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**	**31 Mar 32**	**31 Mar 33**
Operational Expenditure Forecast	$000 (in nominal dollars)										
Service interruptions and emergencies	4,570	3,371	3,483	3,588	3,696	3,808	3,923	4,041	4,163	4,289	4,418
Vegetation management	1,659	1,712	1,751	1,786	1,822	1,859	1,896	1,934	1,972	2,012	2,052
Routine and corrective maintenance and inspection	1,577	1,908	1,927	2,022	2,077	2,234	2,292	2,401	2,474	2,550	2,569
Asset replacement and renewal	2,366	2,882	2,918	3,044	3,123	3,323	3,405	3,549	3,650	3,754	3,791
Network Opex	10,172	9,872	10,079	10,441	10,718	11,223	11,515	11,924	12,260	12,605	12,830
System operations and network support	9,957	9,784	10,009	10,209	10,413	10,622	10,834	11,051	11,272	11,497	11,727
Business support	16,254	17,528	17,931	18,290	18,656	19,029	19,409	19,797	20,193	20,597	21,009
Non-network opex	26,211	27,312	27,940	28,499	29,069	29,650	30,243	30,848	31,465	32,094	32,736
Operational expenditure	36,383	37,184	38,019	38,939	39,787	40,873	41,758	42,772	43,725	44,699	45,566

SCHEDULE 11b: Report On Forecast Operational Expenditure

AMP Planning 1 April 2023 - 31 March 2033

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended	**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**	**31 Mar 32**	**31 Mar 33**
	$000 (in constant prices)										
Service interruptions and emergencies	4,570	3,371	3,404	3,438	3,473	3,507	3,542	3,578	3,614	3,650	3,686
Vegetation management	1,659	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712
Routine and corrective maintenance and inspection	1,577	1,908	1,884	1,938	1,952	2,058	2,070	2,125	2,148	2,170	2,143
Asset replacement and renewal	2,366	2,882	2,852	2,917	2,934	3,061	3,075	3,142	3,168	3,195	3,163
Network Opex	10,172	9,872	9,852	10,006	10,070	10,338	10,399	10,557	10,641	10,726	10,704
System operations and network support	9,957	9,784	9,784	9,784	9,784	9,784	9,784	9,784	9,784	9,784	9,784
Business support	16,254	17,528	17,528	17,528	17,528	17,528	17,528	17,528	17,528	17,528	17,528
Non-network opex	26,211	27,312	27,312	27,312	27,312	27,312	27,312	27,312	27,312	27,312	27,312
Operational expenditure	36,383	37,184	37,164	37,318	37,382	37,650	37,711	37,869	37,953	38,038	38,016
Subcomponents of operational expenditure (where known)											
Energy efficiency and demand side management, reduction of energy losses	390	318	360	360	360	360	360	360	360	360	360
Direct billing*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Research and Development	46	82	50	50	50	50	50	50	50	50	50
Insurance	762	775	793	872	872	872	872	872	872	872	872
Cybersecurity (Commission only)											

* Direct billing expenditure by suppliers that direct bill the majority of their consumers

SCHEDULE 11b: Report On Forecast Operational Expenditure

AMP Planning 1 April 2023 - 31 March 2033

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended	**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**	**31 Mar 32**	**31 Mar 33**
Difference between nominal and real forecasts	$000										
Service interruptions and emergencies	-	-	78	149	223	300	380	463	550	639	732
Vegetation management	-	-	39	74	110	147	184	222	260	300	340
Routine and corrective maintenance and inspection	-	-	43	84	126	176	222	275	327	380	426
Asset replacement and renewal	-	-	66	127	189	262	330	407	482	559	628
Network Opex	-	-	**227**	**435**	**648**	**885**	**1,116**	**1,367**	**1,618**	**1,878**	**2,126**
System operations and network support	-	-	225	425	629	838	1,050	1,267	1,488	1,713	1,943
Business support	-	-	403	762	1,128	1,501	1,881	2,269	2,665	3,069	3,481
Non-network opex	-	-	**628**	**1,187**	**1,757**	**2,338**	**2,931**	**3,536**	**4,153**	**4,782**	**5,424**
Operational expenditure	-	-	**855**	**1,622**	**2,405**	**3,223**	**4,047**	**4,903**	**5,771**	**6,661**	**7,550**

Commentary on options and considerations made in the assessment of forecast expenditure

EDBs may provide explanatory comment on the options they have considered (including scenarios used) in assessing forecast operational expenditure for the current disclosure year and a 10 year planning period in Schedule 15.

