# ASSET MANAGEMENT PLAN

## 2022-2032


mainpower

# CHIEF EXECUTIVE'S MESSAGE

The needs and expectations of our customers are changing. New technology and innovations are opening up new ways of powering the homes and businesses of our region. MainPower sees huge potential ahead. Our vision is to create a smarter future to deliver local value.

In order to realise this potential, MainPower will need to partner with our customers to understand their needs and to provide network services that fit their expectations.

Over the course of the year the Executive have worked to create a strategic long-term framework for MainPower to ensure we safeguard our current network assets and deliver value beyond them. We're calling the framework to tackle these exciting opportunities "MPowered Future". The MPowered Future framework includes four core functions: Networks, Services, Investment and Generation. This new framework will allow us to focus on specific initiatives and ensure that the right resources and skills are available to support and create business efficiencies. As we implement our MPowered Future we remain focused on our vision – creating a smarter future to deliver local value.

MainPower's Asset Management Plan outlines our commitment to providing a safe, secure, reliable and sustainable network that delivers electricity and energy services to homes and businesses in the North Canterbury region, from north of the Waimakariri River, through the Hurunui, to Kaikōura. This Asset Management Plan describes our network, our management practices and the assumptions that support our obligation as the responsible custodian of the MainPower electricity distribution network.

This plan details how MainPower will invest prudently in our electricity distribution network and related services for the next 10 years and how these services will enhance the delivery of safe, reliable and sustainable low-carbon energy – powering our communities while delivering value to our shareholders.

**Andy Lester**
Chief Executive

# CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# 1. SUMMARY

MainPower New Zealand Limited (MainPower) is a consumer-trust-owned electricity distribution business (EDB) that builds, owns, operates and maintains the electricity distribution network in the North Canterbury region. MainPower provides electricity distribution services to more than 42,000 residential and business connections.

We are responsible for providing a safe, secure, reliable and sustainable electricity distribution network and energy services to homes and businesses in the North Canterbury region, from north of the Waimakariri River, through the Hurunui, to Kaikōura.

We play a crucial role supplying the energy needs of our communities, as well as contributing to the growth of a vibrant and prosperous region. The New Zealand electricity sector is facing significant transformation, driven by decarbonisation, decentralisation and digitisation (the "New Energy Future").

Owing to changes in the sector, our role is also changing. This requires a new approach and refreshed thinking about our strategic direction to ensure we continue to build and operate an electricity distribution network for the future that is responsive to consumer demand while delivering value to our consumers, the community and our shareholders.

Efforts over the last three years have focused on improving the stability of the business and identifying and addressing opportunities to make the business more efficient. We believe we have been successful and have moved the business to a healthier position through these efforts. We have adopted and refined systems and processes to ensure we can continue to manage an effective network business. A key achievement was the rethinking of MainPower's strategic intent. A key outcome of this is the continued support of the core network business, ensuring network services will keep up with change within the sector while also delivering value to our consumers and shareholders.

In 2020 MainPower went live with our new advanced distribution management system (ADMS) for the smart operational management of the network. This system was further embedded into our daily operation in 2021. The ADMS is a key part of ensuring our network is ready for a New Energy Future.

We continue to assess our asset management systems, processes and practices against the Commerce Commission's Asset Management Maturity Assessment Tool (AMMAT) and against ISO 55001 via independent evaluation. MainPower remains committed to ensuring our asset management maturity is aligned with our organisational goals and objectives, including compliance with ISO 55001.

Currently our electricity distribution network performance (quality of supply) is unduly affected by defective equipment and planned works. This Asset Management Plan describes the workstreams that will return the quality of supply to past historical trends and improve it into the future.

Changing consumer behaviours, the advent of new technologies and the national transition to a low-carbon economy will all influence the way our electricity distribution network will be used in the future and the services that consumers require. Electricity distribution network development policies and procedures take account of this new trajectory and recognise the need to move from the traditional distribution network approach of demand-based planning to a scenario-based planning approach. This remains a key focus of MainPower's work for the planning period ahead and it now forms part of the Master Plan or Strategic Asset Management Plan.

# 2. ASSET MANAGEMENT PLAN

## 2.1 Our Electricity Distribution Network

MainPower owns and operates North Canterbury's electricity distribution network, from the Waimakariri River in the south up to the Puhi Puhi Valley north of Kaikōura, and from the Canterbury coast inland to Lewis Pass (see Figure 2.1). We provide electricity distribution services to more than 42,000 North Canterbury homes and businesses.

Growth in the region, particularly with new subdivisions, has brought us close to 3,000 new consumers during the past three years. We are committed to contributing to a bright future for our region by delivering an electricity distribution network that is ready for the future.

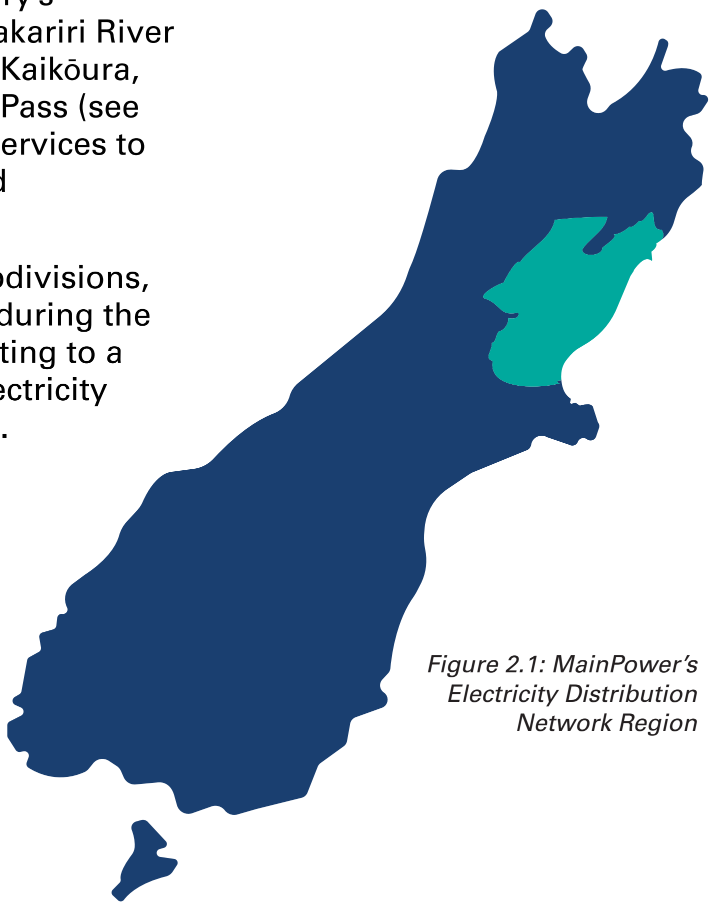


*Figure 2.1: MainPower's Electricity Distribution Network Region*

We have lines and cables operating in three distinct voltage ranges:

- Sub-transmission – 33 kV and 66 kV;
- Distribution – mostly 11 kV and 22 kV, but also 6.6 kV; and
- Low voltage – 230 V single phase or 400 V three phase.

Our electricity distribution network connects to the New Zealand national grid at voltages of 66 kV, 33 kV and 11 kV via Transpower's transmission grid exit points (GXPs). The national transmission grid carries electricity from generators throughout New Zealand to electricity distribution networks and large, directly connected consumers (see Figure 2.2). GXP assets are owned mostly by Transpower, although we own circuit-breaker protection and control equipment at some Transpower sites.

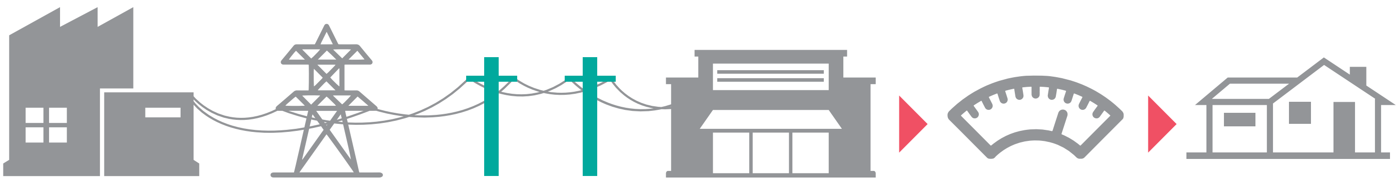



*Figure 2.2: MainPower's Position within the New Zealand Electricity Supply Chain*

## 2.2 MPowered Future

The MPowered Future strategic intent is designed to meet technology and other changes facing the industry. This ensures we are focusing on enabling choice and delivering value to both our shareholders and future generations.

MainPower needs to plan for the changing energy demands of the future. It's not going to be a one-size-fits-all solution, but a suite of solutions that leverage our infrastructure and industry knowledge.

This plan is called MPowered Future. MPowered Future is a fully integrated business planning framework within MainPower.

MPowered Future is a scenario-based planning tool and is about anticipating the future.

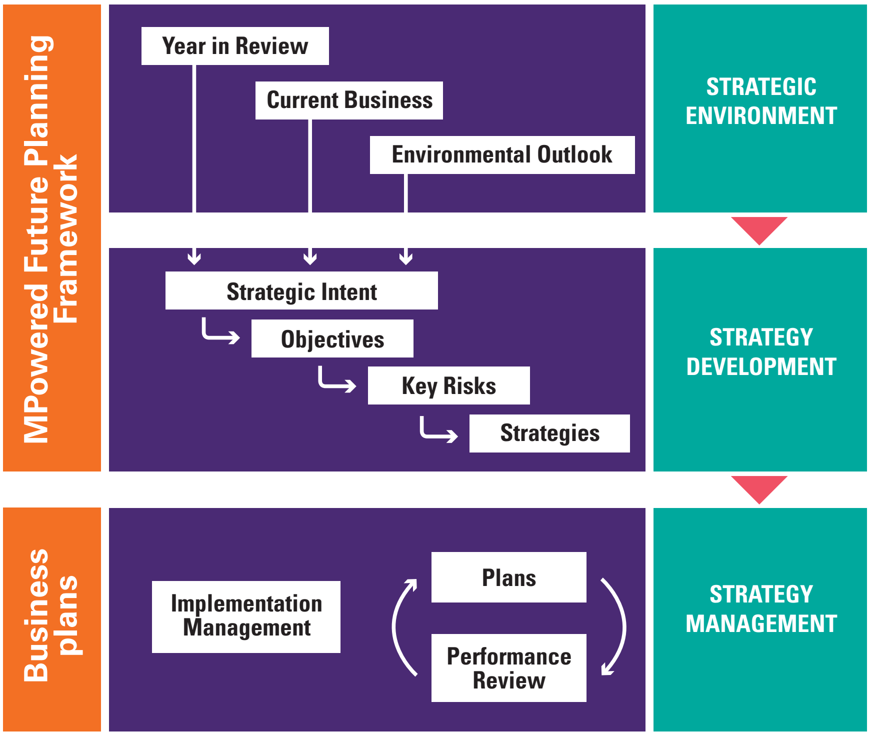



*Figure 2.3: MPowered Future Framework*

### 2.2.1 MPowered Future – Business Planning Framework

The value drivers and planning assumptions derived from the MPowered business planning framework are also used when making asset investment decisions, enabling a transition from deterministic planning to scenario planning, for all growth-related projects.

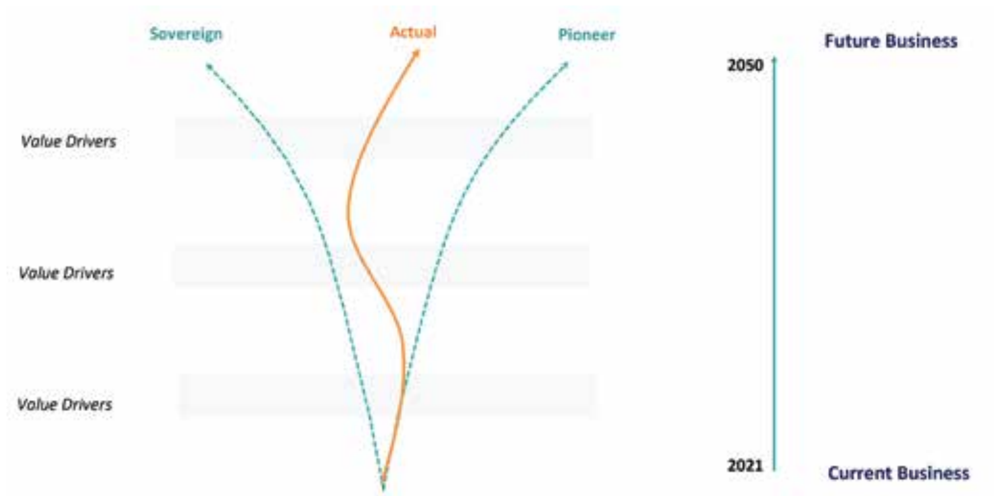



*Figure 2.4: New Zealand Scenarios – Sovereign/Pioneer*

**Sovereign Scenario**

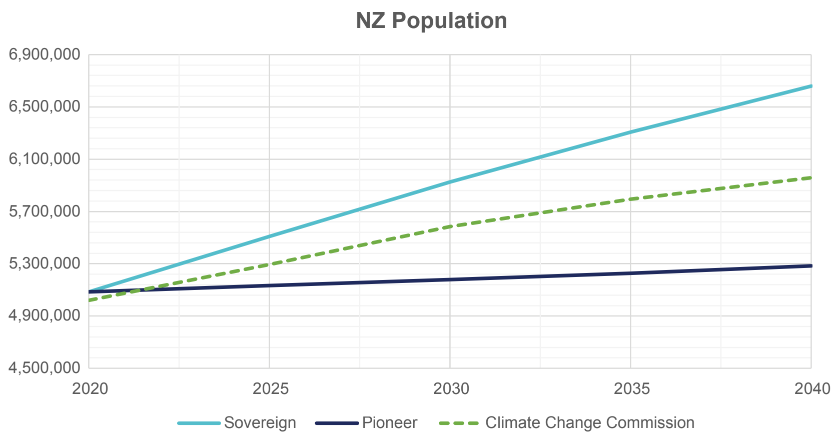
- NZ takes a view that carbon emissions is only one factor and not a key determinant of prosperity.

  NZ continues to rely on market led forces to determine the optimal energy mix with successive governments taking a less regulated approach.

**Pioneer Scenario**

- NZ leads the world in reducing carbon emissions and sees a low carbon economy as a key competitive advantage. The associated economic transformation drives widespread adoption of renewable generation, electrification of the economy and widespread adoption of new technologies.

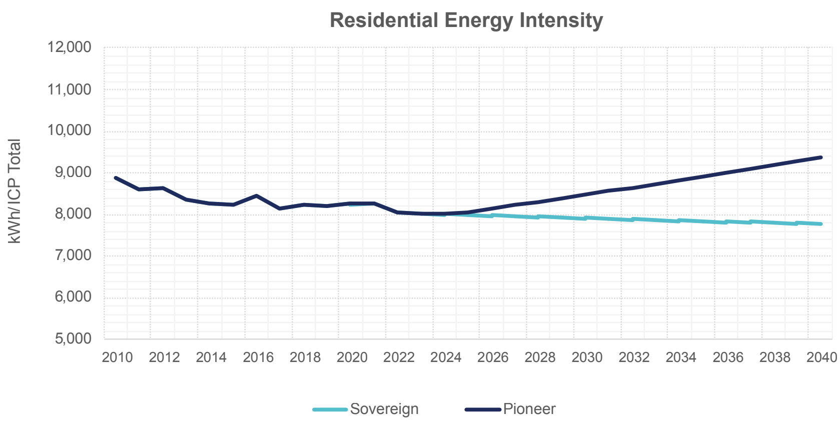
## 2.2.2 Value Drivers




National population growth is based on Stats NZ projections, i.e. they model out population and have high, medium, low scenarios.

Both scenarios are more extreme than the BEC2060 Kea and Tui[1] scenarios which start to converge by 2040 and end up around a population of approximately six million people. The larger driver of the two scenarios remains migration.

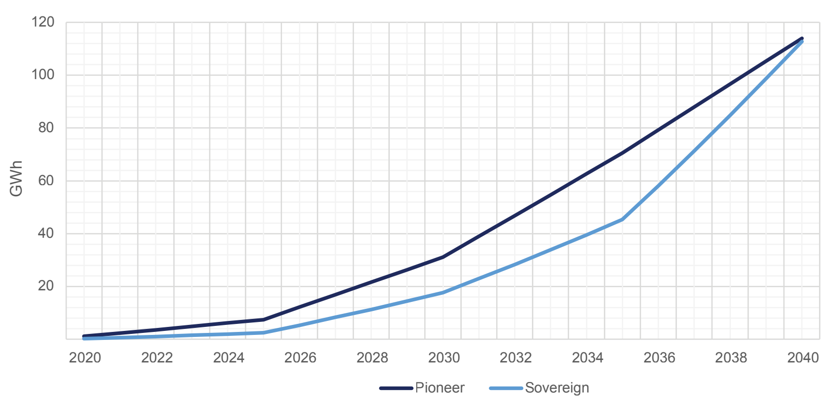
*Figure 2.5: NZ Population Growth Projections*




Residential energy intensity in the Sovereign scenario is consistent with historical trend with declining consumption i.e. newer building stock, improving insulation, double glazing.

Residential intensity increases in the Pioneer scenario as it encourages the replacement of non-electric heating and hot water with electric solutions.

*Figure 2.6: Residential Energy Intensity*



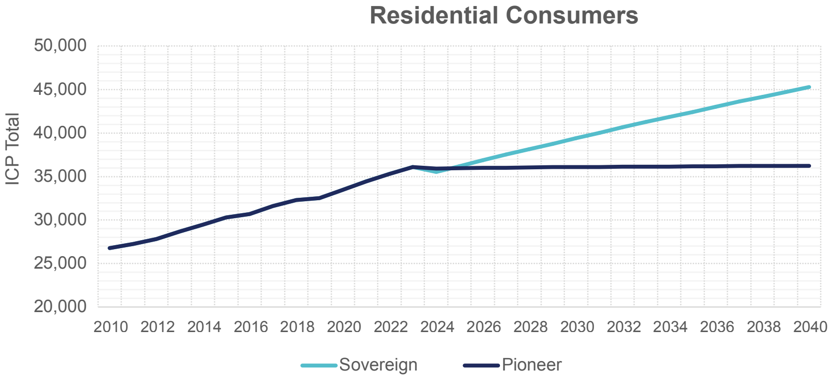

Ownership of vehicles per population rates for Canterbury is higher than the national average and has been increasing over time.

This projection uses EV uptake rates at a national level via the Kea and Tui scenarios, assuming MainPower will be consistent with the national trend.

We have ignored buses and assumed trucks will look at alternate fuel sources like hydrogen.

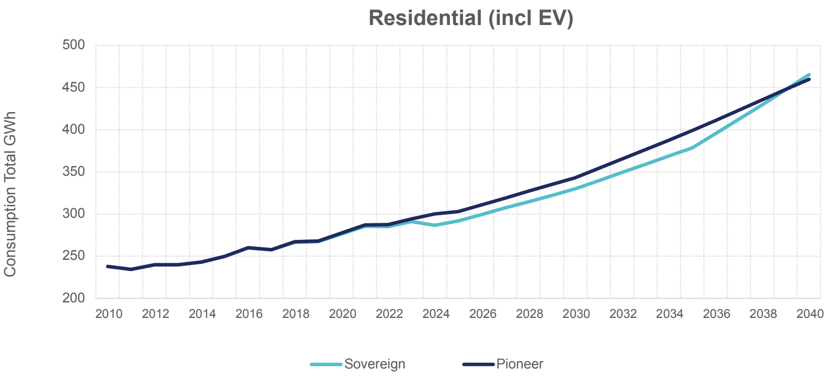
*Figure 2.7: Electric Vehicle Consumption*

[1] BusinessNZ Energy Council BEC2060 project



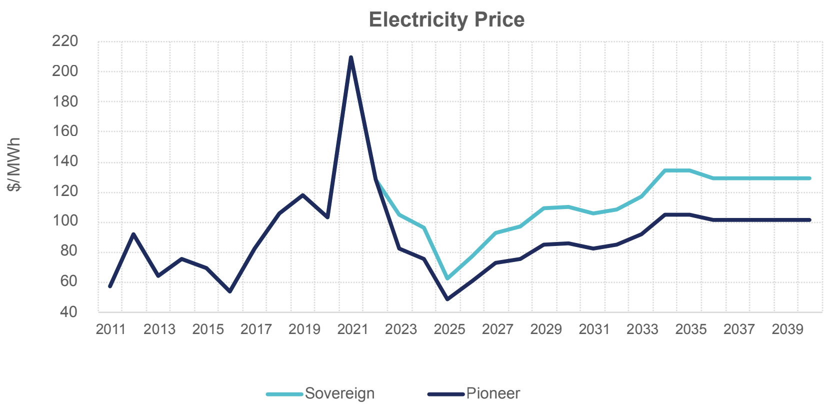

Installation control point (ICP) growth is based on projected population growth and ICP per capita ratios.

*Figure 2.8: Residential ICP Scenarios*




EV consumption is assumed to occur in the residential segment. As the Pioneer scenario simulates a higher EV uptake but lower population growth, it results in a similar total consumption forecast when compared with the Sovereign scenario.

*Figure 2.9: Residential Consumption*




It is assumed that the impact of energy cost to consumers of both the Pioneer and Sovereign scenarios remain marginal. This suggests that consumer behaviour as a function of energy prices remains predictable.

*Figure 2.10: Electricity Price Scenarios*

## 2.3 Asset Management

This Asset Management Plan (AMP) covers a 10-year planning period, from 1 April 2022 to 31 March 2032. It provides our stakeholders with insight and explanation as to how we provide electricity distribution network and energy services in a safe, secure, reliable and sustainable manner that meets their expectations.

The AMP is a planning document that provides information on asset management systems, processes and practices, with a specific focus on development, maintenance and replacement plans for our electricity distribution network assets while also balancing cost, risk and electricity distribution network performance in accordance with our stakeholders' requirements.

The information within the AMP also informs our annual business and financial planning. This ensures sufficient resources are directed to deliver identified asset management needs, consistent with MainPower's overall corporate objectives. The AMP demonstrates our alignment with best-practice asset management processes. The content and structure serve to achieve the information disclosure requirements set out in the Electricity Distribution Information Disclosure Determination 2012.

## 2.3.1 Asset Management Objectives

As the community transitions to a low-carbon economy, the services the electricity distribution network provides will need to change. The services will need to enable widespread use of local generation sources connected to the network at multiple points, with associated two-way power flows. The services will also need to ensure open-access arrangements for consumers to allow them to transact over the network and connect any device they wish within acceptable safety and reliability limits. This means:

- The distribution network will rely on physical assets to convey electricity, as well as from consumer to consumer, or consumer to bulk supply point.
- Consumers will be actively involved in the management of their energy acquisition, generation and consumption.
- The distribution network will provide network connections for multiple sources of distributed generation devices and other consumer-side devices.
- The distribution utility may not become involved in the transactions between consumers and other parties and may only be involved in balancing supply and demand on the network.
- Network stability will be managed by the EDB for a range of operating scenarios.

## 2.3.2 Asset Management System Purpose

The purpose of asset management at MainPower is to:

- Specify the requirements for establishing, implementing, maintaining and improving MainPower's Asset Management System;
- Cultivate a strategic asset management culture within MainPower;
- Define the purpose and contents of key Asset Management System documentation under the Asset Management Framework;
- Define the accountabilities and responsibilities for key documents and processes in the Asset Management System;
- Describe the application of relevant external standards; and
- Ensure the Asset Management System aligns with MainPower's requirements, other business management systems, company objectives and policies.

| | | | |
|---|---|---|---|
| MPNZ BOARD-APPROVED POLICIES | RISK | ENVIRONMENT | ASSET MANAGEMENT |
| INTERNATIONALLY ACCEPTED STANDARDS | ISO 31000 | 1SO 14001 | MPNZ BOARD-APPROVED POLICIES |
| | PROCESSES, PROCEDURES, WORK INSTRUCTIONS, GUIDES, INTERNAL STANDARDS | | |

*Figure 2.11: Asset Management Standards*

## 2.3.3 Asset Management Policy

The Asset Management Policy describes our commitment to asset management, and our AMP sets out how we implement this policy. We are committed to regular review of our processes and systems to ensure continual improvement, as shown in Figure 2.12.


- Compliance and regulatory excellency ensuring we comply with laws, regulation, standards and industry codes of practice
- Ensure consumer engagement effectively informs asset management
- Provide resources that ensure asset management objectives can be delivered


- Apply quality management systems and strive for continuous improvement and innovation
- Apply industry best practice, systems and processes
- Apply performance monitoring and benchmarking against industry
- Apply risk-based approach to managing our assets balancing cost performance and risk
- Ensure network growth delivers consumer requirements while facilitating regional development


- Effective business systems, processes, roles and responsibilities
- Enable collaboration driving strategic change within the industry delivering real value to our customers and market efficiency through transparency


- Manage competency and training
- Effectively plan our activities
- Optimise operational activities and do it right first time

*Figure 2.12: Asset Management Policy*

## 2.3.4 Asset Management System

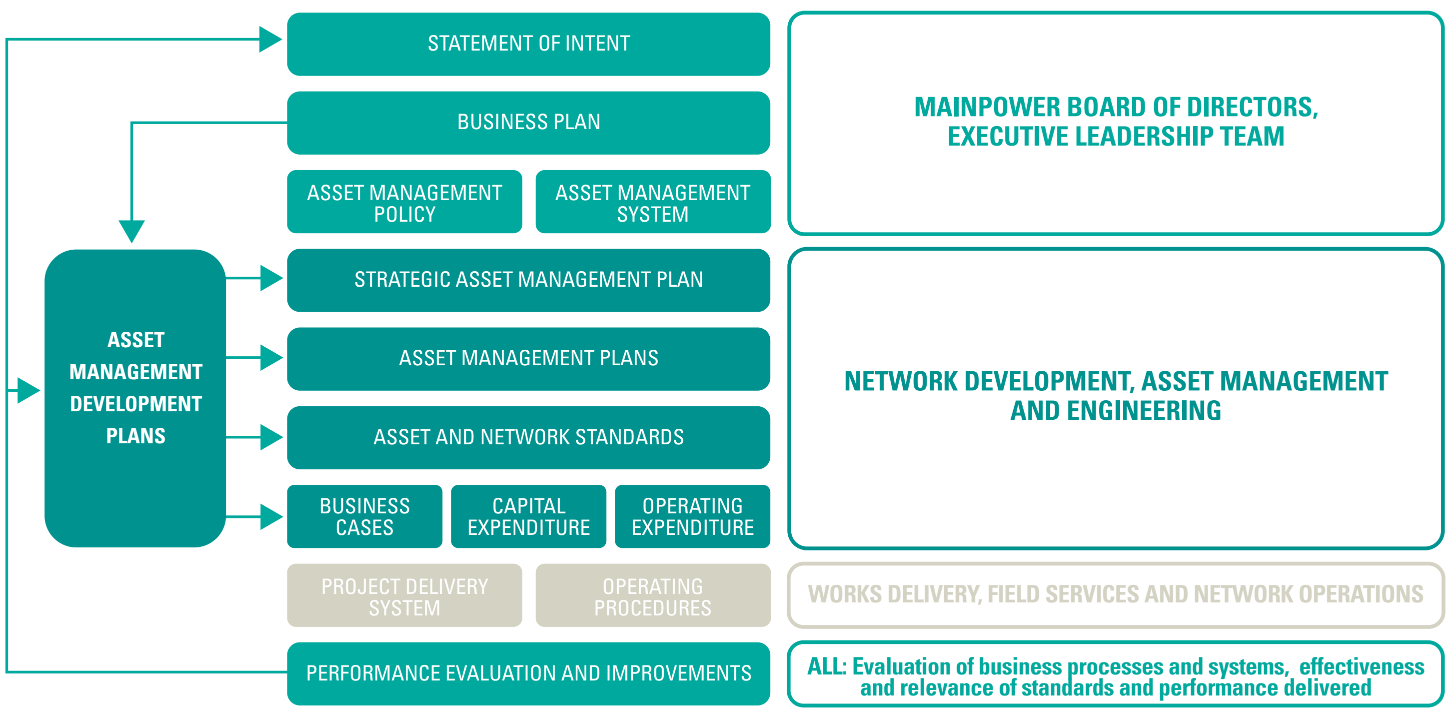



*Figure 2.13: Asset Management Framework*

| Asset Management | DESCRIPTION |
|---|---|
| Statement of Corporate Intent | Presents the strategic direction and operational environment of the organisation. |
| Business Plan | Articulates the business goals and objectives that are aligned with the strategic intent of the organisation and how the business is going to achieve the goals. |
| Asset Management Policy | Defines the key principles, responsibilities and approach to asset management. |
| Asset Management System | System used to manage MainPower's assets. |
| Strategic Asset Management Plan | Optimises value by making appropriate trade-offs between risk, cost and performance. |
| Asset Management Plans | Detail MainPower's plan for managing its assets to deliver an agreed standard of service. |
| Standards | Documents that detail the quality or achievement of assets. |
| Business Cases | Used in project approval process to deliver works detailed in this document through a capital sanction process (this AMP document is not an authorised work programme). |
| Capital and Operating Plan and Expenditure Reports | Used throughout the year to monitor delivery costs against the original plan. |
| Project Delivery Systems | Used to govern and manage the delivery of projects. |
| Operating Procedures | Used to document the safe operation of plant and equipment. |
| Performance Evaluation | Reviews the performance of the asset management system, including service levels to consumers. |

*Table 2.1: Asset Management System Components*

## 2.3.5 Asset Lifecycle

MainPower has adopted a lifecycle asset management process structured on a total lifecycle cost of asset ownership. The framework has its foundation in the activities that occur over the lifetime of the physical asset (see Figure 2.14).

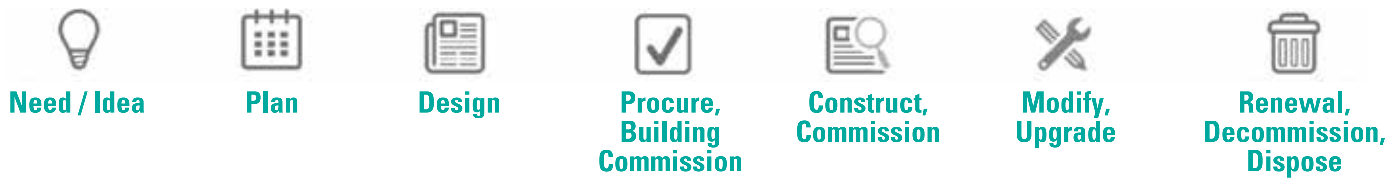



*Figure 2.14: Asset Lifecycle Planning*

The steps of the process are as follows:

- **Develop a need or idea:** The need or idea can come from anywhere within the business. It typically details a high-level view of the intent or requirement of a given project. Each idea is formulated by the project's sponsor, using a "sponsor's brief" document. Once the brief is written, a project is initiated and a project manager is assigned.
- **Plan a project:** The project plan sets out the specific requirements of the project. This includes a definition of the requirements, timelines, resourcing, procurement and risk. The project manager is responsible for the project plan and delivering the project against the plan. The project sponsor approves the plan and provides oversight throughout the project.
- **Design phase:** A completed design is a design that is informed by the requirements of the project, design criteria and standard design. We must complete the design; only then is the design fit for achieving the outcomes of the project. The asset manager must approve the asset before the design process introduces it. All assets on the MainPower electricity distribution network are approved by the asset manager.
- **Construct the asset:** The Service Delivery Team is responsible for project delivery, as detailed within the MainPower Project Delivery System. Later, the final step of "Practical Completion" can be issued only if the asset has a Fleet Management Plan, is entered into the computerised maintenance management system (CMMS) and has a maintenance schedule against the asset, and all asset data are reflected in our geographic information system (GIS).

- **Operate, maintain and monitor:** Asset criticality defines the level of maintenance. The treatment of the asset – in terms of maintenance activities (restoration or prevention) and/or critical spares – is defined in line with the criticality flowchart. Asset data, complete with template work orders entered into the CMMS and informed by rate cards, are used to develop annual resource planning (budgets, people, plant and equipment, and materials).
- **Modify and upgrade:** Assets are assessed against service levels. Sometimes this assessment highlights the need to modify or upgrade an asset. It is noted that assets can be upgraded due to changes in legislation, safe working procedures, etc. Instances also arise where existing assets are relocated based on changes of service levels.
- **Reneval, decommission or dispose:** Both an asset's condition (recorded in the Asset Health Indicator (AHI)) and its level of criticality inform the need for asset renewal, which is assessed against the cost and risk to the business.

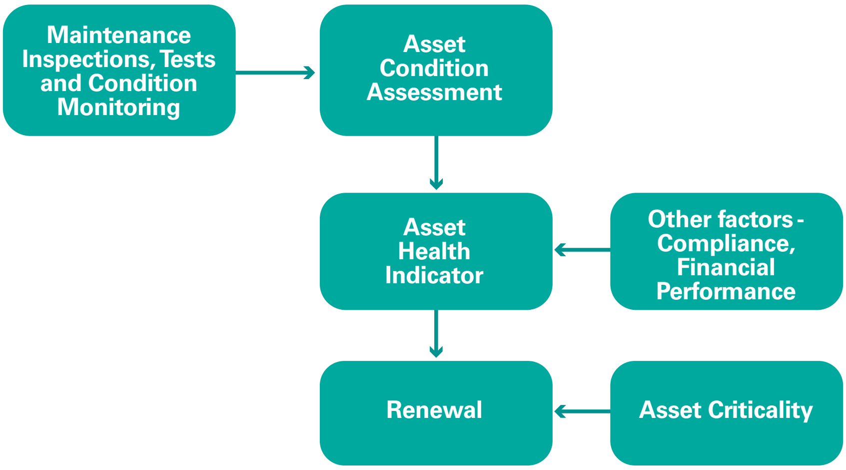



*Figure 2.15: Maintenance Process for Asset Renewal*

## 2.4 Planning Period

The AMP documents the likely development, maintenance and replacement requirements of the network and non-network assets over the next 10 years, from 1 April 2022 to 31 March 2032, with a focus on specific projects that have been identified for the next five years.

There is inherent uncertainty in the AMP forecasts. Several factors contribute to this uncertainty, including pandemics and weather events. Our AMP forecasts are reasonably certain for 5 years. Except for potential large customer developments, including distributed generation, our plan has some certainty for the remainder of the planning period.

## 2.5 Date Approved by Directors

This AMP was completed for asset management purposes in 2021 and was approved by the MainPower Board of Directors at their December 2021 meeting.

## 2.6 Stakeholder Interests

Defining and understanding the needs and desires of our stakeholder groups allows us to structure our strategic objectives and define service levels in a way that is meaningful and relevant. Figure 2.16 shows our stakeholder groups.

| CONNECTED CONSUMERS | COMMUNITY | OTHER STAKEHOLDERS | PARTNERS |
|---|---|---|---|
| Recipients of our services, including residential, small-to-medium businesses, large users, rural (farming) and individually managed consumers. Connected consumers are also preference shareholders. | People within the distribution area that are affected by our network, either in use or during installation and maintenance. | Customers with an interest in the operation of our organisation, including MainPower Trust, Government, regulators, district and regional councils, representative groups, contractors and suppliers, property developers and the media. | Participants in the electricity supply chain that help us meet our connected consumers' needs, including Transpower, electricity retailers, other distributors, electrical contractors and alternative technology providers. |

*Figure 2.16: Our Stakeholder Groups*

## 2.6.1 MainPower Consumers and Customers

Primarily, the link between MainPower's consumers and our customers is through our Use of System Agreement and Connection Agreement. Under Part 12A of the Electricity Industry Participation Code, the Use of System Agreement with our retailer customers is based on conveyance. MainPower's consumers are also our customers for the provision of lines services and this relationship is governed by our Connection Agreement. For the purpose of this AMP, MainPower also refers to our customers as "consumers".

## 2.6.2 Stakeholder Engagement

We identify the expectations and requirements of our stakeholders through a wide range of engagement activities, including consultation, correspondence and online feedback via our website. Our other methods of identification are summarised in Table 2.2.

| Stakeholder | How We Identify the Expectations and Requirements of Stakeholders |
|---|---|
| All stakeholders | • Consultation and correspondence |
| Connected consumers | • Consumer account managers<br>• Consumer discussion groups<br>• Consumer research (quantitative and qualitative methods)<br>• Direct current feedback/interactions<br>• Events (including the Annual Meeting)<br>• Informal contact/discussions<br>• Open days<br>• Public meetings and information sessions<br>• Submissions on discussion papers |
| Community, representative groups | • Direct current feedback/interactions<br>• Forums and working groups<br>• One-on-one meetings<br>• Open days<br>• Submissions on discussion papers |
| MainPower Trust (Ordinary Shareholders) | • Direct current feedback/interactions<br>• Events (including the Annual Meeting)<br>• Operational interface<br>• Other engagement activities |
| Government | • Disclosure requirements<br>• Submissions on discussion papers |
| Regulators | • Adherence to corporate policies<br>• Disclosure requirements<br>• Operational interface |
| District and regional councils | • Disclosure requirements |

| Stakeholder | How We Identify the Expectations and Requirements of Stakeholders |
|---|---|
| Contractors and suppliers | • Direct current feedback/interactions<br>• One-on-one meetings |
| Media | • Briefing sessions<br>• Forums and working groups<br>• Media monitoring and editorial opportunities<br>• Open days<br>• Public meetings and information sessions<br>• Sponsorship involvement |
| Transpower | • Operational interface<br>• Submissions on discussion papers |
| Electricity retailers | • Direct current feedback/interactions<br>• Industry collaboration<br>• Informal contact/discussions<br>• One-on-one meetings |
| Electricity industry | • Forums and working groups<br>• Informal contact/discussions<br>• One-on-one meetings<br>• Open days<br>• Participation in industry (including membership)<br>• Public meetings and information sessions<br>• Submissions on discussion papers |

*Table 2.2: How We Identify the Expectations and Requirements of Our Stakeholders*

## 2.6.3 Summarising the Interests of Our Stakeholders

The expectations of our stakeholders are summarised in Table 2.3.

| Stakeholder | Expectations |
|---|---|
| Connected consumers | • Accessibility – easy to contact provider when necessary<br>• Consistency of service delivery (including response time)<br>• Continuity of supply – keeping the power on<br>• Future innovation<br>• Health, safety and the environment<br>• Price – keeping costs down<br>• Quality – keeping flickering or dimming lights to a minimum<br>• Restoration of supply – reducing length of time when power is off<br>• Transparent communication (including outage information) |
| Community, representative groups | • Community focus<br>• Corporate social responsibility<br>• Engagement and consultation<br>• Public safety around electricity |
| **Other Stakeholders** | |
| MainPower Trust<br>(Ordinary shareholder) | • Delivery of a secure and reliable power supply<br>• Effective and efficient incident response<br>• Future innovation<br>• Health, safety and the environment<br>• Maintaining shareholder value<br>• Prudent risk management<br>• Statutory/regulatory compliance |

| Stakeholder | How We Identify the Expectations and Requirements of Stakeholders |
|---|---|
| Government | • Appropriate investment in infrastructure<br>• Delivery of a secure and reliable power supply<br>• Future innovation<br>• Health, safety and the environment<br>• Industry collaboration |
| Regulators | • Contribution via industry consultations/submissions<br>• Cost-reflective pricing methodology<br>• Delivery of a secure and reliable power supply<br>• Health, safety and the environment<br>• Future innovation<br>• Statutory/regulatory compliance |
| District and regional councils | • Appropriate investment in infrastructure<br>• Collaboration on shared service upgrades<br>• Contribute towards a vibrant and prosperous region<br>• Contribution to planning via consultations/submissions<br>• Delivery of a secure and reliable power supply<br>• Engagement and consultation<br>• Health, safety and the environment<br>• Future innovation |
| Contractors and suppliers | • Effective contractor management<br>• Health, safety and the environment |
| Media | • Effective relationship management<br>• Timely access to information |
| **Partners** | |
| Transpower | • Appropriate investment in infrastructure<br>• Collaboration and effective relationship management<br>• Engagement and consultation<br>• Health, safety and the environment<br>• Transparent communication (including outage information) |
| Electricity retailers | • Continuity and security of supply<br>• Effective systems and processes<br>• Health, safety and the environment<br>• Transparent communication (including outage information) |
| Electricity industry | • Collaboration<br>• Future innovation<br>• Health, safety and the environment<br>• Industry participation<br>• Information and knowledge sharing |
| Bankers and insurers | • Accurate and timely performance information<br>• Confidence in Board and leadership<br>• Good governance<br>• Prudent risk management<br>• Sufficient revenue to maintain asset efficiency and reliability |

*Table 2.3: What Our Stakeholders Expect from Us*

We assess the performance of our electricity distribution network against what our consumers are telling us they want.

### 2.6.4 Managing Stakeholder Interests When They Conflict

Where stakeholder conflicts arise, the priorities for managing the conflicts are ranked in the following order:

1. Safety;
2. Compliance;
3. Service quality;
4. Risk management; and
5. Efficiency and effectiveness.

## 2.7 Accountabilities and Responsibilities

Our electricity distribution network is managed and operated from our Rangiora office at 172 Fernside Road. Our ownership, governance and management structure are outlined in Figure 2.17.

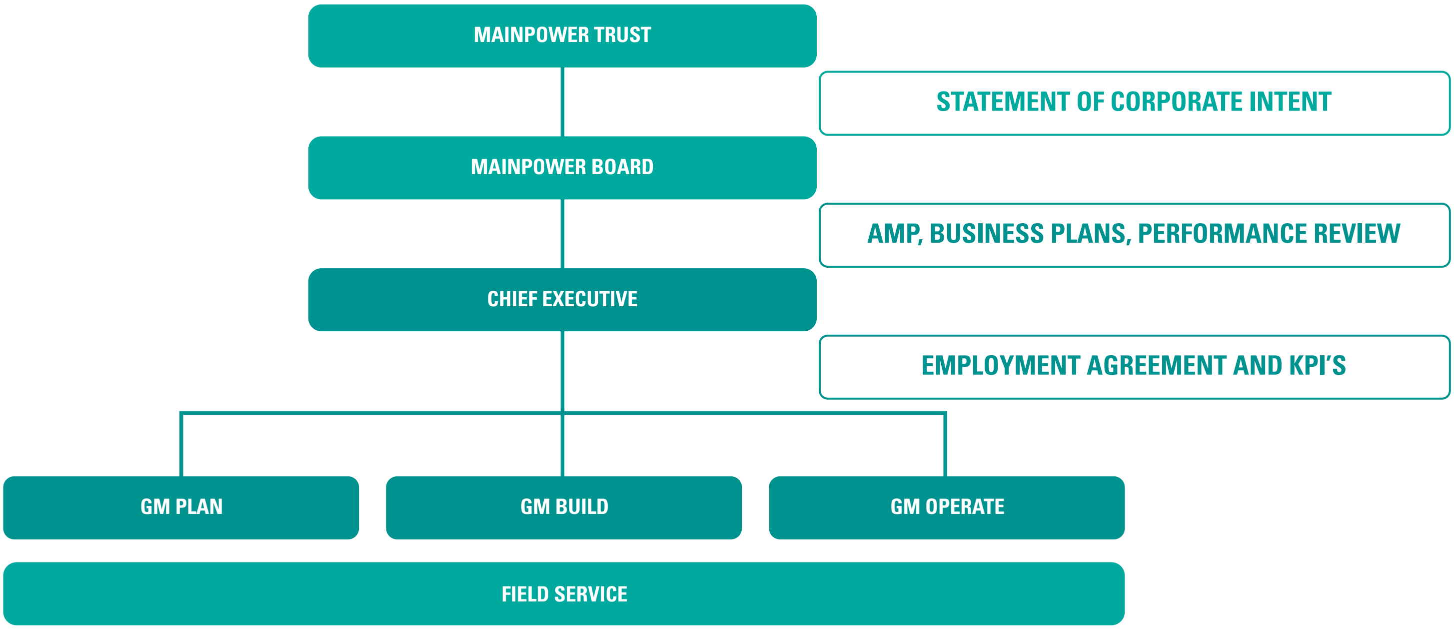



*Figure 2.17: Organisational Management Structure*

### 2.7.1 Ownership

We are 100% shareholder owned by the MainPower Trust, which holds shares in the Company on behalf of preferential shareholders. The Trust appoints the MainPower Board of Directors and agrees the Statement of Corporate Intent. They also provide input, on behalf of their beneficiaries, on matters of relevance to asset management planning, such as price, quality and performance.

The Trust also requires MainPower to measure and compare its performance against a selected sample of other EDBs in terms of profits, price, expenditure and electricity distribution network reliability.

### 2.7.2 Governance and Executive Leadership

MainPower currently has six non-executive Directors who collectively make up the Board of Directors. The Board is accountable to the Trust.

The Board of Directors is responsible for the corporate governance of MainPower. The Board delegates the day-to-day responsibility for the operation and administration of MainPower to the Chief Executive. The Board also approves the AMP, business plan and budget. Financial approvals that exceed the delegated authority of the Chief Executive, such as large investment proposals, require Board approval.

The Chief Executive of MainPower is accountable to the Board through an employment agreement that includes performance criteria.

The AMP serves to communicate to the Board the business's approach to asset management. Corporate objectives, expenditure, electricity distribution network and asset management performance are reported to the Board monthly.

As MainPower transforms its electricity distribution network for a New Energy Future, it has also set up a Strategic Asset Management steering group. The purpose of the steering group is to oversee the strategic direction of asset management and enhance the link between the Board and asset management at MainPower.

### 2.7.3 Field Services

All field services are managed both internally and externally. The work programme is assessed and where resourcing gaps are identified or where MainPower does not have the in-house capability, the works are outsourced. Typically, outsourcing is achieved via a Request for Proposal process. Costs are used to benchmark internal costs. The primary objective is to deliver the work programme detailed within the AMP while ensuring that MainPower benchmarks its service delivery against the market in terms of price and quality.