SCHEDULE 12a: Report On Asset Condition

AMP Planning 1 April 2023 - 31 March 2033

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.

Asset condition at start of planning period (percentage of units by grade)

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
All	Overhead Line	Concrete poles / steel structure	No.	0.12%	0.32%	4.36%	40.80%	54.28%	0.12%	3	3.90%
All	Overhead Line	Wood poles	No.	0.11%	0.86%	9.35%	32.70%	56.92%	0.06%	3	9.94%
All	Overhead Line	Other pole types	No.	0.11%	0.86%	9.35%	32.70%	56.92%	0.06%	2	-
HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km	-	1.12%	6.18%	26.40%	66.29%	-	1	-
HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km	-	-	2.00%	11.15%	86.85%	-	1	-
HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km	-	-	-	3.43%	96.57%	-	1	-
HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km	-	-	-	-	-	-	N/A	-
HV	Subtransmission Cable	Subtransmission submarine cable	km	-	-	-	-	-	-	N/A	-
HV	Zone substation Buildings	Zone substations up to 66kV	No.	-	-	11.54%	84.62%	3.85%	-	4	-
HV	Zone substation Buildings	Zone substations 110kV+	No.	-	-	-	-	-	-	N/A	-
HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	-	-	10.91%	7.27%	81.82%	-	4	-
HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.	-	-	6.06%	6.06%	87.88%	-	4	-
HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.	-	-	-	-	-	-	N/A	-
HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.	-	-	-	-	10.00%	90.00%	4	-
HV	Zone substation switchgear	33kV RMU	No.	-	-	-	4.55%	22.73%	72.73%	4	-
HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.	-	-	-	-	-	-	N/A	-
HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.	-	-	-	-	-	-	N/A	-
HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	-	-	-	-	-	-	N/A	-
HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.	-	-	-	-	-	-	N/A	-

SCHEDULE 12a: Report On Asset Condition

AMP Planning 1 April 2023 - 31 March 2033

Asset condition at start of planning period (percentage of units by grade)

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
HV	Zone Substation Transformer	Zone Substation Transformers	No.	-	-	-	18.37%	81.63%	-	3	-
HV	Distribution Line	Distribution OH Open Wire Conductor	km	-	0.87%	14.93%	30.29%	53.92%	-	3	1.83%
HV	Distribution Line	Distribution OH Aerial Cable Conductor	km	-	-	-	-	-	-	N/A	-
HV	Distribution Line	SWER conductor	km	-	-	-	-	-	-	N/A	-
HV	Distribution Cable	Distribution UG XLPE or PVC	km	-	-	12.52%	12.12%	75.36%	-	1	-
HV	Distribution Cable	Distribution UG PILC	km	-	-	-	47.26%	52.74%	-	1	-
HV	Distribution Cable	Distribution Submarine Cable	km	-	-	-	-	-	-	N/A	-
HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	0.63%	-	2.52%	18.87%	74.84%	3.14%	4	1.34%
HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.	-	1.61%	10.34%	6.90%	81.15%	-	4	11.25%
HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	0.11%	1.12%	6.74%	18.43%	72.25%	1.35%	4	4.39%
HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.	-	-	-	-	-	-	N/A	-
HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	-	0.36%	8.99%	33.01%	57.30%	0.36%	4	10.01%
HV	Distribution Transformer	Pole Mounted Transformer	No.	0.07%	0.62%	2.64%	4.42%	73.73%	18.52%	3	4.75%
HV	Distribution Transformer	Ground Mounted Transformer	No.	0.29%	0.38%	3.84%	25.52%	48.10%	21.86%	3	4.17%
HV	Distribution Transformer	Voltage regulators	No.	-	-	-	-	47.83%	52.17%	4	8.33%
HV	Distribution Substations	Ground Mounted Substation Housing	No.	-	-	-	-	-	-	N/A	-
LV	LV Line	LV OH Conductor	km	-	0.87%	14.93%	30.29%	53.92%	-	1	-
LV	LV Cable	LV UG Cable	km	-	-	21.90%	35.34%	42.76%	-	1	-
LV	LV Streetlighting	LV OH/UG Streetlight circuit	km	-	0.65%	8.90%	8.04%	82.41%	-	1	-
LV	Connections	OH/UG consumer service connections	No.	-	-	-	-	-	-	N/A	-
All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	4.29%	8.34%	10.25%	77.12%	-	3	9.99%
All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot	-	-	9.26%	17.90%	72.84%	-	3	2.93%
All	Capacitor Banks	Capacitors including controls	No.	-	-	-	-	100.00%	-	4	-
All	Load Control	Centralised plant	Lot	-	-	-	-	-	100.00%	3	-
All	Load Control	Relays	No.	-	-	-	-	-	-	N/A	-
All	Civils	Cable Tunnels	km	-	-	-	-	-	-	N/A	-