## 2.8 Assumptions Made

### 2.8.1 Significant Assumptions Made

The following assumptions have been made in the preparation of the AMP:

- Residential subdivision activity will continue or plateau (and possibly reduce) during the planning period.
- Major industrial plants will maintain similar kW and kWh demand for the next five years.
- While a significant renewable energy project (Mt Cass Wind Farm) may obtain approval to proceed within the next reporting cycle, the requirement to connect Mt Cass to the grid is not documented in this AMP.
- Small grid-connected distributed generation will increase throughout the planning period, impacting financial growth but not causing significant electricity distribution network constraints.
- Existing external regulatory and legislative requirements are assumed to remain unchanged throughout the planning period.
- All projections of expenditure are presented in constant terms, as at 1 April 2022, without inflation.
- Transpower will continue to provide sufficient capacity to meet MainPower's requirements at the existing GXPs and will undertake additional investment required to meet future demand, as specified in the development plan.
- MainPower's existing corporate vision and strategic objectives will continue for the planning period.
- Neither MainPower's electricity distribution network nor the local transmission grid will be exposed to a major natural disaster during the planning period.
- Our electricity distribution network will only be exposed to climatic (temperature, wind, snow and rain) variation during the planning period that is consistent with our experience since 2000.
- Seasonal load profiles will remain consistent with recent historical trends.
- Zoning for land use purposes will remain unchanged during the planning period.
- EV-charging loads will not significantly affect electricity distribution network constraints within the planning period.

### 2.8.2 Sources of Information

The principal sources of information relevant to this AMP are as follows:

- MainPower's strategic planning documents, including the Statement of Corporate Intent and the Annual Business Plan and Budget;
- MainPower's Asset Management Policy;
- MainPower's Business Continuity Plan;

- Ongoing consumer surveys;
- Maximum electricity demand at each GXP;
- Regional population data and forecasts sourced from Statistics New Zealand and the Waimakariri, Hurunui and Kaikōura District Councils; and
- Interaction with consumers and the community in relation to possible future developments within the electricity distribution network region.

## 2.8.3 Forecasting Certainty

MainPower considers the following factors could lead to material differences in actual versus planned. However, as the AMP is updated annually, any differences would likely exhibit as a linear change (i.e. not a step change) and would be anticipated in advance.

Changes in demand factors most significantly affect future development plans. Growth that is higher than forecast brings forward the need for investment in additional capacity, security, reliability or increased load management, while growth that is lower than expected can sometimes allow development plans to be deferred.

Uncertainties within our demand assumptions include the following:

- The rate of growth in demand could significantly accelerate or decelerate within the planning period.
- Dry/wet years could affect irrigation demand.
- Significant land-zoning changes may be implemented within the region.
- Significant new loads may require supply.
- Large existing loads may reduce or cease demand.
- Consumers could change their requirements for reliability and/or their willingness to pay for higher/lower levels of service.

Changes in operational factors may require us to reprioritise or reallocate our planned operating expenditure in the short term and increase or decrease operating expenditure or renewals allowances in the medium term. Changes may include the following:

- The electricity distribution network could experience major natural disasters such as earthquake, flood, tsunami or extreme storm.
- Significant storm events could divert resources from scheduled maintenance.
- Regulatory requirements could change, requiring MainPower to achieve different service standards, health and safety standards, or design or security standards.

We have assessed the level of certainty of forecasts relevant to different consumer groups within this AMP's planning period as shown in Table 2.4.

| Timeframe | Location | Constraint | Proposed Remedy |
|---|---|---|---|
| Year 1 | Reasonable certainty | Reasonable certainty | Reasonable certainty |
| Year 2–3 | Some certainty | Reasonable certainty | Reasonable certainty |
| Year 4–6 | Some certainty | Little if any certainty | Some certainty |
| Year 7–10 | Some certainty | Little if any certainty | None |

*Table 2.4: Planning Certainty*

## 2.8.4 Escalation Index

Our input prices are subject to a range of cost pressures, including those that apply to skilled and unskilled labour, material components (e.g. copper, aluminium, steel), the NZD exchange rates and other inputs such as fuel. We have applied the Westpac Economics Forecast Summary Spreadsheet values for the purpose of converting our constant price forecasts to nominal terms, as given in Table 2.5.

| Year | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
|---|---|---|---|---|---|---|---|---|---|---|
| Index | 1 | 1.03 | 1.06 | 1.08 | 1.10 | 1.13 | 1.15 | 1.17 | 1.20 | 1.22 |

*Table 2.5: Escalation Index Based on Westpac Economics Forecast Summary Spreadsheet 1 November 2021*

# 2.9 Sources of Uncertainty

The following factors could lead to material differences in actual outcomes versus planned. However, as this AMP is updated annually, it is expected that any material differences would be anticipated in advance.

## 2.9.1 Demand Factors

Changes in demand factors most significantly impact future development plans. Growth that is higher than forecast can bring forward the need for investment in additional capacity, security or reliability, while growth that is lower than expected can sometimes allow development plans to be deferred. Uncertainties within our demand assumptions include the following:

- Within each region, load patterns could change, resulting in a movement from summer to winter peaks or vice versa.
- Significant land-zoning changes may be implemented within the region.
- Dry/wet years could affect irrigation demand.
- Significant new loads may require supply.
- Large existing loads may reduce or cease demand.
- Customers could change their requirements for reliability and/or their willingness to pay for higher/lower levels of service.
- Significant distributed generation, greater than 10% of its connected substation capacity, may be commissioned within the network supply area.

## 2.9.2 Operational Factors

Changes in operational factors may require us to reprioritise or reallocate our planned maintenance in the short term and increase or decrease maintenance or renewals allowances in the medium term. Changes may include the following:

- The network could experience major natural disasters such as an earthquake, flood, tsunami or extreme storm.
- Significant storm events could divert resources from scheduled maintenance.
- Regulatory requirements could change, requiring MainPower to achieve different service standards, health and safety standards, or design or security standards.
- Unforeseen equipment failure could require significant repair and possibly replacement expenditure.
- Asset management planning that is more detailed, undertaken over the next 3–5 years, could generate development and maintenance requirements that significantly differ from those currently provided for.

# 2.10 Systems and Information Management

The core of all MainPower's Asset Management is our CMMS. The CMMS adopted by MainPower is referred to as the "OneAsset" system. OneAsset is an enterprise resource planning (ERP) tool primarily designed to support financial reporting and operating assets management, through to works and human resources management.

## 2.10.1 Asset Lifecycle Management – Maintenance and Replacement

Preventative maintenance programmes are detailed in MainPower's Maintenance Standards. These are developed for all MainPower asset fleets. The Maintenance Standards are continually reviewed, based on the life and performance analysis of the asset fleets. The backbone of the analysis is asset data. The data (inspection, condition and defects) are collected when carrying out maintenance activities and inform asset health and replacement strategies.

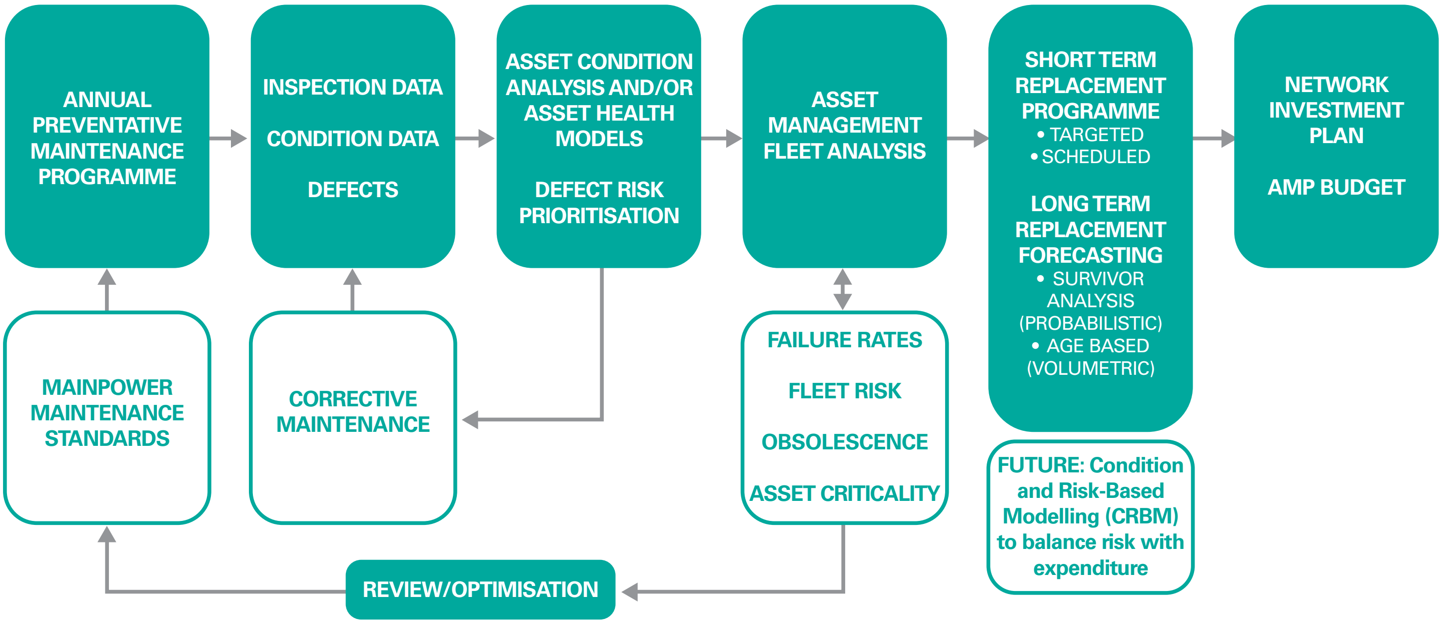



*Figure 2.18: Asset Lifecycle Management*

The asset data are collected and stored in several locations, such as the ERP, GIS and data warehouse systems. This currently presents a risk to the organisation in terms of the integrity of the data and the ability to make good asset management decisions. The aim is to develop a single source of the truth for all asset data within the ERP system, including the implementation of strategic asset management. Currently, renewals are informed primarily by defects and age. The future includes implementing a targeted scheduled replacement programme informed by asset condition, criticality and risk.

## 2.10.2 Limitation of Asset Data and Improvements

MainPower holds good information on our assets. The focus in the future is to centralise all asset data, including vegetation, into a single source of information: TechnologyOne Enterprise Asset Management. A project to achieve this is underway and will provide the foundation for the automated logging of maintenance and condition assessment of all maintenance activities. All maintenance activities allow for asset data to be updated through inspections or routine maintenance.

MainPower has completed a review of our asset data, including consistency of data across multiple systems and the ability of data to support future strategic asset management. While the data currently support MainPower's AMP and work programme, we will look to improve the quality and consistency of our data.

## 2.10.3 Electricity Distribution Network Planning

The planning for electricity distribution network growth is informed by load, connection growth, connection of new technologies and customer projects. This change in capacity requirement is assessed against existing capacity, security of supply standards and reliability. At this point a decision may be made to implement a tactical solution for increased capacity, such as reconductoring or voltage regulator deployment. Alternatively, a decision may be made to upgrade a GXP or zone substation, which is more expensive. The tactical upgrades are primarily used to defer capital expenditure that is more expensive. All capacity upgrades are referred to a capital-sanctioning process.

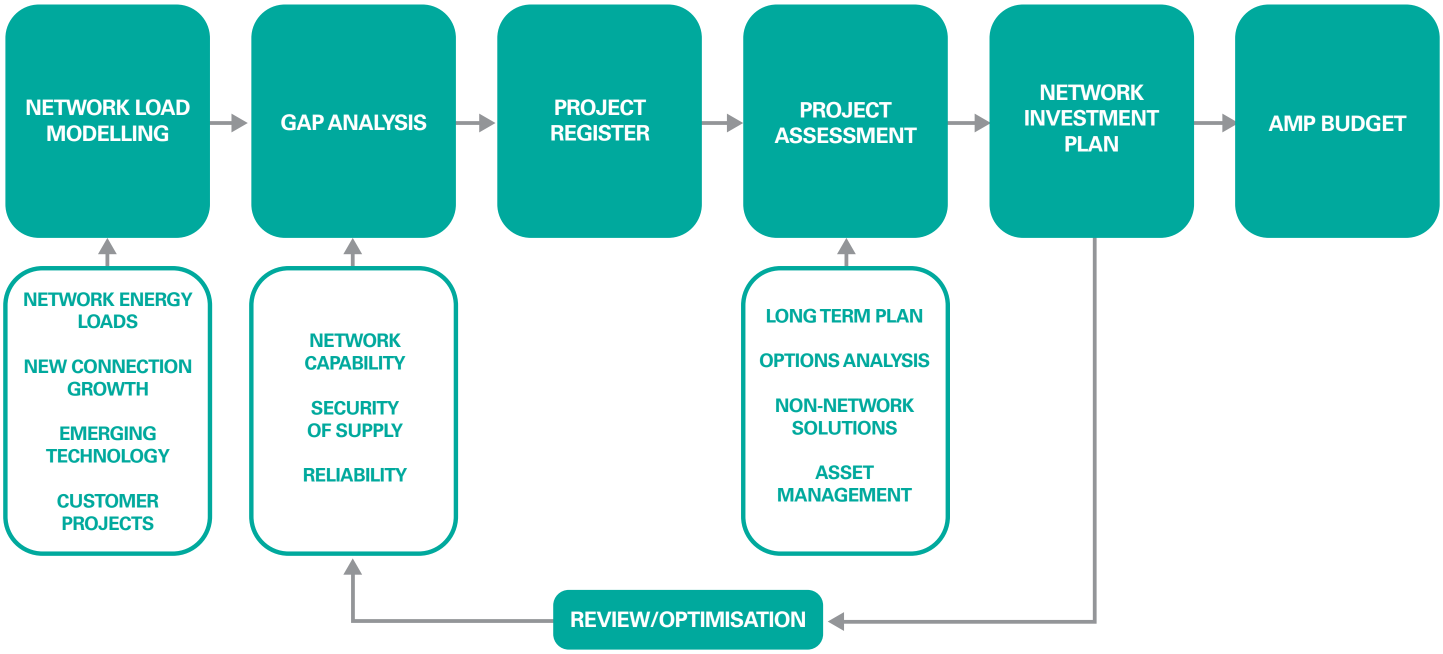
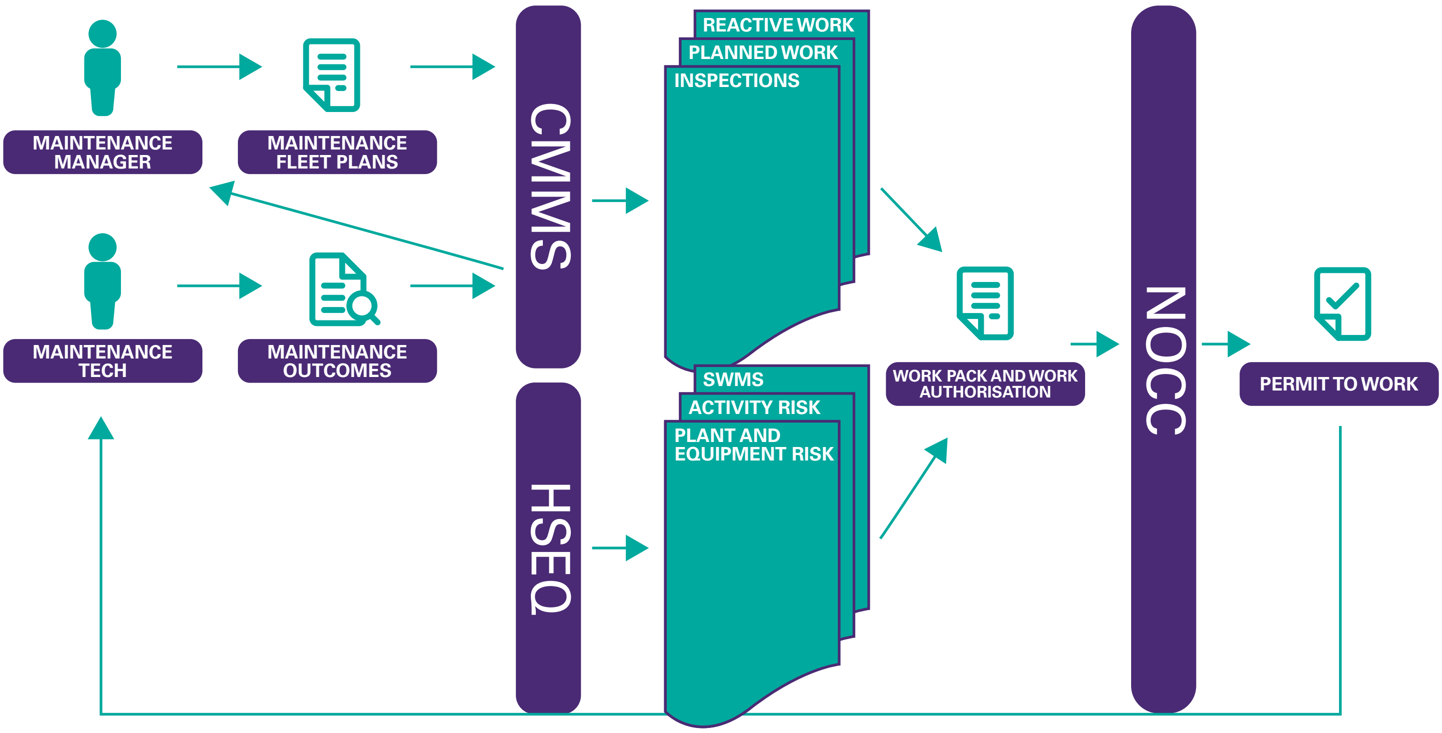



*Figure 2.19: Electricity Distribution Network Development*

## 2.10.4 Maintenance Processes

The requirement to deliver maintenance on our assets is defined in MainPower's Asset Maintenance Standards. The standards are then implemented within MainPower's CMMS ERP system. A summary of the maintenance workflow is detailed in Figure 2.20, including the need to work within a controlled working environment, the issuing of authorisation, and the receiving of asset condition data that are used to manage defects, inform renewals and so on.




*Note.* CMMS = computerised maintenance management system; HSEQ = health, safety, environment and quality; NOCC = Network Operations & Control Centre; SWMS = safe work method statement

*Figure 2.20: Asset Management Workflow Process*

## 2.10.5 Measuring Electricity Distribution Network Performance

MainPower maintains an ISO 90001-certified quality assurance programme and continues to develop, implement and internally audit the programme in accordance with this commitment. Relevant standards for asset management planning include design, purchasing, document and record management, and environmental management. MainPower maintains a document control system under this certification.

The ISO 90001 certification ensures annual review and continual improvement of the documentation systems.

Where asset management design and construction are outsourced, contractors must comply with our asset management processes, controls and documentation systems. All maintenance tasks and asset data collection are maintained within the MainPower CMMS against the applicable asset. Costs associated with the maintenance are linked back to the asset via the work order.

# 2.11 Communication and Participation

MainPower communicates its asset management strategy, objectives and outcomes to stakeholders as outlined in Table 2.6.

| Reporting From/To | Reporting Type |
|---|---|
| MainPower Trust to consumers and the wider community | • Consultation on the Trust's Letter of Expectation to the MainPower Board<br>• MainPower Trust's Annual Report and audited accounts |
| MainPower Board to MainPower Trust | • Statement of Corporate Intent<br>• Company Annual Report, including Chair and Chief Executive's statements and audited accounts<br>• Annual information disclosure<br>• Twice-yearly presentation, including financial and operational performance |
| Chief Executive to MainPower Board | • Chief Executive's statement in the Annual Report, including narrative of the year's highlights<br>• Monthly MainPower Board report, including progress on capital and maintenance programme<br>• Monthly update on network performance and major incidents |
| General Manager Network Planning & Strategy to Chief Executive and MainPower Board | • Annual report on budget and major projects<br>• Monthly report, including year-to-date performance and progress against budget<br>• Individual reports on major projects<br>• Daily updates on areas of concern, including health and safety |
| Managers | • Weekly direct reporting from team meetings<br>• One-on-one discussion with direct managers<br>• Daily updates during brief meetings, including health and safety updates<br>• Monthly management accounting reports |
| Field Services Supervisors | • Weekly progress reports<br>• Monthly meetings on progress to budget |
| External contractor to General Manager Field Services | • Weekly progress reports<br>• Monthly meetings on progress |

*Table 2.6: Reporting Asset Management Plans and Outcomes*

# 3. SERVICE LEVELS AND PERFORMANCE EVALUATION

MainPower's electricity distribution network and business service levels are an integral part of the decision-making processes throughout the organisation. We are committed to listening to our consumers and stakeholders and better understanding their needs. This allows us to monitor and improve the services we provide continuously, throughout our region, now and into the future. We use a range of engagement methods to find out what consumers expect of MainPower and their vision for the future. We believe we have balanced legislative, regulatory and stakeholder requirements in our defined service levels. This section outlines how we engage with our consumers, what they expect from us and how this translates through to our service levels.

## 3.1 Consumer Engagement

We provide electricity distribution services to more than 40,000 homes and businesses across the Waimakariri, Hurunui and Kaikōura regions in the South Island of New Zealand. Types of consumers include residential, small to medium businesses, large and industrial businesses, rural (farming and irrigators) and individually managed consumers (see Table 3.1). Partners include retailers as well as distributed generation owners and operators. Understanding consumer expectations, monitoring and improving the service MainPower provides are all vital if we are to establish and maintain trust and goodwill with our consumers and stakeholders throughout the region. We do this by actively consulting with our consumers. The electricity industry is entering a time of transformation as emerging technologies change the way consumers use and manage energy.

| Consumer Type | Average Number of ICPs | % of ICPs | Units Delivered (GWh) | % of Units Delivered |
|---|---|---|---|---|
| Residential | 34,087 | 80.9% | 285 | 46% |
| Commercial | 6,241 | 14.8% | 120 | 19% |
| Large commercial or industrial | 44 | 0.1% | 58 | 9% |
| Irrigators | 1,427 | 3.4% | 88 | 14% |
| Council pumps | 203 | 0.5% | 13 | 2% |
| Streetlights | 114 | 0.3% | 4 | 1% |
| Individually managed consumer | 1 | 0.0% | 58 | 9% |
| **Total** | **42,117** | **100.0%** | **626** | **100%** |

*Note.* ICPs = installation control points; GWh = gigawatt-hours

*Table 3.1: Consumption and Consumers by Category*

### 3.1.1 Consumer Engagement Workshops

Every second year we hold workshops with consumers across our three main regions. Groups of around 20 consumers explore the price/quality trade-off topics inherent in our network investment decision-making framework, such as reliability, resilience and the future of energy and our electricity network. These workshops aim to enhance engagement with our consumers in relation to asset management. This engagement has provided considerable insights into how MainPower can balance the cost, risk and performance of its electricity distribution network. Given the challenges posed by COVID-19, we expect to complete the next round of engagement sessions in 2022.

### 3.1.2 Online Consumer Surveys

MainPower gathers feedback from a number of online surveys, including the annual Customer Pulse survey. This is designed to give us an understanding of how we are performing over time in a broad range of areas.

## 3.2 What Consumers Have Told Us

In FY21 consumer satisfaction and awareness of MainPower has remained high. It is likely that the COVID-19 pandemic has accelerated a change in consumer needs, where reliability and communication from electricity providers is more important than ever.

### 3.2.1 Consumers – Performance and Service

In FY21 consumer satisfaction and awareness of MainPower has remained high. It is likely that the COVID-19 pandemic has accelerated a change in consumer needs, where reliability and communication from electricity providers is more important than ever.

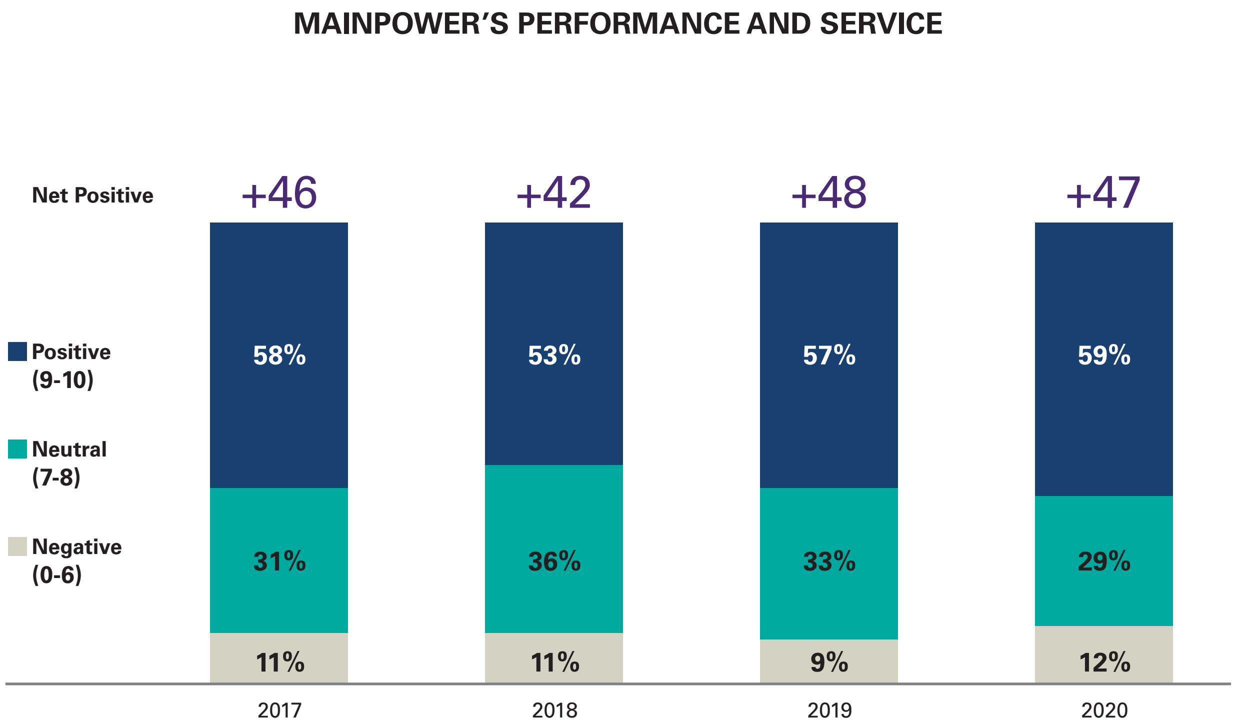



*Figure 3.1: MainPower Consumers' Perceived Performance and Service (Source: Customer Pulse FY21)*

### 3.2.2 Consumers – Reliability

Consumers' high levels of satisfaction are driven by positive perceptions of reliability (see Figure 3.2).

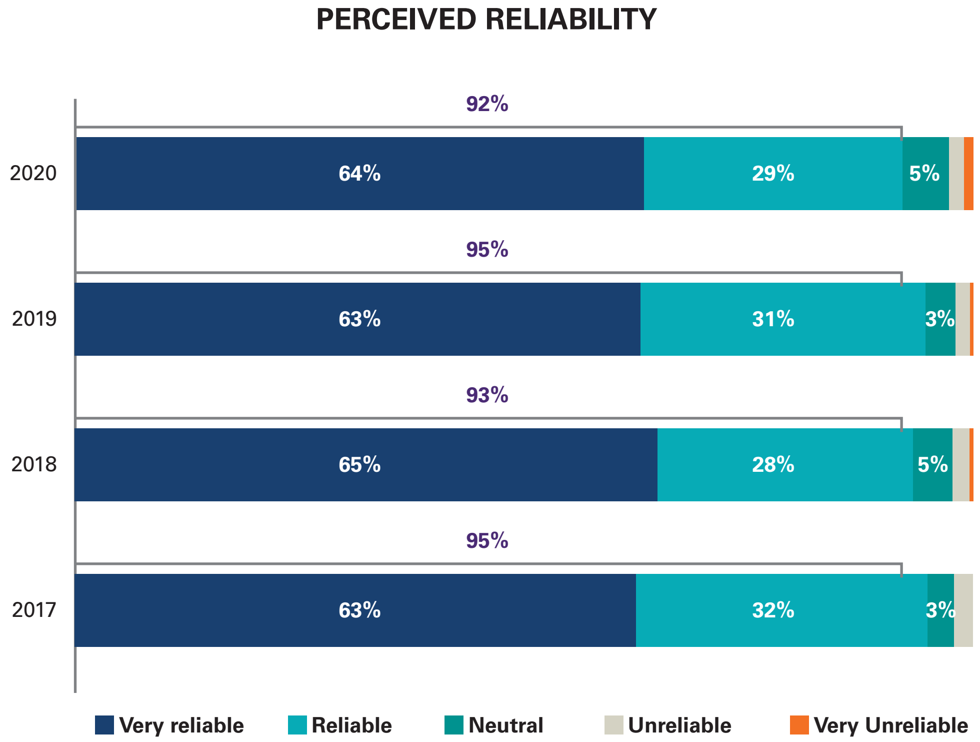



*Figure 3.2: MainPower Consumers' Perceived Reliability (Source: Customer Pulse FY21)*

## 3.2.3 Consumers – Continuity, Quality, Restoration and Price

MainPower delivers strongly in all important service areas, except price (see Figure 3.3).

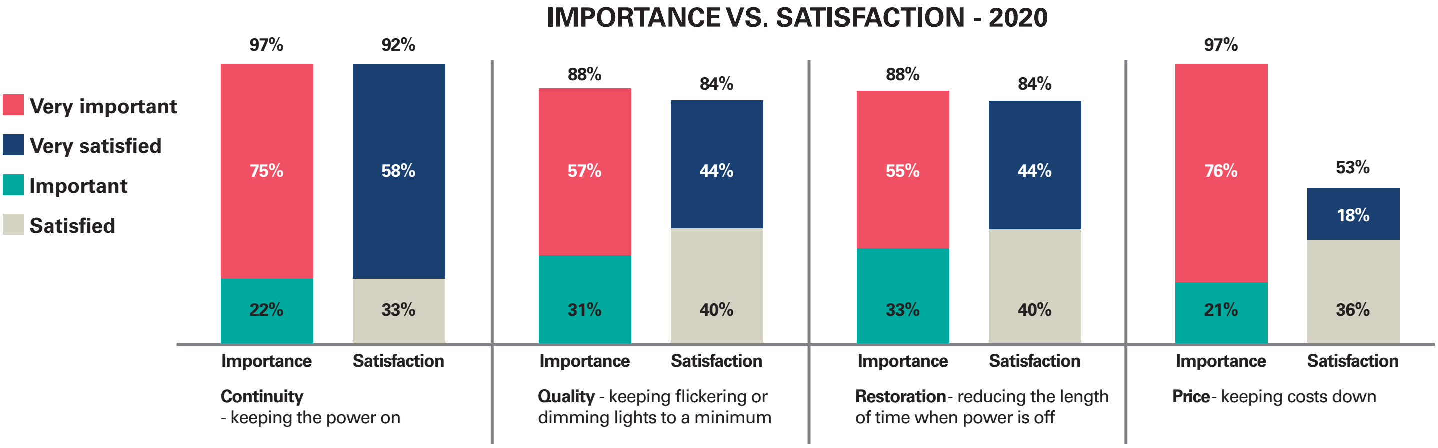



*Figure 3.3: MainPower Consumers' Perceived Importance and Satisfaction across Service Areas (Source: Customer Pulse FY21)*

## 3.2.4 Consumers – Safety Messaging Recall

Prompted recall of safety messages remains high (see Figure 3.4). MainPower has a responsibility to provide relevant safety messages to highlight the risks of electricity. We have a comprehensive safety messaging programme to ensure these messages are communicated through a range of traditional and digital channels.

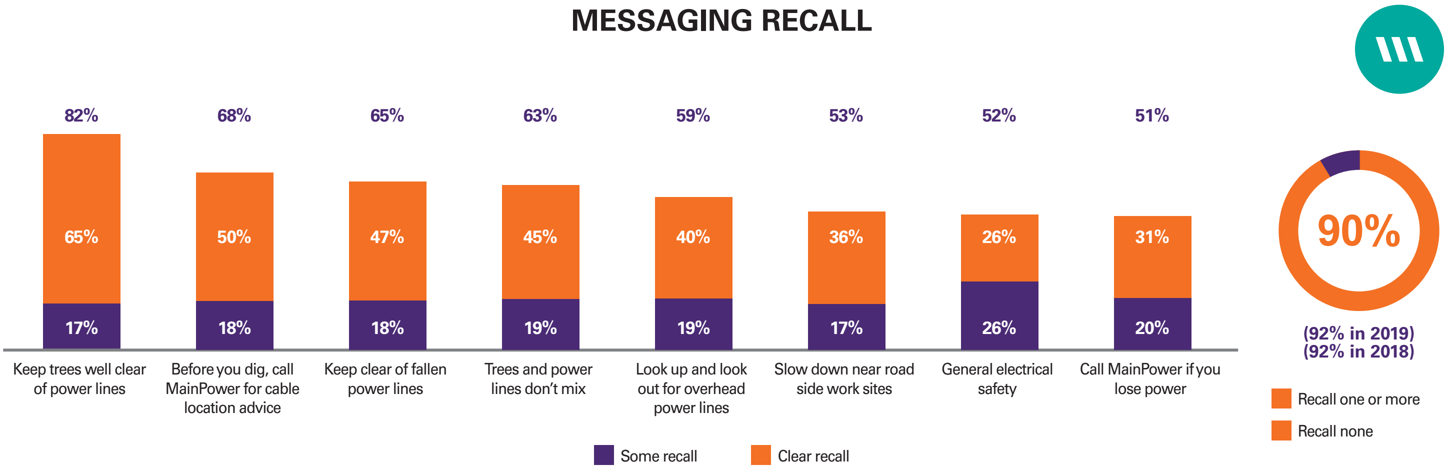



*Figure 3.4: MainPower Consumers' Recollection of Safety Messaging (Source: Customer Pulse FY21)*

## 3.3 Maintaining Performance Indicators

MainPower periodically reviews its performance against its performance indicators in a Plan–Do–Check–Act cycle that is aligned with MainPower's accreditation to ISO 9001, as described in Figure 3.5.


*Note.* SAIDI = System Average Interruption Duration Index; SAIFI = System Average Interruption Frequency Index

*Figure 3.5: MainPower's Performance Indicator Continuous Improvement Process*

### 3.3.1 Inputs

These are based on:

- Consumer expectations from consumer engagement surveys and workshops (as discussed already in Section 3.2); and
- Analysis and industry benchmarking across our peer group (to be discussed in Section 3.6).

### 3.3.2 Planning

Using these inputs, MainPower has refined our network development and asset management guidelines to include:

- Security of Supply Standard;
- Asset Portfolio Strategies, including asset health (condition-based risk management (CBRM)) models;
- Project and Works Delivery Planning and Processes;
- Network Operating Standards;
- Network Architecture Standards; and
- Network Reliability Strategy.

### 3.3.3 Works Programme

Asset Management guidelines are used to inform a targeted AMP work programme and budgeting/resource planning, including:

- Asset replacement/renewals;
- Reliability and security of supply-focused network reinforcement and major capital projects;
- Refined and targeted network maintenance programme; and
- Refined network engineering and design practices.

### 3.3.4 Performance Monitoring

This involves:

- Internal data analytics of historical service levels, including feeder reliability, root cause and common mode failure analysis, and applying predictive modelling; and
- Network service-level performance being continuously monitored with analysis of network outages, monthly reporting of SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index) indices to the MainPower Board against year-to-date forecasts, and specific investigations conducted into major outage causes.

### 3.3.5 Analytics

Continuous improvement principles are employed to feed back the insights from the performance monitoring, data analytics and outage investigations into annual updates of MainPower's electricity distribution network development and asset management documentation, and combines with other inputs to better understand, inform and refine future service levels.

## 3.4 Performance Indicators

### 3.4.1 Reliability

Network reliability is measured by the frequency and duration of interruptions to consumers' electricity supply. Our reliability targets guide our investment decisions and aim to meet both our consumers' expectations and regulatory requirements.

MainPower's key network reliability measures are applied as determined by the Commerce Commission's Electricity Distribution Information Disclosure Determination 2012, and include the following:

- **SAIFI**, which measures the average number of supply interruptions for each consumer during the year; and
- **SAIDI**, which measures the average minutes that a consumer is without power during the year.

The above SAIDI and SAIFI measures include planned and unplanned interruptions on MainPower's sub-transmission and high-voltage networks with a duration longer than one minute. MainPower's consumers view network reliability as a top priority and are generally satisfied with their current level of reliability.

## 3.4.2 Network Restoration

When an unplanned network interruption does occur, we target commencement of restoration of supply within three hours.

Our Network Operations and Field Services teams have people available around the clock to respond when unplanned interruptions occur. Our Network Field Operators are based throughout our region, and we hold strategic spares in our depots to reduce response and repair times.

## 3.4.3 Resilience

Resilience is the ability of MainPower and our network to anticipate, absorb and recover from disruptive and extreme events such as snowstorms and earthquakes. A more resilient network minimises the number of consumers impacted by significant events. We recognise the need to balance the cost of installing backup and redundant systems with providing a reasonable level of service that has the ability to rapidly recover from extreme events. We are exploring ways to better manage MainPower's network and business resilience in line with industry guidelines.

MainPower has recently invested in an advanced distribution management system (ADMS) to help provide better visibility and control of our network. We also see an opportunity to improve both network restoration and resilience performance further through improved network architecture aligned with our Security of Supply Standard (see Section 6 of this document) and enhancing our remote sensing and switching capability throughout the network.

## 3.4.4 Health, Safety and the Environment

Our teams are committed to providing a safe network and healthy working environment across our assets. MainPower promotes public safety around electricity throughout our region to help make sure our community is aware of our assets and activities. We take all practical steps to minimise risk and harm to the public, our people and our service providers, and we measure this using:

- Safety of employees and service providers; and
- Safety of the public.

Our objectives are to:

- Identify, manage and communicate risks associated with the workplace, the electricity distribution network and our business activities;
- Ensure compliance with legislative requirements and industry standards;
- Ensure that employees and field service providers have an appropriate level of training, skill and knowledge to carry out their work safely; and
- Provide safe equipment, plant and systems to ensure public and worker safety.


**AWARENESS OF SAFETY MESSAGING**

*Figure 3.6: Awareness of safety messaging in North Canterbury taken from Customer Pulse Survey 2020*

We regularly monitor, review and report on our legal compliance obligations and risks. The focus of monitoring and reporting is to understand compliance risks. Additionally, as part of the requirements for certification to ISO 9001, ISO 14001 and AS/NZS 4801, we must be able to demonstrate how we manage our legal requirements.

We design, construct, commission, operate and maintain the electricity distribution network and other company assets to ensure that they are safe, fit for purpose and do not pose a risk to health. We also participate in industry-related benchmarking of safety incidents to provide a basis for measuring our performance.

MainPower is committed to protecting and improving our environment, and we recognise our responsibility to strive for environmental sustainability. In addition to our business environmental sustainability drivers, our current network environment measures include the following:

- **Sulphur hexafluoride (SF6) gas:** This gas is used as an interruption medium in switchgear, and the Ministry for the Environment has set a compliance level of less than 1% annual loss, based on the total volume of gas on the network. MainPower is committed to minimising SF6 emissions, and we monitor and report on losses.
- **Oil spills:** Some assets on our network use oil as an insulating medium. We use a range of containment and mitigation solutions to prevent, or minimise the impact of, spills. Our annual target is zero uncontained oil spills across our network.

## 3.4.5 Customer Oriented

Customer engagement is increasing in significance as the electricity industry evolves. By listening to our customers, consumers and community, we can develop a clear understanding of the measures of performance that are most important to them and how MainPower is currently performing against those measures.

MainPower gathers feedback from consumers in our annual Customer Pulse survey, in which we monitor:

- Performance and service;
- Perceived reliability;
- Outage recollection;
- Communication;
- Continuity – keeping the power on;
- Quality – keeping flickering or dimming lights to a minimum;
- Restoration – reducing the length of time when power is off;
- Network pricing;
- Brand awareness;
- Community sponsorship; and
- Safety messaging.

MainPower also assesses our performance in relation to delivering customer-initiated work through our annual service monitoring survey, in which we monitor:

- Engagement effort – how easy it is to do business with MainPower;
- Staff friendliness – to ensure the engagement is proactive and results oriented;
- Quality of work – to ensure we deliver a standard of work that is aligned with our consumers' expectations;
- Timeliness – to ensure work is delivered in accordance with our consumers' expectations;
- Communication – to ensure we communicate with our consumers proactively;
- Staff reliability – to ensure our staff deliver services to our consumers as agreed; and
- Price – to ensure our pricing is fair.

## 3.4.6 Physical and Financial

It is important that MainPower continually assesses our asset management maturity against the requirements of the business and whether we are tracking to achieve the required maturity level. We also review overall organisational financial indicators and how we have performed in delivering the work programme. In addition, MainPower assesses performance against industry peers to ensure we are aligned with the industry using industry benchmarking.

All this is achieved through our processes for:

- Maintenance programme delivery;
- Capital programme delivery;
- Asset management maturity (using the Commerce Commission's AMMAT);
- Financial performance; and
- Industry benchmarking.

| Service Measures and Targets | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Service Class | Performance Indicator | Performance Measure | Past Performance Targets | | Future Performance Targets | | | | | | | | | |
| | | | FY21 | FY22 | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| Reliability | SAIDI – System Average Interruption Duration Index | Average minutes lost per customer per year | 332 | 323 | 280 | 272 | 263 | 255 | 248 | 241 | 235 | 229 | 224 | 220 |
| | SAIFI – System Average Interruption Frequency Index | Average number of times a customer's supply is interrupted per annum | 2.18 | 2.23 | 2.04 | 1.98 | 1.91 | 1.86 | 1.81 | 1.76 | 1.71 | 1.67 | 1.63 | 1.60 |
| | Feed reliability | None – forward indicator only | | | | | | | | | | | | |
| | Unplanned interruptions restored within 3 hours | % of unplanned interruptions where the last customer was restored in less than 3 hours | No targets set (new) | 80% | 80% | | 80% | | 80% | | 80% | | 80% | |
| Health, Safety, Environment and Quality | Safety of workers | No injuries related to a safety critical risk | None | | | | | | | | | | | |
| | Safety of public | No injuries to members of the public | None | | | | | | | | | | | |
| | $SF_6$ gas lost | Gas lost as % to total gas volume | < 1% | | | | | | | | | | | |
| | Oil spills | Uncontained oil spills | None | | | | | | | | | | | |
| Consumer Oriented | Engagement effort | Customer Pulse Survey:<br>1 – very dissatisfied<br>5 – very satisfied | > 2.5 | > 3 | > 3 | | > 3 | | > 3.5 | | > 4 | | > 4 | |
| | Staff friendliness | | > 4 | > 4 | > 4 | | > 4 | | > 4 | | > 4 | | > 4 | |
| | Quality of work | | > 4 | > 4 | > 4 | | > 4 | | > 4 | | > 4 | | > 4 | |
| | Timeliness of service | | > 3.5 | > 4 | > 4 | | > 4 | | > 4 | | > 4 | | > 4 | |
| | Communication | | >3 .5 | > 4 | > 4 | | > 4 | | > 4 | | > 4 | | > 4 | |
| | Staff reliability | | > 4 | > 4 | > 4 | | > 4 | | > 4 | | > 4 | | > 4 | |
| | Final price | | > 4 | > 3.75 | > 3.75 | | > 3.75 | | > 3.75 | | > 3.75 | | > 3.75 | |
| Physical and Financial | Maintenance delivery | Maintenance programme delivery by budget | > 90% | > 90% | > 90% | | > 90% | | > 90% | | > 90% | | > 90% | |
| | Capital delivery | Capital programme delivered by budget | > 90% | > 90% | > 90% | | > 90% | | > 90% | | > 90% | | > 90% | |
| | AMMAT | Complete workstreams noted in AMMAT | > 90% | > 90% | > 90% | | > 90% | | > 90% | | > 90% | | > 90% | |
| | Industry benchmarking | Assess ourselves against:<br>• Operating expenditure per ICP;<br>• Capital expenditure per ICP;<br>• Quality of supply (SAIDI and SAIFI); and<br>• Non-network operating expenditure per ICP. | < 75th percentile | < 75th percentile | < 75th percentile | | < 75th percentile | | < 75th percentile | | < 75th percentile | | < 75th percentile | |

*Table 3.2: MainPower's Performance Indicators and Targets*

## 3.6 Performance Evaluation

### 3.6.1 Network Reliability

Our network reliability is measured using SAIDI and SAIFI indices averaged across the entire network (see Figure 3.7). This provides us with the outage duration (time) and the number of outages that the "average" customer experiences. We analyse our network's quality of supply by causes, asset categories and feeder reliability, which helps to inform forward network-related projects and internal workstream improvements.

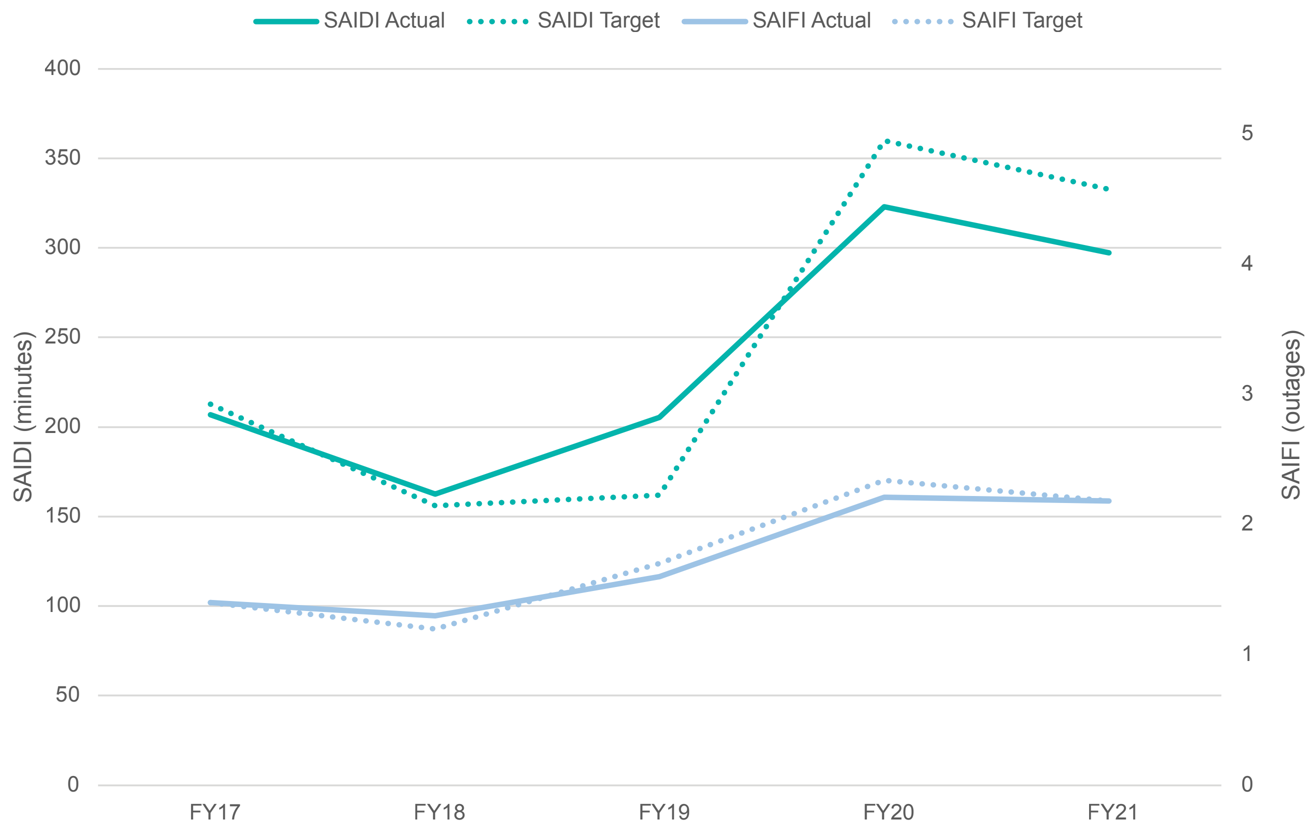



*Figure 3.7: MainPower's Network Reliability SAIDI and SAIFI over 5 years (FY17–FY21)*

MainPower's consumers view network reliability as a top priority and are generally satisfied with their current level of reliability. Examination of network performance over a five-year period points to a step change in MainPower's network performance that has resulted in more outages, and longer duration outages, than might have been expected from historical performance. To understand the cause of this trend, it is helpful to break down reliability into planned and unplanned events (see Figure 3.8 and Figure 3.9).