SCHEDULE 12b: Report of Forecast Capacity

AMP Planning 1 April 2023 - 31 March 2033

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.

12b(i): System Growth - Zone Substations

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
Avalon Dr	20	24	N-1	10	82%	24	89%	No constraint within +5 years	Load to be shifted to surrounding zone substations
Borman	21	21	N-1	11	102%	23	108%	Subtransmission circuit	Limited by the 33kV OH conductor. Planned project for FY25. Some offload to Gordonton once 11kV feeder strength improved. Some offload to Chartwell once new Fairfield or Crosby zone substation and associated 11kV feeders configured
Bryce St	14	23	N-1	5	60%	23	64%	No constraint within +5 years	
Chartwell	20	26	N-1	11	76%	26	81%	No constraint within +5 years	Planned offload to new Fairfield zone substation FY26 - FY28
Claudelands	23	23	N-1	15	100%	23	112%	Transformer	Planned offload to new Fairfield zone substation and Chartwell zone substation
Cobham	13	26	N-1	7	51%	26	57%	No constraint within +5 years	
Finlayson Rd	4	-	N	3	-	-	-	No constraint within +5 years	
Glasgow St	9	-	N	5	-	-	-	No constraint within +5 years	
Gordonton	8	5	N	6	156%	5	156%	Transformer	Currently meets WEL network security criteria. Subtransmission circuit being improved with switchgear upgrade completion FY23. Transformer capacity will be reviewed when transformer renewals due at end of AMP period.
Hampton Downs	2	-	N	3	-	-	-	No constraint within +5 years	Meets security of supply requirements.
Hoeka Rd	8	-	N	9	-	-	-	No constraint within +5 years	Meets security of supply requirements. Industrial load step growth excluded in forecasts due to uncertainty.
Horotiu	20	18	N-1	10	112%	18	125%	Transformer	New Kohia substation planned to support industrial and residential development FY24 - FY25
Kent St	16	23	N-1	8	72%	23	84%	No constraint within +5 years	
Latham Court	20	23	N-1	10	87%	23	90%	No constraint within +5 years	
Ngaruawahia	6	9	N-1	5	67%	8	68%	No constraint within +5 years	
Peacockes Rd	17	26	N-1	10	68%	26	88%	No constraint within +5 years	New Airport substation planned to support industrial and residential development FY28 - FY31

SCHEDULE 12b: Report of Forecast Capacity

AMP Planning 1 April 2023 - 31 March 2033

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
Pukete - Anchor	18	30	N-1	-	59%	30	153%	Transformer	Te Rapa co-generation being decommissioned Jun 2023. 3-winding TX - currently owned by Contact Energy. Pukete Anchor + WEL 11kV load on primary winding will exceed transformer primary 30MVA rating without intervention. Subtransmission cables carry a portion of Sandwich Rd, Tasman, Kent St, Horotiu load. Current work programme to repair cable joints will restore firm capacity. Planned offload to new Kohia zone substation starting FY24 will bring load within firm capacity.
Pukete - WEL's 11kV	10	13	N-1	9	77%	13	153%	Transformer	Te Rapa co-generation being decommissioned Jun 2023. 3-winding TX - currently owned by Contact Energy. Pukete Anchor + WEL 11kV load on primary winding will exceed transformer primary 30MVA rating without intervention. Subtransmission cables carry a portion of Sandwich Rd, Tasman, Kent St, Horotiu load. Current work programme to repair cable joints will restore firm capacity. Planned offload to new Kohia zone substation starting FY24 will bring load within firm capacity.
Raglan	5	-	N-1	4	-	-	-	Subtransmission circuit	Planned Raglan 33kV resilience project, FY25.
Sandwich Rd	24	24	N-1	14	99%	24	103%	Subtransmission circuit	Planned 33kV overhead circuit & river crossing re-tensioning, FY25
Tasman	22	26	N-1	18	87%	26	101%	Transformer	New Exelby substation planned to support Industrial and residential development FY25-FY29
Te Kauwhata	8	10	N-1	3	83%	10	115%	Transformer	Industrial and residential customer dependent growth. Size of transformer will be considered closer to time of renewal.
Te Uku	2	5	N	2	41%	5	20%	No constraint within +5 years	
Wallace Rd	12	15	N-1	9	78%	15	86%	No constraint within +5 years	
Weavers	10	9	N-1	7	108%	9	108%	Transformer	Load can be transferred to the adjacent Glasgow St Substation in the event of a transformer outage. Planned projects to increase transfer capacity within Huntly area
Whatawhata	5	-	N	3	-	-	-	No constraint within +5 years	

[1] Extend forecast capacity table as necessary to disclose all capacity by each zone substation

SCHEDULE 12c: Report on Forecast Network Demand

AMP Planning 1 April 2023 - 31 March 2033

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.

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28
12c(i): Consumer Connections						
Number of ICPs connected in year by consumer type						
*Consumer types defined by EDB**			**Number of connections**			
Residential Customers	1,256	770	1,005	1,282	1,523	1,523
Business Customers	99	61	70	150	104	104
Large Customers - Low Voltage 400V	19	5	3	10	10	10
Large Customers - Medium Voltage 11kV	6	4	2	5	5	4
Large Customers - High Voltage 33kV	-	-	-			1
Asset Specific Customers	-	-	-			
Unmetered Customers	-	-	-			
Connections total	**1,380**	**840**	**1,080**	**1,447**	**1,642**	**1,642**
**include additional rows if needed*						
Distributed generation						
Number of connections made in year	500	513	510	587	675	776
Capacity of distributed generation installed in year (MVA)	2	38	17	3	3	26
12c(ii) System Demand						
Maximum coincident system demand (MW)						
GXP demand	242	294	300	309	316	324
plus Distributed generation output at HV and above	45	-	-	-	-	-
Maximum coincident system demand	**287**	**294**	**300**	**309**	**316**	**324**
less Net transfers to (from) other EDBs at HV and above						
Demand on system for supply to consumers' connection points	**287**	**294**	**300**	**309**	**316**	**324**
Electricity volumes carried (GWh)						
Electricity supplied from GXPs	950	1,287	1,301	1,313	1,341	1,348
less Electricity exports to GXPs	90	40	39	38	37	44
plus Electricity supplied from distributed generation	440	214	237	241	246	282
less Net electricity supplied to (from) other EDBs	(15)	(15)	(15)	(15)	(15)	(15)
Electricity entering system for supply to ICPs	**1,315**	**1,475**	**1,514**	**1,531**	**1,566**	**1,602**
less Total energy delivered to ICPs	1,262	1,401	1,438	1,455	1,488	1,522
Losses	**53**	**74**	**76**	**77**	**78**	**80**
Load factor	52%	57%	58%	57%	57%	56%
Loss ratio	4.0%	5.0%	5.0%	5.0%	5.0%	5.0%

SCHEDULE 12d: Report Forecast Interruptions and Duration

AMP Planning 1 April 2023 - 31 March 2033

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.

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28
SAIDI						
Class B (planned interruptions on the network)	32.8	35.6	36.4	36.5	36.8	36.8
Class C (unplanned interruptions on the network)	67.4	69.5	69.5	69.5	69.5	69.5
SAIFI						
Class B (planned interruptions on the network)	0.19	0.34	0.35	0.35	0.35	0.35
Class C (unplanned interruptions on the network)	1.10	1.02	1.02	1.02	1.02	1.02

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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 May 2022. 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.	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.	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	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.
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?	3	A Strategic Asset Management Plan (SAMP) has been developed. The SAMP documents the link between organisational strategies and stakeholder needs to the asset management strategy.	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.	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.	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?	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.

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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 modelling (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	The organisation's documented asset management strategy and supporting working documents.	Asset management strategy	In what way does the organisation's asset management strategwy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	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.
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 prioritise 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 need 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 optimize 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.	The organisation's asset management plan(s).	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?	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.