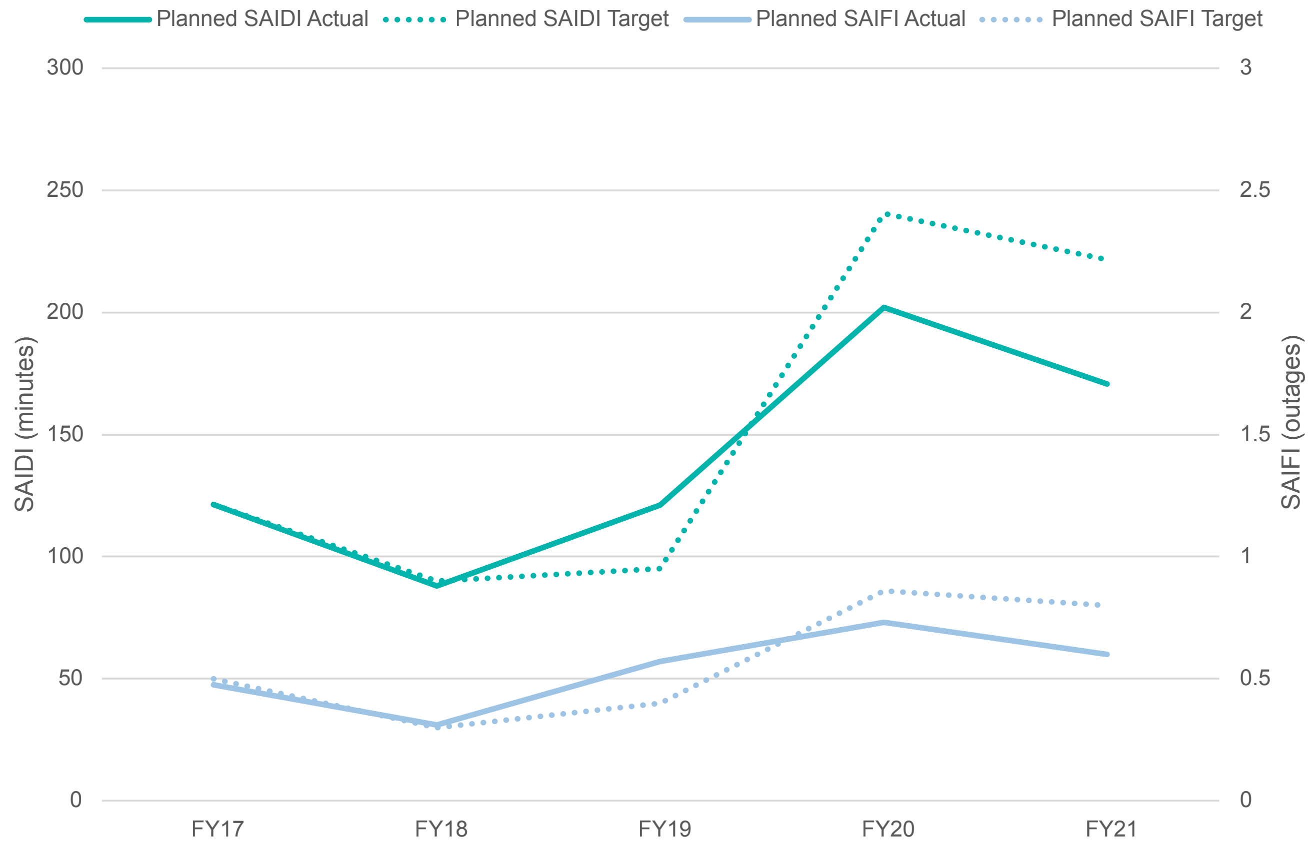



*Figure 3.8: Network Reliability – Planned (FY17–FY21)*

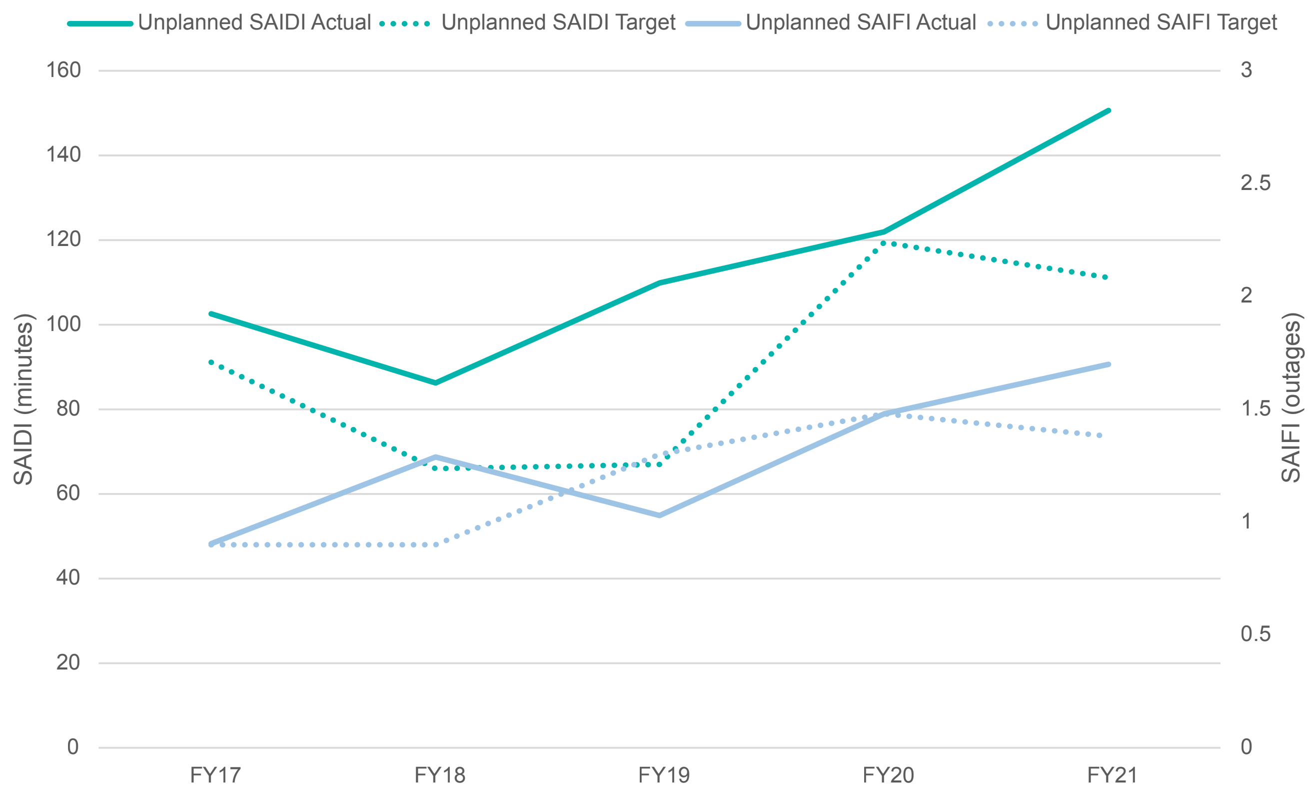



*Figure 3.9: Network Reliability – Unplanned (FY17–FY21)*

From Figure 3.8 and Figure 3.9 it can be seen that, in the past two years, planned outages have had a greater influence on network performance than unplanned outages. This shift in performance is brought on by the need to upgrade the network in line with long-term asset management objectives. Actual outage duration and frequency for planned work was better than forecast despite a year that was affected by the pandemic. Fifty-seven percent of MainPower's SAIDI was attributable to planned works, reflecting our risk-targeted renewals programme and network architecture. Our network architecture is based on a rural, radial configuration with limited ability to supply consumers via alternative sources.

The most significant drivers of unplanned reliability performance in FY22 were related to third party interference, followed by equipment failure and adverse weather events. Unanticipated equipment or system failure events are fed into MainPower's asset management program and analysed for improvement and/or improvements to long-term asset management strategies.

To better understand what contributes to unplanned electricity distribution network reliability, we analyse all outage data by cause, using outage statistics over time to illustrate any underlying trends. We use a 5-year rolling average across all outage categories (see Figure 3.10).

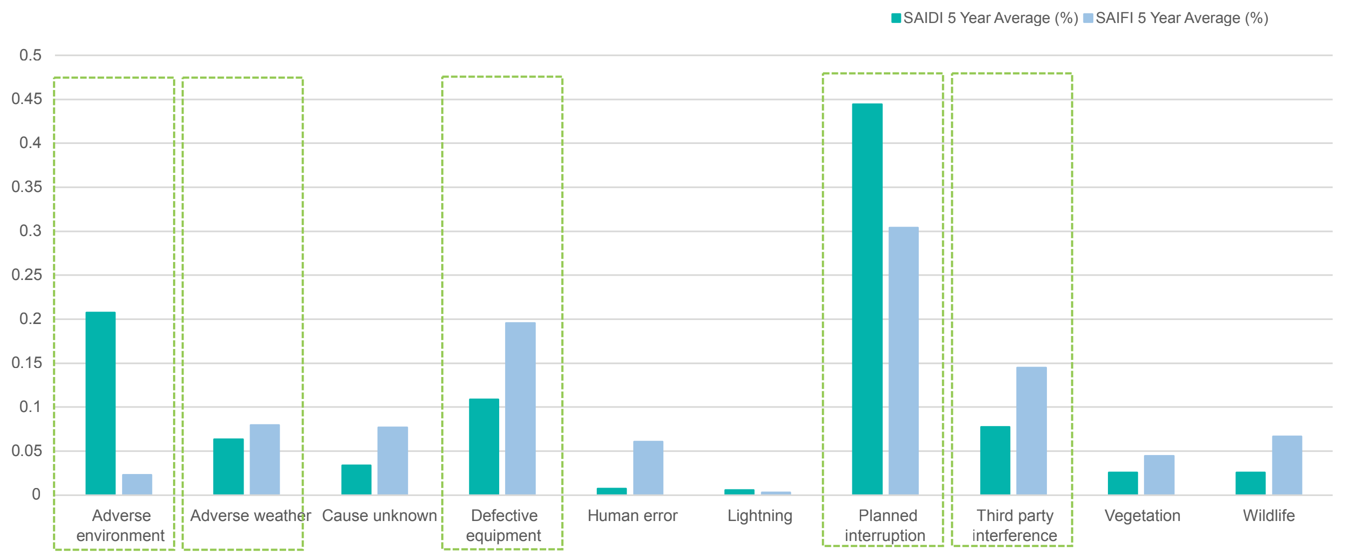



*Figure 3.10: Network Reliability, by Cause (5-Year Rolling Average, FY17–FY21)*

While the analysis provides useful data about the overall contributors to deteriorating network performance, we know that trends can be affected by single events. Therefore, MainPower reviews the outages, by cause, over time. The results are shown in Figure 3.11 and Figure 3.12.

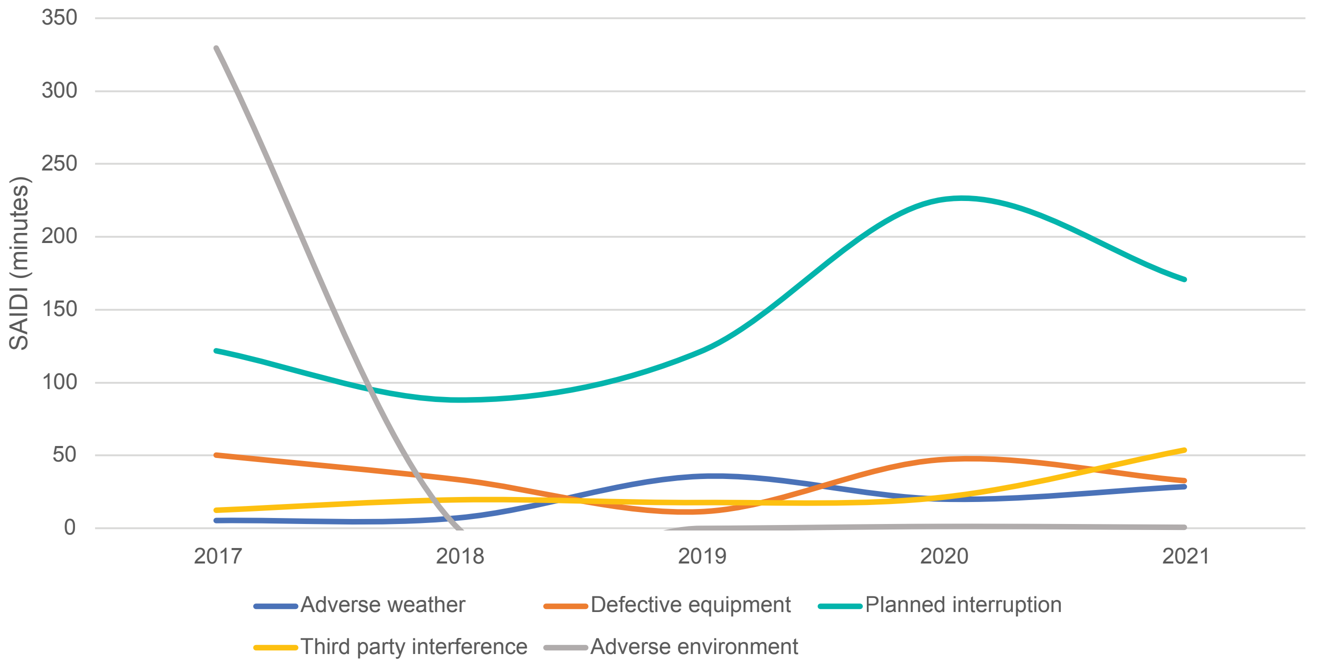



*Figure 3.11: Network SAIDI, by Cause (FY17–FY21)*

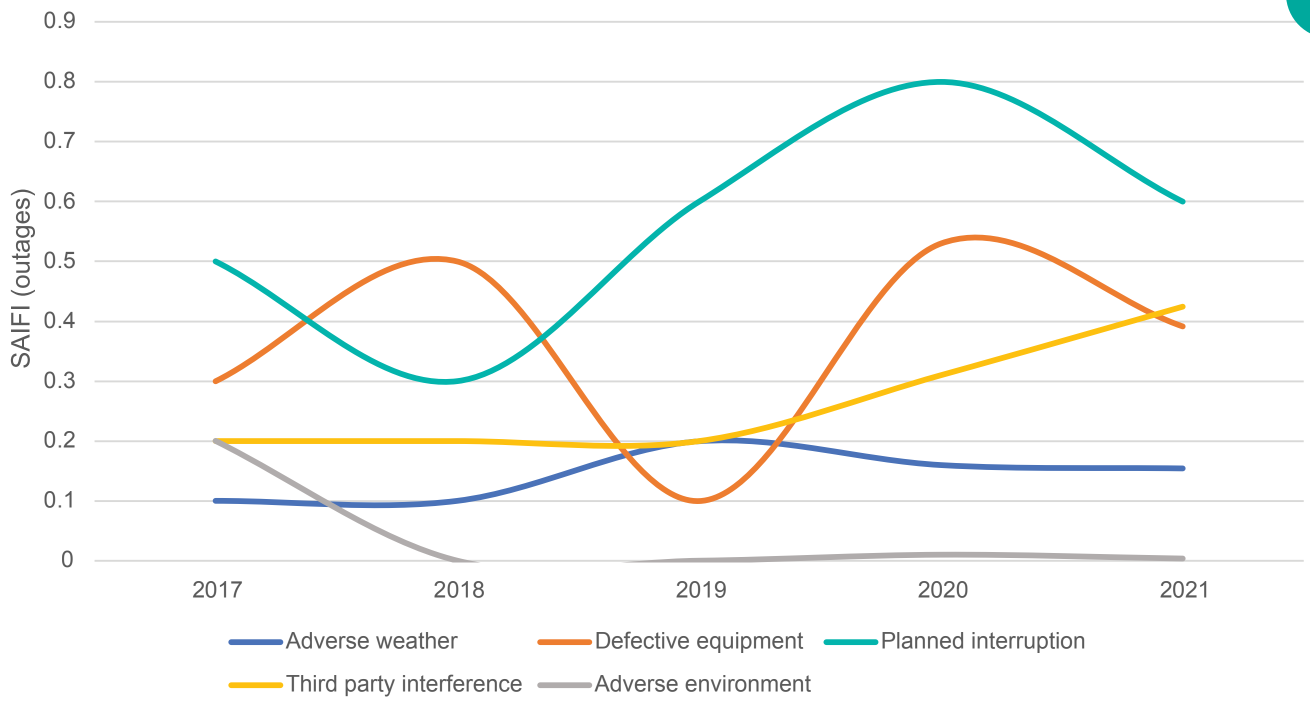



*Figure 3.12: Network SAIFI, by Cause (FY17–FY21)*

The peaking of "adverse environment" in FY17 was due to the Waiau Earthquake, which is excluded from the following network performance evaluation, which identifies the top contributors to outage duration (SAIDI) and outage frequency (SAIFI) over the 5-year period, in order of contribution:

**Outage Duration (SAIDI)**

- Defective equipment
- Third-party interference
- Adverse weather
- Cause unknown
- Vegetation
- Wildlife
- Human error
- Lightning

**Outage Frequency (SAIFI)**

- Defective equipment
- Third-party interference
- Cause unknown
- Adverse weather
- Human error
- Wildlife
- Vegetation
- Lightning

Table 3.3 provides a high-level analysis of the outages by cause.

| Category | Analysis | Initiatives | Update | Target Date |
|---|---|---|---|---|
| Planned Works | MainPower has augmented its planned works programme to target fleet renewal and to improve network resilience. Additional outages are required to implement the improvements given the radial nature of the network. | Embedding and improving upon the functionality of the new ADMS system, improved service delivery through business realignment. | Long-term asset management functions are segregated from service delivery and work planning, and service delivery is managed as a separate department. | FY23 |
| Defective Equipment | Reviewing defective equipment by asset class yields that reliability is adversely affected by:<br>1. Switchgear;<br>2. Ring main units (RMUs);<br>3. Cable faults; and<br>4. Insulators. | Work programme:<br>1. Completion of the Southbrook Zone Substation.<br>2. Upgrade programme for the Amberley, Hanmer and Hawarden zone substations.<br>3. RMU replacement programme.<br>4. Insulator and crossarm inspection programme.<br>5. Lidar aerial inspection pole maintenance programme.<br>6. Line tightening programme.<br>7. Failure modes and effects study to be undertaken on network equipment. | Southbrook Zone Substation complete.<br>RMU replacement programme proceeding well and over 50% complete.<br>Insulator and crossarm inspection programme budgeted in FY23–FY24.<br>Aerial inspection programme budgeted for commencement in FY23.<br>Failure modes and effects study commenced FY22. | FY24–FY25 |
| Adverse Weather | Adverse weather events are relatively infrequent, but rural radial feeders are exposed to windblown interference during storms. | Lidar aerial survey to assist in identifying potential risks from vegetation, line clashes and latent pole-top failures to proactively inform the overhead distribution line maintenance programme. | Taking advantage of the ADMS roll out for early identification of location and potential cause of outages, and for better management of repair activities during weather events. | FY23–FY25 |
| Third-Party Interference | MainPower has a public advertising campaign to communicate the need to watch out for overhead lines. We also issue "High Load" and "Close" approach permits, including action plans where evidence suggests the terms and conditions under which the permit is issued can be ignored. Additionally, customers have 24-hour access to underground cable locations information via the online "beforeUdig" service. | Active watch: MainPower intends to monitor third-party interference and determine whether additional steps need to be implemented. | Third-party interference is still trending in the wrong direction. Funds are available in the FY23 period to increase public awareness of this issue. | FY23 |

*Table 3.3: Network Reliability Improvement Summary*

## 3.6.2 Feeder Reliability

In addition to system-wide interruption cause analysis, we review our network reliability trends over five years at a distribution-feeder level. This helps us understand where parts of our network might be experiencing interruption frequency or duration that is higher than average. The graphs in Figure 3.13 and Figure 3.14 show that the reliability impact started to increase from the top five-worst-performing feeders in the years FY16–FY20 (see details in Table 3.4).

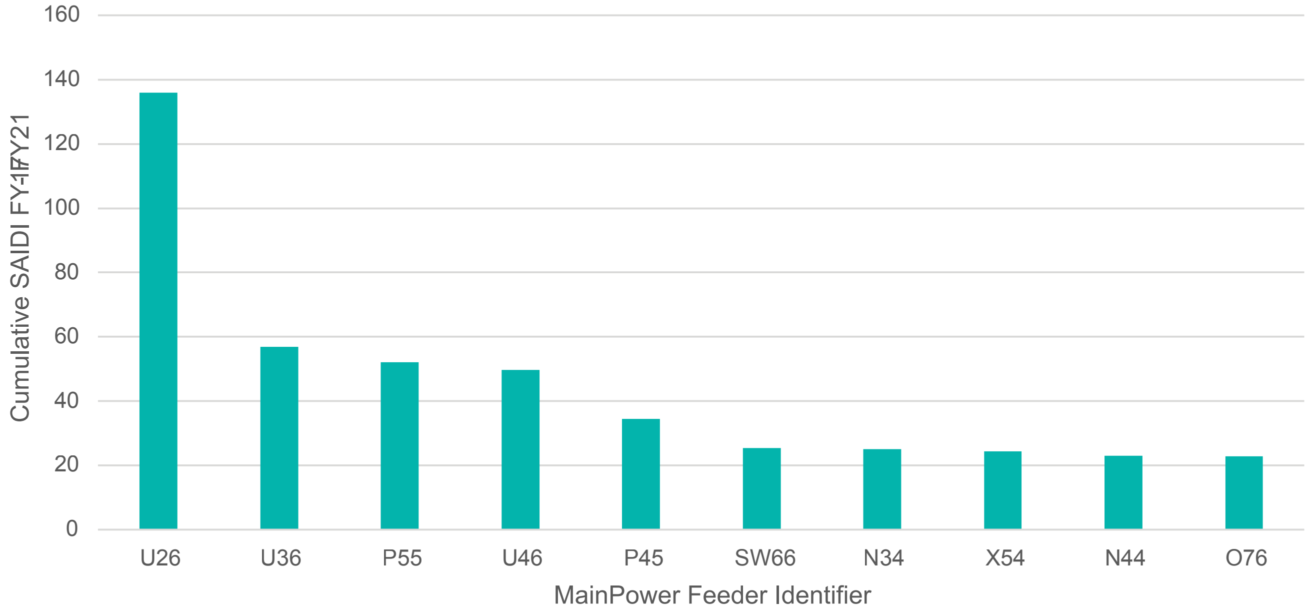



*Figure 3.13: Top 10 Feeders with Highest Cumulative Unplanned SAIDI (FY17–FY21 Average)*

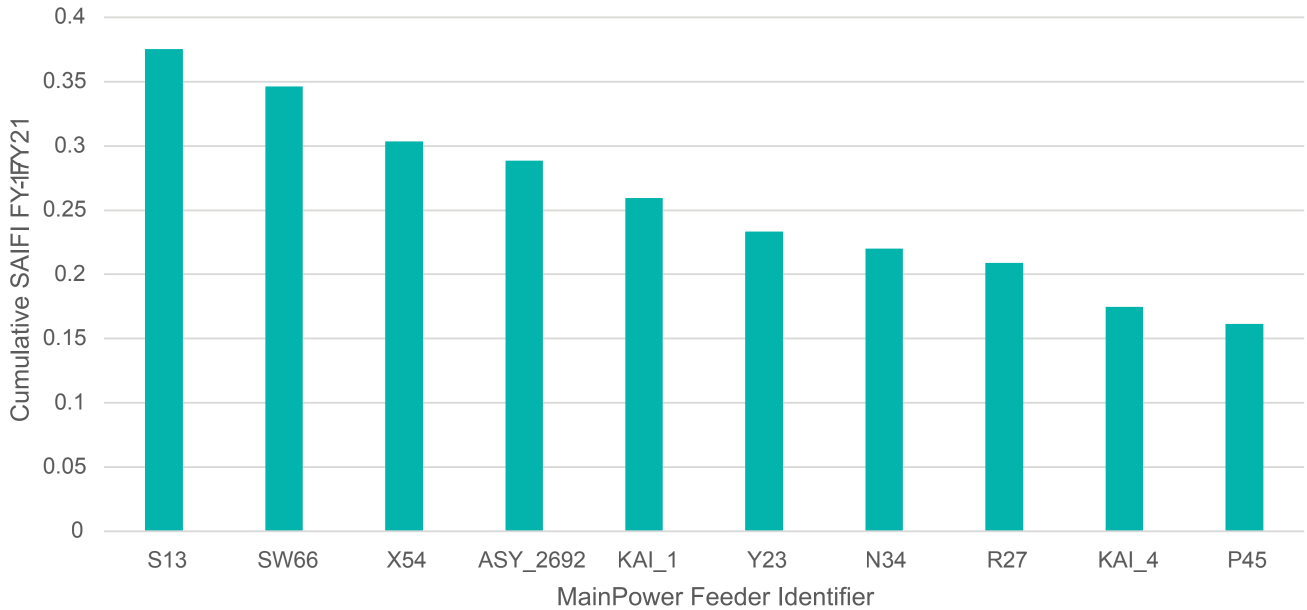



*Figure 3.14: Top 10 Feeders with Highest Cumulative Unplanned SAIFI (FY17–FY21 Average)*

| Feeder | Analysis | Initiatives | Target Date |
|---|---|---|---|
| S13 West | This feeder supplies southern Rangiora and Waikuku township from our Southbrook Zone Substation. Investigation into the feeder found it has urban and commercial loads that are being affected by interruptions mainly caused on the large overhead rural sections of the feeder. These interruptions mainly consist of third-party interference (vehicle contact with assets) and defective equipment, resulting in a large outage area because of the size of the feeder with minimal downstream protection and isolation. | The undergrounding of part of this feeder, performing switching alterations to the feeder configuration to minimise single-interruption impact, and replacing the feeder protection equipment as part of our Southbrook Zone Substation rebuild.<br>This was completed under the Southbrook 66 kV Substation Upgrade Major Project. Increasing the number of feeders out of this substation, and the areas they supply, will have a positive impact on reliability through lower affected customer numbers for any given fault. | FY23 |
| U26, U36 and U46 | These 11 kV feeders supply the Kaikōura region from our Ludstone Zone Substation. These feeders experienced significant interruptions due to damage caused by the 2017 Waiau Earthquake, as well as 11 kV switchgear failure at the Ludstone Zone Substation. These interruptions had a range of causes, mainly cable faults and asset failures. | As the Waiau Earthquake was a single event, we currently do not have any direct initiatives in response to this incident. We are assessing our general network resilience and network design standards. | N/A |
| Y23 and Y33 | These two feeders supply the Amberley, Leithfield Beach and Balcairn areas from our Amberley Zone Substation. They are both long, rural overhead feeders, and analysis of interruptions over the past five years indicates they are prone to unplanned outages caused by vegetation and weather events. | Reconfigure the network in this region to limit the impact of single events and improve and target our vegetation-management programme to prevent vegetation-related outages. As part of the ASY_2692 feeder split project there will be wider network reconfigurations to reduce the impact of these rural faults on the network. | FY22 |
| SW66 | This feeder supplies the West Eyreton region from our Swannanoa Zone Substation. This feeder is also a large rural overhead feeder that has experienced a high number of vegetation- and weather-related interruptions over the past five years. Although it is a rural feeder, this region is more densely populated than a typical rural feeder, and therefore interruptions have a higher impact, owing to the larger number of connections. | A project is underway to install an intermediate circuit breaker and reconfigure the feeder to minimise the number of customers affected by outages. We also aim to improve and target our vegetation-management programme to prevent vegetation-related interruptions.<br>Ongoing reliability of this feeder will be monitored to assess the effectiveness of the new configuration. | FY22 – Complete |
| ASY_2692 | This is a very large rural feeder supplying the Loburn and Okuku areas from the Ashley GXP. We currently have limited line-circuit breakers installed along this feeder and minimal capability to separate or isolate parts of this feeder during interruptions. Analysis of interruptions over the past five years indicates a trend of vegetation, weather and wildlife causes, reflective of the environment the feeder passes through in the foothills of North Canterbury. | An identified network reinforcement project has separated this large feeder into two smaller feeders. This will minimise the overall consumer impact of single outages. As mentioned above, we aim to improve and better target our vegetation-management programme to prevent vegetation-related interruptions. | FY22 – Complete |

*Table 3.4: Network Feeder Reliability Improvement Summary*

## 3.6.3 Reliability Analysis Model

MainPower has been building a reliability analysis model to help develop a more comprehensive understanding about network reliability. This tool allows analysis at an ICP level for both low-voltage and high-voltage outages using data from our ADMS system.

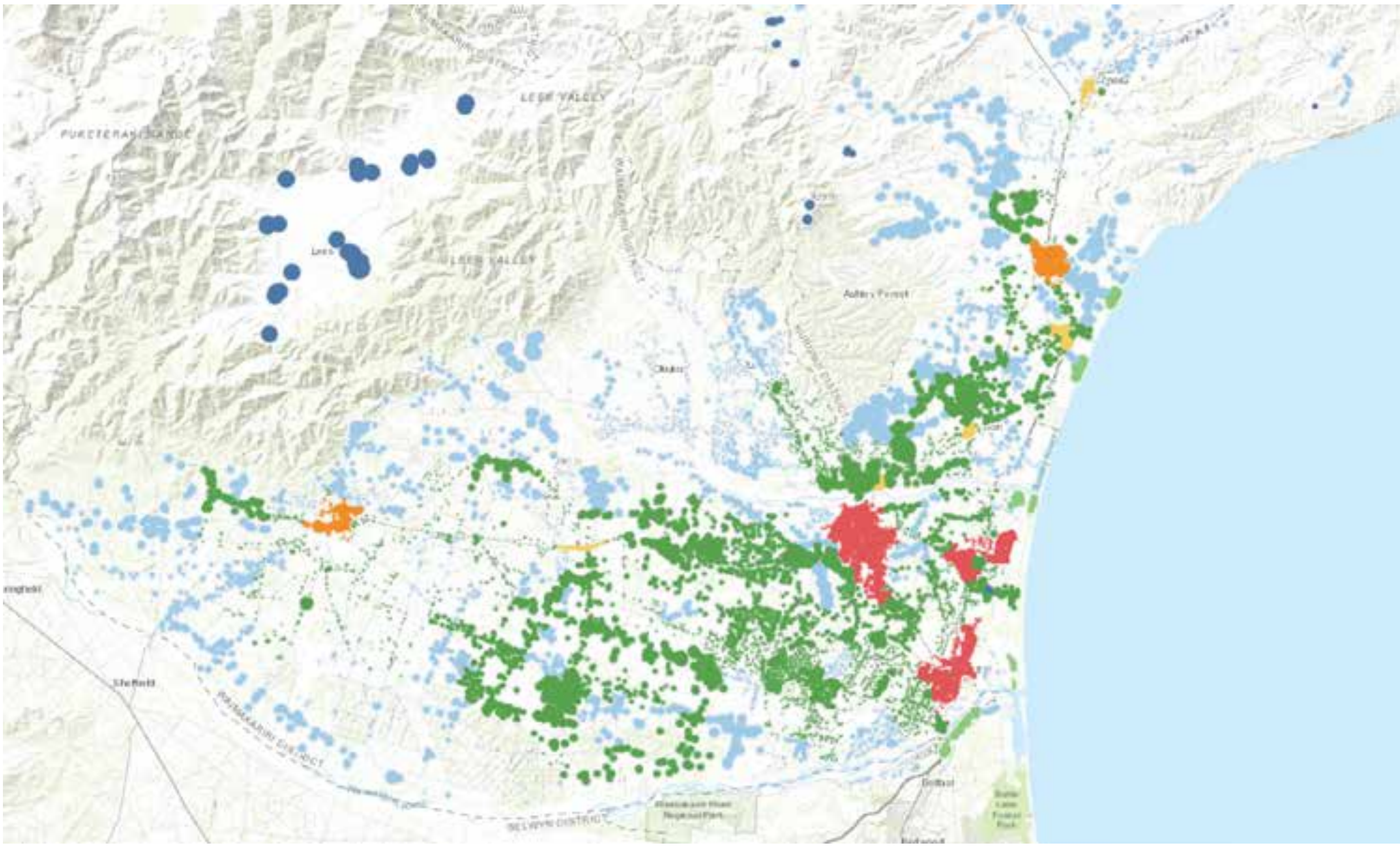


*Figure 3.15: MainPower's Reliability Analysis Model*

We have categorised ICPs using customer category and geographical attributes to better understand and measure our network against expected levels of reliability. We see this as a more customer-centric approach to reliability analysis, extending beyond aggregated feeder reliability levels. We plan on continuing to develop this tool and use it to inform a more targeted approach to our investment in network reliability.

## 3.6.4 Health, Safety and the Environment

We report all employee injury and public safety events through our Vault safety information management system (see Table 3.5). In addition to employee and public safety monitoring, we have been process mapping our critical processes and identifying critical controls. MainPower also places significant emphasis on being an environmentally responsible company and complying with our responsibilities.

| Personal Safety | FY21 Target | FY21 Actual |
|---|---|---|
| No injuries related to a safety critical risk | None | None |
| No injuries to members of the public | None | None |
| SF6 loss (% to total gas volume) | < 1% | < 1% |
| Uncontained oil spills | None | None |

*Table 3.5: Health, Safety, Environment and Quality Evaluation (FY21)*

### 3.6.5 Consumer Oriented

Monitoring and improving service delivery is vital if we are to establish trust and goodwill with consumers and maintain our reputation amongst our stakeholders. While our customer satisfaction scores have continued to improve over time, we recognise additional improvement is required in some areas (see Table 3.6 and Table 3.7).

| Customer Satisfaction | FY21 Target | FY21 Actual |
|---|---|---|
| Engagement Effort | > 2.5 | 3.22 |
| Staff Friendliness | > 4 | 4.27 |
| Quality of Work | > 4 | 4.11 |
| Timeliness of Service | > 3.5 | 3.20 |
| Communication | > 3.5 | 3.11 |
| Staff Reliability | > 4 | 3.73 |
| Final Price | > 3.75 | 3.49 |

*Table 3.6: Consumer Satisfaction and Service Delivery (FY21)*

| Category | Analysis | Initiatives | Target Date |
|---|---|---|---|
| Engagement Effort | MainPower is aware that consumers interact with MainPower for different reasons and that the systems that support individual interactions are at varying stages of integration and maturity. | In 2021 MainPower moved to a "Plan–Build–Operate" model. This resulted in a number of changes to the teams delivering customer-initiated work. As these teams bed down their new structures and processes, we expect to see further improvement in engagement effort scores. | FY22 |
| Timeliness of Service | The respondents of this survey are only those who have engaged with MainPower related to customer-initiated work. The results confirm the challenge faced when balancing work required to deliver the AMP alongside fluctuating customer-initiated works. | A business realignment was undertaken in FY21–FY22 to improve efficiency and communication internally between functions, to allow for improved responsiveness to customers. As these teams bed down their new structures and processes, we expect to see further improvement in timeliness and communication, particularly in relation to customer-initiated work. | FY22 – Complete |
| Communication | Communication in this instance is related to communication surrounding customer-initiated work. We recognise with the recent business realignment there have been communication challenges. | There are several initiatives to address this issue:<br>• Process mapping all existing processes and procedures related to customer-initiated work and finding opportunities for improvement.<br>• The Service Delivery Team is completing customer relationship management development to align the system to their new processes.<br>• The Service Delivery Team has recently introduced service level agreements in regard to responding to customers. | FY23 |

| Category | Analysis | Initiatives | Target Date |
|---|---|---|---|
| Staff Reliability | Customers indicate that MainPower staff are not responding to their needs consistently. | We believe this relates more to communication (as above) and setting expectations early with customers and keeping them informed about progress relating to their jobs on a timely basis. We expect the initiatives above (related to Communication) to have a positive impact on perception of staff reliability. | FY22 |
| Final Price | MainPower recognises there is value in providing more consistent pricing to customers in relation to customer-initiated work. There is always a challenge when pricing customer-initiated work as it is a payment that is not often associated with instant gratification given the nature of our business. COVID-19 has caused significant supply constraints, and the cost of materials have increased. This has been reflected in MainPower's rate cards. | MainPower reviews the pricing rate card regularly to ensure alignment with the current market. MainPower is also undertaking a review of our Network Extension, Upgrades and Capital Contributions Policy to ensure it is fair, sustainable and able to be consistently implemented. | FY22 |

*Table 3.7: Customer Performance Measures*

## 3.6.6 Physical and Financial

### *3.6.6.1 Maintenance*

MainPower has delivered on its safety-critical maintenance throughout FY21. The works also included asset data collection, which enabled MainPower to assess overall asset portfolio health, as detailed in Section 7. Expenditure was within the performance target for the year (see Table 3.8).

| Class | Description | Status | Update |
|---|---|---|---|
| Maintenance | Overhead inspections | Complete | N/A |
| | Zone substations | Complete | N/A |
| | Kiosk substations | Complete | N/A |
| | Transformers | Complete | N/A |
| | Switchgear | Complete | N/A |
| | Secondary systems | Complete | N/A |
| | Underground assets | Complete | N/A |
| | Network property | Complete | N/A |
| | Reactive | Complete | N/A |

*Table 3.8: Maintenance Programme Summary*

### *3.6.6.2 Capital Programme Delivery*

Capital expenditure finished 5% above target for FY21 as MainPower has continued to deliver on the asset expenditure programme, which is informed by asset condition, criticality and the relevant security of supply standard (refer Figure 3.16). This work programme refinement will be reflected in elevated levels of capital expenditure in upcoming years.

| Class | Description | Status | Update |
|---|---|---|---|
| **GXP** | Kaiapoi GXP Project | Closed | Not economically efficient – closed this project. |
| | Culverden GXP Purchase | Closed | Not economically efficient-project closed. |
| **Major Projects** | Ludstone Switchgear Replacement Project | Complete | N/A |
| | Hanmer Line Upgrade Project | In progress | FY26 |
| | Cheviot to Oaro Sub-transmission Line Upgrade | In progress | FY23 |
| | Southbrook Substation Capacity Upgrade | In progress | Southbrook substation complete. Phase II scheduled for completion in FY23. |
| | Amberley Zone Substation 33 kV Upgrade | In progress | Project in progress, with delivery across FY23–FY25. |
| **Reinforcement Projects** | Cheviot North Voltage Regulator and Capacitor Installation | Complete | N/A |
| | Cheviot South Voltage Regulator Installation | Complete | N/A |
| | Ashley Regulator and Capacity Installation | Complete | N/A |
| | Rangiora Northbrook Road Link | Complete | N/A |
| | WDC Blake Street | Complete | N/A |
| | X53–X56 Link Burnt Hill | Complete | N/A |
| | Rangiora East Belt North | Complete | N/A |
| | Amberley South de-loading | Complete | N/A |
| **Renewals** | Overhead, replaced 654 | Complete | N/A |
| | RMU, replaced 17 | Complete | N/A |
| | Low-voltage link box, replaced 80 | Complete | N/A |
| | Low-voltage switchgear units, replaced 10 | Complete | N/A |

*Table 3.9: Capital Programme Summary (FY20)*

### 3.6.6.3 Financial Performance

| Expenditure on Assets | Forecast ($000) | Actual ($000) | % variance |
|---|---|---|---|
| Consumer connection | 4,500 | 6,886 | 53% |
| System growth | 6,249 | 3,899 | (38%) |
| Asset replacement and renewal | 8,000 | 9,115 | 14% |
| Asset relocations | – | – | – |
| Reliability, safety and environment: | | | |
| Quality of supply | 192 | 195 | 1% |
| Legislative and regulatory | – | 27 | – |
| Other reliability, safety and environment | 2,962 | 2,794 | (6%) |
| Total reliability, safety and environment | 3,154 | 3,015 | (4%) |
| Expenditure on network assets | 21,903 | 22,915 | 5% |
| Expenditure on non-network assets | 7,000 | 3,479 | (50%) |
| **Expenditure on assets** | **28,903** | **26,394** | **(9%)** |
| | | | |
| **Operating Expenditure** | | | |
| Service interruptions and emergencies | 700 | 1,158 | 65% |
| Vegetation management | 921 | 606 | (34%) |
| Routine and corrective maintenance and inspection | 4,179 | 3,293 | (21%) |
| Asset replacement and renewal | – | 12 | – |
| **Network opex** | 5,800 | 5,069 | (13%) |
| System operations and network support | 6,180 | 9,309 | 51% |
| Business support | 7,210 | 4,011 | (44%) |
| **Non-network opex** | 13,390 | 13,320 | (1%) |
| **Operating expenditure** | **19,190** | **18,388** | **(4%)** |

*Figure 3.16: Financial Performance FY21*

| Category | Analysis | Initiatives | Target Date |
|---|---|---|---|
| Revenue | No target. | Complete | N/A |
| Customer | Contestable in nature and slightly below target, mainly due to subdivision works being completed in other years and the ability to connect to the network with limited resources. | Complete | N/A |
| Expenditure on Assets | Aligned with planned budget and planned units of replacement. Budget overall exceed ed target because of changes in accounting standards relating to the recognition of long-term leases at the full net present value. | Complete | N/A |
| Operational Expenditure | All maintenance, both planned and reactive, was completed in the reporting year. | Complete | N/A |

*Table 3.10: Financial Performance Analysis and Initiatives*

### 3.6.6.4 Asset Management Maturity

Owning the right assets, managing them well, funding them sustainably and managing the risks are all critical to the ongoing provision of the high-quality and cost-effective services that MainPower provides to its consumers. This means MainPower is committed to ensuring investment management and asset performance practices remain fit for purpose.

Using the Commerce Commission's AMMAT, MainPower reassesses its asset management system and processes, and develops improvement plans. Progress is summarised in the following tables.

| Defining the Requirements | Improvement | Actual | Target Date |
|---|---|---|---|
| Levels of Service and Performance Management | MainPower has introduced the Voice of the Customer programme, which has enabled MainPower to translate consumer requirements into network performance. | Customer engagement completed – work remains on translating what our customers are telling us into actual service levels. | FY22 |
| Demand Forecasting | This remains a key focus for MainPower, taking into consideration consumer segments, location and the network impact of emerging technology and a low-carbon economy. | To be completed. | FY23 |
| Asset Register Data | Major advancements have been made in ensuring asset data (including condition data) are logged against the asset in the CMMS. | Completed – went live with a new CMMS, poles loaded, remainder of the assets in FY22. | FY20–FY22 |
| Asset Condition Assessment | A condition assessment programme is in place for poles, which is MainPower's largest asset class by quantity. All pole renewals are now informed by condition data, compliance and criticality. | Expand to all asset portfolios by FY22. | FY22 |
| Risk Management | Risk has been integrated into the network, including division/team, plant, equipment and activity risk, as well as documentation of controls. High risks are introduced in the Corporate Risk Register. | Completed. | FY19 |

*Table 3.11: Asset Management Maturity Requirements*

| Lifecycle Decision Making | Improvement | Actual | Target Date |
|---|---|---|---|
| Decision Making | Decision making for major capital is assessed against a capitalisation process that is informed by a security of supply standard and reliability classification. MainPower is introducing risk-based decision making across its business. | Completed.<br>MainPower introduces its Security of Supply Standard – projects link to this Standard. | FY22 |
| Asset Class [Renewal] Strategies | A Condition and Criticality Framework has been introduced and remains to be implemented. | In progress.<br>This has been introduced within this AMP for three asset classes. | FY24 |
| Operational Planning and Reporting | Business emergency response plans and escalation are developed and implemented. Asset planning is informed by demand (e.g. quantity of consumer connections). | Completed.<br>We have implemented coordinated incident management system (CIMS) training for our staff for event management. | FY21 |
| Maintenance Planning | Maintenance activities are prescribed for all asset classes. These remain to be implemented in the CMMS for all assets. | Completed.<br>MainPower has asset maintenance standards for all its assets, which were introduced into the CMMS in Q1 2019. | FY20 |
| Capital Investment Strategies | Capital expenditure is prescribed, linking cost, risk and network performance. | To be completed. | FY22 |
| Financial and Funding Strategies | Funding for capital expenditure is on a 10-year cycle, informed by asset performance, reliability and supporting assumptions. | To be completed. | FY22 |

*Table 3.12: Lifecycle Decision-Making Improvements*

| Asset Management Enablers | Improvement | Actual | Target Date |
|---|---|---|---|
| Asset Management Teams | The Network Strategy and Planning Team has been created within MainPower. Staff understand their roles, and asset management best practice is supported by the Executive Team. | Completed. | FY19 |
| Asset Management Plan (AMP) | MainPower's AMP describes service levels and assets and includes a 10-year forecast of expenditure. Asset management improvement plan created. | Completed annually. | FY22 |
| Information Systems | A comprehensive asset register exists. Systems have been introduced to track consumer requests and defects. Works management remains to be automated using schedules linked to assets, creating work orders automatically. | Completed. MainPower CMMS is now the single source of the truth for all our assets. | FY19 |
| Service Delivery Models | Service-Level Agreements are currently being implemented, defining minimum levels of service required from internal crews, and formal contracts exist where external providers are required. | To be completed. | FY22 |
| Quality Management | MainPower is accredited to ISO 9001 and all asset management processes are documented. | Completed. | FY19 |
| Improvement Planning | Improvement planning is currently in place and includes efficiency and productivity within the business, and an upgrade to the CMMS. The projects are approved, funding in place and progress against the plan is reported to the Executive and Board. | Underway. | FY22 |

*Table 3.13: Asset Management Enablers Improvements*

| Maintaining Our Assets | 2019 Actual | Target 2020–2021 |
|---|---|---|
| Asset Maintenance Standards | MainPower has maintenance standards for all our assets. | Implement standards with scheduled maintenance in TechnologyOne for all asset classes. |
| Asset Portfolio Strategies | To be started. | MainPower to have Asset Portfolio Strategies for all assets. |
| Asset Health Indicator (AHI) | AHIs are implemented for three asset classes. | Establish and monitor asset health for all asset classes. |
| Asset Maintenance and Replacement | AHI models will inform condition and risk-based approach to asset management. | Apply condition and risk-based maintenance and replacement programmes. |
| Regional Planning | AMP contains a regional approach to network development planning. | Extend network planning to provide region-specific Master Plans. |
| Engineering Design | Standard designs aligned with regional EDBs are in progress. | Develop standard engineering designs across main asset classes. |
| New Energy Future | Active watch. | Monitor emerging technologies and conduct network development scenario planning. |

*Table 3.14: Areas of Focus for Asset Management Indicators*

## 3.6.7 Industry Benchmarking

The objective of benchmarking is to observe and understand how MainPower is performing as an organisation when compared with other EDBs. MainPower benchmarks itself against the seven network businesses listed in Table 3.15 based on a ICP density (± 2.0).

| Organisation | ICP/km | ICPs |
|---|---|---|
| Eastland Network | 6.5 | 25,658 |
| Network Waitaki | 7.0 | 13,040 |
| Buller Electricity | 7.3 | 4,683 |
| Marlborough Lines | 7.6 | 25,855 |
| Alpine Energy | 7.7 | 33,446 |
| Top Energy | 8.0 | 32,537 |
| MainPower | 8.0 | 40,515 |
| Horizon Energy | 9.7 | 25,255 |
| Median | 7.7 | 25,757 |

*Table 3.15: Benchmark Organisations (2020 Data from Commerce Commission Performance Accessibility Tool)*

### *3.6.7.1 Network Operating Expenditure*

MainPower's network operating expenditure, which includes planned and unplanned network maintenance and fault response, was low during the 2020 financial year (see Figure 3.17). This reflected MainPower reviewing its asset management practices detailed in the last AMP. Expenditure is expected to increase to above the peer group average as MainPower implements its revised asset management practices.