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication.	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?	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.
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.	The organisation's asset management plan(s). Documentation defining roles and responsibilities of individuals and organisational departments.	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	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.

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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)	2	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. If appropriate, the performance management team. Where appropriate the procurement team and service providers working on the organisation's asset-related activities.	The organisation's asset management plan(s). Documented processes and procedures for the delivery of the asset management plan.	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)	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.
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 of 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.	The organisation's plan(s) and procedure(s) for dealing with emergencies. The organisation's risk assessments and risk registers.	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?	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 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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	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)?	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.
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.	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.	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	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.

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Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	3	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.	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.	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	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.
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.	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.	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?	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.

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	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)?	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.

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Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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 for knowledge, skills and experience required for staff working on or 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 & 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.	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.	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	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.
50	Training, awareness and competence	How does the organization 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.	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.	Training, awareness and competence	How does the organization 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?	The organization 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 organization 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.

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Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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 and disclosures 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).	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.	Communica-tion, partic-ipation 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?	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.
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?	3	The organisation has established documentation that comprehensively describes all the main elements of its asset management system and the interactions between them. The main document that outlines the asset management system is the Strategic Asset Management Plan (SAMP). The SAMP, 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.	The documented information describing the main elements of the asset management system (process(es)) and their interaction.	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?	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.

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Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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	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.	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?	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.
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	WEL 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.	The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls.	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?	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 a 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.

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Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	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.
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.	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.	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?	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.

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	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?	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.
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.	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	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?	The organisation has not considered the need to identify its legal, regulatory, statutory and other asset management requirements.	The organisation identifies some 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

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Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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	The SAMP outlines the overall process and linked documents. These 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	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.	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?	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.
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	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.	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?	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.

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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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 programme.	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.	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).	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	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.

Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	Investigation of asset-re-lated failures, incidents and nonconfor-mities	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?	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.
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	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.	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	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.

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. **Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55**

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
109	Corrective & 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.	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	Corrective & 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?	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 recognized 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

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Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	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?	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.

SCHEDULE 13: Report On Asset Management Maturity

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Company Name: WEL NETWORKS LTD | AMP Planning Period: APR 2023 - MAR 2033 | Asset Management Standard Applied: PAS 55

Question No.	Function	Question	Score	Evidence—Summary	Why	Who	Record/ documented Information	Function	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4
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.	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.	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?	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.

Electricity Distribution Information Disclosure (Targeted Review Tranche 1) Amendment Determination 2022

SCHEDULE 14a: Mandatory Explanatory Notes on Forecast Information

1. This Schedule requires EDBs to provide explanatory notes to reports prepared in accordance with clause 2.6.6.
   This Schedule is mandatory—EDBs must provide the explanatory comment specified below, in accordance with clause 2.7.2. This information is not part of the audited disclosure information, and so is not subject to the assurance requirements specified in section 2.8.

Commentary on difference between nominal and constant price capital expenditure forecasts (Schedule 11a)

2. In the box below, comment on the difference between nominal and constant price capital expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11a.

Box 1: Commentary on difference between nominal and constant price capital expenditure forecasts

The inflation forecasts for the 10 year planning period are based on the latest available Treasury forecasts at the date of compilation: 14 Dec 2022 Treasury HEFU

Commentary on difference between nominal and constant price operational expenditure forecasts (Schedule 11b)

3. In the box below, comment on the difference between nominal and constant price operational expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11b.

Box 2: Commentary on difference between nominal and constant price operational expenditure forecasts

(as per commentary above)

11 Appendices

WEL NETWORKS AMP 2023

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
ADMS	Advanced Distribution Management System
AHI	Asset Health Index
AIS	Air Insulated Switchgear
AMMAT	Asset Management Maturity Assessment Tool
AMP	Asset Management Plan
AUFLS	Automatic Under Frequency Load Shedding
BESS	Battery Energy Storage System
CB	Circuit Breaker
CBD	Central Business District
CBRM	Condition Based Risk Management
CDEM	Civil Defence Emergency Management
CMMS	Computerised Maintenance Management System
CO_2	Carbon Dioxide
Code	Electricity Industry Participation Code 2010
CoF	Consequences of Failure
DC	Direct Current
DER	Distributed Energy Resources
DERM	Distributed Energy Resources Management
DGA	Dissolved Gas Analysis

DFA	Delegated Financial Authority
DMS	Distribution Management System
DRC	Disaster Recovery Centre
DSO	Distributed System Operator
EDB	Electricity Distribution Business
ENA	Electricity Networks Association
ERP	Enterprise Resource Planning
ETR	Estimated Time to Restore
EV	Electric Vehicle
FACTS	Flexible Alternating Current Transmission System
FDC	Cost of financing
FMECA	Failure Modes and Effects Criticality Analysis
FY	Financial Year
GHG	Greenhouse Gas
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
ISO	International Organization for Standardisation
ID	Information Disclosure
IL	Importance Level

IT	Information Technology
kV	Kilovolts
kW	Kilowatt
LEVCF	Low Emissions Vehicle Contestable Fund
LiDAR	Light Detection and Ranging
LV	Low Voltage
MEP	Metering Equipment Provider
MAF	Ministry of Agriculture and Fisheries
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
NBS	New Building Standard
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
PSMS	Public Safety Management System
PV	Photovoltaic
RAMC	Risk and Audit Management Committee
RCA	Root Cause Analysis
RCM	Reliability Centred Maintenance
RFP	Request for Proposals
RFT	Request for Tender
RFQ	Request for Quotation
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
SDG	Sustainability Development Goals
SF_6	Sulphur Hexafluoride
SFRA	Sweep Frequency Response Analysis
SO	System Operator
T1	Tier One
T2	Tier Two
TCFD	Task Force on Climate Related Financial Disclosures
TRIFR	Total Recordable Injury Frequency Rate

Trust	WEL Energy Trust
UG	Underground Assets
UN	United Nations
VoLL	Value of Lost Load
WEL	WEL Networks Limited
WLCC	Whole of Life Cycle Cost
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, 1.1.2, 1.1.3, 3.2, 6
3.3.2	States the corporate mission or vision as it relates to asset management.	Executive Summary, 1.1.2, 3.2, 4
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, 4.1
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, 4.1
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, Appendix C

Reference	Requirement	Document Reference
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.	3.1.3
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, 4.2.5, 4.3
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.	6.1.2 8.2.1, 8.3.2, 9.1.2
3.8.1	All significant assumptions must be quantified where possible.	6.1.2, 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.	6.1.2, 6.4, 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.	6.1.2, 8.2.1, 8.3.2, 9.1.2

Reference	Requirement	Document Reference
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.	6.2.1, 6.2.3, 6.2.4, 6.3, 9.1.2
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.	9.1.2
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.	6.1-6.4, 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 8.3.2, 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.	4.2.3, 8.1, 8.2, 8.4
3.13.2	Planning and implementing network development projects.	4.2 - 4.4
3.13.3	Measuring network performance.	5.3 - 5.5
3.14	The AMP must include an overview of asset management documentation, controls and review processes.	3.2, 4.1 - 4.5

Reference	Requirement	Document Reference
Communication Processes		
3.15	The AMP must include an overview of communication and participation processes.	3.1
Financial Values		
3.16	The AMP must present all financial values in constant price New Zealand dollars except where specified otherwise.	Chapter 6 - 9, 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.	1.6.1
4.1.3	A description of the load characteristics for different parts of the network.	1.2, 6.9
4.1.4	Peak demand and total energy delivered in the previous year, broken down by sub-network, if any.	1.4, 6.9
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, 6.9.3

Reference	Requirement	Document Reference
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; 6.5.3, 6.9.2 - 6.9.4
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, 6.9.2 - 6.9.4
4.2.5	A description of the low voltage network including the extent to which it is underground.	1.2; 2.4; 2.5, 2.8
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
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	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

Reference	Requirement	Document Reference
4.5.3	Distribution and LV lines. EDB owned mobile substations and generators whose function is to increase supply reliability or reduce peak demand	1.2.1, 2.4.3, 2.9.1, 3.1.1, 3.2.2, 6.7.3
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	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	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.	5.2 - 5.5
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.	5.3.4 – 5.3.8, 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 - 5.5
9	Targets should be compared to historic values where available to provide context and scale to the reader.	5.2-5.4
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 - 5.5