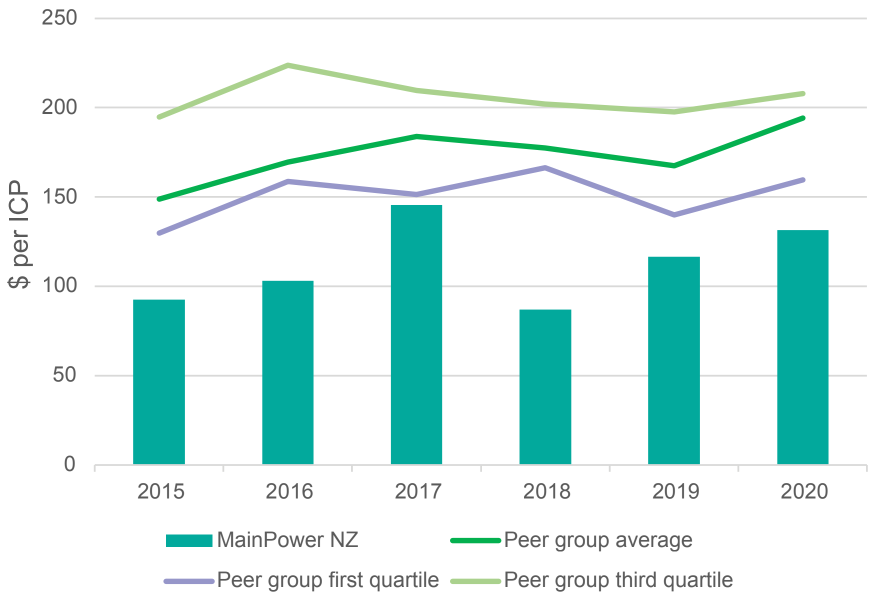



*Figure 3.17: Benchmarking – Network Operating Expenditure Per ICP*

## 3.6.7.2 Non-Network Operating Expenditure

Non-network operating expenditure, which includes corporate, business support, asset management planning and network operation, has increased by 50% since 2015 and is now similar to the peer group average (refer Figure 3.18). This reflects MainPower's focus on improving asset management maturity and the development of robust and effective business processes.

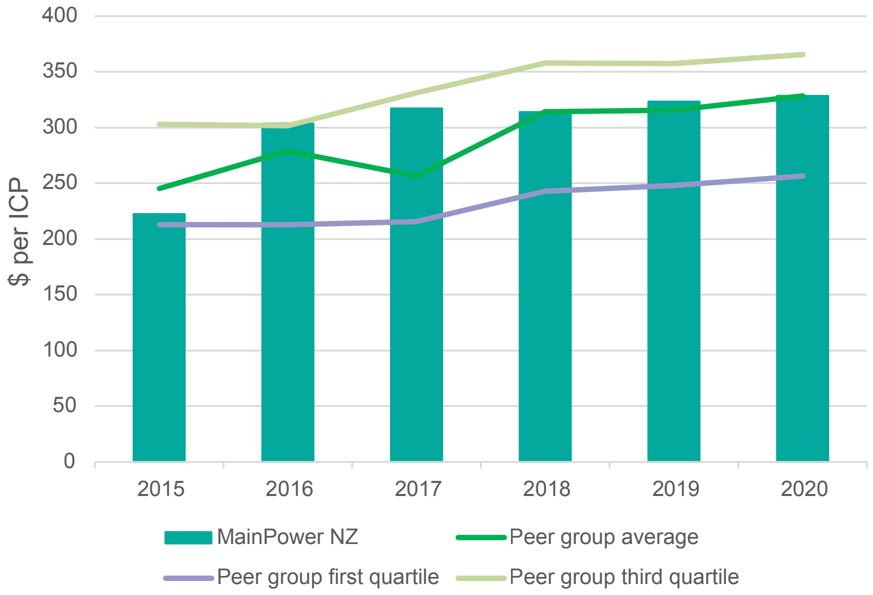



*Figure 3.18: Benchmarking Non-Network Operating Expenditure Per ICP*

## 3.6.7.3 Capital Expenditure on Network Assets

Capital expenditure is the cumulative expenditure required to deliver network requirements, including:

- Capacity;
- Security of supply; and
- Asset replacement and renewals.

MainPower's capital expenditure on network assets for the period 2018–2019 was below its peer group first quartile and group average (refer Figure 3.19) and has increased to peer group average in FY20. Going forward, this is expected to remain at sustained levels owing to works required to deliver security of supply, network reliability and an increase in MainPower's replacement and renewals programme.

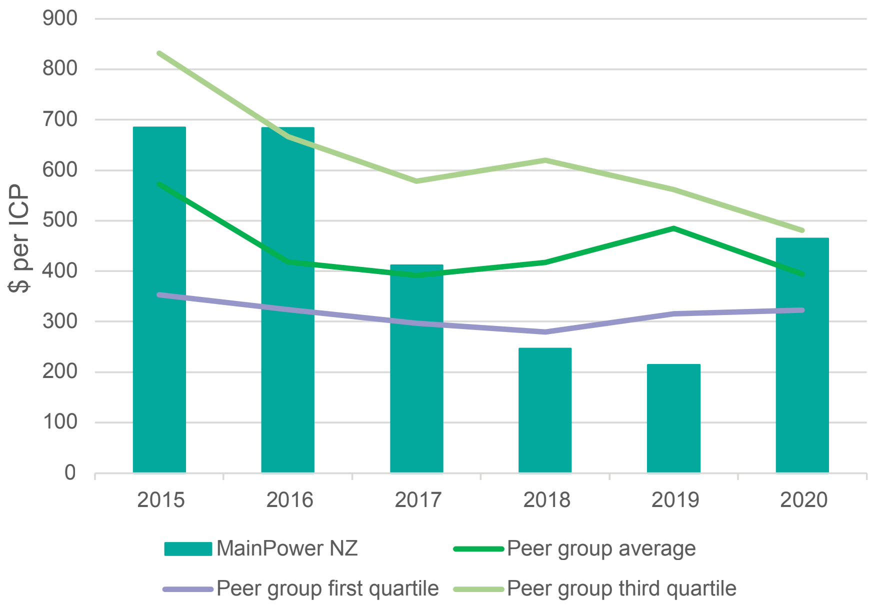



*Figure 3.19: Benchmarking Network Capital Expenditure Per ICP*

### *3.6.7.4 Reliability*

Reliability for MainPower remains within the figures for our industry peers. However, forecast SAIDI and SAIFI means that we are trending towards the 75th percentile (see Figure 3.20 and Figure 3.21). Initiatives have been identified to address quality of supply for MainPower in the future and return it to within historical norms.

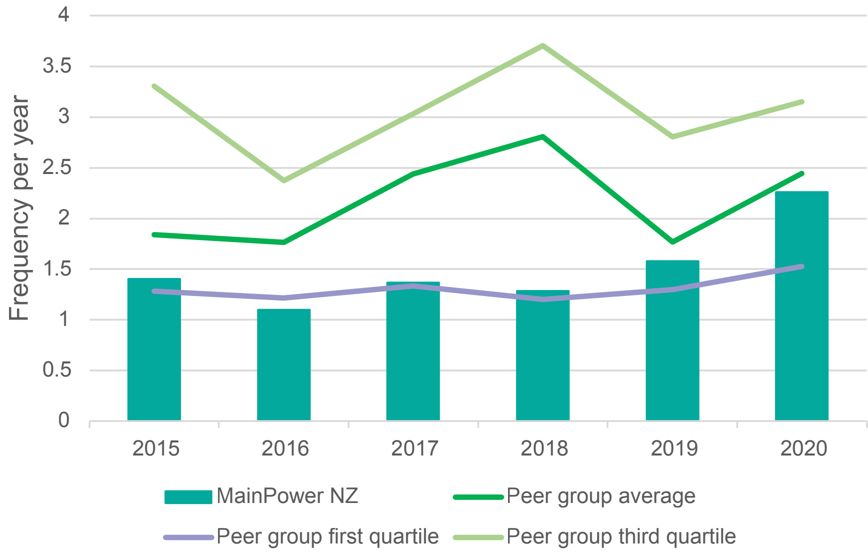



*Figure 3.20: Normalised SAIFI Benchmarking*

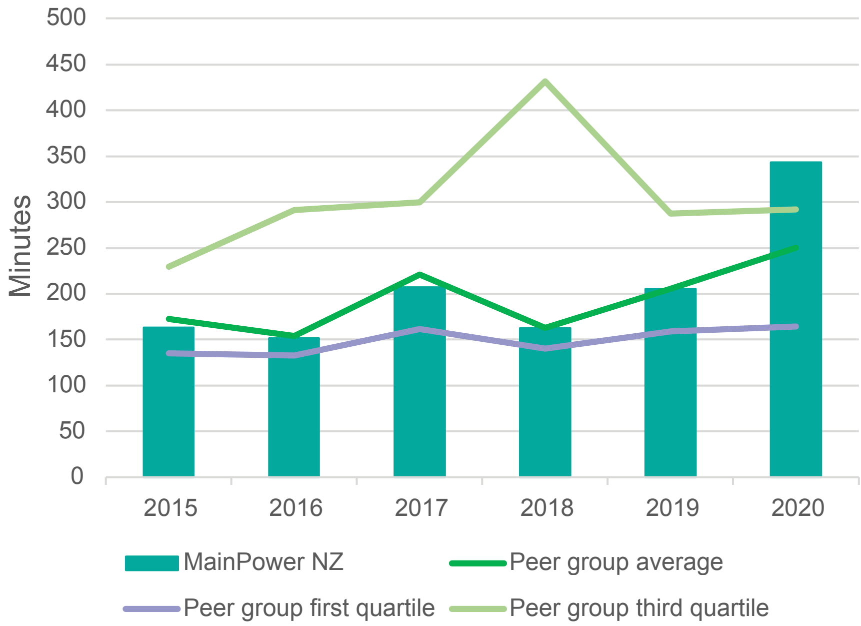



*Figure 3.21: Normalised SAIDI Benchmarking*

## 3.7 Changes in Forecast Expenditure

A change in forecast expenditure that may materially affect performance definitions is not expected within the reporting year. Any instances where expenditure may affect network performance in the future will be reported and the internal response will be defined and implemented.

# 4. RISK AND THE ENVIRONMENT

## 4.1 Our Approach to Risk

Protecting the public, our team, our service providers, and the environment from the inherent risks posed by our electricity distribution network sits behind everything we do. Our Asset Risk Management programme is structured to incorporate these elements of public, personnel and environmental protection into a programme that ensures continuity of electricity supply, efficient protection of network assets, and protection of shareholder and commercial interests whilst ensuring that MainPower continues to meet its service level targets.

MainPower recognises that risk management is an integral part of good governance and best management practice and has adopted the principles of risk management as detailed in AS/NZS ISO 31000:2009 Risk Management- Principles and Guidelines.

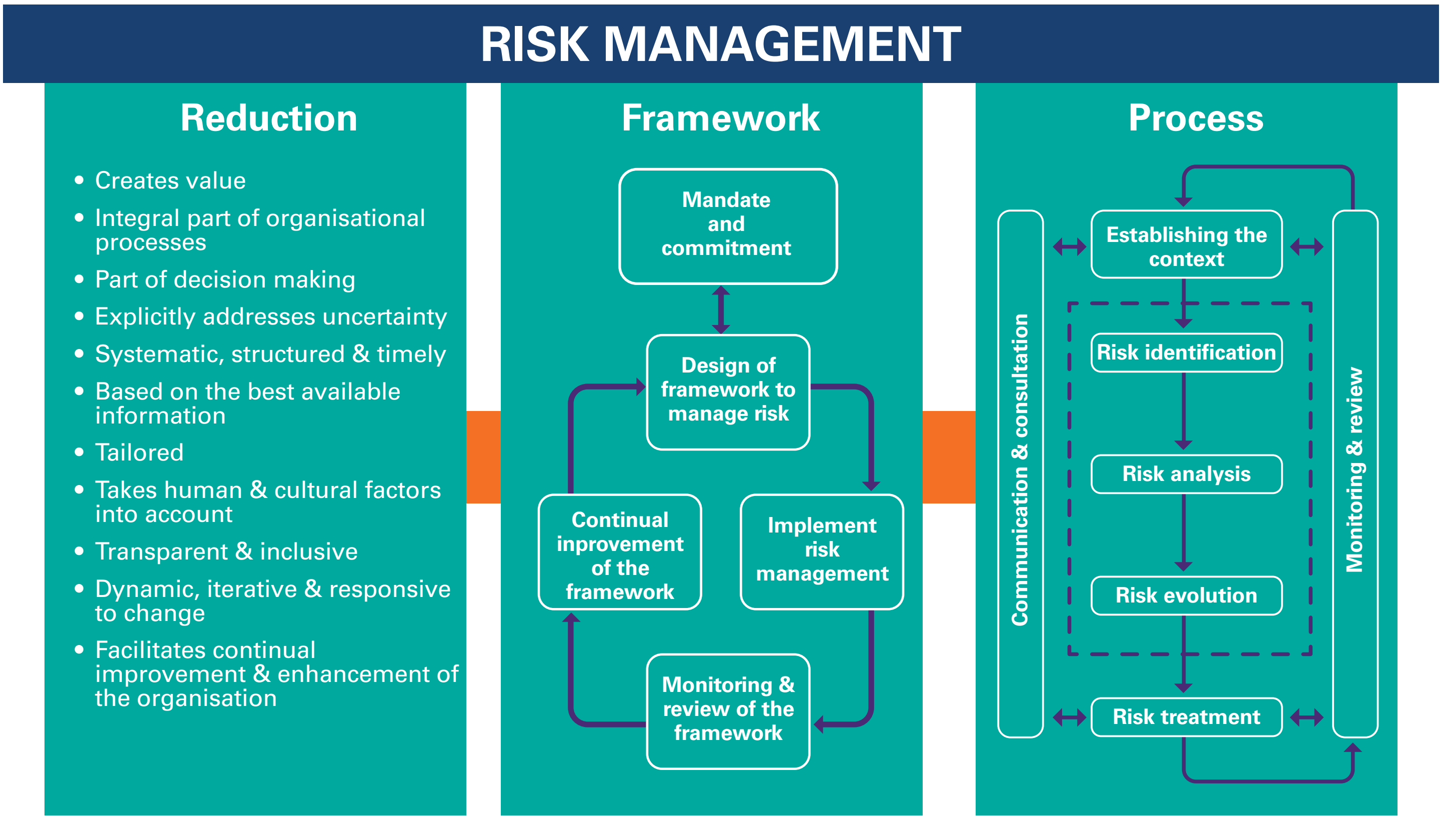



*Figure 4.1: Risk Management Framework (drawn from ISO 31000:2018)*

The principles in Figure 4.1 describe the essential attributes of good risk management; the framework provides a risk management structure, while the process prescribes a tailored approach to understanding, communicating and managing our risk in practice.

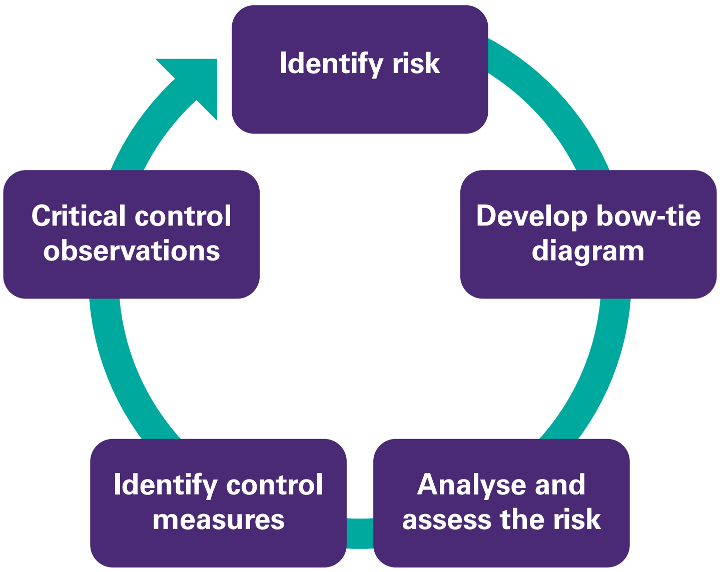



*Figure 4.2: MainPower's Risk Management Process*

Asset risks are identified from asset management studies, risk registers, industry forums, incident analyses, audits, inspections, field observations, site-specific safety plans and safety observations and are captured in an online platform that is used to manage and report on risks, criticality levels and control measures.

Bow-tie diagrams are developed to visualise the risks and provide a means to qualify and communicate the control measures that manage each risk. Bow-tie diagrams are also used to support investigating incidents, critical tasks and managing safety and business critical risks.

A customised risk matrix is used to assess and quantify the likelihood and consequence of individual risks, generate a risk rating, and evaluate risks against established acceptance criteria.

Bow-tie diagrams are used to develop and refine effective control measures to manage identified risks and define the auditing requirements and effectiveness of each of the control measures.

Compliance is assured through measured compliance reporting of critical control observations carried out by all staff, captured in MainPower's online platform.

The Chief Executive has ultimate responsibility and accountability for ensuring that risk is managed across MainPower. The Chief Executive and Executive Team provide leadership, agree the strategic direction and risk appetite, and promote a health and safety oriented culture to ensure the best outcome for MainPower, our people and the community.

The MainPower Board actively considers risks during strategic and tactical decision-making processes (as do all levels of management), as well as determining the level of residual risk/appetite they are willing to accept.

A key priority of MainPower's Strategic Plan is to strengthen the links between critical risk, critical processes and incidents, focusing on prevention and reduction. Essential to this process is having a clear understanding of what our safety and business-critical risks are, and providing assurance that controls are effective.

### 4.1.1 Critical Risks

Critical risks are defined as anything that has the actual or potential ability to cause death to employees, contractors or members of the public, cause significant property damage, or cause MainPower to be severely affected as a business.

### 4.1.2 High-Impact, Low-Probability Events

MainPower has adopted several methods to ensure the risks to the network are managed effectively. MainPower uses the bow-tie risk methodology to analyse and demonstrate causal relationships in high-risk scenarios. In addition, assessments have been undertaken to identify those assets at threat from high-consequence events (high impact/low probability).
High-impact, low-probability events are discussed in the following sections, namely:

- Natural disasters, where the extent of damage and the likelihood of occurrence can be estimated; and
- Climate change, the impact of which can be assessed, and which will manifest in the future.

#### *4.1.2.1 Grid Exit Points*

GXP stations are situated at Kaiapoi, Southbrook, Ashley, Waipara and Culverden. Transpower has completed an extensive programme of seismic damage mitigation, which included MainPower's GXPs. The assessment concluded that Transpower's assets could withstand earthquakes up to the magnitude experienced in the Kaiapoi region in 2010.

#### *4.1.2.2 Sub-Transmission and Distribution Systems Risk*

We have undertaken a qualitative study on the impact of natural disasters on our sub-transmission and distribution systems. That study identified earthquakes as being of greatest risk to our sub-transmission system. We considered three earthquake-intensity scenarios for the network. The average damage ratios shown in Table 4.1 represent the percentage of the

| | 1:500 years | 1:200 years | 1:100 years |
|---|---|---|---|
| Sub-Transmission Network | 6.2% | 3.2% | 1.2% |
| Distribution Network | 17.0% | 9.8% | 4.1% |

*Table 4.1: Summary of Average Damage Ratio on Our Sub-Transmission Network and Distribution Network*

While some sections of each system were assessed at a ratio of more than 10% under certain earthquake scenarios, overall damage to the sub-transmission and distribution systems did not exceed 6.2% and 17%, respectively, under any of the three earthquake scenarios.

Natural hazards of flood, windstorm, electrical storm, snowstorms and tsunami to the sub-transmission and distribution system are considered in Table 4.2. The information was sourced from external publications such as the Canterbury Regional Council Natural Hazards in Canterbury report, which has been reviewed against network design criteria.

| Hazard | Analysis | Probability/Consequence |
|---|---|---|
| Flood | • The risk to overhead lines from flood hazard is limited, even in a 100-year flood event.<br>• Damage is isolated, resulting from landslips and/or subsidence or damage to individual poles sited within the normal course of a river.<br>• A 500-year flood event would result in extensive flooding of some urban areas and subsequent damage to ground-mounted distribution equipment. | Probability: Low<br>Consequences: Low |
| Windstorm | • Damage to overhead lines is routinely caused by high winds.<br>• Historically, this has resulted in minor and isolated damage.<br>• Our design criteria meet or exceed the requirements for a 50-year return period event, as set out in Australian/New Zealand Standard AS/NZS 7000:2016.<br>• The most severe winds are winds from the north-west (these occurred in 1945, 1964, 1975, 1988 and 2013).<br>• The peak wind speed of 193 km/hr recorded in August 1975 exceeded the 100-year recurrence interval.<br>• Average recorded wind speeds in Christchurch approach 45% of design speed on 54 days a year and 66% on three days a year.<br>• Canterbury has recorded four significant tornado events in the last 25 years; none were located in our distribution area. | Probability: High<br>Consequences: Low |
| Electrical storms | • Most parts of Canterbury have few electrical storms.<br>• Over the plains, fewer than five thunder days, on average, occur each year, with the highest frequencies occurring between September and March.<br>• Near the Southern Alps, 20 thunder days, on average, occur each year, with the highest frequencies during April and May.<br>• Zone substations, transformers and communications equipment are protected with lightning arrestors. | Probability: Moderate<br>Consequences: Low |
| Snowstorm | • Canterbury occasionally experiences weather events that deposit heavy, wet snow on overhead lines.<br>• Higher inland areas can be subject to ice build-up with coincident wind loading, which places high loads on overhead infrastructure.<br>• Isolated sections of overhead lines may also be exposed to a theoretical risk of avalanche. | Probability: Moderate/high<br>Consequences: Low |
| Tsunami | • While the occurrence of a tsunami is uncertain, this hazard is recognised as being a realistic possibility for Canterbury.<br>• There is a potential significant hazard at the mouth of both the Waimakariri and Ashley Rivers, at Leithfield Beach, Motunau, and at Kaikōura where the narrow continental shelf and presence of submarine canyons makes this area particularly susceptible, especially Goose Bay and Oaro.<br>• The majority of overhead lines are not generally exposed to this hazard. | Probability: Remote<br>Consequences: Insignificant |

*Table 4.2: Hazard Identification of Sub-Transmission and Distribution Systems*

### 4.1.2.3 Natural Hazard Exposure Limits for our Zone Substations

We have developed natural hazard exposure limits for our zone substation assets, using a weighting factor for the strategic importance of individual sites. This weighting is based on asset value, peak load and the capability to switch load away from the substation. The measures used to define risk factors and risk priorities are:

- Risk Factor = Probability (years recurrence) × Consequence (% damage); and
- Natural Hazard Exposure = Risk Factor × Weighted Strategic Importance.

This assessment identifies earthquake hazards as the greatest risk to zone substations.
Flood hazards for zone substations are not rated as significant, owing to the location and/or the resilience of design of a substation in a 1 in 500-year flood event (the likelihood that a 500-year flood event will occur in any given year). Other meteorological hazards have comparatively high probabilities, but the consequences for these assets are generally insignificant or modest.

### 4.1.2.4 Measuring High-Impact, Low-Probability Risks

Natural hazards with the potential to damage major network assets that affect the most consumers are considered for risk mitigation. Those assets are:

- 66 kV and 33 kV sub-transmission systems;
- Zone substations; and
- Communications systems (see Table 4.3).

| | Risk | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Asset | Earthquake | Avalanche | Landslide | Tsunami | Volcanic Eruption | Flood | Snow | Wind | Lightning | Extreme Temperature | Drought | Wildfire | Climate Change |
| 33 kV Sub-Transmission System | H | H | H | L | L | M | H | M | L | L | L | H | L |
| 33 kV Sub-Transmission System | H | H | H | L | L | M | H | M | L | L | L | H | L |
| Zone Substation | M | L | L | L | L | L | L | L | M | L | L | M | L |
| Communications Systems | M | L | L | L | L | L | L | M | H | H | L | H | L |

*Table 4.3: Assessment of High-Impact, Low-Probability Risks*

## 4.1.3 Conventional Risk

### 4.1.3.1 Communications and Control Systems

MainPower's voice and data networks have radio sites at Mt Grey, Mt Cass, Beltana, Wallace Peak, Kaikōura and Burnt Hill. Mt Grey and Wallace Peak are exposed to heavy snow that can damage aerials and cause power outages. The sites have battery backup which supports the system for a limited time in the event of severe weather events.

The data network supports the supervisory control and data acquisition (SCADA) system and the load control system. Loss of data communication affects both these systems. The ability to control load may be especially important during cold weather, and we have enough local staff at, or near, remote sites to operate the load control system manually.

Our in-vehicle radio communication system can act as a backup for the cellular network. A fleet of strategically located vehicles can relay information through each vehicle's radio system.

## 4.1.3.2.1 Zone Substations

| Asset Failure | Issues that Contribute to Failure | Mitigation |
|---|---|---|
| Protection Tap-Changer | • Typically caused by complex under/over-voltage protection and transformer Buchholz, and inter-trip systems on older sites.<br>• Protection fails during paralleling of feeders.<br>• Battery failure. | • A protection design review has been completed to standardise the types of systems used and their settings. Protection systems are simplified or removed when appropriate.<br>• The risk of damage occurring to a transformer or consumer equipment due to an under/over-voltage event is extremely low.<br>• Additional precautions and cross-checks are now made before undertaking any load-transfer switching.<br>• Battery voltage is inspected monthly. |
| Contacts | Tap-changers have moving parts that suffer from wear. | • Tap-changers are inspected regularly.<br>• Tap position and voltage is continually monitored via SCADA; if a tap-changer fault occurs we can quickly deploy staff to fix the problem.<br>• Spare contact parts are maintained in stock. |
| Circuit Breakers | Circuit breakers and reclosers approaching their end of life become increasingly unreliable. | • A replacement programme is underway on old circuit breakers.<br>• Any zone substations with two or more 11 kV feeders can bypass one faulty circuit breaker, if necessary.<br>• If a circuit breaker fails at the remaining smaller rural sites, we can easily bypass the faulted circuit breaker as a temporary measure to restore power.<br>• The sophisticated adjustable protection systems on new circuit breakers mean that we can keep one spare circuit breaker for use at multiple sites. |
| Bus-Work | Bus-work can suffer from broken insulators, deterioration of the fault current and negative external influences. | • Split bus systems and double-banked transformers help to provide some redundancy. |
| Transformers | A transformer bank can fail suddenly because of an internal explosion. | • Spare emergency power transformers are kept in stock for transformer failures.<br>• Some larger sites (i.e. GXPs, Southbrook, Kaikōura and Culverden) have dual transformer banks to provide redundancy.<br>• Designs allow for transfer of load between zone substations to provide additional redundancy where possible.<br>• In a civil emergency, we can use additional initiatives, such as asking other lines companies to provide spare transformers.<br>• We can use diesel generation sets where appropriate.<br>• Planned upgrade projects will improve cover when a transformer fails in the future. |

*Table 4.4: Mitigation of the Effects of Zone Substation Assets Failing*

An additional mitigating technique is load control. We will use load control as the first mitigation technique by using our Decabit injection system at zone substations during peak load. Table 4.5 shows the amount of load control available on each GXP station.

| GXP | Load reduction available, assuming that water heating has been on all day | Load that must be restored, assuming that water heating has been off for 3 hours |
|---|---|---|
| Southbrook | 5.3 MW | 16.5 MW |
| Kaiapoi | 2.6 MW | 8.1 MW |
| Ashley | 0.5 MW | 1.0 MW |
| Waipara | 1.3 MW | 4 MW |
| Culverden | 1.4 MW | 4.5 MW |

*Table 4.5: Available Load Control, by GXP*

#### 4.1.3.2.2 66 kV and 33 kV Sub-Transmission System

The sub-transmission systems between Southbrook and Waipara, and between Waipara and Kaikōura, can transfer load in either direction. This flexibility offers an alternative supply to major and minor zone substations located along this route. This now also applies to the two sub-transmission circuits supplying Swannanoa and Burnt Hill from Southbrook. For this reason, any asset failure on these line routes would only cause a short duration interruption while power is switched from the other supply.

Spare parts are carried in sufficient quantity to cover the most likely cause of asset failure, including conductor, insulators, poles and hardware.

No 33 kV radial lines to other substations have an alternative supply. However, these substations typically have a smaller number of consumers, and we can rectify any asset failure quickly because we have spares available.

A 22 kV supply from Mouse Point can back up the Waipara Hawarden 33 kV line for most of the year.

### *4.1.3.3 Alternative Supply Routes for our Distribution System*

Major 22 kV and 11 kV feeders are backed up by alternative supply routes. Where more than two major feeders supply an area, each feeder is generally designed to carry a maximum of 75% of its rating. This allows some spare capacity for backup. Where only two feeders are available, the designs are based on maximum loadings of 50% of their rating.

Major low-voltage networks are designed on a similar basis to the distribution system. In an emergency in an urban area, we can generally link low-voltage networks to ensure supply is maintained.

We hold minimum quantities of spares to cover faults and emergencies on the distribution network. These spares include larger critical items such as distribution transformers, switchgear and poles.

Likely causes of asset failure in underground systems are termination and joint problems, as well as excavation damage.

### 4.1.3.4 Alternative Supply for Main Towns on Our Network

Asset failure in the main urban areas of North Canterbury can affect many consumers. In these areas, we use alternative supplies to ensure consumers continue to receive electricity, as described in Table 4.6.

| Location | Mitigation |
|---|---|
| Rangiora | • The level of interconnection between all six feeders is high.<br>• Two feeders from Southbrook are capable of 9 MW each.<br>• The two feeders from Rangiora North are capable of 4 MW each.<br>• At peak times, the network is capable of meeting load requirements with one feeder out from each of the Southbrook and Rangiora Substations. |
| Kaiapoi | • All four feeders at Kaiapoi have a high degree of interconnection and are capable of supplying 4 MW each.<br>• At peak times, the system is capable of meeting the load requirements with one feeder out of operation. |
| Amberley | • Amberley is supplied from both the Broomfield and Balcairn feeders, using tie-points at Douglas Road and Greys Road. We can shift load to Mackenzies Road to ensure backup is available. |
| Cheviot | • We can supply the entire town feeder from the north feeder by using a tie-switch outside the Cheviot Substation. |
| Culverden | • Culverden has two main supply options using the 22 kV supply from two feeders out of Mouse Point Substation.<br>• Another 22 kV supply is available from Hawarden Substation to the south, if needed. |
| Hanmer | • Hanmer is supplied from either the Argelins or Scarborough feeders, except in the most heavily loaded periods (typically, holiday weekends during winter). During these times, heavy load controlling is required to maintain supply to all consumers. |
| Kaikōura | • The Ludstone Substation has four feeders that can supply into the Kaikōura township.<br>• The north and south feeders are lightly loaded and can back each other up.<br>• The Churchill Street and town feeders are more heavily loaded and require a combination of feeders to take over supply without overloading a remaining feeder during peak times.<br>• Each feeder has multiple paralleling points and enough capacity, with many combinations of circuits, to supply the town. Load control is unnecessary. |
| Oxford | • Oxford is supplied from a single Burnt Hill Substation feeder. We can easily isolate a fault and quickly restore supply to consumers.<br>• Alternative feeders from the Burnt Hill Substation can take over the town supply if necessary. |
| Woodend and Pegasus | • Supply to Woodend and Pegasus is normally split across three feeders from Kaiapoi. There is insufficient capacity to supply all urban customers from only two feeders at peak load times.<br>• During emergencies, the Southbrook Substation can provide an additional feeder, but this involves an operational phase shift between the Southbrook and Kaiapoi GXP Substations. |

*Table 4.6: Alternative Supply Options, by Location*

### 4.1.3.5 Asset Failure Recovery Systems

An independent expert has reviewed our asset failure recovery systems. Their assessment considered the eight biggest asset failure scenarios, based on impact on our consumers. Those scenarios included zone substation transformer failure, feeder cable failure, major circuit-breaker failure and major line failure.

Procedures to restore assets following failure are documented and robust. Even so, the expert's assessment made some recommendations from which we developed an action plan. Those recommendations and the plan are shown in Table 4.7.

| Recommendations | Action Plan |
|---|---|
| Procure oil spill kits (if the risk is considered great enough) for any sites that do not yet have them. | Oil spill kits are in MainPower work vehicles. |
| Ensure that the spare 33/11 kV transformers and 1 of the 2 Kaikōura transformers are kept on standby for use. Consider moving the spare transformer to the substation most at risk of failing. | Spare transformers are kept in stock.<br>A spare 2.5 MVA transformer is now located at Hanmer. |
| Consider building extra transformer pad and bus-work at remote single-transformer substations so they fit the dimensions of the spare transformer. | The portable generator truck provides a better backup facility. |
| Ensure sufficient spare lengths of 66 kV and 33 kV single-core cross-linked polyethylene (XLPE) cable are stored at Rangiora – suggest a minimum of 3 lengths (each of 10 m), along with 2 complete sets of jointing kits, 2 complete termination kits, 6 jointing sleeves, 6 termination lugs and a compression tool. | Jumper cable sets are made up and stored in the yard. |
| Ensure sufficient spare lengths of 22 kV and 11 kV single-core XLPE cable are stored at Rangiora – suggest a minimum of 3 lengths (each of 10 m), along with 2 complete sets of jointing kits, 2 complete termination kits, 6 jointing sleeves, 6 termination lugs and a compression tool. | Jumper cable sets are made up and stored in the yard. |
| Ensure 3 spare 66/33 kV poles and arms are stored at each of Mouse Point or Culverden GXP, Swannanoa or Burnt Hill, and Cheviot. | Minimum quantities of spares are maintained at Rangiora, with some items stored at depots. |
| Ensure a spare 33 kV breaker and a reasonable array of spares for all makes are held at Rangiora. | Spare 11 kV, 22 kV and 33 kV circuit breakers are held at Rangiora. |
| Ensure access is secured to 4×4 line trucks with Palfinger hydraulic post-hole borer and elevated platform. | MainPower and its subsidiaries own or lease all the equipment. |
| Ensure the equipment to locate faults in cables is maintained in full working order and is always available. | The process to ensure equipment maintenance and availability started in 2019. |
| Prepare switching plans for restoring supply if a fault occurs on Cable S13–S421, or Fuller, Hilton, Waipara to Cheviot and Kaikōura to Waipara lines. Consider protection settings and any phase differences. | Already developed as refresher training programmes for controllers. |
| Secure access to an excavator to help dig up faulty cables – could be helpful to pre-arrange services with local contractors. | Secure access is now available. |

*Table 4.7: Recommended Measures and Action Plan to Reduce Risk*

### *4.1.3.6 Security of Supply Due to Transpower Upgrading Its Assets*

Transpower's risk management plans for all its GXP stations in North Canterbury are shown in Table 4.8. Recent upgrades mean that MainPower now has four 66 kV circuits supplying the southern region. This has improved our security of supply into the largest load area.

| Site | System No. | Installed Capacity | Cooling | Ratio (kV) | Contingency Plans |
|---|---|---|---|---|---|
| Ashley | T3/T5 | 2 × 40 MVA 3ph | ONAN<br>OFAF | 66/11 | • N-1 capacity (switched)<br>• Spare bank at Islington |
| Culverden | T1 | 2 × 30 MVA 3ph<br>1 × 10/20 MVA 3ph | ONAN<br>ONAN | 220/33<br>66/33 | • N-1 capacity<br>• Spare bank at Islington |
| Kaiapoi | T1/T2 | 2 × 38 MVA 3ph | ONAN<br>OFAF | 66/11 | • N-1 capacity<br>• Spare bank at Islington |
| Southbrook | T1/T2 | 2 × 30/40 MVA 3ph | ONAN<br>OFAF | 66/33 | • N-1 capacity<br>• Spare 20 MVA bank at Islington |
| Waipara | T3 | 1 × 10/16 MVA 3ph | ONAN<br>OFAF | 66/33 | • Spare 20 MVA bank at Islington<br>• Waipara load can be spread across other MainPower substations |

*Note.* ONAN = oil natural, air natural; OFAF = oil forced, air forced; N-1 is an indication of power supply security that specifically means that when one circuit fails, another will be available to maintain an uninterrupted power supply.

*Table 4.8: Transpower's Risk Management Plans for Their GXPs*

## 4.1.4 Climate Change

Our electricity assets are vulnerable to changes in climate and extreme weather events. The impacts of Climate Change are already being observed in the frequency and severity of storms in recent years resulting in extensive damage to MainPower's network and significant disruption to our customers. Considerable work has been undertaken to strengthen the resilience of our network to these extreme events.

MainPower has identified other climate related risks including bushfire risk during sustained periods of dry weather and the risk of asset flooding due to storm surges and high tides. The following table summarises the risk work that has been undertaken and subsequent management plans in place.

| Threat | Risk | Risk Treatment |
|---|---|---|
| Severe weather | Risk of asset damage from vegetation | • Vegetation management including an increase in tree scoping from 5 yearly to 2 yearly<br>• Corona aerial and infrared inspections<br>• Lidar technology<br>• Community awareness through website, radio and community pages |
| Wildfire | Risk of fire from asset failure<br><br>Risk of fire from vegetation<br><br>3rd party impacts | • Climb and tighten programme<br>• Cross arm replacement programme<br>• Pole replacement programme<br>• Service box inspections<br>• Corona aerial and infrared inspections<br>• Investigating non-combustible drop out fuses<br>• Disabling of reclosures |
| Rising sea levels/extreme flooding | Risk of erosion, impact to drainage, shifting population | • Lidar aerial surveys<br>• Review of asset locations in low lying and coastal areas. |
| Changing supply/demand trends | Risk of change in electricity use, low carbon economy, hight prices on carbon | • MPowered future – decarbonisation, decentralisation, digitalisation<br>• Consumer engagement and VOLL surveys<br>• Pricing methodology responding to changing customer behaviour |

*Table 4.9:Climate Change risk*

## 4.2 Risk Mitigation

### 4.2.1 Asset Risk

Maintaining our network is a key priority and includes a scheduled programme of planned works, as well as a defect management programme.

MainPower is moving to a conditioned-based risk management (CBRM) approach, based on the Electrical Engineers' Association (EEA) Asset Health Guide and Asset Criticality Guide, in combination with CBRM principles from the United Kingdom. This allows us to use condition data, attribute data and probability of failure to develop asset health ratings for our assets which, when combined with asset criticality, allows us to optimise asset portfolio investment and target our highest-risk assets.

### 4.2.2 Business Continuity Planning

Our Business Continuity Plan is incorporated into our Incident Management Plan (see Section 4.2.3), designed to minimise disruption after a critical event. We have identified our critical business activities and processes and the types of events that can interrupt them.

The plan has assessed critical risks arising from:

- Disruption of electricity supply during a natural disaster;
- Disruption of electricity supply from a major supplier (e.g. Transpower);
- Climate change impacts (e.g. rising sea level, extreme flooding, extreme change in temperature and significant weather events, wildfire);
- Disrupted systems and lack of staff during a pandemic;
- Legislative non-compliance; and
- Risk of fire from our assets or work undertaken within the network area.

### 4.2.3 Using an Incident Management Plan to Respond to Any Disruptive Incident

The Incident Management Plan guides our response to any disruptive incident that has a serious impact to our people, operations, services and reputation. The plan outlines how we will strategically and operationally manage our response so that we can prevent or reduce the impact and can continue to deliver those functions and services that are critical to our business.

Part of our response has been to adopt an incident management framework that outlines how we respond to, and operate in, any disruptive incident. The framework is based on New Zealand's Coordinated Incident Management System (CIMS) and covers the 5 R's – Reduction, Readiness, Response, Recovery, Review (see Figure 4.3).

Simulations are practised at least twice per year, with additional training exercises facilitated across the Incident Management Team to increase competency.

# The 5 "R's"

**Reduction**

Active identification and management of risks that could lead to a business disruption via MainPower Risk Management Plan

**Readiness**

Appropriate training for staff, preparation of contingency plans and incident management exercises (including business disruption)

**Response**

Activation of this Incident Management Plan and associated processes

**Recovery**

Restoring the business to the same (or otherwise agreed) state following an incident

**Review**

Evaluating the incident response to identify and correct weknesses as well as determine strengths

*Figure 4.3: New Zealand's Coordinated Incident Management System: Five R's*

## 4.2.4 Liaising with Civil Defence and Emergency Management

As a "Lifeline Utility", we are obliged under the law (including the Civil Defence Emergency Management Act 2002) to ensure we can continue to function, even potentially at a reduced level, during and after an emergency, and that we have plans available to ensure continued operation. We are also obliged to participate in developing the National Civil Defence Emergency Management (CDEM) Strategy and CDEM Plans, and to provide technical advice to the Director and CDEM Groups as required.

As noted above, some of our recovery plans will activate once predetermined triggers are met.

## 4.2.5 Using Insurance Practices to Minimise the Impact from Loss of, or Damage to, Our Assets

We maintain an insurance programme with an objective to cost-effectively minimise the impact to MainPower from any loss of, or damage to, our assets. We currently operate three insurances that are relevant to our network operation:

- Public liability insurance;
- Materials damage on stations, including zone substations, load plants and contained structures; and
- Ground mounted transformers.

It is not cost effective to insure the remaining sub-transmission and distribution systems with external providers. MainPower maintains a self-insurance fund to cover those network assets that cannot be insured cost effectively. The amount of insurance is reviewed regularly and held in a self-insurance fund.

# 4.3 The Environment

MainPower has adopted an integrated approach to manage, deliver and continually improve the environmental aspects of our business activities, products and services. MainPower's Environmental Management Plan includes the following initiatives:

1. Identify and manage assets impacted by climate change (see Section 4.1.4 above).
2. Management of SF6.
3. Reduce carbon emissions.
4. Reduce waste, repurpose, and reuse.
5. Increase Awareness of sustainability initiatives.
6. Support conservation efforts.
7. Expand sustainability initiatives.

# 5. MAINPOWER'S NETWORK

## 5.1 Description of MainPower's Electricity Distribution Network

MainPower's electricity distribution network extends from Kainga, Stewarts Gully and Coutts Island north of Christchurch City, through the Waimakariri, Hurunui and Kaikōura districts, up to the Puhi Puhi Valley north of Kaikōura and inland to Lewis Pass.

The geographic extent of the network is represented in Figure 5.1, with each blue dot representing a consumer connection.

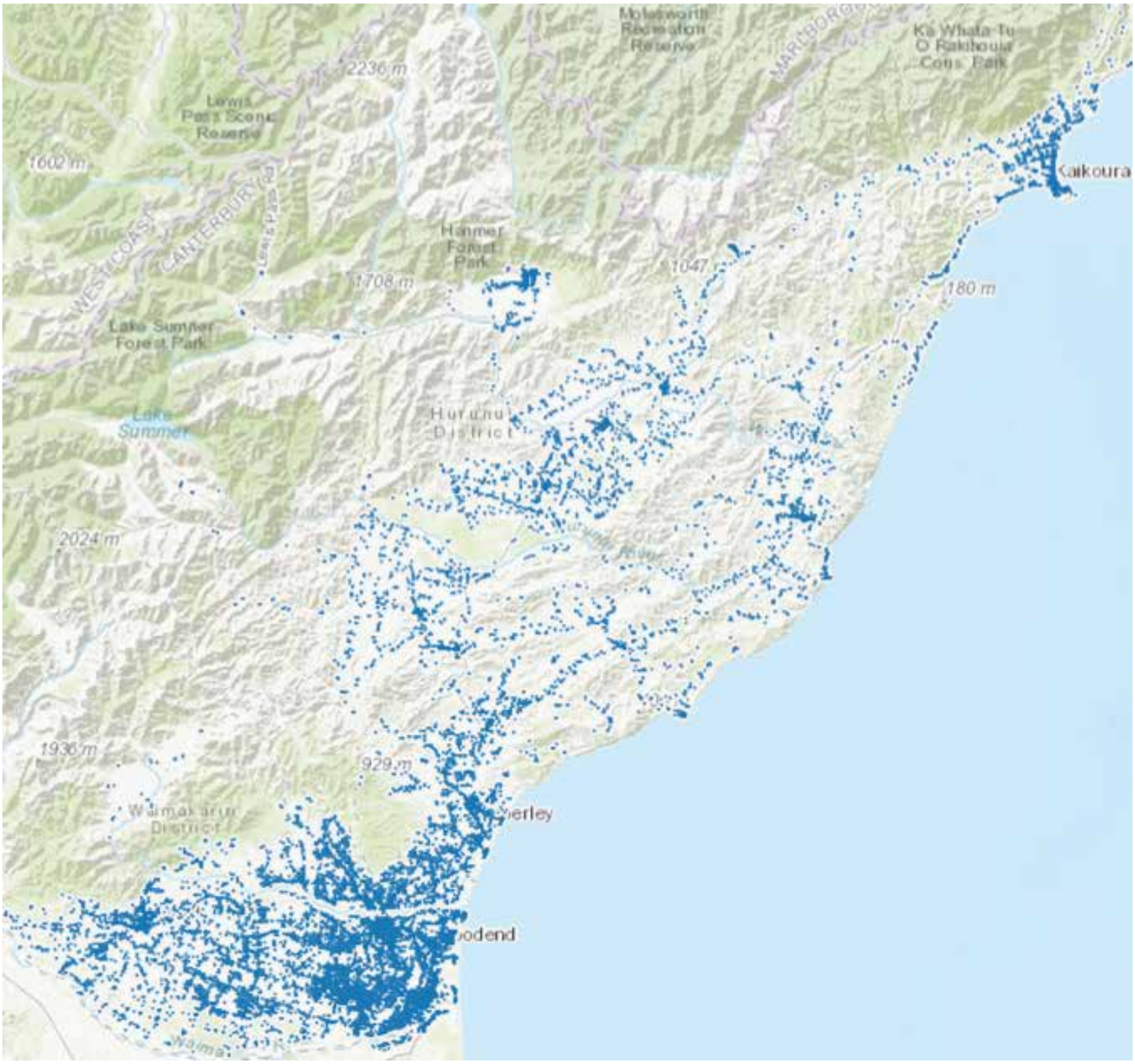



*Figure 5.1: MainPower's Electricity Network Consumer Geographic Distribution*

### 5.1.1 Large Consumers

Our large consumers are:

- **Daiken NZ medium-density fibreboard mill at Ashley:** The Daiken mill is supplied from the Ashley GXP via four 11 kV feeders, which provide reasonable levels of security. The Daiken controllers can disconnect power supply during emergencies, and maintenance is scheduled to coincide with Daiken maintenance programmes or times of low production.
- **Hellers meat-processing plant at Kaiapoi:** The site has undergone rapid growth, and the total load can be switched between two 11 kV feeders. Hellers has also installed a backup generator for critical supply during emergencies.
- **Sutton Tools NZ Limited tool-manufacturing plant in Kaiapoi:** This plant can be supplied from either of two 11 kV supplies from the Kaiapoi switching station, and one of these can also be swapped to an independent backup feeder.
- **McAlpines sawmill at Southbrook:** Recently, this mill has been transferred onto a new high-security dual-feeder-supplied switchboard, which has reduced the risk of power interruptions to the site.
- **Mitre 10 Megastore at Southbrook:** This site has an alternative 11 kV feeder.
- Belfast Timber Kilns at Coutts Island: This plant is connected near the end of a rural 11 kV spur line. No alternative supply is available at the site. Line maintenance is scheduled to coincide with plant maintenance programmes.

We also have several large supermarkets and other commercial businesses located in Rangiora, Kaiapoi and Kaikōura. The transformers for each of these sites are part of ringed feeders with RMUs, allowing alternative switching of supply in the event of a fault on one feeder.

### 5.1.2 Load Characteristics

| Substation | FY18 (MVA) | FY19 (MVA) | FY20 (MVA) | FY21 (MVA) | Peak |
|---|---|---|---|---|---|
| Southbrook | 23 | 22.8 | 24.9 | 27.4 | Winter |
| Swannanoa | 16 | 15.2 | 15.5 | 15.1 | Summer |
| Burnt Hill | 15 | 15.0 | 15.3 | 15.5 | Summer |
| Amberley | 6 | 6.0 | 5.4 | 5.4 | Winter |
| Mackenzies Road | 2 | 1.6 | 3.3 | 1.8 | Summer |
| Greta | 1 | 1.3 | 1.3 | 1.4 | Summer |
| Cheviot | 3 | 3.2 | 3.4 | 3.5 | Summer |
| Leader | 2 | 1.5 | 1.5 | 1.5 | Summer |
| Ludstone Road | 6 | 5.9 | 5.3 | 5.7 | Winter |
| Mouse Point | 15 | 15.6 | 15.2 | 14.5 | Summer |
| Hanmer | 5 | 4.8 | 4.3 | 4.2 | Winter |
| Lochiel | 0 | 0.1 | 0.1 | 0.1 | Summer |
| Hawarden | 4 | 3.7 | 3.6 | 3.8 | Summer |
| Kaiapoi GXP | 28.8 | 29.0 | 29.5 | 31.6 | Winter |

*Table 5.1: MainPower Network Load Characteristics*

### 5.1.3 Peak Demand and Total Energy Delivered

| System Measure | 2020 | 2021 |
|---|---|---|
| Peak load | 115.4 MW | 127.6 MW |
| Energy entering the system | 671 GWh | 666 GWh |
| Energy delivered | 632 GWh | 626 GWh |
| Loss ratio | 5.7% | 5.9% |
| Load factor | 66% | 60% |
| Average number of ICPs | 40,515 | 42,117 |
| Zone substation capacity (base ratings) | 132 MVA | 132 MVA |
| Distribution transformer capacity | 573 MVA | 580 MVA |
| Distribution transformer capacity utilisation | 20.4% | 22% |
| Circuit length lines | 5,039 km | 5,165 km |

*Table 5.2: System Measures*

| Consumer Group ICPs | Average Number of ICPs | |
|---|---|---|
| | 2020 | 2021 |
| Residential | 33,052 | 34,087 |
| Commercial | 5,748 | 6,241 |
| Large commercial or industrial | 48 | 44 |
| Irrigators | 1,354 | 1,427 |
| Council pumps | 200 | 203 |
| Streetlights | 112 | 114 |
| Individually managed consumer | 1 | 1 |

*Table 5.3: Key MainPower Network Statistics*

## 5.2 Network Configuration

### 5.2.1 Transmission Network Configuration

The 220 kV South Island transmission network is owned and managed by Transpower New Zealand Limited. Four 220 kV circuits supply Transpower's Islington Substation from the Waitaki basin, with double-circuit and single-circuit tower lines from Tekapo, Ōhau and Benmore following different routes to Islington. A single-circuit tower line also connects Livingston and Islington.

MainPower's distribution network is supplied via five Transpower GXPs from the 220 kV and 66 kV transmission circuits out of Islington (see Figure 5.2). Table 5.4 provides a summary of the GXP substations in the North Canterbury region.


*Figure 5.2: Transpower's North Canterbury Transmission Grid*

| GXP | Description | |
|---|---|---|
| **Kaiapoi** | Transformer Capacity | 76 MVA |
| | Firm Capacity | 38 MVA |
| | Peak Load | 29.5 MW |
| | Configuration | Two 38 MVA 66/11 kV three-phase transformers |
| | Supply to MainPower | Eight 11 kV circuit breakers |
| **Southbrook**<br><br>**66 kV** | Supply to MainPower | Four 66 kV circuit breakers (Swannanoa, Burnt Hill, Southbrook × 2) |
| **Ashley** | Transformer Capacity | 80 MVA |
| **ASY011** | Firm Capacity | 40 MVA |
| | Peak Load | 13.9 MVA |
| | Configuration | Two dual-rated 40 MVA 66/11 kV three-phase transformers. |
| | Supply to MainPower | One transformer normally feeding five 11 kV circuit breakers supplying the rural area.<br><br>One transformer normally feeding four 11 kV circuit breakers for the Daiken plant (which produces medium-density fibreboard). |

| GXP | Description | |
|---|---|---|
| **Waipara** | Transformer Capacity | 160 MVA |
| **WPR0331 and 0661** | Firm Capacity | 80 MVA to the 66 kV bus |
| | Peak Load | 14.0 MW total at 66 kV, 7.9 MW at 33 kV |
| | Configuration | Two 80 MVA 220/66 kV transformers directly connected to the Islington–Kikiwa 220 kV circuits – the 66 kV supply from these transformers feeds a single 66/33 kV dual-rated 10/16 MVA three-phase transformer. |
| | Supply to MainPower | Two 33 kV and one 66 kV feeder circuit breakers and one 66 kV load plant circuit breaker. |
| **Culverden** | Transformer Capacity | 60 MVA |
| **CUL0331 and 0661** | Firm Capacity | 30 MVA to the 33 kV bus |
| | Peak Load | 21.9 MW |
| | Configuration | Two 30 MVA 220/33 kV transformers directly connected to the Islington–Kikiwa 220 kV circuits – a 10/20 MVA 33/66 kV transformer rated at 13.09 MVA with no fans has been installed to supply 66 kV to Kaikōura. |
| | Supply to MainPower | 33 kV via two feeder circuit breakers and cables, 66 kV feeder circuit breaker. |

*Table 5.4: Description of Each GXP*

## 5.2.2 Sub-Transmission Configuration

The location of Transpower's GXPs supplying our network along with MainPower's zone substations and 66 kV and 33 kV sub-transmission circuits are shown in Figure 5.3.


*Figure 5.3: MainPower's Sub-transmission Network*

### 5.2.3 Distribution Configuration

MainPower's distribution system is largely rural, with many long radial spurs. The 11 kV and 22 kV distribution is approximately 90% overhead-line network. The only areas of significant underground reticulation are the townships of Rangiora and Kaiapoi, where 11 kV reticulation in Rangiora and Kaiapoi is approximately 90% underground.

### 5.2.4 Distribution Substations

As our high-voltage distribution network is predominantly overhead, most distribution substations are pole mounted. In rural areas, distribution substations are typically pole mounted for transformers up to 200 kVA and ground mounted above 200 kVA, although many irrigation consumers require their high-voltage spurs to be underground, with ground-mounted distribution substations. Pole-mounted transformers are protected with expulsion drop-out fuses and low-voltage high rupturing capacity (HRC) fuses where practicable.

The main urban areas have largely underground distribution with ground-mounted substations. Most substations located in residential or rural areas are located on private property within easements or on land purchased by MainPower. Our distribution substations consist of a range of construction types and designs, as outlined below:

- **Building substations:** Large buildings or rooms of poured concrete and stucco exteriors. These were generally built with exposed overhead 11 kV bus-work, but most have been changed to more modern ground-mounted RMUs. They are ideal locations for automated switchgear.

- **Kiosks:** Smaller, predominantly front-access steel kiosks housing the transformers and switchgear. RMUs are used with an 11 kV HRC fuse protecting the transformer. The box design allows for a maximum transformer size of 500 kVA; however, these have to be de-rated because of reduced cooling. Low-voltage panels are typically the open-style Lucy HRC fuses, but many of these have been replaced with DIN standard switchgear.

- **Mini-sub:** Mini-substation packages with RMUs in every second substation and air-mounted fuses in the remainder.

- **Outdoor:** More recently, outdoor transformers with cable boxes and separate front-access outdoor cabinets for the RMUs and low-voltage panels are being used. This design allows more flexibility for a wider range of switchgear for changing transformer sizes, for accessibility and allowing the full rating of the transformer to be used.

### 5.2.5 Low-Voltage Distribution Configuration

Approximately 70% of our low-voltage network is underground, typically located in the larger urban areas. Cables are typically terminated in plastic service boxes above ground, with larger link boxes used to create tie-points between substations, where practicable, increasing security of supply.

Overhead low-voltage systems are located in smaller townships and rural areas to enable cost-effective supply to a number of consumers from one transformer. Most overhead low-voltage conductors are bare conductor or covered copper.

Almost all new low-voltage reticulation since 1990 has been underground. Conversion to underground reticulation is the preferred replacement strategy for old low-voltage lines, where this can be justified economically.

## 5.3 Overview of Assets, by Category

### 5.3.1 Sub-Transmission

The sub-transmission system is a mixture of 33 kV and 66 kV circuits on hardwood poles, with newer lines predominantly constructed using concrete poles, with a few short-cabled sections.

## 5.3.2 Zone Substations

Network assets are housed within zone substation buildings or on zone substation sites, including power transformers, circuit breakers, disconnectors and projection systems.

## 5.3.3 Overhead Distribution

Historically, large numbers of hardwood poles were used on the overhead network. Larch poles impregnated with creosote were used in the late 1950s through to the 1960s, in combination with hardwoods. Treated Corsican pine poles were used from 1973 and concrete poles were also purchased from the mid-1970s. The main pole types used today are H5-treated radiata pine and pre-stressed concrete.

During the past 11 years, many lines have been converted from 11 kV to 22 kV by changing the insulators. This has largely been undertaken in rural areas experiencing high growth in irrigation demand and dairy conversions.

## 5.3.4 Underground Distribution

Most of the high-voltage underground cables are either 95 mm2 or 185 mm2 aluminium, although more recently, 300 mm2 aluminium cables have been used for major urban feeders or to supply distribution switching stations. Smaller sizes are being used for rural customer spurs.

## 5.3.5 Distribution Substations

Most customers are supplied from primary distribution substations at voltages of 11 kV or 22 kV. A small number of customers are supplied from single-wire earth return systems operating at 6.6 kV or 11 kV, and a very small number of remote customers from distribution transformers on the 33 kV sub-transmission system. However, as this arrangement constrains the operation of the sub-transmission system, they are progressively being removed.

Substations are either ground-mounted outdoors or within an enclosure, or pole mounted. As our distribution area is mainly rural, most substations are pole mounted. Most recent designs have used mini-subs, micro-subs or the Pegasus Modular configuration, using a standalone transformer with high-voltage and low-voltage cable boxes and a separate shell for the high-voltage and low-voltage switchgear.

MainPower has more than 7,500 distribution transformers, which come from a variety of manufacturers, including Tyree, ABB, Astec, Tolley and Wilsons. Large quantities of transformers were purchased between 1967 and 1973 because of the growth in the distribution network at this time. Many of these were in the 10–30 kVA range.

## 5.3.6 Distribution Switchgear

There are several different types of circuit breakers and reclosers on the system, including bulk oil, SF6 and vacuum types. All circuit breakers purchased since 1995 are remote controllable.

Most of the air break switches installed between 1950 and 1980 were Canterbury Engineering types 955, DA2, DA27, NL7 and NG10. More recently, Schneider's integrated spar-mounted air break switches and Electropar EPS2 switches have been used. Sealed switches are replacing critical air break switches and almost all are remote controlled.

During the 1970s and 1980s, ABB's SD range of oil RMUs were used, followed in the 1990s by increased use of air-insulated Holec MD series (Magnefix) switchgear. The Holec Xiria sealed air-insulated range has also been used since 2000.

## 5.3.7 Load Control

We employ Landis & Gyr SFU-G and SFU-K ripple injection plant using Decabit code for load control and tariff switching. The plants operate at an injection frequency of 283 Hz, and all plants are GPS synchronised.

Most of the receiver relays are in new smart meters or are Zellweger/Enermet RM3, installed between 1993 and 1997. The remainder are the later Landis & Gyr RC5000 series, while more-recent purchases are RO3-type relays.

## 5.3.8 Streetlights

Most streetlights are controlled by ripple relays located at local low-voltage distribution substations, where the relays receive a signal by ripple injection initiated from a light-level sensor. Dedicated street light supply cables loop around several lights from each control point. A small number of lights are controlled from local photocell sensors. Street light relays are modern and reliable, with extremely low reported failure rates.

## 5.3.9 Supervisory Control and Data Acquisition (SCADA)

In the 2020 MainPower reporting year, implementation and deployment of the Open Systems International Monarch ADMS progressed.

MainPower's first SCADA system used remote terminal units communicating with Conitel protocol, and these have now either been completely changed to more modern DNP3 remote terminal units or slaved to more modern remote terminal units on site. All remote sites now communicate via the DNP3 protocol. Work is proceeding on new field devices with remote communication facilities. We are committed to using the latest distribution automation technologies to improve system performance and fault response times.

## 5.3.10 Communications

Our voice and data radio equipment has migrated to new systems during the past eight years and operates reliably. Tait voice radios and Mimomax data radios are currently employed. During 2016, "lone worker" and "worker down" functions were added to the voice radio platform via the use of portable radios working through the base vehicle radio.

## 5.3.11 Protection and Metering Systems

All modern zone substations use Areva, SEL or Siemens digital electronic protection systems. Older substations have GEC electromechanical relays, which are still reliable but have limited setting ranges and functionality. Several individual relays in these substations have been replaced in conjunction with circuit-breaker replacements. We also own high-voltage metering systems for several large users, including the Daiken medium-density fibreboard plant and McAlpines' timber-processing plant.

## 5.3.12 Power Factor Correction Plant

While MainPower has no system power factor correction installations of its own, the Daiken medium-density fibreboard plant at Ashley has two 11 kV capacitor banks. Transpower has also installed power factor correction for voltage support on the 66 kV bus at Southbrook.

## 5.3.13 Property and Buildings

MainPower owns substation buildings, offices, administration buildings and operational buildings. All our buildings are well maintained. MainPower relocated to a new, purpose-built head office and works facility in June 2014.

## 5.3.14 Assets Owned at Transpower Grid Exit Points

MainPower owns metering and communications equipment at Transpower GXPs that connect to our network. These monitor load for load management and revenue metering. All have Ion-type meters, installed after 2000. MainPower's ripple injection plants are located in Transpower GXPs at Waipara, Ashley and Kaiapoi. We also have SCADA and local service equipment associated with load control at these sites.

## 5.3.15 Mobile Substations and Generators

We have invested in a mobile diesel generation plant to assist with reducing the number of planned interruptions. The plant is rated at 275 kVA. The generator has been fitted on a tandem-axle truck along with the transformer, protection systems and connecting leads. The generator is used during planned work to maintain the supply to customers, and it has enough capacity to supply the average load of an urban transformer kiosk. Alternatively, it can be connected to overhead lines at 11 kV or 22 kV, supplying up to 100 customers. We also have a smaller 88 kVA generator for use with low-voltage customers. This is often large enough to supply small subdivisions during maintenance.

## 5.4 Network of the Future

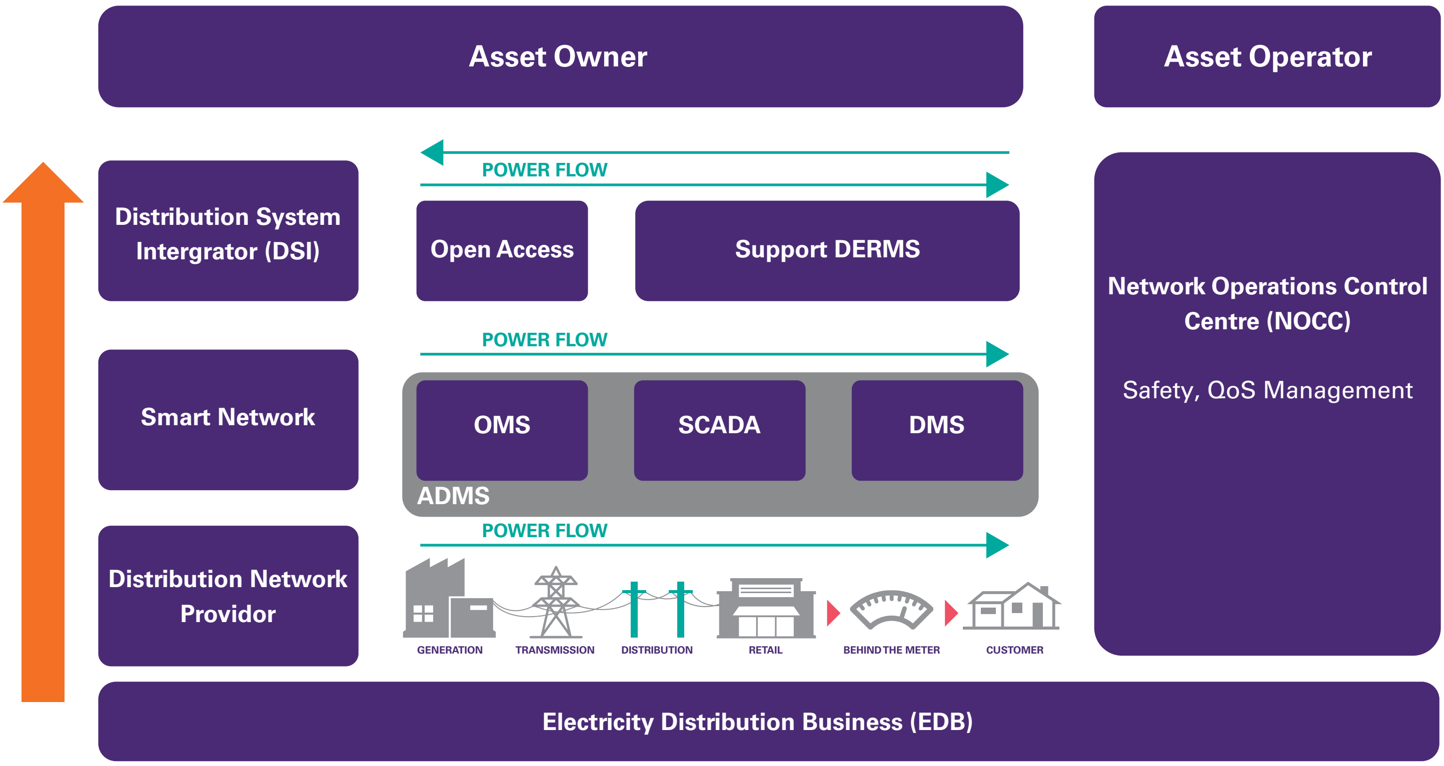
A network of the future enables the widespread use of local generation sources connected to the network at multiple points, with associated two-way power flows. It also ensures open-access arrangements for consumers to allow them to transact over the network and to connect any device they wish within acceptable safety and reliability limits. In addition:

- It relies on physical assets to convey electricity, as well as from consumer to consumer, or consumer to bulk supply point.
- Consumers are actively involved in their energy acquisition, generation and consumption management.
- It provides network connections for multiple sources of distributed generation devices and other consumer-side devices.
- The distribution utility may not become involved in the transactions between consumers and other parties, nor in the balance between supply and demand.
- Network stability is managed by the EDB for a range of operating scenarios.

### 5.4.1 Network of the Future Roadmap

The network services that MainPower and the electricity distribution network currently provide need to change to consider the impact of consumer LCT choice – for instance, EVs, energy storage, solar panels. It is also likely electricity markets at the distribution level will emerge as consumers want to extract full value from their LCT resources, increasing the likelihood for the role of a distribution system operator to manage these new energy transactions.

While the emergence and the role of new energy markets remain uncertain, MainPower is confident that our network services and offering will need to change to support consumers and their LCT choice. We propose to achieve this through an Open Access model, Open Access for all market participants supporting the possible future role of a distribution system operator. This methodology is aligned with the Electricity Networks Association's Network Transformation Roadmap.




*Note.* DERMS = distributed energy resource management system; OMS = outage management system; SCADA = supervisory control and data acquisition; DMS = distribution management system; ADMS = advanced distribution management system; QoS = quality of supply

*Figure 5.4: Transformation Roadmap Programme*

MainPower has already invested in systems and processes to facilitate our shift from being a network service provider to a smart network provider. This was achieved through the deployment of an ADMS. The ADMS consists of:

- an **outage management system (OMS)** for the management and reporting of outages on the network;
- a **supervisory control and data acquisition (SCADA)** system for the day-to-day management and visualisation of the operating status of the network, including trending and reporting; and
- a **distribution management system (DMS)** for monitoring the performance of the distribution system, allowing users to anticipate and respond to potential overloading and under-voltage situations before they become critical.

Through our Network Transformation Plan, it is MainPower's intent to develop an open architecture network that we refer to as a distribution system integrator. Providing a smart network is a key milestone on this journey.

### *5.4.1.1 Distribution Network Provider*

A distribution network provider is the organisation that owns the electricity distribution network assets and provides the physical processes and systems that support the assets (i.e. asset management, system maintenance, security of supply, system resilience, etc.).

### *5.4.1.2 Distribution System Integrator*

A distribution system integrator allows for the widespread use of local generation sources connected to the network at multiple points, with associated multi-directional power flows. A distribution system integrator ensures open-access arrangements for consumers and other market participants, allowing parties to transact over the network and to connect any device they wish, within acceptable safety and reliability limits.

### *5.4.1.3 Electricity Distribution Business*

In New Zealand, an EDB is the network company or lines company that owns and operates the regional network of overhead wires and underground cables suppling electrical energy to consumers. These days, an EDB is typically both a distribution network provider and distribution network operator combined into a single entity.

## 5.4.2 Network Transformation Plan

More work is required to achieve distribution system integrator status. This work is summarised in Table 5.5, including how we are tracking to complete these workstreams.

| Objectives | Description | Description | Status |
|---|---|---|---|
| Consumer Insights | Understand consumer motivations and behaviours to determine:<br>1. The impact on distributed energy resource deployment and consumption patterns; and<br>2. New load requirements. | • Low-voltage monitoring strategy.<br>• Understand distributed energy resource deployment through scenario planning.<br>• Understand new loads.<br>• Understand new distributed generation. | • Trial low-voltage monitoring deployed.<br>• ADMS reports on ICP outage basis.<br>• MPowered Future complete for scenario planning.<br>• Distributed generation support for Kate Valley and Mt Cass Windfarm's distributed generation. |
| Managing Uncertainty | Stay abreast of technology developments and update the EDB industry. Update this roadmap to remain relevant. | • Continuous monitoring. | • Ongoing. |
| Open Network Framework | Access to the electricity distribution network by existing and new consumers and traders to connect and operate any equipment they desire (specifically distributed energy resources and new loads) with appropriate consideration of:<br>• cost of access;<br>• network operation and system security;<br>• standard equipment; and<br>• standard access arrangements. | • Enable distributed energy resource trading.<br>• Trial distributed energy resource and demand response for network support.<br>• Demand response framework. | Currently review how distributed energy resource and distributed generation can be contracted differently, taking advantage of an intermediary as opposed to a pricing tariff, which is the existing method. |
| Standardise Technical Arrangements | Provide consistent method of connection of any equipment (distributed energy resources or appliances) across all EDB areas. Ensure equipment complies with approved standards to minimise its impact on the electrical power system. | • Standard distributed energy resource connection standards.<br>• Equipment standards.<br>• Network engineering.<br>• Cyber security and autonomous distributed energy resource. | Already engage with other EDBs to support consistent agreements, equipment standards and asset management practices. |
| Network Operation, Monitoring and Stability | Ensure the stability of the open network through deeper monitoring of the network and improved planning techniques. | • Low-voltage monitoring and visibility.<br>• Understand impact on network stability of multiple distributed energy resources. | Low-voltage monitoring remains a work in progress.<br>Roadmaps are developed to deliver:<br>• Power flow management;<br>• State estimator;<br>• Volt-Var, and compensation;<br>• Fault location isolation and service restoration. |
| Build EDB Capability | Understand networks in greater depth, their ability to host distributed energy resources, congestion, and contracting for network support. Ensure working understanding of regulations and obligations. | • Procurement and contract for services management.<br>• Asset management maturity. | Contestable asset management, customer connections and network access for third parties are developed and implemented. Maturity improvements include upgrades to MainPower ERP and the implementation of CBRM models. |

*Table 5.5: Network Transformation Plan*

# 6. NETWORK DEVELOPMENT PLANNING

Network development planning is a significant focus for MainPower within our asset management framework and processes. Given the changes already identified and the ways MainPower's network is predicted to be used in future, the current traditional distribution network approach of demand-based deterministic development planning will no longer meet the future needs of our consumers – both current and new market participants.

The underlying elements and influences of these changes from the perspective of an EDB are:

- Significantly greater integration between distributed generation, transmission and energy storage on the network, together with increased interaction with active traditional consumers;
- New technologies producing variable power sources, two-way power flows and new demands that are already creating serious challenges on networks internationally;
- The impact of new commercial parties, models and business platforms, working through both the distribution network and the "internet of things" but impacting on the use of the network;
- A growing focus on energy communities, peer-to-peer trading and local markets;
- The impact of non-linear loads, such as rapid EV chargers, on standard network infrastructure and the ability to manage the significant demand peaks and power-quality issues these introduce at the low-voltage distribution level;
- The potential for use of separated distribution micro grids where these are the most economical solution when considering renewals or new supplies; and
- The national transition to a low-carbon economy.

The above can be summarised as highlighting the need to move from the traditional passive distribution network to an active network that has more dimensions.

In response to this, MainPower is currently re-evaluating its network development planning methodology. In simplistic terms, we see the need to move from the traditional distribution network approach of demand-based, deterministic planning to scenario-based planning. To achieve this, new skills and systems will be required. We are actively engaged in identifying how these requirements will be met through learning from the experiences of others (both locally and internationally) and by participating in the results, learnings and tools being made available from industry working groups such as GREEN Grid, Electricity Networks Association and EEA forums. This evolution of our network development approach will help us better understand the range of capacity and service requirements the network will need to deliver.

We also recognise that this new future for distribution networks offers increased opportunities for non-network solutions (where economically viable) and for existing and new market participants to provide energy solutions. MainPower recognises the need to identify these opportunities in a timely manner to facilitate the market response and potentially seek providers of non-network solutions.

Although we are reviewing our network development planning processes to accommodate the above changes, our network development plans remain primarily driven by safety, security of supply, reliability and compliance requirements – these will evolve to include the future requirements for the North Canterbury region.

The following section identifies the current deterministic planning process, with some innovation based on our thinking about the future and early movements to a new model of network development planning.

## 6.1 Network Development Planning Criteria

Our network development is informed by our defined levels of service and performance, planning criteria and standard design implementations, which are a function of:

- Capacity;
- Power-quality compliance;
- Security, and
- Reliability.

We use options analysis to consider alternative development and engineering solutions. When selecting a solution, we consider cost and sustainability.

### 6.1.1 Capacity

We must ensure there is sufficient capacity available to meet network peak load. This is provided through network capacity in conjunction with our demand-side management capability.

We follow a process of forecasting network demand and assessing this demand against our Security of Supply Standard to establish the areas where we may experience a shortfall in capacity at a defined security level.

We plan to implement and monitor security performance indicators to show the capacity we provide at each security level.

### 6.1.2 Power-Quality Compliance

One of the key criteria for distribution development planning is power-quality compliance, such as voltage. Voltage performance is monitored by SCADA using field voltage measurements, load flow analysis, manual voltage checks (under normal and abnormal configurations) and investigations into consumer complaints about power quality.

Voltage regulators are used at 11 kV and 22 kV to assist in maintaining the voltage within the statutory voltage limits. Zone substation voltage regulators are generally set to control in the 100–102% band of nominal voltage at sites with 1.25% control steps. With line drop compensation, voltage regulation is set to control within the 11,000–11,300 V band. Line drop compensation is rarely used because of the large consumer spread along the distribution lines.

Field voltage regulators generally have 0.625% control steps and are set to operate in the range 10,900–11,000 V.

Systems are generally designed to have less than 10% total voltage drop to the network connection point to allow for additional voltage drop when the system is being supplied in an abnormal configuration (e.g. during an equipment outage). In normal operating configurations, this also allows for the bus voltage to be reduced by 1% to facilitate a higher penetration of distributed generation.

### 6.1.3 Security

Security of supply is the ability of the network to meet normal demand under contingency events, such as equipment failure. The more secure the network, the greater the ability to continue to provide supply during a contingency or to perform restoration from a fault or series of faults.

Note that security of supply differs from reliability. Reliability is a measure of how the network actually performs and is measured through indices such as the number of times supply to consumers is interrupted.

## 6.2 Project Prioritisation

A risk-based approach is applied to establish project prioritisation, in combination with other factors such as:

- Compliance and safety;
- Meeting service obligations and targets as defined by our consumers;
- Cost–benefit analysis; and
- Options analysis.

In general terms, development projects are prioritised as follows:

- Addressing compliance, health, safety and environmental issues;
- Consumer-driven projects for new connections or upgrades;
- Providing for load growth; and
- Meeting consumer service levels.

Prior to the commencement of each planning period, potential projects for the following 10 years are identified. Inputs to the prioritisation process include:

- Determining the primary driver for the project;
- Impact on consumers if the project does not proceed, or if it is deferred;
- Seasonal requirements;
- Cost and funding implications;
- Alternative non-network solutions; and
- Planning uncertainties.

## 6.3 Security of Supply Classification

The following sections describe how we define security of supply classifications for zone substations and distributed connected loads.

### 6.3.1 Zone Substation Security

Zone substations are classified for security according to Table 6.1.

| Substation Class | Substation Load Type | Targeted Duration for First Transformer, Line or Cable Fault | Targeted Duration for Bus or Switchgear Fault |
|---|---|---|---|
| **AAA** | Urban or industrial load > 10 MW peak or 30 GWh annual consumption | No interruption | No interruption for 50% and restore the rest within 2 hours |
| **AA** | Urban load > 2 MW peak or 6 GWh annual consumption | 45 minutes | Restore 75% within 2 hours |
| **A1** | Predominantly rural and semi-rural loads totalling > 1 MW | Isolation time | Repair time |
| **A2** | Predominantly rural and semi-rural loads totalling < 1 MW | Repair time | Repair time |

**Zone Substation Classification Descriptions:**

**AAA** Supply is uninterrupted in the event of the outage of one major element of the sub-transmission network. Load can be transferred to other substations without interruption by switching on the network, if necessary, to avoid exceeding ratings.

**AA** Supply may be lost in the event of the outage of one major element of the sub-transmission network. Supply can be restored within 45 minutes by switching at the sub-transmission or distribution level.

**A1** Supply may be lost in the event of the outage of one major element of the sub-transmission network. Supply can be restored by switching after the faulted element is isolated.

**A2** Supply may be lost in the event of the outage of one major element of the sub-transmission network. Supply cannot be restored until the faulty element is repaired or replaced.

*Table 6.1: Security of Supply Zone Substation Restoration Times*

### 6.3.2 Distributed Load Classifications

Distribution loads are classified according to Table 6.2.

| Classification | Description |
|---|---|
| L1 | Large industrial (> 5 MW/15 GWh of industrial load) |
| L2 | Commercial/Central business district (> 5 MW/15 GWh of commercial load) |
| L3 | Metropolitan (> 2 MW/6 GWh of urban mixed load) |
| L4 | Rural (predominantly rural and semi-rural areas) |
| L5 | Remote rural |

*Table 6.2: Security of Supply Load Types*

### 6.3.3 Security Level

Network configuration is arranged so that the security criteria shown in Table 6.3 can be met, subject to technical and economic feasibility.

| Load Type | Security Level |
|---|---|
| L1 | After a fault is located, supply can be restored to all but the isolated section in 1 hour. The isolated section shall be limited to 500 kVA, unless it is a single consumer with a load in excess of this. |
| L2 | After a fault is located, supply can be restored to all but the isolated section in 2 hours. Restoration of supply via low-voltage connection is acceptable here. The isolated section shall be limited to 750 kVA, unless it is a single consumer with a load that is in excess of this. |
| L3 | After a fault is located, supply can be restored to all but the isolated section in 3 hours. The isolated section shall be limited to 1.5 MVA or 4.8 GWh. |
| L4 | After a fault is located, supply can be restored to any section of the feeder with a load exceeding 1.5 MVA or 4.8 GWh in 4 hours. |
| L5 | After a fault, supply may remain interrupted until repairs are completed. |

*Table 6.3: Distribution Load Security Level*

## 6.4 Use of Standard Designs

Standard designs are used to achieve, and are aligned with, MainPower's asset management objectives. Standard designs exist for all MainPower overhead structures. Work is currently being undertaken to further standardise our engineering solutions. Standard designs are identified through:

- Total cost of ownership;
- Economies of scale;
- Compliance;
- Service levels;
- Security of supply; and
- Safety.

## 6.5 Strategies for Energy Efficiency

MainPower has a focus on improving the energy efficiency of our network through reducing losses (where reasonably practical), placing a high value on efficiency parameters when purchasing new equipment, and on education programmes to improve demand-side management.

All conversions from 11 kV to 22 kV will cause a replacement transformer to be installed that meets the new Minimum Energy Performance Standards. Additionally, we consider loss capitalisation when purchasing transformers. As a company, MainPower actively promotes energy efficiency in the community through consumer education and our community sponsorship programme (insulation and energy efficiency solutions). We are actively engaging with our consumers and assessing demand-side management concepts regarding emerging technologies and consumer behaviour.

# 6.6 Network Planning

## 6.6.1 Overview

We use the term "growth and security" to describe capital investments that increase the capacity, functionality or size of our network. These include the following four main types of investments:

- **Major projects** – more than $0.5 million, generally involving sub-transmission, zone substation or GXP works.
- **Reinforcement projects** – typically below $0.5 million, including distribution-feeder capacity and voltage upgrades, security (N-1) reinforcements, distribution substation and transformer upgrades, and low-voltage reinforcement.
- **Open-access network investments** – investments to support the transition towards an open-access network, including network monitoring, communications and power-quality management.
- **Reliability and automation** – include network automation projects to help manage the reliability performance of our network; currently integrated within our major projects and reinforcement projects.

## 6.6.2 Demand Trends

Our network demand forecasting process forecasts demand at Transpower's North Canterbury GXPs and MainPower's zone substations over the next 10 years.

When developing demand forecasts, several key inputs are applied, including:

- Population and household projections obtained from Statistics New Zealand;
- Local District Scheme and Community Plans;
- Notified changes in land use designations;
- Known commercial, residential and industrial developments;
- Historical electrical demands;
- Non-network solutions (such as demand management);
- Historical extreme movements in temperature and rainfall where this affects peak demand;
- Expected economic developments; and
- Emerging technology adoption, such as EVs.

Our network continues to undergo steady growth, as shown by both ICP and population growth in Figure 6.1.
The consistent growth shown in the network is mainly due to:

- Steady residential subdivision activity in Kaiapoi and Rangiora;
- Commercial development in Rangiora; and
- Irrigation developments and other agricultural loads.

Growth in each area of our network varies because of changes in demographics and regional characteristics. The map in Figure 6.1 indicates annual ICP and population growth rates, by planning area, for MainPower's network region.

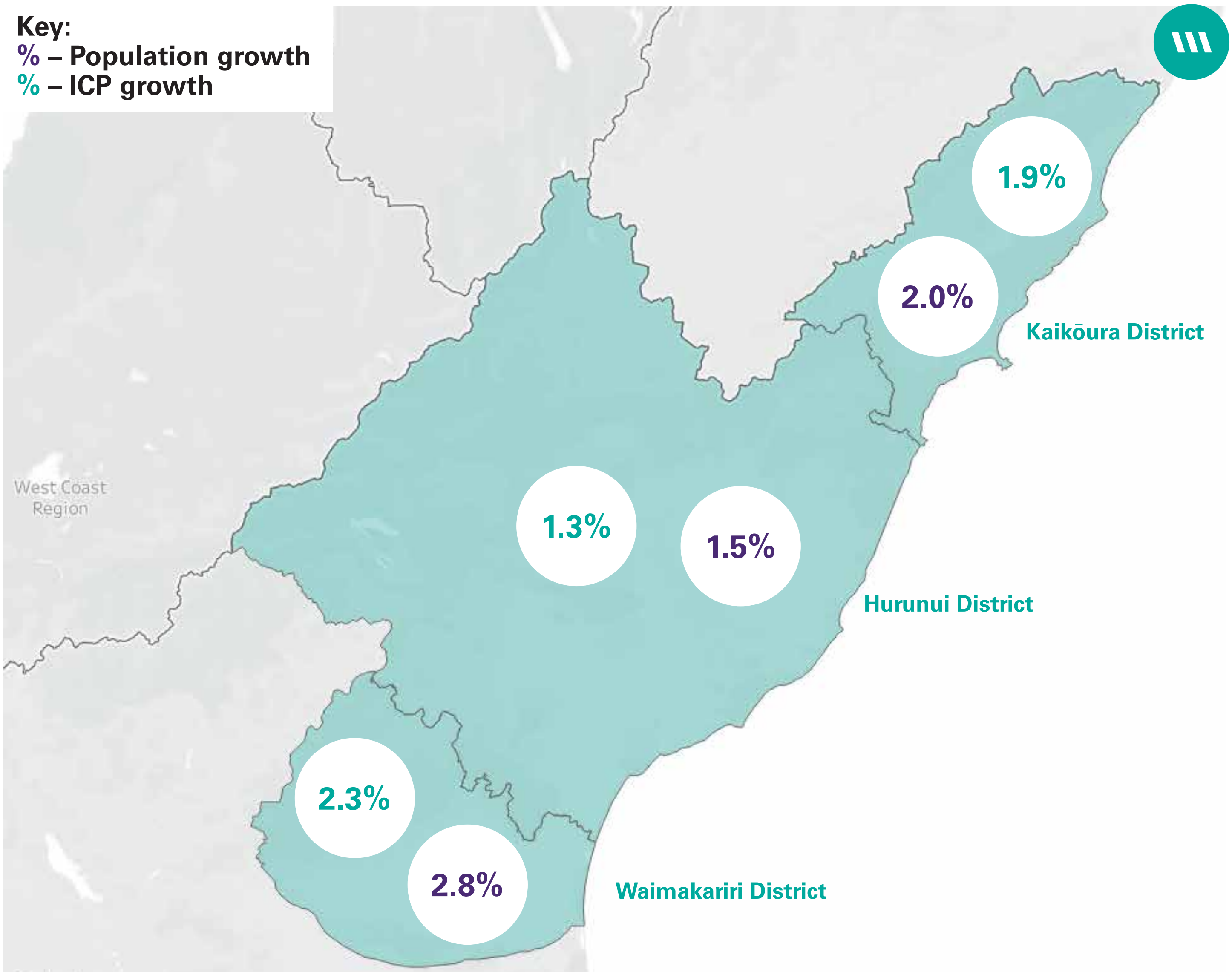



*Figure 6.1: Annual ICP and Population Growth Rates by Planning Area*

## 6.6.3 Reliability

The number and duration of service interruptions are of primary interest from the consumers' point of view, as specified in Section 3 of this document. MainPower uses reliability statistics and targets to identify if and where system improvement is needed. We select development options based on the lowest whole-of-life cost to provide the functionality and meet target reliability outcomes.

## 6.6.4 Forecast Impact of Distributed Generation and Demand-Side Management

All demand forecasts take into consideration the impact of existing and proposed distributed generation known to MainPower through engagement with our consumers. This includes energy-efficiency initiatives, with the major contributor being irrigation schemes converting to piped irrigation. Our load-forecasting process considers the impact of the demand-side management scheme that MainPower already employs.

Figure 6.2 and Figure 6.3 show the growth of small-scale (< 100 kW capacity) distributed generation within the network. The connection rate is increasing very slowly. On average, approximately 550 kWh of generation is exported per kW of capacity. This corresponds to more than 40% of the energy produced from the connected distributed generation. The average connected distributed generation per consumer across the three planning regions are Waimakariri (4.94 kW, 1,057 consumers or 3.4% of total consumers), Hurunui (5.92 kW, 210 consumers or 2.5% of total consumers) and Kaikōura (4.6 kW, 30 consumers or 1.1%).

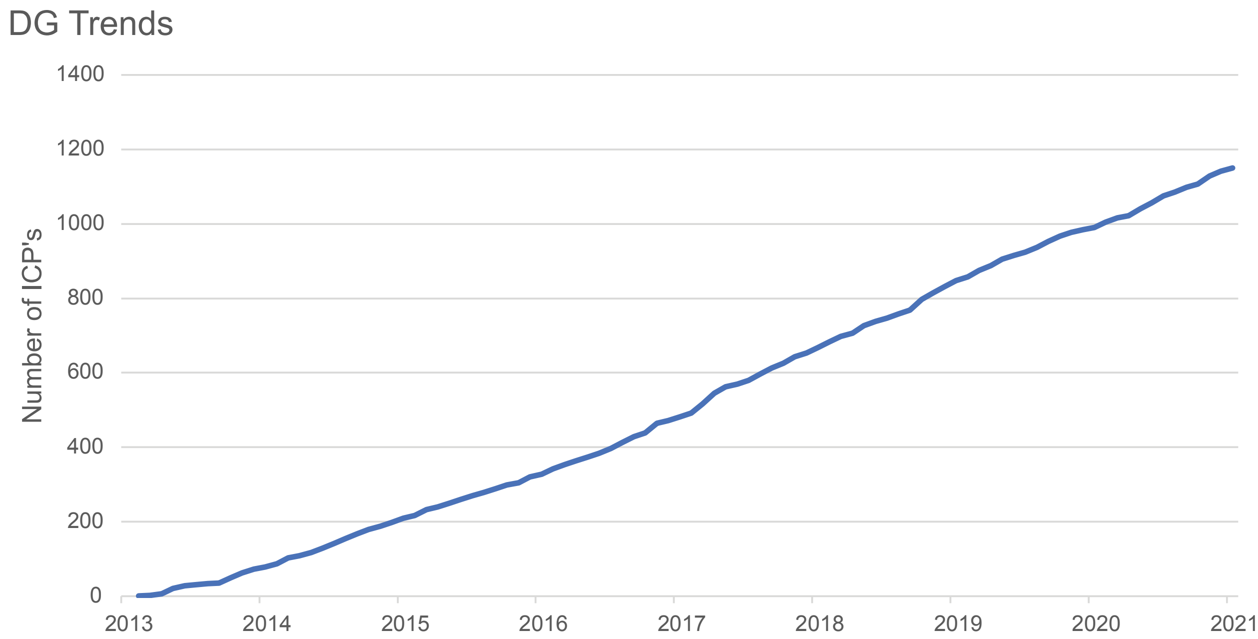



*Figure 6.2: Distributed Generation Trends up to January 2021*

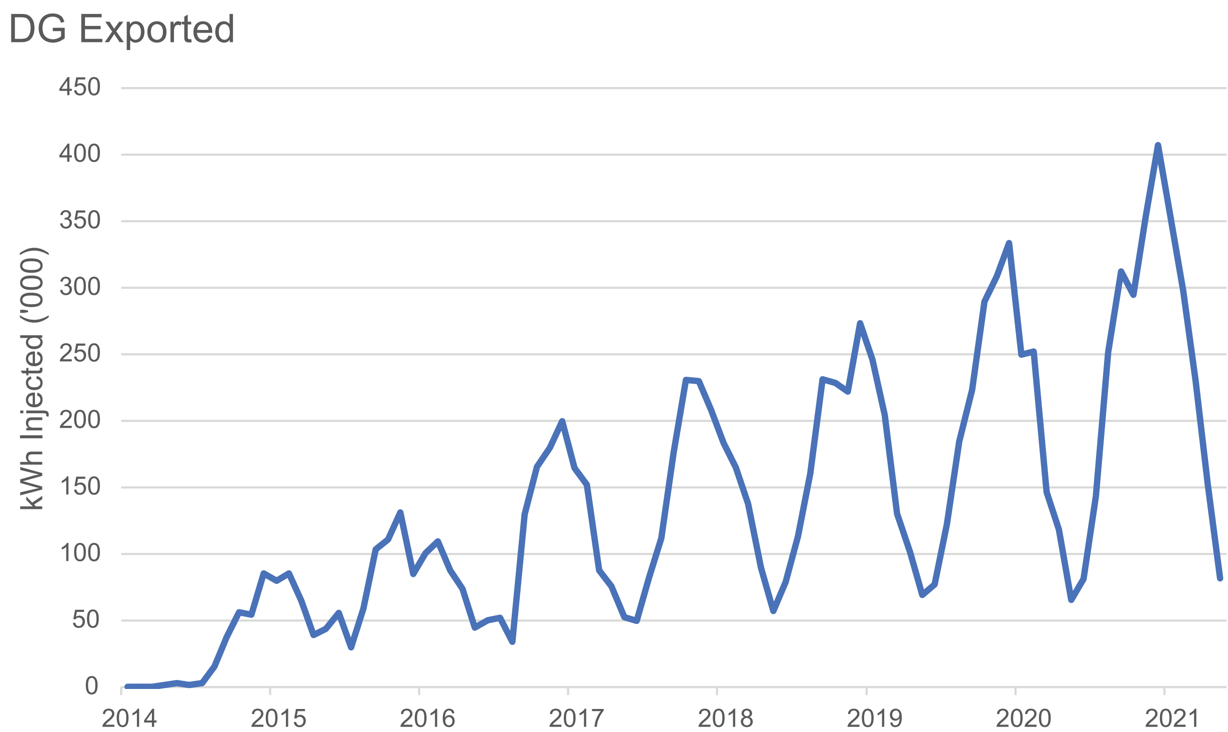



*Figure 6.3: Distributed Generation Exported Volume*

## 6.6.5 Distribution Innovation

MainPower's future focus in network development planning includes the development of regional Master Plans – documents that will detail projected demand growth, reliability statistics and network projects in defined North Canterbury areas.