Reference	Requirement	Document Reference
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.	6.1.2 - 6.5
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 - 6.5
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 – 4.5
11.4	The use of standardised designs	4.3.1
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.	3.2.1, 4.1, 6.6, 6.7.1, 6.7.2, Executive Summary
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.	6.5.1
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.	6.4, 6.8, 6.9
11.8.1	The AMP must explain the load forecasting methodology and indicate all the factors used in preparing the load estimates.	6.4

Reference	Requirement	Document Reference
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.	6.9
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.	6.4, 6.9
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.	6.7.2
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:	
11.9.1	The reasons for choosing a selected option for projects where decisions have been made.	6.6, 6.9, 6.10
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.	6.4 - 6.9
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; 5.3.4-5.3.6, 6.3.5, 6.5, 8.1.1
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:	
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.	6.4 - 6.10
11.10.2	A summary description of the programmes and projects planned for the following four years (where known).	6.4 - 6.10
11.10.3	An overview of the material projects being considered for the remainder of the AMP planning period.	6.4 - 6.10

Reference	Requirement	Document Reference
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.	6.2.1; 7.1
Non-network solutions		
11.12	A description of the EDB's policies on non-network solutions, including:	
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.	6.6.2, 6.7.1
11.12.2	The potential for non-network solutions to address network problems or constraints.	6.6.2 - 6.7.4
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		

Reference	Requirement	Document Reference
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
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
13.2	Development, maintenance and renewal policies that cover them.	7
13.3	A description of material capital expenditure projects (where known) planned for the next five years.	7.3.1
13.4	A description of material maintenance and renewal projects (where known) planned for the next five years.	7.3.2
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, 4.2.2, 6.5.4

Reference	Requirement	Document Reference
14.3	A description of the policies to mitigate or manage the risks of events identified in subclause 14.2.	3.3.5, 6.5.4
14.4	Details of emergency response and contingency plans.	3.3.5, 6.5.4
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.	5.4.5
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.	1.1.3; 1.1.4

WEL AMP 2023 Compliance Check - Tranche 1		
Reference	**Requirement**	**AMP Document Reference**
Amendment Q1 – expand ID requirements related to how much notice of planned interruptions is given to consumers, including planned interruptions that are booked but not carried out.		
Q1A - Narrative Disclosure	Describe how WEL provides notice and communicates planned and unplanned interruptions, including any plans for changes or improvements in this area.	5.3.3
Amendment Q2 – add ID requirements on power quality.		
Q2 – Narrative Disclosure	Requirement for EDBs to describe their practices for monitoring voltage (including any plans for improvements) including:	
Q2(i)	what the EDB is doing to develop and improve practices for monitoring voltage quality on its low voltage (LV) network (eg, the EDB may provide reference to any work they are undertaking with other companies);	6.7.2
Q2(ii)	work EDB is doing on their LV network to address any known non-compliance with the applicable voltage requirements of the Electricity (Safety) Regulations 2010;	6.7.2
Q2(iii)	how EDB is responding to and reporting on voltage quality issues when it identifies them, or they are raised by a stakeholder (eg, the EDB may provide reference to performance over the previous period to give the forward plan context);	6.7.2
Q2(iv)	how EDB is communicating the work it is doing to improve voltage quality on its LV network to affected consumers	5.3.3, 6.7.2
Amendment Q3 – add ID requirements on practices for connecting new consumers and altering existing connections.		
Q3A – Narrative Disclosure	Require EDBs to describe their practices for connecting consumers and making alterations to existing connections, including:	
Q3A(i)	the EDB's approach to planning and management regarding connecting new consumers or making alterations to existing connections (offtake and injection connections);	3.1, 4.1, 5.3.3
Q3A(ii)	how the EDB is seeking to minimise the cost to consumers of new or altered connections;	3.1, 4.1, 5.3.3
Q3A(iii)	the EDB's approach to planning and managing communication with consumers about new or altered connections;	3.1, 5.3.3
Q3A(iv)	commonly encountered delays, issues, and potential timeframes for different connection types.	5.3.3