The purpose of the regional Master Plans is to:

- Improve stakeholder engagement involving local councils, suppliers of technology, community and energy users;
- Provide a consultative platform to accept new technology or behavioural changes to assist with deferring network expenditure and reducing supply-related costs;
- Detail our approach to network augmentation and the service levels delivered – where no feasible market-driven alternative solution exists, MainPower may then apply a traditional network development planning approach;
- Provide regional documents to all stakeholders, market participants and energy consumers; and
- Facilitate a market response by encouraging the use of non-network or non-lines network solutions – these do not necessarily need to be delivered by MainPower; they can be supplied, maintained and operated by others.

# 6.7 Long-Term Sub-Transmission Network Strategy

MainPower has developed a long-term sub-transmission strategy to help inform and align future investment (Figure 6.4). This long-term strategy targets the following key objectives:

- Enable and support regional growth.
- Provide an appropriate security of supply.
- Facilitate continuous improvement in network reliability.
- Standardise sub-transmission and distribution assets.
- Facilitate consumer-driven technology adoption.

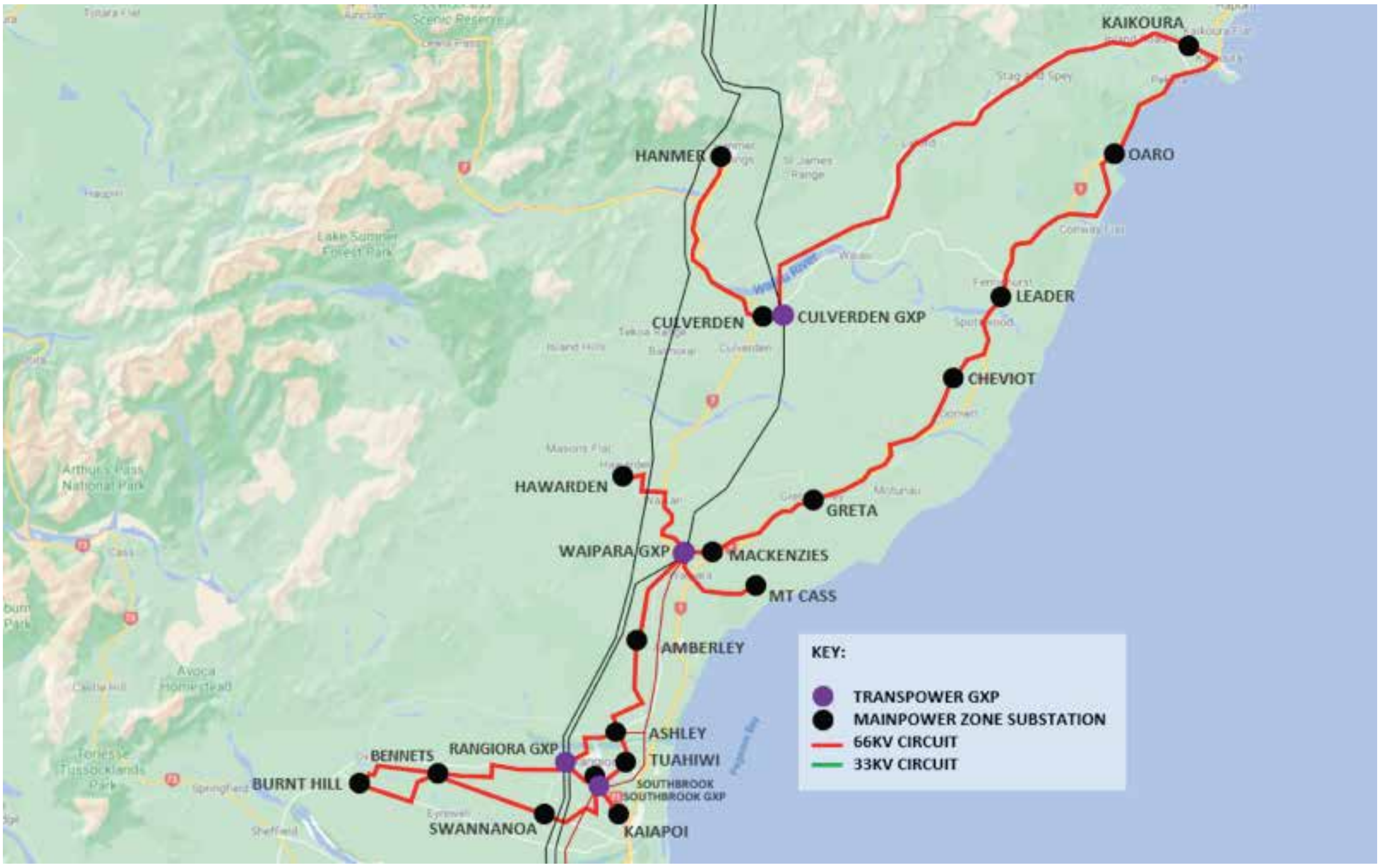



*Figure 6.4: MainPower's Long-Term Sub-Transmission Network Strategy*

The Network Regional Plans identified in the following sections have been developed to align and facilitate MainPower's long-term sub-transmission network strategy.

# 6.8 Network Regional Plans

MainPower's network spans three main regions across North Canterbury: Waimakariri, Hurunui and Kaikōura. We have divided the network into these planning areas to better understand and focus our investment planning to local needs. These area plans are summarised below.

## 6.8.1 Waimakariri Regional Overview

The Waimakariri area plan covers the region from the Waimakariri River to Balcairn, and between the South Island's east coast and the Main Divide. The main towns include Kaiapoi, Oxford, Pegasus, Rangiora and Woodend.

The region's proximity to Christchurch has contributed to its substantial residential growth, further supported by Waka Kotahi NZ Transport Agency projects to further develop the Christchurch Northern Motorway.

The region is characterised by flat, open plains used for a range of farming activities, combined with an increasing number of small to medium-sized lifestyle blocks. Seasonal weather extremes, including snow and strong winds, can affect the region's quality of supply. In addition, peak electricity demand in Burnt Hill and Swannanoa occurs during summer when the thermal ratings of overhead lines are limited by the higher ambient temperatures.

MainPower's sub-transmission network in the Waimakariri area is supplied from Transpower's Southbrook GXP.

The sub-transmission network is dominated by a large overhead 66 kV ring circuit, serving Burnt Hill and Swannanoa, with a double-circuit 66 kV tower line feeding Kaiapoi, which is owned by Transpower. The 66 kV Burnt Hill and Swannanoa ring currently operates in an open state, each being supplied from Southbrook. Our sub-transmission and distribution networks in the Waimakariri area are predominantly overhead, reflecting the rural nature of the area.

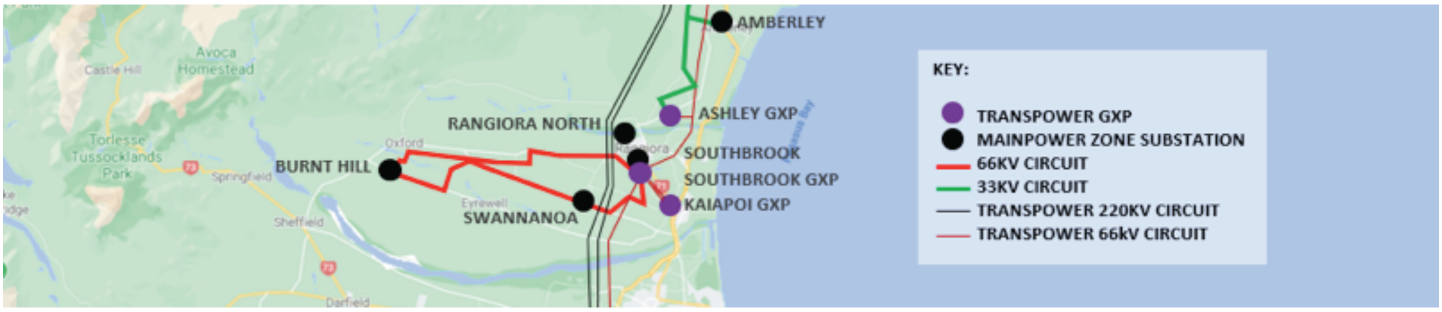



*Figure 6.5: Waimakariri Region Sub-Transmission Network (Existing)*

### *6.8.1.1 Demand Forecasts*

In New Zealand, an EDB is the network company or lines company that owns and operates the regional network of overhead wires and underground cables suppling electrical energy to consumers. These days, an EDB is typically both a distribution network provider and distribution network operator combined into a single entity.

| Substation | Security Class | Class Capacity (MVA) | Demand Forecast (MVA) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| **Ashley GD** | AA+ | 0 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 |
| **Ashley GN** | A1 | 40 | 6.9 | 7.0 | 7.1 | 7.3 | 7.4 | 7.5 | 7.7 | 7.8 | 8.0 | 8.1 |
| **Burnt Hill** | A1 | 23.0 | 15.8 | 16.0 | 16.2 | 16.4 | 16.6 | 16.8 | 17.0 | 17.2 | 17.5 | 17.7 |
| **Kaiapoi** | AAA | 40 | 31.5 | 32.7 | 33.9 | 35.1 | 36.3 | 37.5 | 38.7 | 39.9 | 41.1 | 44.7 |
| **Southbrook** | AAA | 40.0 | 30.9 | 31.8 | 32.8 | 33.9 | 34.9 | 35.9 | 37.0 | 38.2 | 39.4 | 40.6 |
| **Swannanoa** | A1 | 23.0 | 15.5 | 15.7 | 15.9 | 16.1 | 16.3 | 16.6 | 16.8 | 17.1 | 17.4 | 17.6 |

*Note.* Grey shading indicates peak demand is forecast to exceed current security-class capacity.

*Table 6.4: Waimakariri Area Network Demand Forecast*

### 6.8.1.2 Network Constraints

Major constraints affecting the Waimakariri area are shown in Table 6.5.

| Load Affected | Major Issues | Growth and Security Projects |
|---|---|---|
| Ashley Grid Direct | The Ashley Grid Direct supplies one major consumer and cannot be restored within 15 seconds. | We recognise this as a gap in the Security of Supply Standard and have discussed and agreed this configuration with the single consumer supplied via this site. |
| Southbrook, Burnt Hill, Swannanoa and Kaiapoi | Limited ability to achieve Transpower's load requirements during a half-bus outage. | Tuahiwi Zone Substation programme.<br>Develop long-term 66 kV interconnection capacity between Waipara, Southbrook, and the future Tuahiwi Zone Substation. |

*Table 6.5: Waimakariri Area Network Constraints*

### 6.8.1.3 Major Projects

Below are individual summaries of the major growth and security projects planned for the Waimakariri area.

| Southbrook 66 kV Zone Substation | |
|---|---|
| Expected Project Timing | FY20–FY23 |
| Strategic Drivers | System Growth, Quality of Supply – Resilience, and Asset Replacement and Renewal |
| Business Case Required? | Yes |

*Table 6.6: Southbrook 66 kV Zone Substation*

This is a four-year project to rebuild MainPower's Southbrook Zone Substation as a 66/11 kV zone substation and decommission the existing 33/11kV substations at Southbrook and Rangiora North. This will:

- Increase the Southbrook N-1 capacity from 29 MVA to 40 MVA to meet existing and future loads in this region.
- Remove the phase shift between the Southbrook 11 kV and the neighbouring Ashley and Kaiapoi Zone Substations, increasing MainPower's ability to transfer load and switch the network under contingency events.
- Replace end-of-life 33 kV switchgear.
- Improve network reliability and security of supply in the surrounding Southbrook and Rangiora regions.
- Reduce the arc-flash risk of the Southbrook Zone Substation.

This project spans four years, with the new 66/11kV zone substation to be completed in FY22 and the decommissioning stage to be completed in FY23.

| Tuahiwi 66/11 kV Zone Substation | |
|---|---|
| Expected Project Timing | FY23, FY26–FY29 |
| Strategic Drivers | System Growth, Quality of Supply – Resilience |
| Business Case Required? | Yes |

*Table 6.7: Tuahiwi 66/11 kV Zone Substation*

Residential and commercial growth in the Rangiora, Woodend, Ravenswood and Pegasus areas will drive the need for a new zone substation east of Rangiora. The Tuahiwi Zone Substation programme incorporates a series of sub-projects to construct a 66 kV sub-transmission network and a new Tuahiwi 66 kV Zone Substation. The overall programme is staged as follows:

- Stage 1 – Tuahiwi 66 kV Sub-transmission Line Design: The first stage of this programme is the line route detailed design, including easements and consents for a 66 kV overhead line connecting Ashley GXP, Tuahiwi 66 kV Zone Substation site, and from Tuahiwi Zone Substation to the Southbrook GXP (FY23). The design stage will allow construction from Ashley to the Rangiora Woodend Road area and will be timed to provide support at 11 kV for the eastern rural area. Completion of the circuit in approximately 2029 will coincide with construction work on the substation.

- Stages 2 and 3 – Ashley to Tuahiwi 66 kV Sub-transmission Line Build: These stages construct the Ashley to Tuahiwi 66kV sub-transmission line, which will initially operate at 11 kV, providing additional capacity into the Tuahiwi region until the Tuahiwi Zone Substation is completed.

- Stages 4, 5 and 6 – Tuahiwi Zone Substation Design and Construction: Stages 4, 5 and 6 will extend on initial concept studies to deliver a full detailed design and construct the new Tuahiwi 66 kV Zone Substation and terminate the 66 kV sub-transmission line from Ashley to commission the new Zone Substation.

- Stage 7 – Southbrook to Tuahiwi 66 kV Sub-transmission Line Build: Stage 7 completes the Tuahiwi Zone Substation programme by constructing the Southbrook to Tuahiwi 66 kV sub-transmission circuit, providing full N-1 supply to the Tuahiwi Zone Substation.

### *6.8.1.4 Reinforcement Projects*

MainPower invests in tactical network reinforcement projects to improve network reliability and security of supply, as well as to help defer higher-capital projects. Table 6.8 summarises the reinforcement projects in the Waimakariri area.

| FY | Project Title | Description |
|---|---|---|
| FY22 –FY23 | Townsend Road Feeder | Install 300 mm2 AL XLPE 11 kV cable to Pentecost Road to create a new feeder route to south-western Rangiora, increasing capacity and security of supply. |
| FY23 | Burnt Hill, Swannanoa and Southbrook Zone Substation Phase Matching | Rectify the phase differences between zone substations in the Waimakariri area to allow parallel supply of power and increase alternate supply options. |
| FY23 | Kaiapoi–Island Road Upgrade | Install a 300 mm2 AL XLPE 11 kV cable from the Kaiapoi GXP to beyond the urban area to increase capacity in the region. |
| FY23 | Kaiapoi Red Zone | Remove and renew assets in the Kaiapoi Red Zone that are underutilised to improve network connectivity and reliability. |
| FY23 –FY24 | Mandeville Area Voltage Improvements | Install a regulator and reconductor sections of the line between Kaiapoi and Mandeville to improve the voltages in that area of the network. |
| FY24 | Fernside Reconfiguration | Reconfigure supply to the Fernside area to improve security of supply and reliability after the Southbrook Zone Substation upgrade. |
| FY24 | Reinforce X52 Burnt Hill | Increase the security of supply of feeder X52 by upgrading 660 m of conductor in North Eyre Rd. |
| FY24 | Reinforce SW63 and SW66 Swannanoa | These are large, highly loaded feeders with limited switching capability. The project improves safety and reliability by installing three remote-controlled switches. |
| FY25 | Kaiapoi KAI_7 Feeder Split | Improve the reliability and capacity of the large Wetheral feeder (KAI_7) by extending and livening a second 300 mm cable from the Kaiapoi GXP. |
| FY25 | Loburn Barkers Road Links | Create a mesh network with links along Barkers Road to improve security of supply for the area. |
| FY25 | East Belt to Railway Link | Improves security of supply to central Rangiora by linking capacity from the eastern feeders and removing significant commercial load from a spur connection. |
| FY25 | Marsh Rd Feeder Creation | Install a new cable from Southbrook Substation to Marsh Road to improve the capacity to Pegasus/Ravenswood by 2 MW and improve reliability. |
| FY25 –FY27 | Birch Hill Link Stages 1 and 2 | Link the Okuku and Ashley Gorge feeders to the Summerhill feeder in the Birch Hill area to improve reliability and security of supply for the region. |
| FY26 | Loburn Feeder | Create a new Loburn feeder to separate the supply to Loburn and Marshmans Road, Sefton, to improve the security and reliability of both areas. Uses an existing spare Ashley circuit breaker. |
| FY27 | Kaiapoi 8376 to S11 Link | Create an interconnection between 11 kV feeders in Kaiapoi to increase alternate supply options. |
| FY27 | Burnt Hill X53–X56 Link | Link 22kV from Thongcastor Road to Harmans Gorge Road via the end of Depot Gorge Road. This requires the conversion of part of Depot Gorge Rd to 22kV and will improve reliability and security of supply. |
| FY27 –FY32 | 22kV Upgrades | Network-wide transition from 11 kV to 22 kV staged over several years to support load growth in identified areas. |
| FY28 | Stone Street Underground | Remove the last of the overhead network on Stone Street in Kaiapoi utilising existing cables and ducts. |
| FY29 | Rangiora Western Overhead Feeder | Build an overhead link down Lehmans Road to strengthen the supply to north-western Rangiora where considerable load growth due to residential subdivisions is expected. |
| FY29 –FY31 | Tuahiwi to Rangiora Feeders | Install 300 mm2 AL XLPE feeder cables between the new Tuahiwi 66 kV Zone Substation and the eastern side of Rangiora to improve security of supply. |
| FY30 | West Belt Underground | Underground the south end of West Belt to remove ageing overhead assets and improve network connectivity. |
| FY30 | Oxford to German Road Link and Switch Install | Link the Ashley Gorge feeder to X57 on German Road to improve security of supply and reliability. |
| FY32 | Burnt Hill X53 to X55 Link | Create a mesh network between these two feeders to provide alternate supply options for high use ICPs. |

*Table 6.8: Waimakariri Area Reinforcement Projects*

## 6.8.2 Hurunui Regional Overview

The Hurunui area plan covers the region north of Balcairn to the Conway River, and between the South Island's east coast and the Main Divide. The main towns include Amberley, Cheviot, Hawarden, Culverden, Rotherham, Waiau and Hanmer.

Amberley's location on SH1 and its relative proximity to Christchurch has contributed to its recent residential and commercial growth. The Culverden basin and Cheviot area have seen rapid irrigation and dairy development during the last 20 years, with relatively low residential and general commercial growth. The Waipara area has also had significant vineyard developments established. In the north, Hanmer is a medium-sized tourist destination with steady growth anchored largely around the Hanmer Springs Thermal Pools and Spa complex. Hanmer's network load is dominated by tourist and holiday home activities.

The region is characterised by a mixture of flat, open plains, rolling hills and rugged hill country. South of Amberley, land is used for a range of farming activities, with an increasing number of small to medium-sized lifestyle blocks. Seasonal weather extremes, including snow and strong winds, can affect the region's quality of supply. In addition, electricity demand in the central Culverden basin, Waipara, Cheviot and Parnassus area are summer peaking when the thermal ratings of overhead lines are limited by the higher ambient temperatures. The northern and southern areas are winter peaking.

MainPower's sub-transmission network in the Hurunui area is supplied from Transpower's Waipara and Culverden GXPs. The area uses a combination of 66 kV and 33 kV sub-transmission voltages, with our long-term plan to phase out 33kV. The sub-transmission network consists of a long 66 kV and 33 kV interconnection between Waipara and Culverden GXPs, which supplies the Mackenzies Road, Greta, Cheviot and Parnassus substations in the Hurunui area, as well as the Oaro and Kaikōura/Ludstone Road substations in the Kaikōura area. Hanmer is on a 33 kV spur from the Culverden GXP, while Amberley is tee-connected on a 33 kV circuit from the Waipara GXP to Ashley GXP.

The Kate Valley Landfill site is generating a significant and growing amount of electricity from its landfill gas (currently up to 4 MW). In addition, the neighbouring Mt Cass is forecast to become the site of a large wind farm. Both of these would feed back to the Waipara GXP.

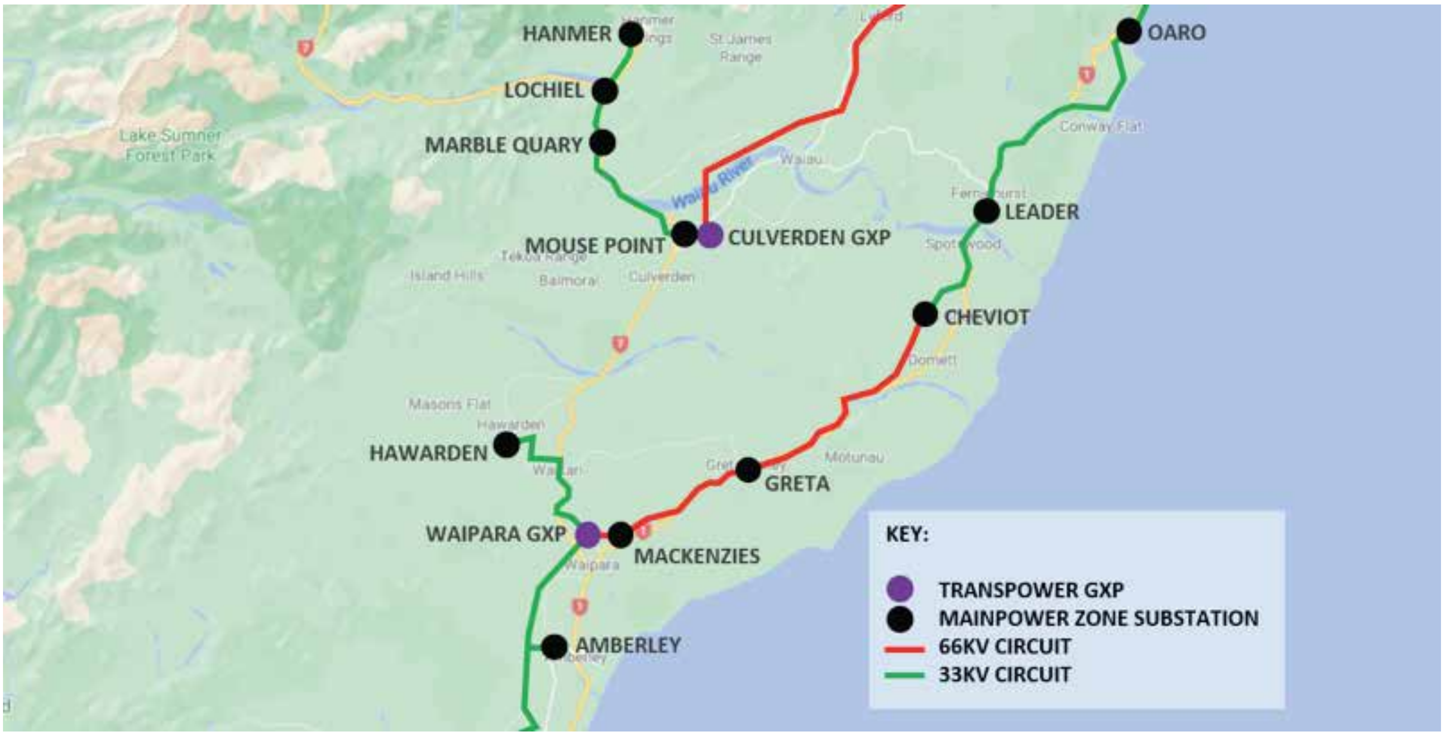



*Figure 6.6: Hurunui Sub-Transmission Network (Existing)*

### 6.8.2.1 Demand Forecasts

Demand forecasts for the Hurunui Zone Substations are shown in Table 6.9.

| Substation | Security Class | Class Capacity (MVA) | Demand Forecast (MVA) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| **Amberley** | A1 | 5 | 5.6 | 5.8 | 6.1 | 6.4 | 6.7 | 7.0 | 7.3 | 7.6 | 8.0 | 8.3 |
| **Mackenzies Rd** | A1 | 4 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.6 | 2.6 | 2.6 |
| **Greta** | A1 | 4 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.6 | 1.6 |
| **Cheviot** | A1 | 4 | 3.6 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.3 |
| **Leader** | A1 | 2 | 1.6 | 1.6 | 1.7 | 1.7 | 1.8 | 1.8 | 1.8 | 1.9 | 1.9 | 2.0 |
| **Hawarden** | A1 | 4.5 | 4.1 | 4.2 | 4.3 | 4.4 | 4.6 | 4.7 | 4.9 | 5.0 | 5.1 | 5.2 |
| **Mouse Point** | AA | 13 | 14.8 | 14.9 | 15.1 | 15.3 | 15.4 | 15.6 | 15.7 | 15.9 | 16.1 | 16.2 |
| **Marble Point** | A2 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| **Lochiel** | A2 | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| **Hanmer** | AA | 2.5 | 4.9 | 5.0 | 5.1 | 5.2 | 5.2 | 5.3 | 5.4 | 5.5 | 5.6 | 6.0 |

*Note.* Grey shading indicates peak demand exceeds current security-class capacity.

*Table 6.9: Hurunui Area Network Demand Forecasts*

### 6.8.2.2 Network Constraints

Major constraints affecting the Hurunui area are shown in Table 6.10.

| Load Affected | Major Issues | Growth and Security Projects |
|---|---|---|
| Amberley | The peak load cannot be supplied in the event of a transformer outage. | • Planned load transfer to Mackenzies Road Zone Substation, to minimise the capacity shortfall.<br>• Upgrade of Amberley Zone Substation FY23–FY25. |
| Greta | This is an N substation and peak load cannot be supplied in the event of a transformer outage. | • The Greta area will be linked to the Cheviot Substation to provide switchable backup at 22/11 kV in FY23. |
| Cheviot | This is an N substation and peak load cannot be supplied in the event of a transformer outage. | • The Cheviot–Oaro 66 kV Upgrade in FY21–FY22 will increase the capacity of the Leader Substation to supply into the northern Cheviot area during peak summer loads.<br>• The Cheviot area will be linked to the Greta Substation to provide switchable backup at 22/11 kV in FY23.<br>• Leader Substation capacity will be increased in FY22. |
| Leader | This is an N substation and peak load cannot be supplied in the event of a transformer outage. | • The Cheviot–Oaro 66 kV Upgrade will increase the capacity of the Leader Substation from 2 MVA to 4 MVA in FY22.<br>• There are currently no plans to provide full switchable backup within the planning period. |
| Hawarden | Peak load cannot be supplied in the event of a transformer outage.<br>The substation is supplied from a single 33 kV spur line. | • The substation is planned to be rebuilt as a dual transformer substation in FY24–FY27.<br>• Load-transfer capacity from Mouse Point will be increased to 4 MW in FY25–FY26, enabling full backup for the existing load plus normal growth. Peak load for Hawarden is primarily driven by irrigation load, and we are exploring load control options in this area. |
| Mouse Point | The peak load is above the N-1 transformer rating.<br>Switching of the 33 kV supply following a cable fault is local and would require more than 45 minutes. | • MainPower has installed emergency control on irrigation loads in this region to allow all but irrigation loads to be restored on a single 13 MVA transformer. A spare 8 MVA transformer is held as a backup.<br>• Summer cyclic ratings will be established to maximise the contingency rating.<br>• The substation will be rebuilt as 66/22 kV, in a full N-1 configuration, in FY29–FY31. |
| Hanmer | The peak load is above the capacity of the installed spare transformer.<br><br>The substation is supplied from a 33 kV radial spur. | • The second transformer and upgraded 11 kV switchboard will provide backup at peak loads in FY25.<br>• The 33 kV line will be upgraded over FY20–FY24 to improve its resilience and minimise the risk of prolonged outages in an extreme event. |

*Table 6.10: Hurunui Area Network Constraints*

### 6.8.2.3 Major Projects

The following tables summarise the major projects (growth and security) planned for the Hurunui area.

| Amberley Zone Substation Upgrade | |
|---|---|
| Expected Project Timing | FY23–FY25 |
| Strategic Drivers | System Growth, Quality of Supply, Asset Replacement and Renewal |
| Business Case Required? | Yes |

*Table 6.11: Amberley Zone Substation Upgrade*

This project involves replacement of the Amberley 33 kV Zone Substation, rebuilding it for future 66/11 kV operation on a new site and eliminating the existing sub-transmission line spur connection. It will be configured as an N-1 substation, will remove capacity and security constraints, and will replace the end-of-life assets. The long-term plan is to convert the 33 kV

sub-transmission line to 66 kV from FY32–FY33. The project will be staged as follows:

- **Stage 1 – Consenting and Detailed Design:** The first stage of this programme is the detailed design for the Zone Substation site, including sub-transmission line terminations provisioned for future 66 kV. Any consenting requirements are also included in this stage.

- **Stages 2 and 3 – Amberley Zone Substation Build:** These stages construct the zone substation site and commission to operate at 33 kV until the sub-transmission line upgrade project is completed in FY32–FY33.

- **Stage 4 – Waipara-Amberley-Ashley Sub-transmission Line Upgrade:** Stage 4 completes the Amberley 66/11 kV Zone Substation upgrade programme by upgrading the existing 33 kV line to 66 kV, allowing the zone substation to operate at 66/11 kV.

| Hawarden Zone Substation Upgrade | |
|---|---|
| Expected Project Timing | FY24–FY27 |
| Strategic Drivers | Asset Replacement and Renewal, System Growth |
| Business Case Required? | Yes |

*Table 6.12: Hawarden Zone Substation Upgrade*

The Hawarden Zone Substation has reached end of life, and load is forecast to increase due to irrigation projects in the region. The zone substation will be replaced with a dual transformer zone substation designed for 66/22 kV operation to improve interconnection capability with Mouse Point. The substation will be initially operated at 33/11 kV using existing 33/11 kV transformers. Site investigation and procurement is planned for FY24, followed by detailed design in FY25 and then procurement and construction in the following two years.

There is potential for the proposed irrigation development in the Hawarden area to change the scope and timing of this project.

| Mouse Point Substation Upgrade | |
|---|---|
| Expected Project Timing | FY29–FY31 |
| Strategic Drivers | System Growth, Security of supply, Asset Replacement and Renewal |
| Business Case Required? | Yes |

*Table 6.13: Mouse Point Substation Upgrade*

The peak load of the Mouse Point Zone Substation exceeds the continuous rating of its firm capacity and is approaching the cyclic rating of the transformers. The zone substation assets are also approaching end of life. MainPower is currently investigating relocation to the Transpower Culverden GXP site. This upgrade project is to rebuild the zone substation either on or near the Culverden GXP site. The substation will be constructed at 66/22 kV, although initially operated at 33/22 kV. It is forecast that Transpower will replace the 220 kV/33 kV transformers at the GXP with 220/66 kV transformers around FY35. The timing of works will be dependent on load growth and whether other technologies, such as distributed generation, effectively reduce the region’s summer peaks.

| Hanmer Sub-Transmission Network Upgrade | |
|---|---|
| Expected Project Timing | FY23–FY26 |
| Strategic Drivers | System Growth, Security of Supply, Asset Replacement and Renewal |
| Business Case Required? | Yes |

*Table 6.14: Hanmer Sub-Transmission Network Upgrade*

The Hanmer Zone Substation does not currently meet MainPower's Security of Supply Standard of restoration within 45 minutes following a single sub-transmission failure. The existing overhead-line structures are approaching end of life and need replacement. The cost to replace and maintain the existing sub-transmission line and build a second sub-transmission circuit to achieve the full security of supply is very high, therefore this programme is targeted at the following:

- Hanmer sub-transmission line upgrade: Improve the resilience and reliability of the existing line with stronger conductor and structures. The line route and structure footings will also be reviewed to mitigate the impact of potential natural hazards where possible.
- Hanmer Zone Substation concept study and upgrade: The Hanmer Zone Substation peak load currently exceeds the peak rating of the second transformer, leaving part of the Hanmer region load at risk of prolonged outage following a fault. This project is to review the existing zone substation configuration, investigate options to improve security of supply for the Hanmer region and replace the 11 kV oil-filled switchgear that is reaching end of life.

Potential subdivision growth in the Hanmer region may impact on the scope and timing of this project; however, this is not currently confirmed.

### 6.8.2.4 Reinforcement Projects

| FY | Project Title | Description |
|---|---|---|
| FY23 | Amberley North Load Transfer | Extend and upgrade 11 kV lines in Georges Road, Waipara, to enable transfer of load from the Amberley Substation to the Mackenzies Road Substation. |
| FY24 | Amberley Beach Alternate Supply | Build 800 m of new line in Hursley Terrace Road to provide an alternative supply to Amberley Beach. |
| FY24 | Amberley Reserve Road Link/Feeder and Circuit Breaker | Construct a new line to supply the rural area north of Amberley independent of the urban supply to improve reliability and capacity for the Amberley urban area. |
| FY24 | Greta–Cheviot 22 kV Link | Improve security of supply to the Cheviot and Greta Zone Substations by extending the Cheviot South feeder 1,500 m to link to Greta feeder G31 to allow transfer of load between the two substations. |
| FY26 | Cheviot–Leader Upgrade | Improve security of supply of Cheviot and Leader by upgrading the 11 kV conductor between Parnassus and the Waiau East/West Rds. |
| FY26 | Hawarden–Mouse Point Link Upgrade | Install a voltage regulator and switches to enable increased remote load-transfer capacity between Hawarden and Culverden (Mouse Point Substation). |
| FY28 | Greta–Hawarden Link Upgrade | Install a voltage regulator and upgrade conductor in the Scargill Valley to increase transfer capacity between Greta and Waikari (Hawarden Zone Substation). |
| FY28 –FY31 | Mouse Point Feeder | Create a Mouse Point feeder to the Culverden township to provide security of supply for the existing Culverden South loads (P25 & P35 feeders) and increase transfer capacity to Hawarden to meet the Security of Supply Standard. |
| FY30 | Amberley Douglas Road Cable | Install a 300 mm cable down Douglas Road to improve security of supply for both Amberley and Amberley Beach. |
| FY31 | Culverden Constitution Road Link | Construct 3.2 km of new line to provide a mesh supply to the Mount Palm area, which requires significant capacity due to dairy in the area and currently has no alternate supply. |

*Table 6.15: Hurunui Area Reinforcement Projects*

## 6.8.3 Kaikōura Regional Overview

The Kaikōura area plan covers the region north of the Conway River to the Puhi Puhi Valley north of Kaikōura, and between the South Island's east coast and the Main Divide. The area extends north up the coast to Half Moon Bay. Kaikōura is the main township in the region.

Kaikōura is a significant tourist destination and a key stop-off point on SH1 for people travelling between Blenheim and Christchurch. Like Hanmer, the town is also a popular holiday location, particularly for Canterbury residents. Growth is dependent on the strength of the tourism industry. The area was severely affected by earthquake damage and associated access constraints. Future growth is uncertain. Kaikōura's isolated location on SH1 may make it a key charging location for EVs in the future.

The region is characterised by a mixture of narrow, rocky coastal margins, flat open plains, steep bushy valleys and rugged hill country. The flats are used for a range of farming activities, including dairying, without the intensive irrigation of other areas. Seasonal weather extremes, including snow, strong winds and rain can affect the region's quality of supply and access for repairs. Electricity demand is reasonably flat, with high winter loads balanced by increased visitor numbers in summer. Demand typically peaks on cold holiday weekends.

The Kaikōura area is normally supplied from the Culverden GXP at 66 kV, transitioning to 33 kV at Kaikōura as shown in Figure 6.7. The small coastal communities south of Peketā are supplied from the 33 kV and 66 kV interconnection between Kaikōura and the Waipara GXP.

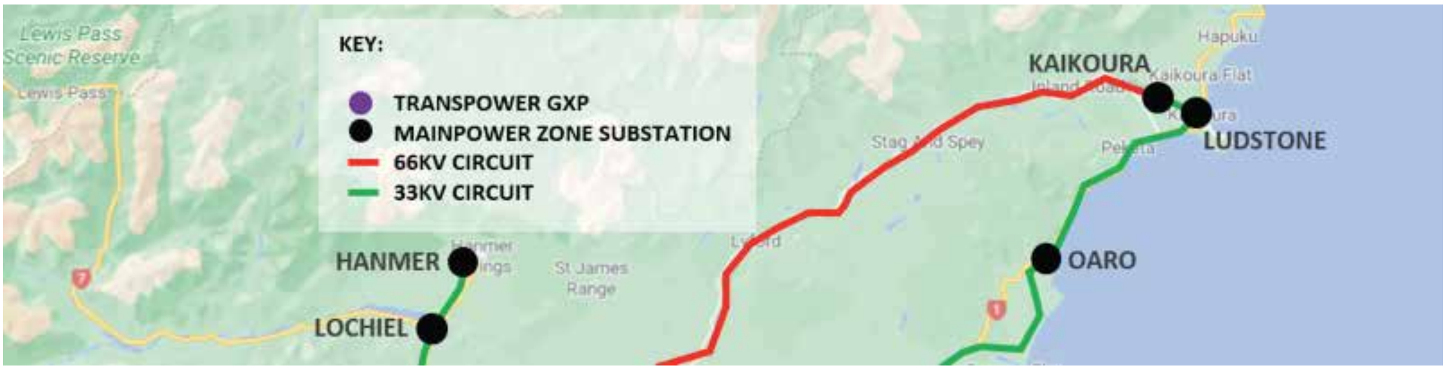



*Figure 6.7: Kaikōura Region Sub-transmission Network*

### 6.8.3.1 Demand Forecasts

Demand forecasts for the Kaikōura Zone Substations are shown in Table 6.16.

| Substation | Security Class | Class Capacity (MVA) | Demand Forecast (MVA) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| **Ludstone** | AA | 6 | 6.0 | 6.2 | 6.3 | 6.5 | 6.6 | 6.8 | 6.9 | 7.1 | 7.2 | 7.8 |
| **Oaro** | A1 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |

*Note.* Grey shading indicates peak demand is forecast to exceed current security-class capacity.

*Figure 6.16: Kaikōura Area Network Demand Forecasts*

### 6.8.3.2 Network Constraints

Major constraints affecting the Kaikōura area are provided in Table 6.17.

| Load Affected | Major Issues | Growth and Security Projects |
|---|---|---|
| Kaikōura township and surrounding rural region | The required 45-minute security of supply switching time for a sub-transmission fault cannot be met at peak load times. In addition, the backup N-1 capacity from Waipara GXP has reached full capacity. Growth is also likely to exceed the cyclic rating of the transformers by FY30 | • Upgrade of the existing 33 kV sub-transmission system from Cheviot to Oaro to 66 kV, FY21–FY23.<br>• Ludstone Zone Substation voltage support, FY25.<br>• MainPower is intending to utilise cyclic transformer ratings and load management to manage load until a project to rebuild the Ludstone Zone Substation at the Kaikōura 66/33 kV Substation site starts at the end of the planning period. |

*Figure 6.17: Kaikōura Area Network Constraints*

### 6.8.3.3 Major Projects

The tables below summarise the major growth and security projects planned for the Kaikōura area.

| Raramai Tunnel Realignment | |
|---|---|
| Expected Project Timing | FY23–FY24 |
| Strategic Drivers | Security of Supply, Asset Replacement and Renewal |
| Business Case Required? | Yes |

*Table 6.18: Raramai Tunnel Realignment*

MainPower's sub-transmission line between Oaro and Kaikōura, along the Kaikōura coast, was affected by the 2017 Kaikōura earthquake. Short-term repairs were performed on the line section that crosses over the Raramai tunnel; however, these require review and replacement to provide a long-term resilient solution for this section of the sub-transmission network.

| Cheviot to Oaro Sub-Transmission Line Upgrade | |
|---|---|
| Expected Project Timing | FY21–FY23 |
| Strategic Drivers | Security of Supply, System Growth |
| Business Case Required? | Yes |

*Table 6.19: Cheviot to Oaro Sub-Transmission Line Upgrade*

The line between Cheviot and Oaro is constructed at 66 kV but is currently operating at 33 kV. This project shifts the 66/33 kV transformer from Cheviot to Oaro, allowing the line to operate at 66 kV. Land has been purchased for the relocation of the Oaro Zone Substation to a new site where the new 66/33 kV transformer will be located.

| Ludstone Zone Substation Voltage Support | |
|---|---|
| Expected Project Timing | FY25 |
| Strategic Drivers | Security of Supply, Quality of Supply |
| Business Case Required? | Yes |

*Table 6.20: Ludstone Zone Substation Voltage Support*

The sub-transmission system between Culverden and Waipara is long and constrained by reactive voltage drop. This project is to add power factor correction at Ludstone Zone Substation to provide voltage support during high-load periods.

#### *6.8.3.4 Reinforcement Projects*

Demand forecasts for the Kaikōura Zone Substations are shown in Table 6.16.

| FY | Project Title | Description |
|---|---|---|
| FY24 –FY26 | Kaikōura Town Security Upgrades | Underground the existing overhead double circuit supplying the Kaikōura township with 300 mm cables to provide sufficient backup and more efficient load transfers between feeders. |

*Figure 6.21: Kaikōura Region Reinforcement Projects*

## 6.9 Network Development Programme Summary

The overall summary of the major, reinforcement and GXP projects for the 10-year planning period across all planning regions is summarised below. Several large projects create a "lumpy" major project expenditure, balanced by activity in minor works.

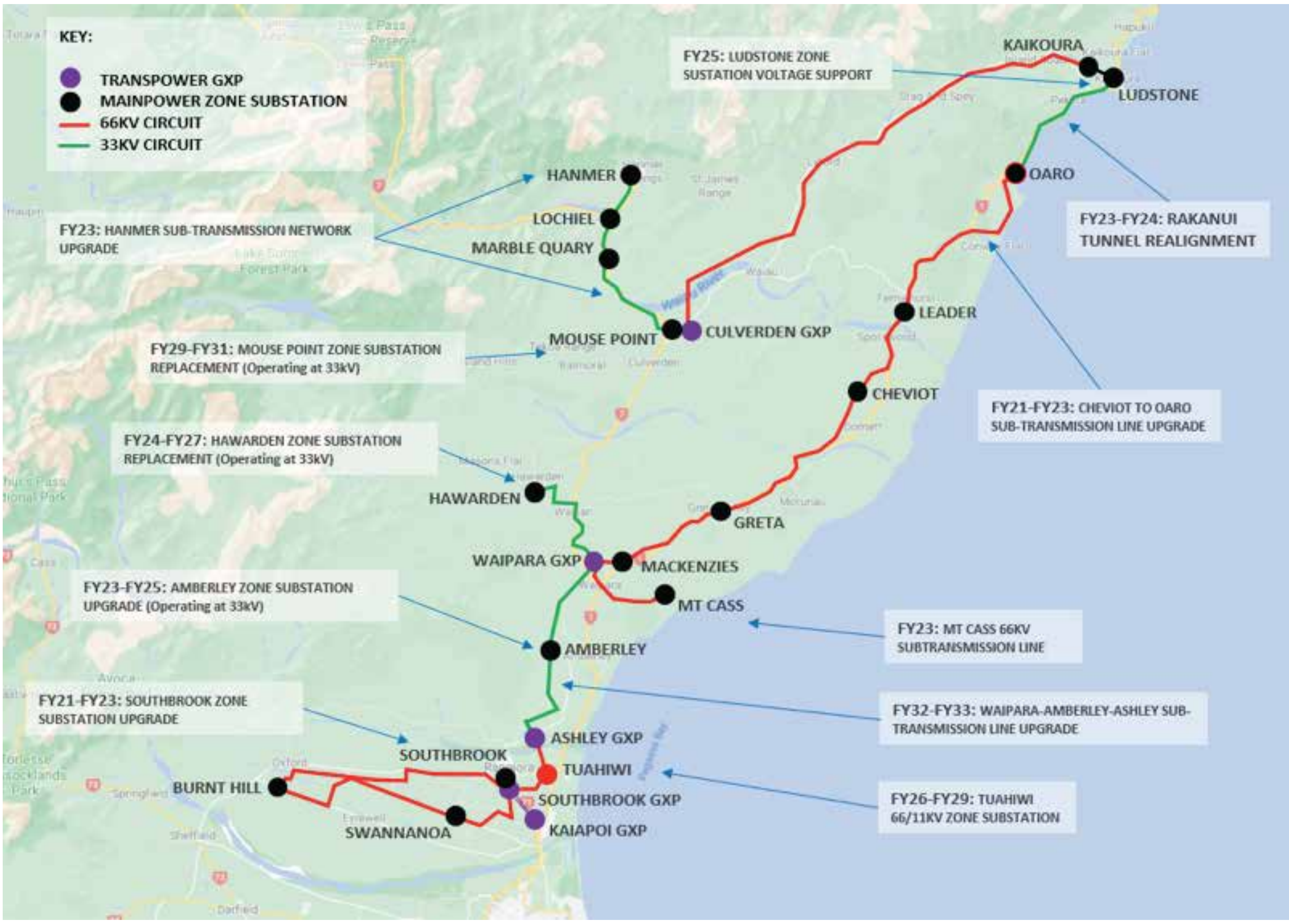



*Figure 6.8: 10-year AMP Projects*

## 6.9.1 Major Projects Summary

| Project/Programme | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
|---|---|---|---|---|---|---|---|---|---|---|
| Southbrook Zone Substation Upgrade | ■ | | | | | | | | | |
| Cheviot to Oaro Sub-transmission Line Upgrade | ■ | | | | | | | | | |
| Raramai Tunnel Realignment | ■ | ■ | | | | | | | | |
| Hanmer Sub-transmission Network Upgrade | ■ | ■ | ■ | ■ | | | | | | |
| Amberley Zone Substation Upgrade | ■ | ■ | ■ | | | | | | | |
| Hawarden Zone Substation Upgrade | | ■ | ■ | ■ | ■ | | | | | |
| Ludstone Zone Substation Voltage Support | | | ■ | | | | | | | |
| Tuahiwi Zone Substation | ■ | | | ■ | ■ | ■ | ■ | | | |
| Mouse Point Zone Substation Upgrade | | | | | | | ■ | ■ | ■ | |
| Kaikōura Zone Substation | | | | | | | | | | ■ |
| **MAJOR PROJECT EXPENDITURE ($000)** | **3,955** | **5,420** | **5,110** | **5,580** | **5,520** | **5,500** | **6,750** | **3,500** | **3,500** | **2,000** |

*Table 6.22: Major Projects Programme Summary*

## 6.9.2 Reinforcement Projects Summary

| Project/Programme | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
|---|---|---|---|---|---|---|---|---|---|---|
| BH, Swann, Sthbk ZS phase matching | ■ | | | | | | | | | |
| Kaiapoi – Island Rd upgrade | ■ | | | | ■ | | | | | |
| Kaiapoi Red Zone | ■ | | | | | | | | | |
| Amberley north load transfer | ■ | | | | | | | | | |
| Mandeville area voltage improvement | ■ | | | | | | | | | ■ |
| Fernside reconfig. Swann-SBK | ■ | | | | | | | | | |
| Reinforce X52 Burnt Hill | | ■ | | | | | | | | |
| Reinforce SW63 & 66 Stage 2 | | ■ | | | | | | | | |
| Amberley Beach alternative supply | | ■ | | | | | | | | |
| Amberley Reserve Rd link/feeder & CB | | ■ | | | | | | | | |
| Kaikōura town security upgrades | | ■ | | ■ | | | | | | |
| Greta – Cheviot 22kV link | | ■ | ■ | ■ | | | | | | |
| Automate existing RMUs | | ■ | ■ | ■ | ■ | | | | | |
| East Belt – UG & Railway link | | | ■ | | | | | ■ | | |
| Marsh Rd feeder creation | | | ■ | | | | | | | |
| Kaiapoi – K7 feeder split | | | ■ | | | | | | | |
| Loburn Barkers Rd links | | | ■ | | | | | | | |
| Birch Hill link stages 1 & 2 | | | ■ | | ■ | | | | | |
| New Loburn feeder | | | | ■ | | | | | | |
| Cheviot – Leader upgrade | | | | ■ | | | | | | |
| Mouse Pt – Hawarden link | | | | ■ | | | | | | |

| Project/Programme | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
|---|---|---|---|---|---|---|---|---|---|---|
| Kaiapoi 8376 to S11 link | | | | | ■ | | | | | |
| Burnt Hill X53–X56 link | | | | | ■ | | | | | |
| 22kV upgrades | | | | | ■ | | | | ■ | ■ |
| Kaiapoi Stone St UG | | | | | ■ | ■ | | | ■ | |
| Leithfield Beach – Mays Rd link | | | | | | ■ | | | | |
| Greta – Hawarden upgrade 1 MW | | | | | | ■ | | | | |
| Mouse Pt new Cable Feeder Stage 1 & 2 | | | | | | ■ | ■ | ■ | | |
| Rangiora western OH feeder | | | | | | ■ | ■ | ■ | | |
| Tuahiwi to Rangiora feeder | | | | | ■ | | ■ | ■ | ■ | |
| West Belt UG | | | | | ■ | | ■ | ■ | | |
| Amberley Y33 Douglas Rd cable | | | | | ■ | | | ■ | | |
| Oxford German Rd link + 2x Entec | | | | | ■ | | | ■ | ■ | |
| Culverden Constitution Rd link | | | | | ■ | | | | ■ | |
| Burnt Hill X53–X55 link | | | | | | | | | ■ | ■ |
| Network automation | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Network intelligence – Network monitoring | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Unscheduled reinforcement | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| **NETWORK REINFORCEMENT EXPENDITURE ($000)** | **2,977** | **2,450** | **2,500** | **2,600** | **2,600** | **2,300** | **2,500** | **2,750** | **2,200** | **2,216** |

*Table 6.23: Reinforcement Projects Budget Summary*

### 6.9.3 Alternatives and Deferred Investment

Projects presented within the AMP are subjected to internal approval through MainPower's business case approval process. Part of the approval process includes evaluating the projects against alternatives, demand-side management and deferral.

## 6.10 Distributed Generation Policies

Our policies on distributed generation are located on our website (mainpower.co.nz/get-connected). These set out the requirements for connecting distributed generation (of less than 10 kW and greater than 10 kW) and general safety requirements. We also comply with Part 6 of the Electricity Industry Participation Code in this respect.

## 6.11 Uneconomic Lines

The remote nature of parts of our network results in network assets that test the bounds of economic investment. As part of our network development-planning processes, we will identify remote uneconomic supplies and explore, through a consultation process with consumers and market participants, alternative solutions for supplying these locations when the present assets are due for replacement.

In this reporting period MainPower intends to identify sub-economic lines and facilitate a market response through a Request for Price process to identify non-network solutions that are more sustainable, with the intent to decommission sub-economic lines.

# 6.12 Non-Network Solutions

## 6.12.1 Load Control

We use ripple control to manage peak demand, alleviate network constraints, defer capital investment and reduce transmission charges. Irrigation load can also be controlled during contingencies or at times of system constraints. Other initiatives under consideration are tariff restructuring to encourage night load.

The introduction of the Upper South Island Load Control system has resulted in a flat load profile for the upper South Island transmission system. Additional controls are being used to ensure that individual GXP and zone substation peaks are managed. In particular, the Southbrook Zone Substation load is actively managed through winter peak loads to maintain security levels (to achieve N-1 loading whenever possible). The Kaikōura load is also controlled during maintenance outages on the Culverden–Kaikōura 66 kV line. At these times, our 66 kV/33 kV coastal backup line is unable to transmit the normal daily peaks.

## 6.12.2 Demand-Side Management

Demand-side management involves measures to manage power system load and optimise its use. In 2004, MainPower embarked on a programme to implement several demand-side management initiatives. To date, the benefits of implementing this programme have included:

- Reduction in peak loads on the network;
- Reduction in costs associated with Transpower peak charges and deferred network capital investment;
- Providing consumers with opportunities to reduce their energy costs;
- Demonstrating a commitment to energy efficiency; and
- Raised awareness of MainPower in the community.

## 6.12.3 Distributed Energy Resources

Aligned with MainPower's Demand-Side Management scheme, "non-network" solutions such as distributed energy resources (solar, storage, energy efficiency) can help to offset or delay network growth expenditure.

The Amuri area has already been identified as having demand exceeding MainPower's Security of Supply Standard, and the deployment of renewable resources could offset this constraint.

In this reporting period, MainPower intends to facilitate a market response through a Request for Price process to identify non-network solutions that are more sustainable, with the intent to alleviate security-of-supply risk in the Amuri area.

# 7. MAINPOWER'S ASSETS

This section provides an overview of MainPower's lifecycle asset management approach for our asset portfolio. Our whole-of-life approach is governed by the Asset Management Policy outlined in Section Two of this document.

We recognise the need to migrate from traditional, age-based replacement and reactive renewals of assets to a holistic approach to portfolio management. We have implemented a forecasting method of asset replacement that is more prescribed through the adoption of the EEA Asset Health Indicator (AHI) guide to quantify and inform our replacements. The models utilise condition data collected from inspections and maintenance programmes, engineering expertise and asset information to optimise replacement. We consider this planned approach more sustainable for managing work programmes, as well as more effective in reducing outages and optimising our asset portfolios. In 2021 we started the journey to further improve on this by initiating a project to implement CBRM models and adopting the EEA Asset Criticality Indicator guide.

Our asset management drivers are informed by several reviews and consumer consultations. This includes the service-level requirements determined through consumer engagement, environmental initiatives, compliance requirements and health and safety considerations.

MainPower's network assets, discussed in the next section and shown in Table 7.1, are grouped into eight portfolios to reflect the way we manage these assets.

## 7.1 Asset Portfolio

Asset portfolio management is an integral part of MainPower's asset management system. It defines the maintenance and renewal programmes for each of the asset fleets to help achieve our asset management objectives. Our goal is to deliver acceptable electricity distribution network service levels, ensure assets are safe and fit for purpose, and minimise the total cost of ownership.

| Asset Portfolio | Asset Fleet |
|---|---|
| **Overhead Lines** | Poles and pole structures |
| | Conductors |
| **Switchgear** | Circuit breakers, reclosers and sectionalisers |
| | Ring main units (RMUs) |
| | Air break switches |
| | Low-voltage switchgear |
| **Transformers** | Zone transformer |
| | Ground-mounted distribution transformers |
| | Pole-mounted distribution transformers |
| | Regulators |
| **Zone Substations** | Zone substations |
| | Switching substations |
| **Underground Assets** | Low-voltage underground cables |
| | High-voltage underground cables |
| | Low-voltage service boxes |
| | Low-voltage link boxes |
| **Vegetation Management** | Vegetation |

| Asset Portfolio | Asset Fleet |
|---|---|
| **Secondary Systems** | DC systems |
| | Protection systems |
| | Earthing systems |
| | Communications/SCADA |
| | Load control/ripple plant |
| **Property** | Electricity distribution network buildings – distribution |
| | kiosks |
| | Non-electricity distribution network buildings |

*Table 7.1: Portfolio and Asset Fleet Mapping*

For each asset portfolio, we outline the key information that informs our asset management decisions. The key points covered are:

- High-level objectives;
- Fleet statistics, including asset quantities and age profiles;
- Fleet health, condition, failure modes and risks;
- Preventative maintenance and inspection tasks; and
- Replacement (renewal) strategies.

## 7.2 Overhead Lines

MainPower has approximately 56,000 poles in service carrying over 4,000 km of high- and low-voltage overhead conductor. Figure 7.1 shows the MainPower distribution network, giving an overall geographic view.

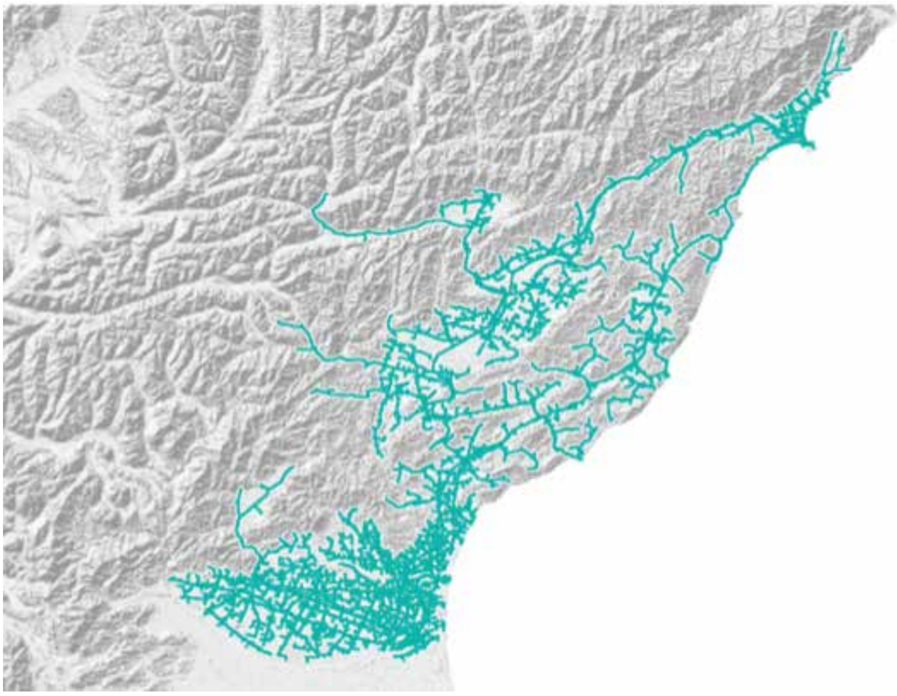


*Figure 7.1: MainPower's Electricity Distribution Network's Geographical Distribution*

MainPower's pole inspection and renewal programme aims to proactively minimise the risks from pole failures while balancing cost. As most of our overhead electricity distribution network is accessible to the public, managing our overhead structure assets is a key priority to help ensure public safety.

## 7.2.1 Poles and Pole Structures

MainPower has a large range of pole types, including:

- Hardwood (pre mid-1970s);
- Larch poles impregnated with creosote (late 1950s to 1960s);
- Treated pine (post mid-1970s); and
- Concrete (post 1960s).

The main pole types used today are H5-treated radiata pine and pre-stressed concrete.

There are approximately 9,000 concrete poles in use on the network today, including reinforced and pre-stressed concrete. Reinforced concrete poles contain reinforcing steel bars covered by concrete; these were used regularly from the 1960s to 1980s. Reinforced concrete poles were produced by many different manufacturers, resulting in differences in design, manufacturing standards and material quality. This has caused differing lifecycle performances, especially in our coastal areas. Most new poles installed today are pre-stressed and are designed and manufactured to meet stringent structural standards, with a design life of 80 years.

### *7.2.1.1 Maintenance*

Maintenance is based on a condition-based assessment carried out on a five-year rotation. The inspections are governed by MainPower's Overhead Inspection and Maintenance Standard, MPNZ 393S049. The inspections cover pole condition and pole attachments such as crossarms, insulators and conductors. During the next 12 months, we are undertaking a review of our pole-testing methodology to ensure it remains fit for purpose and in line with industry standards.

A summary of the overhead inspection and maintenance programme, including crossarms and conductors, is provided in Table 7.2.

### *7.2.1.2 Replacement and Disposal*

MainPower employs a condition-based replacement programme resulting from data collected during the overhead five-yearly inspection programme. Pole replacements are also triggered by the need to upgrade conductors because of condition or capacity, or to improve the environmental resilience of the line structure. As part of conductor upgrade projects, we identify poles that are in poor condition and coordinate their replacement alongside the conductor upgrade to ensure efficient delivery.

## 7.2.2 Crossarms and Insulators

Crossarms support and space the insulators that support the conductor on an overhead-line structure. A crossarm assembly is made of one or more crossarms and a range of subcomponents, such as insulators, high-voltage fuses, surge arrestors, armour rods, binders and jumpers, and arm straps. MainPower uses hardwood timber crossarms that have a nominal asset life of 35 years, and insulators including porcelain, glass and polymer types.

Based on ongoing monitoring, the number of defects of pole-top equipment is found to be increasing steadily, in part due to the increased number of ageing assets, resulting in equipment that is more susceptible to rot and electrical tracking.

### *7.2.2.1 Maintenance*

Inspection and maintenance of crossarms is included in MainPower's Overhead Inspection and Maintenance Standard, MPNZ 393S049, summarised in Table 7.2. Thermal imaging and acoustic testing are currently being investigated, to consider incorporating them into the inspection.

To minimise the steady increase of the defects of pole-top equipment, a line tightening programme is initiated to reduce any potential increase of defective failures.

### *7.2.2.2 Replacement and Disposal*

A pole-top equipment replacement is initiated to address the potential fire risk due to failure. The programme is delivered to replace them individually and in conjunction with the pole-replacement programme, through either coordinating works during outages, or replacing entire structures if required because of a combination of poor-condition elements.

## 7.2.3 Conductors

MainPower has a wide range of conductor types spread over three main categories:

- Sub-transmission overhead conductors;
- High-voltage distribution overhead conductors; and
- Low-voltage overhead conductors.

The type of conductors used is influenced by economic, location, environmental and performance factors. Owing to the rural nature of our network, overhead conductors are a significant component, and we are working to better understand this asset fleet and its end-of-life condition indicators.

Many rural areas still have old bare or covered copper conductor in service. Covered copper conductor in some areas is starting to show signs of insulation peeling and fraying. There are also sections where the conductor has been re-joined over the years, using "Sleeves", "Fargos" or "Twist Joints".

### *7.2.3.1 Maintenance*

Inspection and maintenance of conductors is included in MainPower's Overhead Inspection and Maintenance Standard, MPNZ 393S049, summarised in Table 7.2.

### *7.2.3.2 Replacement and Disposal*

MainPower does not currently have a scheduled replacement programme in place for conductors; however, we are working to better understand the condition of this asset fleet during the next 12 months, which may result in a future scheduled replacement programme based on condition inspection.

MainPower's overhead inspection and maintenance is summarised in Table 7.2 for poles, conductors, crossarms and line hardware.

| Component | Maintenance/Renewal Category | Action |
|---|---|---|
| Poles | Asset inspection/condition assessment | Five-yearly pole test and overhead inspection programme |
| | Routine and preventative | Maintenance based on condition assessment data |
| | Refurbishment and renewal | Condition-based, from data collected during the inspection programme |
| Conductors | Asset inspection/condition assessment | Five-yearly overhead inspection for corrosion, binder fatigue and incorrect sag |
| | Routine and preventative | Maintenance based on condition assessment data |
| | Refurbishment and renewal | Replacement based on condition assessment data |
| Crossarms | Asset inspection/condition assessment | Five-yearly inspection as part of the overhead inspection programme |
| | Routine and preventative | Maintenance based on condition assessment data |
| | Refurbishment and renewal | Replacement based on condition assessment data from the inspection programme |
| Line Hardware | Asset inspection/condition assessment | Five-yearly inspection as part of the overhead inspection programme |
| | Routine and preventative | Maintenance based on condition assessment data |
| | Refurbishment and renewal | Replacement based on condition assessment data |

*Table 7.2: Overhead Electricity Distribution Network Inspection Matrix*

# 7.3 Switchgear

Switchgear is used for switching, isolating and protecting the electricity distribution network. This section covers the following types of switchgear:

- Circuit breakers, reclosers and sectionalisers;
- RMUs;
- Pole-mounted switches; and
- Low-voltage switchgear.

## 7.3.1 Circuit Breakers, Reclosers and Sectionalisers

MainPower's circuit breakers, reclosers and sectionalisers provide protection and the isolation of faults and allow safe and efficient switching of the electricity network. Circuit breakers are generally located at zone substations. Reclosers and sectionalisers are located on overhead-line structures.

Figure 7.2 shows the number and age of circuit breakers, reclosers and sectionalisers (including spares).

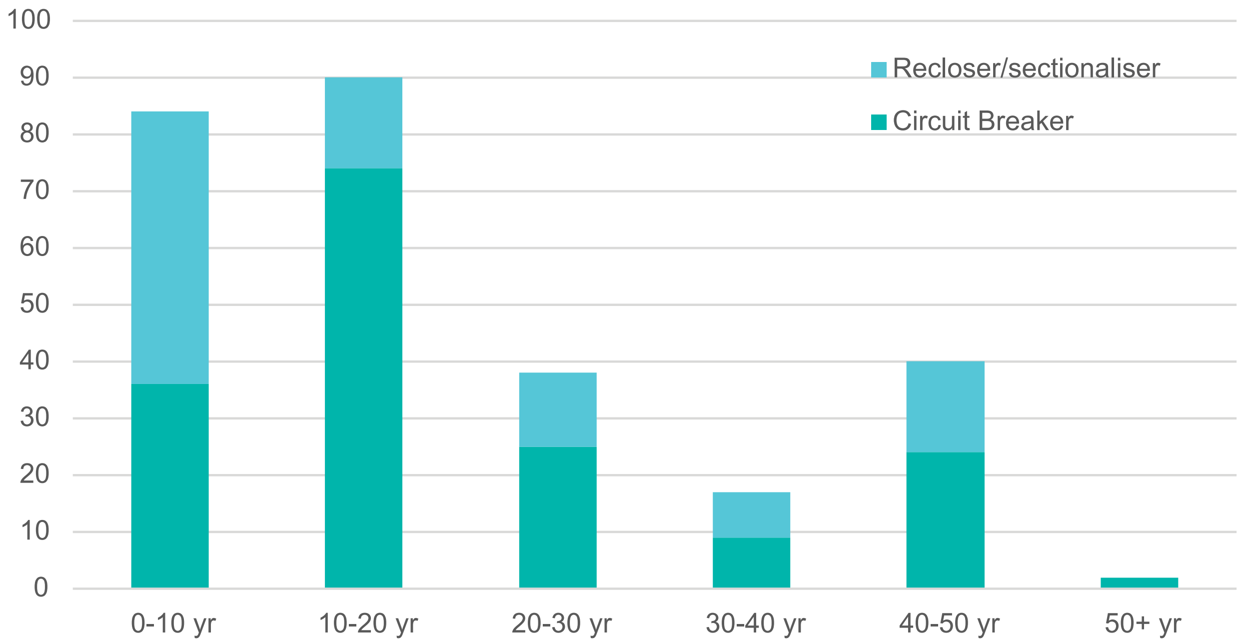



*Figure 7.2: Switchgear Age Profile*

MainPower's older circuit breakers are predominantly oil filled (bulk or minimum oil). Circuit breakers that are 25 years old and younger generally use gas or a vacuum as the interruption medium and insulation. A model based upon the EEA AHI guide has been developed for all circuit breakers (excluding reclosers and sectionalises), shown in Figure 7.3.

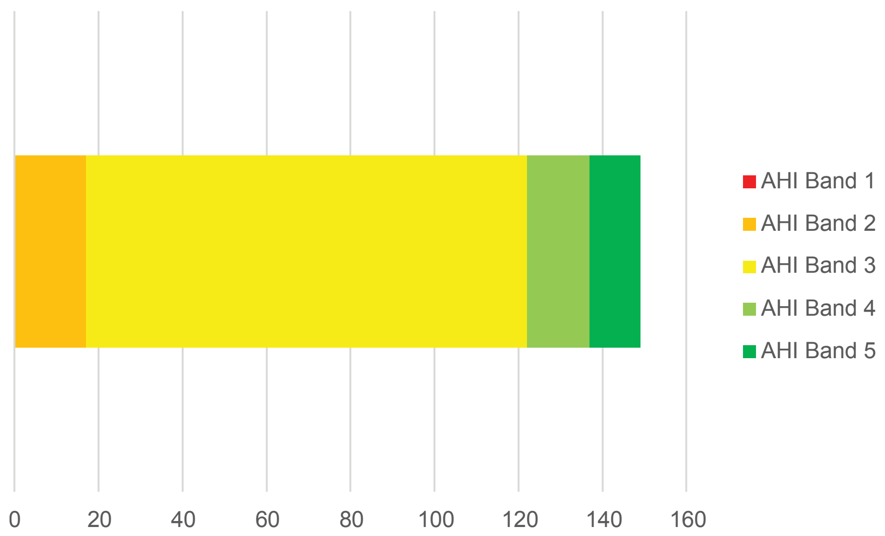



*Figure 7.3: Circuit Breaker Current Asset Health Profile*

The general guide is that:

- H1 is at end of serviceable life and immediate intervention is required;
- H2 likely requires intervention as end-of-life drivers for replacement are present; and
- H3, H4 and H5 indicate good condition but still require regular inspection and maintenance.

Figure 7.4 shows the same information but includes the relevant criticality of each asset. This information gives a clearer picture of the overall risk and importance of the asset.

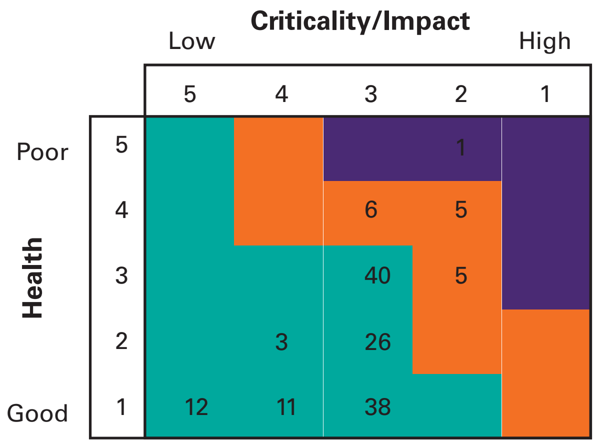



*Figure 7.4: Circuit Breaker Criticality/Health Matrix*

## *7.3.1.1 Maintenance*

Routine maintenance is important to ensure satisfactory operation of the switchgear throughout its intended serviceable life. Maintenance involves visual inspections to identify units or structures in poor condition, partial discharge and infrared testing to locate units showing signs of deterioration, and full servicing to ensure satisfactory operation of the equipment.

Siemens Fusesaver sectionalisers are also interrogated, via a Bluetooth connection, for information that includes the state of the internal battery and operation count. Table 7.3 summarises the maintenance types and frequencies for the different types of switchgear.

| Type | Frequency |
|---|---|
| Circuit breakers | • 3 monthly – Visual inspection<br>• 12 monthly – Partial discharge test + infrared test<br>• 3 yearly – Full service (including clean and oil change if required) |
| Reclosers and sectionalisers (sub-transmission and distribution) | • 12 monthly – Visual inspection<br>• 2.5 yearly – Infrared scan<br>• 10 yearly – Full service (including clean and oil change if required) |

*Table 7.3: Switchgear Maintenance Programme Summary*

## *7.3.1.2 Replacement and Disposal*

Scheduled replacement is based on asset condition and health, informed by MainPower's asset health model. This is combined with an asset criticality score and ranks the switchgear in order of priority for replacement. As a result, MainPower's replacement programme for this asset fleet is focused on older oil-filled switchgear, including South Wales circuit breakers and McGraw Edison reclosers.

MainPower's key drivers for this replacement programme are minimising risk and improving network reliability, as well as operational control of the network. We expect unscheduled replacement works to reduce during the next five years as the maintenance and replacement programme matures.

## 7.3.2 Ring Main Units

As shown in Figure 7.5, MainPower's RMUs are:

- Cast resin (1960s through to early 2000s);
- Oil filled (1960s through to early 2000s);
- Vacuum (post 2000); and
- SF6 (post 2000).

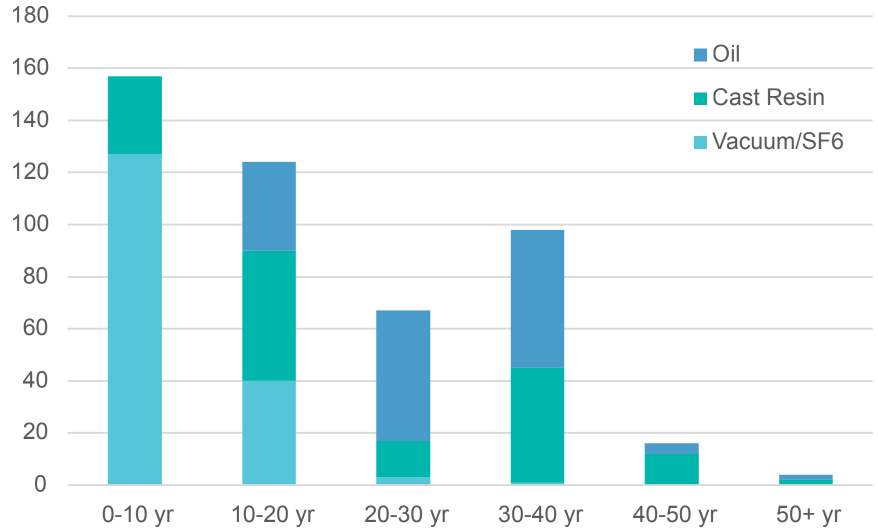



*Figure 7.5: RMU Quantities and Age Profile*

MainPower's older oil-filled RMUs currently have operational restrictions to reduce any inherent risk, and our replacement programme is targeting these assets to remove them from the network. A MainPower RMU asset health model has been developed to help optimise the replacement and maintenance programme for this asset fleet, as shown in Figure 7.6.

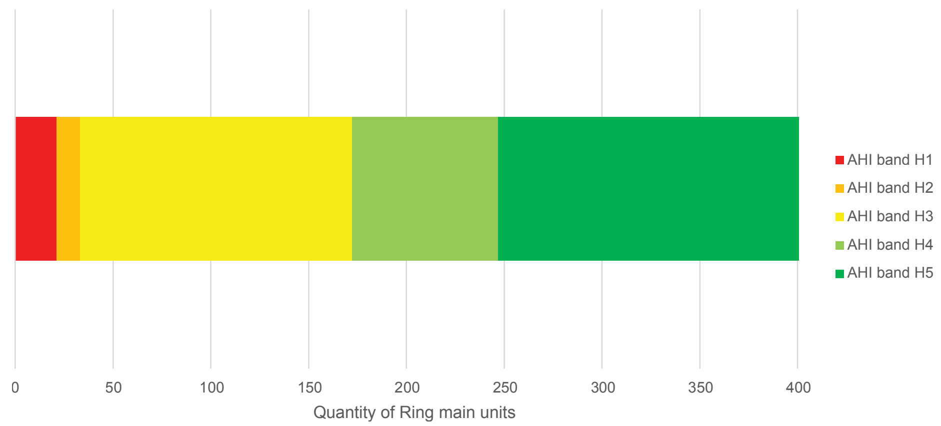



*Figure 7.6: RMU Current Asset Health*

### *7.3.2.1 Maintenance*

Regular maintenance is important to ensure the safe and efficient operation of RMUs. Oil-filled and cast resin types are typically more expensive to maintain and service than the vacuum and SF6 types. SF6 units are checked regularly for gas levels to ensure there are no gas leaks.

Table 7.4 shows the maintenance types and frequencies for the different types of units.

| Type | Frequency |
|---|---|
| Oil filled | • 12 monthly – Inspection + partial discharge test<br>• 5 yearly – Service (including oil change) + infrared test |
| Cast resin | • 12 monthly – Inspection + partial discharge test + infrared test<br>• 5 yearly – Service (including a full clean of contacts) |
| Vacuum/SF6 | • 12 monthly – Inspection + partial discharge test<br>• 5 yearly – Service + infrared test |
| All | • Real time – Indication including SF6 gas pressure alarm, operation count (where available) |

*Table 7.4: Switchgear Inspection and Maintenance Summary*

### *7.3.2.2 Replacement and Disposal*

MainPower's RMU replacement programme is targeting the units with a low health score. In the medium to long-term, it is expected that approximately 10 units will be replaced per year. These target units are imposed with operation restrictions and do not meet MainPower's long-term safety requirement.

## 7.3.3 Pole-Mounted Switches

Pole-mounted switches are used from 11 kV up to 66 kV across the MainPower network, with an extensive range of makes and models, namely:

- Canterbury Engineering Type (1950s to 1980s);
- Dulmison, Electropar and ABB (1980s to present); and
- Entec Fully Enclosed Vacuum Break (present).

Most historical pole-mounted switches are air break designs, with an increasing number of vacuum switches. The vacuum break switches have a good load-breaking ability, in addition to providing remote control and indication, helping to improve network visibility and providing opportunity for increased automation. Figure 7.7 gives the age profile of the pole-mounted switches.

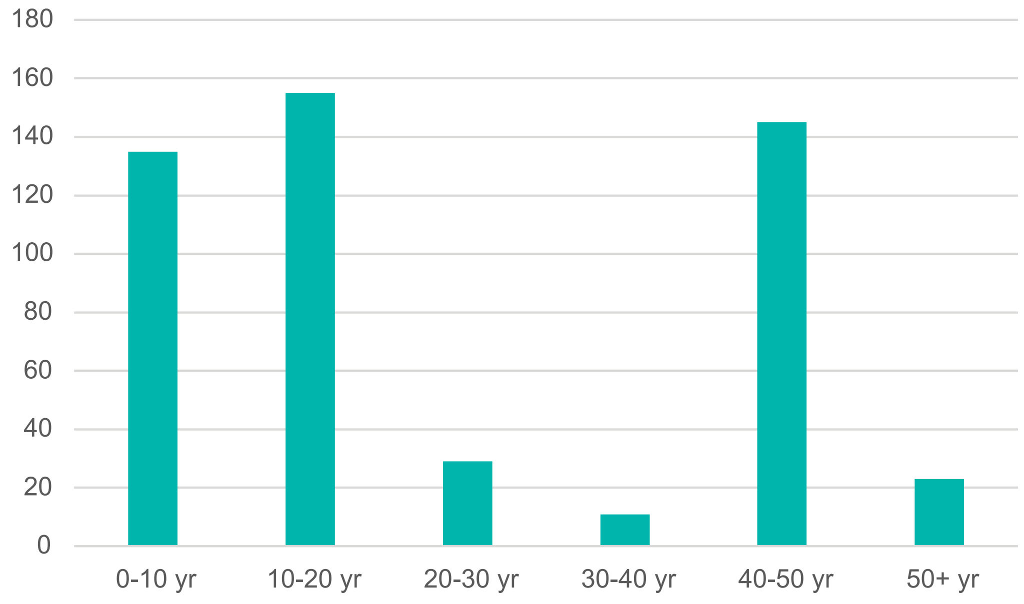



*Figure 7.7: Pole-Mounted Switch Quantities and Age Profiles*

The mechanisms on air break switches are prone to sticking or seizing if not operated or maintained for extended periods of time. This can cause unexpected delays during operation and further damage to the switch if it does not open or close correctly. This is addressed through a regular inspection and maintenance programme, as outlined below.

#### 7.3.3.1 Maintenance

Pole-mounted switches are maintained every five years. This includes a condition assessment of the switch, which is combined with inspection and asset data to inform the replacement programme (see Table 7.5).

| Type | Frequency |
|---|---|
| Pole-mounted switches | 5 yearly – Visual inspection + full service + infrared test to identify hotspots |

*Table 7.5: Pole-Mounted Switchgear Inspection and Maintenance Summary*

#### 7.3.3.2 Replacement and Disposal

A replacement programme is in place to replace the older switches, prioritised through asset inspection data and observed asset reliability information. The implementation of the ADMS will enable more accurate collection of switch operation frequency and condition data from visual inspections, which will feed into an asset health replacement model to better prioritise the programme.

### 7.3.4 Low-Voltage Switchgear

There are a range of different types of low-voltage switchgear on MainPower's network, the main types being:

- Exposed (skeleton) panels;
- D&S fused switches;
- Terasaki circuit breakers;
- ABB Fastline (SLK) fuse gear; and
- DIN-style fused switches (current type for new installations).

There is currently limited data in our asset database regarding quantities and types of low-voltage switchgear. MainPower has initiated an inspection programme to collect asset attribute and condition information. The known issues for the switchgear types outlined above are shown in Table 7.6.

| Low-Voltage Switchgear Type | Known Issues/Defects |
|---|---|
| Exposed (skeleton) panels | • Porcelain fuse handles, which can be the cause of localised heating<br>• Exposed bus-work |
| D&S fused switches | • Incomplete switching risk |
| Terasaki circuit breakers | • Incomplete switching risk |
| ABB Fastline (SLK) fuse gear | • Localised heating due to poor cable terminations |
| DIN-style fused switches | • Localised heating due to poor cable or fuse terminations |

*Table 7.6: Low-Voltage Switchgear Common Defects*

#### 7.3.4.2 Maintenance

A visual inspection every 12 months is used to identify any hotspots and units in poor condition, as well as operational issues (see Table 7.7). Any defects are investigated, with the condition and criticality of the switchgear used to either prioritise corrective maintenance or schedule replacement.

| Type | Frequency |
|---|---|
| Low-voltage switchgear | 12 monthly – Visual inspection + infrared scan + condition assessment |

*Table 7.7: Low-Voltage Switchgear Inspection Summary*

#### 7.3.3.2 Replacement and Disposal

Because of the lack of asset data, replacement of low-voltage switchgear is mainly reactive and generally initiated from the electricity distribution network defect system. When collection of the type and condition of switchgear is completed, as mentioned above, a scheduled replacement programme will be created to systematically replace the older, less reliable units. The units most likely to be prioritised for replacement will be the exposed panels, D&S fused switchgear and Terasaki circuit breakers, owing to their issues.

# 7.4 Transformers

The sub-categories and quantities of MainPower's transformers are summarised in Table 7.8.

| Transformer Fleet | Quantity |
|---|---|
| Power transformers | 26 |
| Distribution transformers | 8,339 |
| Voltage regulators | 22 |

*Table 7.8: MainPower's Transformers*

## 7.4.1 Power Transformers

MainPower's Zone Substation power transformers transform sub-transmission voltages of 66 kV or 33 kV down to distribution voltages of 11 kV, 22 kV or 400 V. Their power ratings range from 0.3 kVA for isolated rural supplies up to 40 MVA within the densely populated parts of the network. MainPower also has five power transformers held as strategic spares. These are surplus units, typically made available from network upgrades, and are held to support network resilience and emergency responses.

MainPower uses transformer condition analysis and diagnostic tests to optimise management of its power transformer fleet. The age profile of the in-service transformers is shown in Figure 7.8. The power transformer fleet has a typical nominal life of 45 years; however, this can vary significantly, depending on the load and operating conditions.

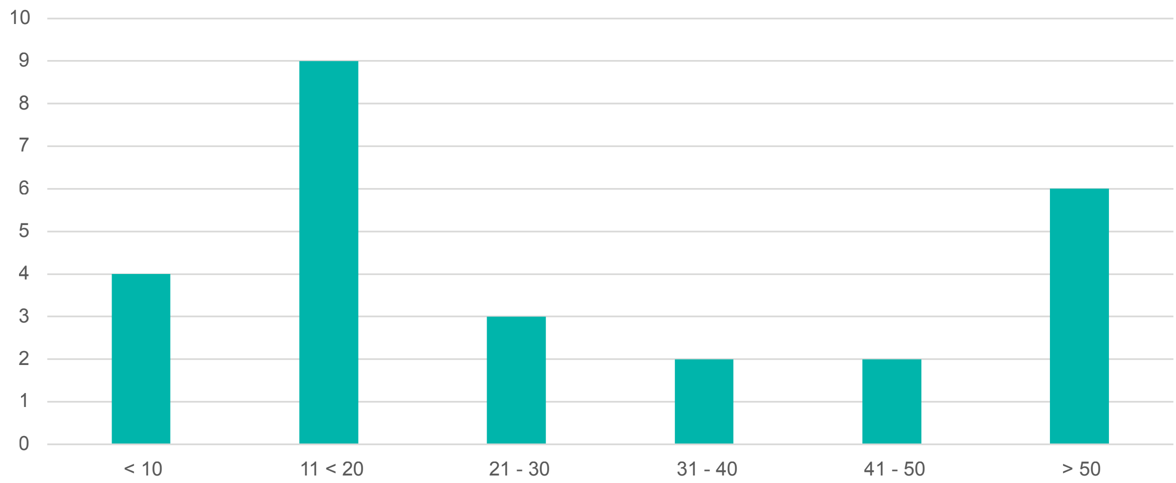



*Figure 7.8: Power Transformer Age Profile*

The power transformer fleet is managed using MainPower's Power Transformer AHI Model. The model was improved in 2019, resulting in a realignment of some transformers across categories, with three units moving out of Band 4 into Band 5, and one unit moving from Band 4 to Band 3, giving a better representation of the asset fleet health (see Figure 7.9).

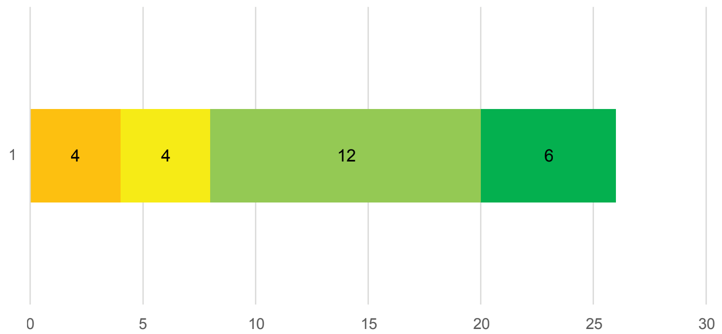



*Figure 7.9: Power Transformer Current Asset Health*

Three of the units with the lowest AHI scores are in the 51- to 60-year age bracket and have end-of-life indicators showing they are likely to have less than 10 years of life remaining. The other low-scoring unit on the AHI Model is in the 41- to 50-year age bracket. The remaining units are showing no major defects and are ageing in accordance with their typical lifespans and loadings.

### 7.4.1.1 Maintenance

Power transformers are frequently inspected as part of MainPower's three-monthly zone substation inspections, in addition to specific diagnostic testing (see Table 7.9). Dissolved gas analysis is carried out annually, with the strategic spare transformers included in the annual dissolved gas analysis to check their ongoing suitability for service.

| Type | Frequency |
|---|---|
| Power transformers | 3 monthly – Visual inspection as part of zone substation inspection schedule |
| | 12 monthly – Dissolved gas analysis |
| | 12 monthly – Thermographic and acoustic partial discharge tests |
| | 3 yearly – Major service, including tap-changer service, electrical testing of transformer and accessories |

*Table 7.9: Power Transformer Inspection and Maintenance Summary*

Oil treatment for moisture and acidity have been carried out historically, and this has been found to affect the chemical tracers for ageing. This was suspended in 2019 to enable dissolved gas analysis results that are more accurate.

### 7.4.1.2 Replacement and Disposal

No immediate replacements are planned for the current financial year. Close monitoring of the ageing trends and paper strength on the three units showing end-of-life indicators is continuing. The timing for replacement will be coordinated with planned 66 kV network upgrades to maximise the asset life and optimise investment.

### 7.4.2 Distribution Transformers

MainPower has more than 8,300 distribution transformers in service, with approximately 85% pole mounted and the remaining units ground mounted either in kiosk substations or as standalone units. These transformers supply end users with single-phase 230 V or three-phase 400 V. The age profile of these is shown in Figure 7.10.
Failure modes that drive distribution transformer replacement are:

- Oil leaks;
- Significant rust; and
- Electrical failure.

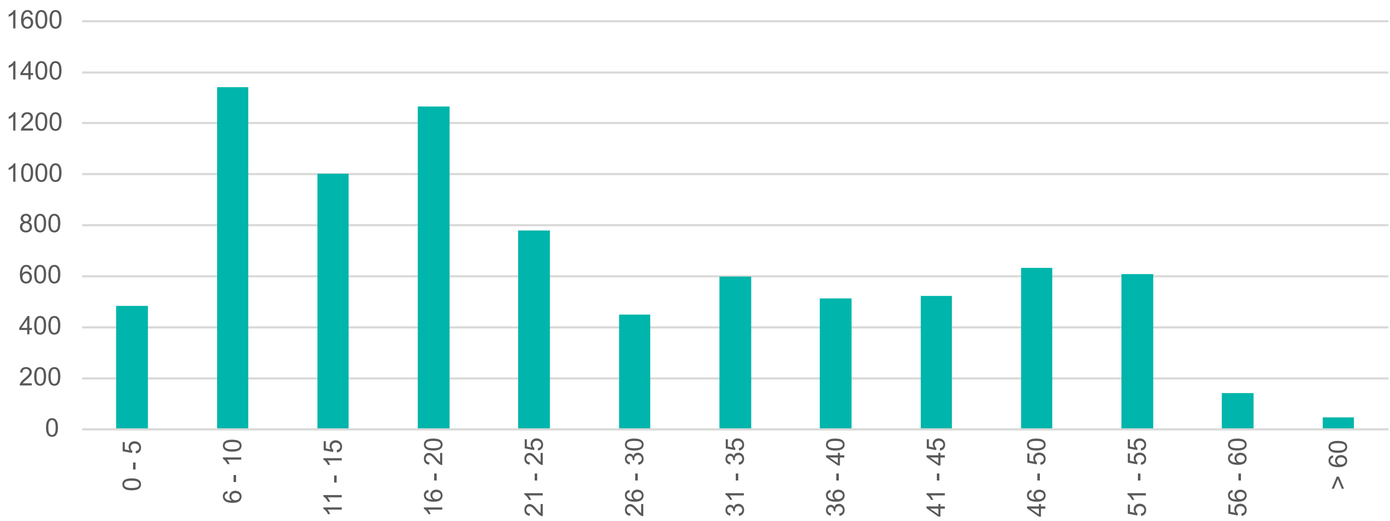



*Figure 7.10: Distribution Transformer Age Profile*

## 7.4.3 Ground-Mounted Distribution Transformers

MainPower operates approximately 800 ground-mounted distribution transformers. All units are mineral oil filled. The ratings, quantities and age profiles are summarised in Table 7.10 and Figure 7.11.

| Rating | Number of Transformers | % of Total |
|---|---|---|
| > 15 and ≤ 30 kVA | 18 | 1% |
| > 30 and ≤ 100 kVA | 552 | 41% |
| > 100 and ≤ 500 kVA | 691 | 52% |
| > 500 kVA | 81 | 6% |
| **Total** | **1,342** | **100%** |

*Table 7.10: Ground-Mounted Distribution Transformers – Quantities*


*Figure 7.11: Ground-Mounted Distribution Transformers – Age Profiles*

### *7.4.3.1 Maintenance*

Ground-mounted distribution transformers are inspected on both an annual and a five-yearly cycle (see Table 7.11). Oil samples are taken for analysis on units over 500 kVA on a five-yearly basis owing to the size and criticality of these units.

| Type | Frequency |
|---|---|
| Ground-mounted transformers | 12 monthly – General external condition assessment and labelling |
| | Five yearly – Full visual check of all components and testing of the earthing systems |

*Table 7.11: Ground-Mounted Transformer Inspection and Maintenance Summary*

### *7.4.3.2 Replacement and Disposal*

Ground-mounted transformers are replaced as they meet end-of-life criteria, informed by the inspection programme and reported defects. Scrap units are drained of oil and then sold to approved scrap dealers. Used oil is stockpiled until enough volumes are accumulated, and then it is disposed of using approved used-oil dealers.