Reference	Requirement	AMP Document Reference
Amendment Q4 – add ID requirements on customer service, eg, customer complaints.		
Q4 – Narrative Disclosure	a requirement for EDBs to describe their current customer service practices including:	
Q4(i)	the EDB's customer engagement protocols and customer service measures – including customer satisfaction with the EDB's supply of electricity distribution services	5.3.3
Q4(ii)	the EDB's approach to planning and managing customer complaint resolution	5.3.3
Amendment Q5 – add ID requirements on information about customer charters and guaranteed service level (customer compensation) schemes, eg, information about existing schemes		
Q5	Require that EDBs publicly disclose up-to-date copies of:	As below
Q5 (i)	the EDB's existing customer charters including guaranteed service levels, if any;	-
Q5 (ii)	information about existing customer compensation schemes (if any) that it has in place	5.3.3
Amendment Q13 – refine ID requirements on third party interference interruptions by breaking down into more specific categories, such as vehicle damage, 'dig in', overhead contact, and vandalism.		
Q13	Require EDBs to break down reporting of interruptions caused by third-party interference in Schedule 10(ii) to include commonly occurring interruptions resulting from external contractors or members of the public. The new table of additional third-party reporting categories includes:	
Q13(i)	'Dig-In': means any unintended damage to any underground network asset caused by a third party;	Not required for March 2023 disclosure.
Q13(ii)	Overhead Contact: means any form of unintended damage to any above ground network asset caused by contact that is not related to vegetation or animals;	Not required for March 2023 disclosure.
Q13(iii)	Vandalism: means any intentional destruction of, or damage to, any network asset;	Not required for March 2023 disclosure.
Q13(iv)	Vehicle Damage: means any unintended damage to any network assets including poles, ground mounted transformers, pillar boxes, but excluding overhead lines, caused by a ground vehicle; and	Not required for March 2023 disclosure.
Q13(v)	Other	Not required for March 2023 disclosure.
Amendment D2 – add requirements on new connections likely to have a significant impact on network operations or asset management priorities		
D2 – Narrative Disclosure	Require EDBs to disclose a description of:	
D2(i)	how the EDB measures the scale and impact of new connections;	6.5
D2(ii)	how the EDB takes the timing and uncertainty of new connections into account;	6.5
D2(iii)	how the EDB takes other factors into account, eg, the network location of new connection	6.5
D2(iv)	how the EDB assesses and manages the risk posed by uncertainty regarding new connections	6.2.4, 6.5

Reference	Requirement	AMP Document Reference
Amendment D4 – add reporting requirements on EDBs' innovation practices		
D4 – Narrative Requirement	Require EDBs to describe their innovation practices, including a description of:	
D4(i)	any innovation practices the EDB has planned or undertaken since the last AMP or AMP update was published, including case studies and trials;	6.6, 6.7 8.2.6
D4(ii)	what the desired outcome of any innovation practices is, and how it may improve outcomes for consumers	6.6.3
D4(iii)	how the EDB measures success and makes decisions regarding any innovation practices, eg, how the EDB decides whether to commence, commercially adopt, or discontinue any innovation practices;	6.6, 6.7
D4(iv)	how the EDB's decision-making about innovation practices may depend on the work of other companies, including other EDBs and providers of nonnetwork solutions; and	6.6, 6.7
D4 (v)	the types of information the EDB uses to inform or enable innovation practices, and their approach to seeking that information.	6.4 - 6.7
Amendment AM7A/AM7B – improve lifecycle asset management planning provisions (vegetation, assumptions)		
AM7A	EDBs are required to provide information on vegetation management-related maintenance, and summary discussion of the approach and assumptions that underpin the process used for vegetation management.	8.2.3
AM7B	EDBs are required to provide the assumptions and rationale used to inform capital expenditure forecasts for asset investments.	8.1 - 8.4
Amendment AM8A/AM8B – improve lifecycle asset management planning provisions (processes, forecast assumptions) and provide additional information on data and models		
AM8A	amending clause 3.11 of Attachment A to require EDBs to provide a description of:	2024 Requirement
AM8A(i)	how asset management data informs the models that an EDB develops and uses to assess asset health;	8.2
AM8A(ii)	how the outputs of these models are used in developing capital expenditure projections.	8.2
AM8B	That EDBs provide information regarding its consideration of non-network solutions to inform its expenditure projections (capex and opex). This must include an explanation of the approach and assumptions the EDB used to inform these expenditure projections.	6.6 - 6.7

Appendix C: Director Certification

Certification for Year-beginning Disclosures

Pursuant to clause 2.9.1 of Section 2.9

We, Barry Spence Harris, 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 beenmeasured 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 aredocumented in retained records.

Director
28 March 2023

Director
28 March 2023

WEL Networks

AN ENERGY COMPANY OF THE FUTURE