## 7.4.4 Pole-Mounted Distribution Transformers

MainPower operates approximately 7,000 pole-mounted distribution transformers. All units are mineral oil filled. Their ratings, quantities and age profiles are summarised in Table 7.12 and Figure 7.12.

| Rating | Number of Transformers | % of Total |
|---|---|---|
| ≤ 15 kVA | 3,002 | 43% |
| > 15 and ≤ 30 kVA | 1,939 | 28% |
| > 30 and ≤ 100 kVA | 1,792 | 25% |
| > 100 kVA | 315 | 4% |
| **Total** | **7,048** | **100%** |

*Table 7.12: Pole-Mounted Transformer Quantities*

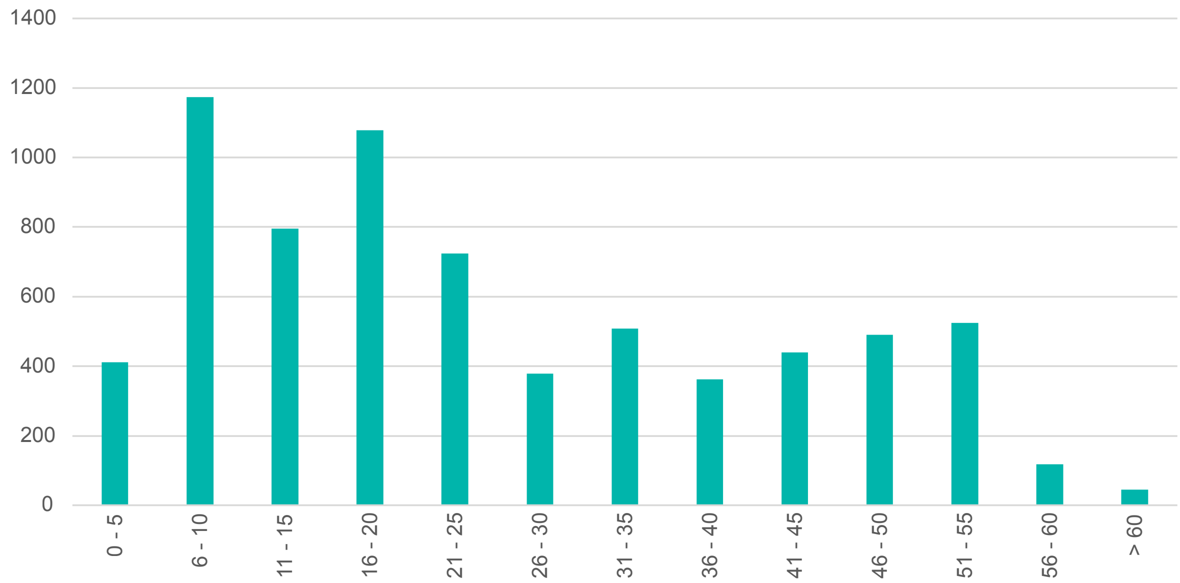



*Figure 7.12: Pole-Mounted Distribution Transformer Age Profiles*

### *7.4.4.1 Maintenance*

Pole-mounted distribution transformer inspections are carried out from the ground and include testing of the earthing system (see Table 7.13).

| Type | Frequency |
|---|---|
| Pole-mounted distribution transformers | 5 yearly – Full visual check of all components + testing of the earthing systems |

*Table 7.13: Pole-Mounted Distribution Transformer Inspection Summary*

### *7.4.4.2 Replacement and Disposal*

Ground-mounted transformers are replaced as they meet end-of-life criteria, informed by the inspection programme and reported defects. Scrap units are drained of oil and then sold to approved scrap dealers. Used oil is stockpiled until enough volumes are accumulated, and then it is disposed of using approved used-oil dealers.

## 7.4.5 Voltage Regulators

MainPower operates 21 single-phase 11 kV voltage regulators, which are located across 10 sites, with five new sites commissioned in March 2020. Voltage regulators act to stabilise the voltage in the distribution network within prescribed limits for consumers. This asset fleet will remain active, with the possibility of further installations if voltage issues are predicted because of load growth across the network.

The voltage regulators are mostly 220 kVA General Electric devices with automatic controllers. The age profile is between 1 and 20 years, with an expected life of 45 years in normal service. No issues have been identified with the existing regulator assets.

### *7.4.5.1 Maintenance*

The regulator's maintenance programme is aligned with MainPower's asset inspections and maintenance programme for pole-mounted transformers (see Table 7.14).

| Type | Frequency |
|---|---|
| Regulators | 5 yearly – Asset inspection, including oil sampling |

*Table 7.14: Regulator Inspection and Maintenance Summary*

### *7.4.5.2 Replacement and Disposal*

No replacements are planned for this asset class. Disposal of these units will be in line with other oil-filled equipment at the end of their life, expected in around 30 years' time.

## 7.4.6 Zone Substations

MainPower's electricity distribution network is supplied via five GXPs from the Transpower 220 kV and 66 kV transmission circuits passing through the region. There are 17 MainPower zone substations that operate at 66 kV and/or 33 kV to supply the 11 kV and 22 kV distribution network. A pictorial view of the electricity distribution network is shown in Figure 7.13, followed by a summary of the zone substation capacity and feeders (Table 7.15).

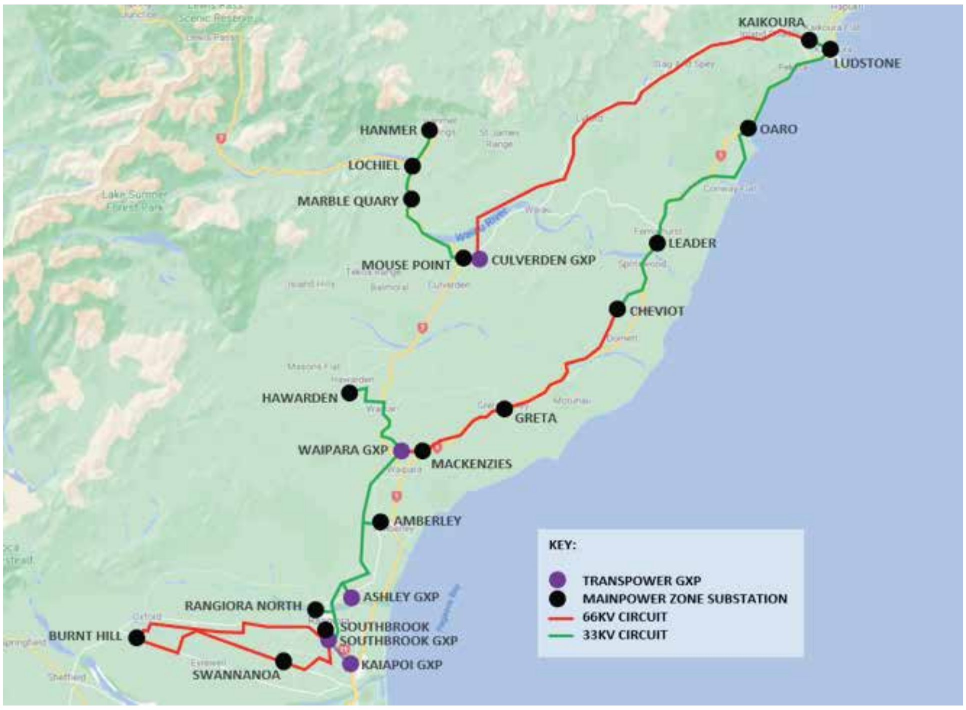



*Figure 7.13: Zone Substation Locations*

| Rating | Voltage (kV) | Substation Capacity (MVA) | # Feeders | Type |
|---|---|---|---|---|
| Southbrook | 66/11 | 80 | 6 | Indoor |
| Swannanoa | 33/22 | 46 | 5 | Indoor |
| Burnt Hill | 66/22 | 46 | 6 | Indoor |
| Amberley | 33/11 | 8 | 3 | Indoor |
| Mackenzies Rd | 66/11 | 4 | 3 | Outdoor |
| Greta | 66/22 | 4 | 3 | Outdoor |
| Cheviot | 66/11 | 4 | 3 | Outdoor |
| Leader | 33/11 | 0.3 | 3 | Outdoor |
| Oaro | 33/11 | 4 | 1 | Outdoor |
| Ludstone Rd | 33/11 | 12 | 4 | Indoor |
| Hawarden | 33/11 | 4 | 3 | Outdoor |
| Mouse Point | 33/11 | 26 | 4 | Outdoor |
| Marble Point | 33/11 | 2 | 1 | Outdoor |
| Lochiel | 33/11 | 0.2 | 1 | Outdoor |
| Hanmer | 33/11 | 12 | 2 | Indoor |
| Kaikōura | 66/33 | 16 | 1 | Outdoor |

*Table 7.15: Zone Substation Statistics*

### *7.4.6.1 Maintenance*

Zone substations are maintained on three overlapping cycles, ranging from regular visual inspections through to a major zone substation service requiring substation shutdown (see Table 7.16).

| Type | Frequency |
|---|---|
| Zone substations | 3 monthly – Visual inspection/visual condition assessment |
| | 12 monthly – Thermographic and partial discharge testing |
| | 3 yearly – Major zone substation service with electrical testing on all equipment |

*Table 7.16: Zone Substation Inspection and Maintenance Summary*

### *7.4.6.2 Replacement and Disposal*

Replacement of zone substations is typically driven by network growth and managed as a major capital expenditure project. Where possible, timing is optimised to coordinate replacement of end-of-life assets with additional sub-transmission development drivers, which include engineering, economic and security of supply analysis and optimisation.

## 7.4.7 Switching Substation

In addition to zone substations, MainPower operates seven switching stations that form part of the 11 kV electricity distribution network (see Table 7.17). These are strategic switching points that supply various feeder circuits throughout a localised area.

| Site | Voltage | # Feeders | Type |
|---|---|---|---|
| Pegasus | 11 kV | 5 | Indoor |
| Kaiapoi North | 11 kV | 6 | Indoor |
| Rangiora West | 11 kV | 4 | Indoor |
| Percival St | 11 kV | 8 | Indoor |
| Oxford | 11 kV | 3 | Indoor |
| Bennetts | 11 kV | 3 | Indoor |
| Kaiapoi S1 | 11 kV | 4 | Indoor |

*Table 7.17: 11 kV Switching Stations*

### *7.4.7.1 Maintenance*

Switching substations are maintained on the same cycles as zone substations as those mentioned above.

### *7.4.7.2 Replacement and Disposal*

Switching station assets that reach their maximum practical life as assessed by AHIs are considered for replacement with modern, compact, ground-mounted kiosks.

# 7.5 Underground Assets

The underground assets portfolio is made up of four asset fleets, shown in Table 7.18.

| Asset Fleet | Length/Quantity |
|---|---|
| High-voltage underground cables | 358 km |
| Low-voltage underground cables | 1,187 km |
| Low-voltage service boxes | Approx. 10,000 |
| Low-voltage link boxes | 649 |

*Table 7.18: Underground Asset Quantities*

### *7.5.1 High-Voltage Underground Cables*

MainPower's high-voltage underground cables are primarily either 95 $mm^2$ or 185 $mm^2$ aluminium conductor, although more recently, 300 $mm^2$ aluminium conductor cables are being used for major urban feeders or to supply distribution switching stations. Smaller sizes, typically 35 $mm^2$ aluminium conductor, are used for rural consumer spurs.

Most of our conductor assets are within their nominal technical life. Known defects with this asset class are generally related to the cable terminations or joints. In particular, historical "pothead"-type terminations are replaced proactively because of known age-related failures.

### 7.5.1.1 Maintenance/Inspections

The inspection criteria for these assets fall within the maintenance and inspection programmes for other asset types, typically assets housing and supporting the cable termination, such as distribution buildings, distribution kiosks, overhead lines and zone substations. All end terminations are inspected by either thermographic or acoustic inspection, no less than five yearly, as part of these inspection programmes.

The only exception is sub-transmission cables, which operate at higher than 22 kV; these cables have specific electrical tests conducted on a five-yearly basis to monitor and trend their conditions. This is due to the higher impact of failure with these assets.

We are actively engaged in supporting and educating the local community and contractors about the risks of excavating near underground cable assets. We are a member of the “beforeUdig” online service and provide cable-locate and stand-over services to local contractors or individuals.

### 7.5.1.2 Replacement and Disposal

MainPower does not currently have a scheduled replacement programme for underground high-voltage cables. Replacement for cables is typically the result of inspection data or faults. At this time no cables (including sub-transmission) have conditions that project replacement within the next 10 years.

## 7.5.2 Low-Voltage Underground Cables

MainPower’s low-voltage underground cables are primarily 185 mm² aluminium cables, with some 120 mm² aluminium cables historically installed in smaller subdivisions, owing to their lower load requirements.

### 7.5.2.1 Maintenance/Inspections

The inspection criteria for these assets fall within the maintenance and inspection programmes for other assets, which typically are assets housing and supporting the cable termination, such as distribution buildings, kiosks and boxes, overhead low-voltage lines and zone substations. Most end terminations are inspected visually at five-year intervals, with a criticality-based approach employed to cable termination locations in higher-criticality areas such as business districts, parks, public amenity areas and schools (see Table 7.19).

| Type | Frequency |
|---|---|
| Low-voltage underground cables | 2.5 yearly – High-criticality location cable termination inspection |
| | 5 yearly – As part of general inspection and maintenance programme |

*Table 7.19: Low-Voltage Underground Cable Inspection Summary*

### 7.5.2.2 Replacement and Disposal

MainPower does not currently have a scheduled replacement programme for underground low-voltage cables. Replacement for cables is typically the result of inspection data or faults.

## 7.5.3 Low-Voltage Distribution Boxes

MainPower's low-voltage distribution boxes consist of:

- **Service boxes:** These are small plastic boxes manufactured by either Gyro Plastics or TransNet, typically housing up to 12 standard domestic service fuses, which are used for single- or three-phase consumer connections. Some larger boxes, the same make as link boxes, are used for commercial connections where physically larger fuses are required. Some historical service box types exist on the network that are constructed of metal frames with fibreglass lids.

- **Link boxes:** These are larger than service boxes, made of thermoplastic, and typically house 4–10 vertically mounted service fuses for either domestic or commercial consumer connections. Link boxes provide an alternative supply point between distribution transformers and allow reconfiguration of the network. Some historical steel boxes exist on the network.

Low-voltage distribution boxes incorporate safety features into box design. Access is restricted and controlled via our NOCC.

MainPower recently initiated a new condition assessment programme to document the condition of these assets. This programme is underway and will collect condition data electronically on all link and service boxes over the five-year maintenance cycle.

Service boxes are undergoing a detailed inspection because of known overheating problems at service fuses. All service boxes on MainPower's network will have the quality of fuse terminations inspected over a five-year period, projected to be completed in 2023. Defects with service fuse terminations are repaired as found.

### *7.5.3.1 Maintenance*

Criticality-based maintenance is employed to determine the inspection priority of the low-voltage distribution boxes. For those located in higher-criticality areas, such as business districts, parks, public amenity areas and schools, these receive a more frequent inspection programme (see Table 7.20).

| Type | Frequency |
|---|---|
| Low-voltage distribution boxes | 2.5 yearly – High-criticality location, low-voltage distribution box inspection |
| | Table 7.20: Low-Voltage Distribution Box Inspection Summary |

*Table 7.19: Low-Voltage Distribution Box Inspection Summary*

### *7.5.3.2 Replacement and Disposal*

MainPower currently has a programme to replace historical metal frame service boxes over the next 10 years, driven by asset condition. Other low-voltage distribution box replacements are primarily driven by defects identified by the inspection programme, or as a result of third-party damage.

# 7.6 Vegetation Management

The majority of MainPower's overhead network is in rural areas. Vegetation is an ongoing concern and a common cause of outages, especially during high-wind events. MainPower communicates regularly with the public through different channels, including local newspapers and radio. MainPower's aim is to educate tree owners and the public about their responsibility for maintaining trees and the risks of trees falling on power lines.

MainPower has a dedicated team for managing vegetation, including a skilled team of arborists who undertake inspections and trimming around MainPower's network.

### *7.6.1 Maintenance*

In 2020 a review of our vegetation management programme was conducted with the aim of reducing unplanned outages and the risk of vegetation making contact with lines.

Prior to this review, MainPower split vegetation into three groups depending on the criticality of the overhead lines. The highest criticality lines (sub-transmission) were inspected on an annual basis, the lowest criticality lines (rural spurs with few connections) were on a three-yearly cycle, and all lines in between were on an 18-month cycle.

Starting with the 2020/2021 financial year this programme was changed so that all lines are inspected annually. This is expected to reduce the number of unplanned outages by ensuring no vegetation enters the lines growth limit zone. Lines in higher fire risk areas are inspected in September each year so that notice letters can be sent and vegetation trimmed before the peak of summer, reducing the potential for contact with lines and potential for fires to start.

MainPower has two full-time arborist crews who carry out most of the vegetation maintenance within our region and provide supervision to third-party contractors working in the vicinity of our lines. These crews are supported by a Vegetation Inspector and Vegetation Control Supervisor, who work as required with tree owners and local authorities to support the maintenance programme.

# 7.7 Secondary Systems

Secondary systems provide protection and operational control to the electricity distribution network's primary assets. This section covers the following types of secondary systems:

- DC systems;
- Protection;
- Communication/SCADA; and
- Load control/ripple plant.

The secondary system assets help MainPower deliver its reliability and safety-service levels. They are a vital asset fleet for ensuring the protection of the electricity distribution network assets, personnel and the general public. The systems are required to operate during loss of electricity supply to their respective sites and enable restoration.

## 7.7.1 DC Systems

MainPower's DC systems are split into two parts:

- Batteries; and
- Battery chargers.

There are a range of different manufacturers and models of batteries across the network, typically installed in zone and switching substations, pole-mounted recloser sites and communication and repeater sites (see Table 7.21).

| Asset | Nominal Life | Quantity |
|---|---|---|
| **DC batteries** | 10 years | 242 |
| | 5 years | 241 |
| | 2 years | 3 |
| | **Total** | **486** |

*Table 7.21: DC Battery Quantities Based on Nominal Life*

MainPower has recently standardised to one battery supplier to provide efficiencies in procurement, installation and operation. Some known defects across the battery fleet include a shorter-than-expected asset life and historical issues caused by installing incorrect battery types for the intended purpose.

DC chargers include rectifiers, DC-DC converters, controllers and other associated hardware. MainPower has a range of types, from older in-house-built types through to modern SCADA-connected units. As with battery replacement, one local supplier has been chosen for all new chargers.

### *7.7.1.1 Maintenance*

Batteries and DC chargers are frequently inspected and tested because of their importance for monitoring and controlling the network under contingency events (see Table 7.22).

| Location | Frequency |
|---|---|
| Substation | 3 monthly – Visual inspection + self-test (if available with charger model)<br>12 monthly – Electrical tests |
| Recloser | 12 monthly – Visual inspection + electrical test |
| Communication site | 6 monthly – Visual inspection + electrical test |
| All sites | Real time – Battery/charger diagnostics (if connected via SCADA) |

*Table 7.22: DC Battery and Charger Inspection and Maintenance Summary*

### *7.7.1.2 Replacement*

Scheduled replacement of batteries is prioritised based on a combination of age relative to expended design life and inspection data. Batteries that prematurely fail are immediately replaced. DC charger replacement is primarily driven by either end-of-life, obsolescence or lack of SCADA functionality.

## *7.7.2 Protection*

The electricity distribution network has protection relays located in zone and switching substations, RMUs and reclosers. Figure 7.14 shows the number and age of the current protection relays.

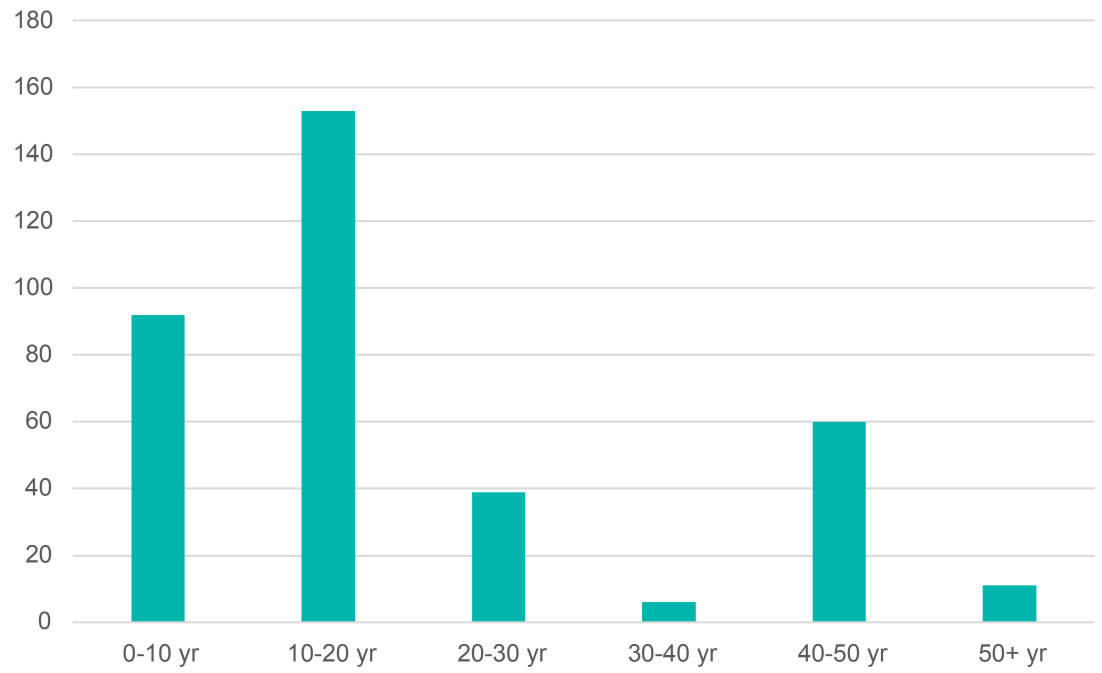



*Figure 7.14: Protection Relay Age Profile*

### 7.7.2.1 Maintenance

Regular maintenance of the protection relays is critical in verifying operations and providing protection of the electricity distribution network primary assets (see Table 7.23).

| Location | Frequency |
|---|---|
| Zone/switching substation | • 3 monthly – Visual inspection<br>• 3 yearly – Full system test (electromechanical)<br>• 6 yearly – Full system test (digital) |
| Recloser | • 12 monthly – Visual inspection<br>• 5 yearly – Full system test |
| RMU | • 12 monthly – Visual inspection<br>• 5 yearly – Full system test |
| All sites | • Real time – Relay fail and other diagnostics (where available with digital relays) |

*Table 7.23: Protection Relay Inspection and Maintenance Summary*

### 7.7.2.2 Replacement

Where possible, scheduled replacement of protection relays is combined with the replacement of the associated switchgear. MainPower also has a replacement programme to progressively replace older electromechanical relays with modern digital relays, providing additional protection functionality and control.

### 7.7.3 Communications and SCADA

MainPower operates both a voice and data communications network via a combination of digital and analogue radio and fibre. The communications network is characterised by radial links out of the MainPower head office, located in Rangiora, to cover the densest part of the electricity distribution network in the Waimakariri region. A long-reach radio link extends up the East Coast to service the Kaikōura region. Fibre links are limited to six sites within the Rangiora urban area, including MainPower's head office, four substation sites and the Waimakariri District Council offices.

Seven radio repeater sites are used to support the communications network, with three located in zone substations and four standalone repeater sites. A visual representation of the radio communications, which currently use Tait voice radios and Mimomax data radios, is shown in Figure 7.15.


*Figure 7.15: MainPower's Voice and Data Communications Network*

MainPower's SCADA system is an Open Systems International ADMS. All remote SCADA sites use the DNP3 communication protocol. MainPower is also trialling new field devices with remote communication facilities for improved visibility and control of the network.

The data and voice networks run on Tait EE band equipment for the mobile repeaters and J band for the inter-site linking. MainPower has deployed several narrow-band digital radio systems of both point-to-point and point-to-multipoint. These provide communications for SCADA remote terminal units and remote engineering access at very low bandwidths, using a mixture of Mimomax, Dataradio and Racam RipEX technology. The maximum capacity of the newer systems currently deployed is 360 kbit/s and is operating reliably.

### *7.7.3.1 Maintenance*

Communication and SCADA systems are constantly monitored by the MainPower Engineering Team. Equipment at both zone substation and repeater sites are regularly inspected and serviced on a schedule every six months for visual inspections and 12 months for diagnostic testing and servicing

| Asset Fleet | Frequency |
|---|---|
| Communications and SCADA | 6 monthly – visual inspections |
| | 12 monthly – diagnostic testing and servicing |

*Table 7.24: Communications and SCADA System Inspection and Maintenance Summary*

### *7.7.3.2 Replacement and Disposal*

MainPower is planning progressive replacement of the analogue radio systems with a digital radio system at each of the repeater sites. The increase in capacity and functionality of the digital radio systems can support native lone- and remote-worker systems and increase bandwidth for improved digital services at substations.

## 7.7.4 Load Control and Ripple Plant

MainPower uses Landis & Gyr SFU-G and SFU-K ripple injection plant, using Decabit code for load control and tariff switching. The plants operate at an injection frequency of 283 Hz, and all plants are GPS synchronised. Most load control receiver relays are in consumer smart meters or are Zellweger/Enermet RM3 installed between 1993 and 1997. The remainder are the later Landis & Gyr RC5000 series and, more recently, RO3-type relays (see Table 7.25).

| Rating | Age (years) | Operating Voltage (kV) |
|---|---|---|
| Kaiapoi GXP | 26 | 11 |
| Ludstone Rd | 13 | 11 |
| Mouse Point | 15 | 33 |
| Southbrook | 15 | 33 |
| Waipara GXP | 14 | 33 |
| Ashley GXP | 23 | 11 |
| Swannanoa | 31 | 22 |
| Burnt Hill | 31 | 22 |

*Table 7.25: Load Plant Location, Age and Operating Voltage*

While the load control plants are generally in good condition, the SFU-G transmitter at Kaiapoi GXP is considered obsolete by Landis & Gyr and is no longer supported. MainPower has a complete spare unit on warm standby in case of failure.

### 7.7.4.1 Maintenance

Load plant control and specialist equipment maintenance is contracted out to Landis & Gyr under a service agreement. This covers annual inspections and testing, as well as carrying critical spares in their Auckland warehouse. MainPower has a 24-hour response arrangement with Landis & Gyr to attend to any faults that MainPower's technicians cannot repair.

MainPower staff carry out separate inspections and services of the high-voltage equipment on an annual and three-yearly cycle. Defects are reported and managed as per MainPower's defect management processes.

### 7.7.4.2 Replacement and Disposal

The 33 kV load plant at Southbrook has been replaced with an 11 kV containerised unit during the zone substation rebuild in 2021. This will make available an SFU-K transmitter that will be used to replace the obsolete Kaiapoi SFU-G unit. The remaining Southbrook components will be assessed for their suitability as spares for other sites, following detailed assessment after decommissioning.

## 7.8 Property

MainPower owns a range of buildings that serve both the electricity distribution network and non-network services. This covers corporate structures and properties, communication repeater sites, zone substation control buildings and distribution substations, which are a mix of buildings and smaller housings for electrical equipment. The types and numbers are shown in Table 7.26.

| Building Type | Quantity |
|---|---|
| Control building | 22 |
| Distribution substation | 34 |
| Holiday home | 2 |
| Office | 4 |
| Repeater site | 4 |
| Staff house | 3 |
| Storage building | 6 |
| Equipment and kiosk cover | 781 |
| **Total** | **856** |

*Table 7.26: MainPower's Property and Building Assets*

### 7.8.1 Zone Substation Buildings

There are 22 control buildings located across MainPower's zone substations. These buildings range from small portable sheds, housing up to five control panels, through to multiroom permanent constructions that include indoor switchgear and toilet facilities. A breakdown by construction and purpose is shown in Table 7.27.

| Construction Type | Control Only | Control + High-Voltage Switchgear |
|---|---|---|
| Timber | 5 | 2 |
| Concrete block | 4 | 2 |
| Concrete tilt slab | 0 | 7 |
| Container | 0 | 2 |
| **Totals** | **9** | **13** |

*Table 7.27: Zone Substation Building Types*

### 7.8.1.1 Maintenance

Zone substation buildings are inspected on a three-monthly regime as part of the zone substation routine inspection programme, as shown in Table 7.28.

| Asset Fleet | Frequency |
|---|---|
| Zone substation buildings | 3 monthly – Visual inspection |

*Table 7.28: Zone Substation Building Inspection Summary*

All zone substation buildings had a detailed seismic assessment and building code compliance assessment carried out during the 2019 financial year. The outcome of this assessment will inform whether future strengthening work is required.

Asbestos surveys have been carried out on all zone substation buildings. Warning notices have been fitted where asbestos has been found (or assumed to be present) in the building materials or equipment in the buildings.

### 7.8.1.2 Replacement and Disposal

The Rangiora North Zone Substation building will be removed following decommissioning of the zone substation in the 2022 financial year.

## 7.8.2 Distribution Substation Buildings

MainPower has 33 distribution substations that are housed in standalone buildings. These were generally built during the Municipal Electricity Department era and are of solid concrete or masonry construction. They typically contain high-voltage switches or circuit breakers, an 11 kV/400 V transformer and a low-voltage distribution panel. Their ages range from 19 to 61 years, with most in the range of 50 to 60 years, as shown in Figure 7.16.

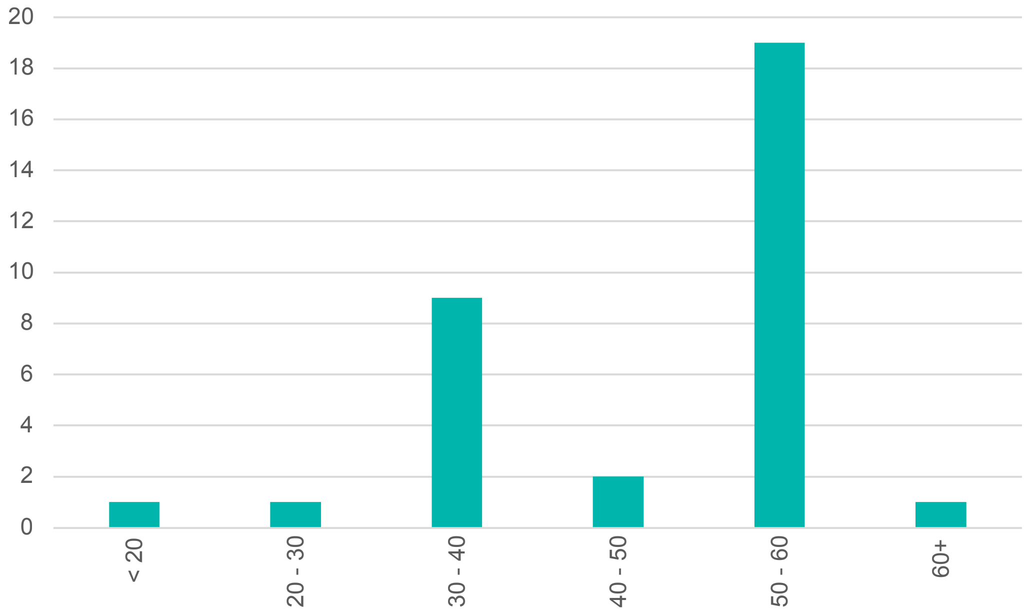



*Figure 7.16: Kiosk Building Age Profile*

These buildings are considered to be in generally good condition, given their age. However, MainPower undertook a detailed structural assessment during 2019 to determine their suitability for future use. Initial results indicate they are fit for purpose, with some modifications required on a selection of buildings to increase their strength, typically in the roofing.

### 7.8.2.1 Maintenance

The kiosk buildings are of solid concrete or masonry construction and require little ongoing maintenance. Repairs and maintenance are carried out following issues raised during routine kiosk inspections or in field defect reports.

#### 7.8.2.2 Replacement and Disposal

Structural assessments of the kiosk substation buildings have not indicated any serious faults with the buildings. No building replacements are planned in this 10-year planning period.

### 7.8.3 Distribution Kiosks

Distribution kiosks are small ground-mounted covers that house electrical equipment. The covers are constructed from various materials, typically steel, fibreglass or plastic (see Figure 7.17).

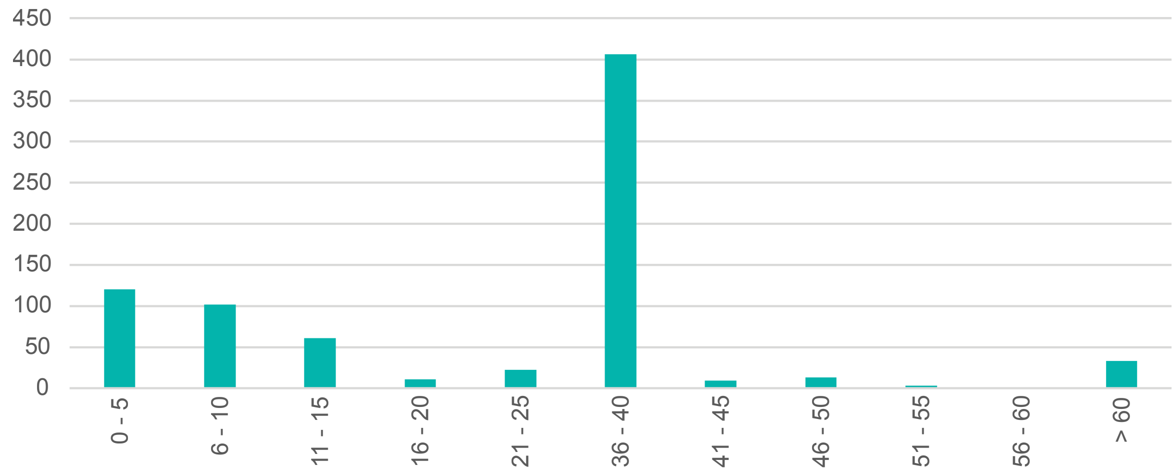



*Figure 7.17: Age Profile of Kiosk Covers (Enclosures)*

#### 7.8.3.1 Maintenance

Kiosk covers are visually inspected on an annual basis as part of the electrical equipment inspections at the site.

#### 7.8.3.2 Replacement and Disposal

MainPower does not currently have a scheduled replacement programme for distribution kiosk enclosures. Defective enclosures identified during inspections are repaired where possible or replacement is coordinated with other works.

## 7.8.4 Non-Electricity Distribution Network Buildings

MainPower owns offices, administration buildings, operational buildings, and staff and holiday housing throughout the North Canterbury region (see Table 7.29). MainPower relocated to a new, purpose-built head office and works facility in Rangiora in June 2014.

| Description | Location | Age (Years) |
|---|---|---|
| Staff Housing – #1 | Culverden | 4 |
| Staff Housing – #2 | Culverden | 3 |
| Staff Housing – #3 (unoccupied, to sell) | Culverden | 51 |
| Office building | Culverden | 42 |
| Storage shed/workshop | Culverden | 42 |
| Holiday home | Hanmer Springs | 42 |
| Holiday home | Kaikōura | 42 |
| Corporate office and operational facilities | Rangiora | 7 |

*Table 7.29: MainPower's Non-Electricity Distribution Network Buildings*

MainPower's head office serves as the main location for corporate and operational management of the business and electricity distribution network.

The buildings consist of:

- A two-storey 2,100 $m^2$ office building constructed to an Importance Level 4 standard;
- A single-storey 320 $m^2$ café constructed to an Importance Level 3 standard; and
- A 2,000 $m^2$ single-storey stores, garage and workshop building with 660 $m^2$ of mezzanine storage area, constructed to an Importance Level 3 standard.

MainPower's electricity distribution NOCC and server room are both located in the head office building, with the ability to work remotely if required to ensure ongoing operational capability during a major event. MainPower also provides the site as a backup Emergency Response Centre for local authorities in the event those authorities' main facilities are not occupiable.

MainPower recently had installed at our site a peak ground acceleration monitor, which supplies real-time data following earthquake events. The data are received within 90 seconds of an earthquake and compare the site acceleration against building service levels, informing key staff of any possible damage to the building or its services.

### *7.8.4.1 Maintenance*

Much of the facilities and equipment across MainPower's non-network property requires regular maintenance to ensure operational functionality. Ongoing contracts are managed with around 30 service providers to ensure the sites are maintained.

### *7.8.4.2 Renewal*

We have a projected renewal programme out to FY50, with major replacement scheduled for FY25 and FY28, mainly consisting of renewing internal finishes such as carpet and paint, and external finishes such as wall cladding.

# 7.9 Electricity Distribution Network Expenditure

## 7.9.1 Electricity Distribution Network Planned and Corrective Expenditure

| Asset Portfolio | Expenditure ($000) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| Overhead Network | 7,300 | 7,265 | 7,230 | 7,195 | 7,160 | 7,125 | 7 7,100 | 7,065 | 7,030 | 7,000 |
| Kiosks and Building Substations | 1,100 | 1,122 | 1,020 | 1,200 | 1,250 | 1,055 | 1,020 | 1,020 | 1,020 | 1,020 |
| Transformers | 375 | 381 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 370 |
| Switchgear | 320 | 300 | 310 | 315 | 345 | 300 | 265 | 316 | 316 | 315 |
| Secondary Systems | 295 | 435 | 360 | 280 | 60 | 185 | 355 | 330 | 550 | 550 |
| Underground Network | 715 | 675 | 746 | 628 | 568 | 568 | 568 | 568 | 560 | 550 |
| Network Property | 120 | 114 | 62 | 62 | 75 | 61 | 61 | 61 | 61 | 61 |
| Network Management | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| Corrective Replacement | 275 | 275 | 265 | 250 | 240 | 230 | 200 | 195 | 190 | 185 |
| **Network Replacement Subtotal** | **10,625** | **10,692** | **10,498** | **10,434** | **10,203** | **10,029** | **10,074** | **10,060** | **10,233** | **10,176** |

*Table 7.30: Electricity Distribution Network Maintenance Planned and Corrective Expenditure*

## 7.9.2 Electricity Distribution Network Maintenance Expenditure

| Asset Portfolio | Expenditure ($000) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| Overhead Network | 1,865 | 1,902 | 1,902 | 1,740 | 1,612 | 1,612 | 1,606 | 1,606 | 1,606 | 1,606 |
| Zone Substations | 594 | 974 | 574 | 590 | 974 | 613 | 548 | 1,018 | 628 | 628 |
| Kiosks and Building Substations | 544 | 544 | 544 | 544 | 544 | 544 | 544 | 544 | 544 | 544 |
| Transformers | 318 | 295 | 279 | 256 | 305 | 318 | 295 | 27 | 256 | 305 |
| Switchgear | 326 | 303 | 291 | 326 | 303 | 291 | 326 | 303 | 291 | 327 |
| Secondary Systems | 143 | 143 | 143 | 143 | 143 | 143 | 143 | 14<br>3 | 143 | 143 |
| Low-Voltage Network | 279 | 172 | 374 | 374 | 374 | 374 | 374 | 374 | 374 | 374 |
| High-Voltage Cables | 161 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 |
| Network Property | 26 | 26 | 26 | 26 | 26 | 16 | 16 | 16 | 16 | 16 |
| Network Management | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 100 | 95 | 90 |
| Vegetation | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| **Network Maintenance Subtotal** | **5,361** | **5,623** | **5,396** | **5,262** | **5,544** | **5,173** | **5,115** | **5,542** | **5,111** | **5,191** |

*Table 7.31: Electricity Distribution Network Maintenance Expenditure*

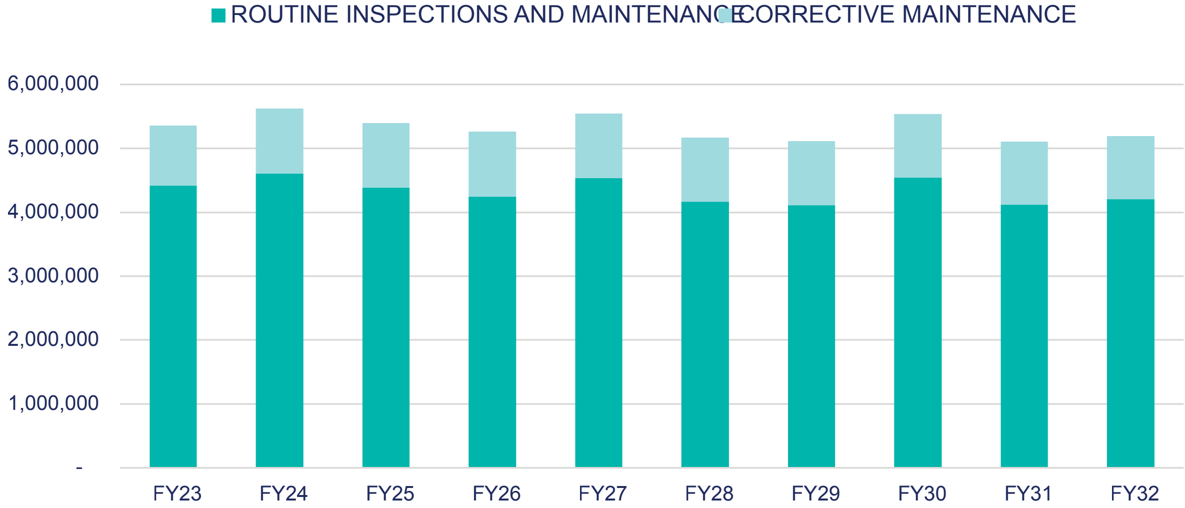



*Figure 7.18: 10-Year Network Maintenance Expenditure Forecast*

# 7.10 Innovations

MainPower has initiated the process of implementing maintenance schedules against assets within the TechnologyOne Enterprise Asset Management CMMS. Template work orders will be set up for each asset fleet, with data collection points to record the outcome of maintenance activities. Data collection points will also be used to record information to help determine the condition of the assets. The increased accuracy of the data relating to our assets will lead to the optimisation of renewing our assets.

MainPower is also moving towards strategic asset management and portfolio optimisation within the TechnologyOne platform to renew assets based on asset condition and criticality. All data collection points, determined when completing the maintenance activities, are assigned against the assets within the OneAsset system. Assets will be tested using offline technology that syncs once the device is brought back into the coverage area.

# 7.11 Non-Electricity Distribution Network Assets

## 7.11.1 IT Systems

MainPower's information technology (IT) system consists of multiple software applications hosted internally on physical architecture within a data centre or operated as software as a service (SaaS). Disaster recovery is provided via replication of the internally hosted systems using a data centre in Christchurch.

Integral to the support of this architecture is an integration layer that facilitates the movement of data and synchronisation of master records to ensure integrity between applications.

The key components of MainPower's IT platform are:

- A TechnologyOne ERP-integrated platform that is used for all asset management, works management and financial reporting;
- GE Digital's Smallworld GIS, which is used as the primary geographical data repository for electricity distribution asset data;
- Customer relationship management from Salesforce for managing ICP data, including registry obligations, billing history, and shareholder information on behalf of the Trust; and
- Open Systems International ADMS for controlling and operating MainPower's network.

### *7.11.1.1 Enterprise Resource Process Upgrade*

The TechnologyOne platform will be migrated to a SaaS, with improvements to the ERP product's usability and the available functionality. The transition to SaaS over the next four years provides access to new functionality, which enables improvements to our asset management and operational practices.

#### 7.11.1.2 Technology Integration

The Dell Boomi Integration platform has been implemented to replace the existing bespoke integrations, enabling rapid deployment of new integrations and proactive operational monitoring of the integration environment.

#### 7.11.1.3 Data Warehouse and Decision Support Expansion

Further investment in data warehouse and analytics technology is planned to improve strategic and operational decision making, with a focus on opportunity identification and improved service delivery.

#### 7.11.1.4 Integrated Management System and Current State Management

A capability to leverage the current state of the organisation will be implemented to enable service improvement. The organisation has implemented the Promapp and State3 technologies to create and maintain visibility of the organisation's current state from process, people, technology and consumer experience perspectives.

#### 7.11.1.5 Document Management

A core component of our operational capability is controlling and accurately versioning documents and ensuring that the organisation can easily access these documents. The current document management system no longer meets the requirements of the business, and a new project within the business aims to implement an integrated, modern and secure document management solution.

### 7.11.2 Assets Owned at Transpower Grid Exit Points

MainPower owns metering and communications equipment at Transpower GXPs that connect to our network to monitor load for load management and for revenue metering. All have Ion-type meters, installed after 2000. MainPower's ripple injection plants are located in Transpower GXPs at Waipara, Ashley and Kaiapoi. We also have SCADA and local service equipment associated with load control at these sites.

### 7.11.3 Mobile Generation Assets

MainPower has invested in a mobile diesel generation plant to assist with reducing the number of planned interruptions. The plant is rated at 275 kVA. The generator has been fitted on a tandem-axle truck along with the transformer, protection systems and connecting leads. The generator is used during planned work to maintain the supply to customers. It has enough capacity to supply the average load of an urban transformer kiosk, or it can be connected to overhead lines at 11 kV or 22 kV, supplying up to 100 customers. We also have a smaller 88 kVA generator for use with low-voltage customers. This is often large enough to supply small subdivisions during maintenance.

### 7.11.4 Other Generation

MainPower owns and operates a 1 MW generation asset located at Cleardale and is connected to the distribution network owned and operated by Electricity Ashburton. The Cleardale site is operated, managed and maintained in alignment with the MainPower network. This generation asset is identified as non-network and does not form part of MainPower regulatory reporting.

# 8. FINANCIAL EXPENDITURE

This section provides a summary of our expenditure forecasts during the 10-year AMP planning period. It is structured to align with the internal expenditure categories and forecasts provided in earlier sections.

## 8.1 Total Network Expenditure Summary

### 8.1.1 Total Network Expenditure Forecast

| Category | Expenditure ($000) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| Network Major Projects | 3,955 | 5,420 | 5,110 | 5,580 | 5,520 | 5,000 | 6,750 | 3,500 | 3,500 | 2,000 |
| Network Reinforcement Projects | 2,976 | 2,450 | 2,500 | 2,600 | 2,600 | 2,300 | 2,500 | 2,750 | 2,200 | 2,216 |
| Network Replacement | 10,625 | 10,692 | 10,498 | 10,434 | 10,203 | 10,029 | 10,074 | 10,060 | 10,233 | 10,176 |
| Network Maintenance | 5,361 | 5,623 | 5,396 | 5,262 | 5,544 | 5,173 | 5,115 | 5,542 | 5,111 | 5,191 |
| Network Operations | 1,455 | 1,450 | 1,445 | 1,440 | 1,435 | 1,430 | 1,425 | 1,420 | 1,415 | 1,410 |
| Non-Network | 3,979 | 2,564 | 2,439 | 1,989 | 1,739 | 1,739 | 1,739 | 1,739 | 1,739 | 1,739 |
| Customer-Initiated Works | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| **TOTAL** | **34,351** | **34,199** | **33,388** | **33,305** | **33,041** | **31,671** | **33,604** | **31,011** | **30,197** | **28,733** |

*Table 8.1: Total Expenditure Summary*

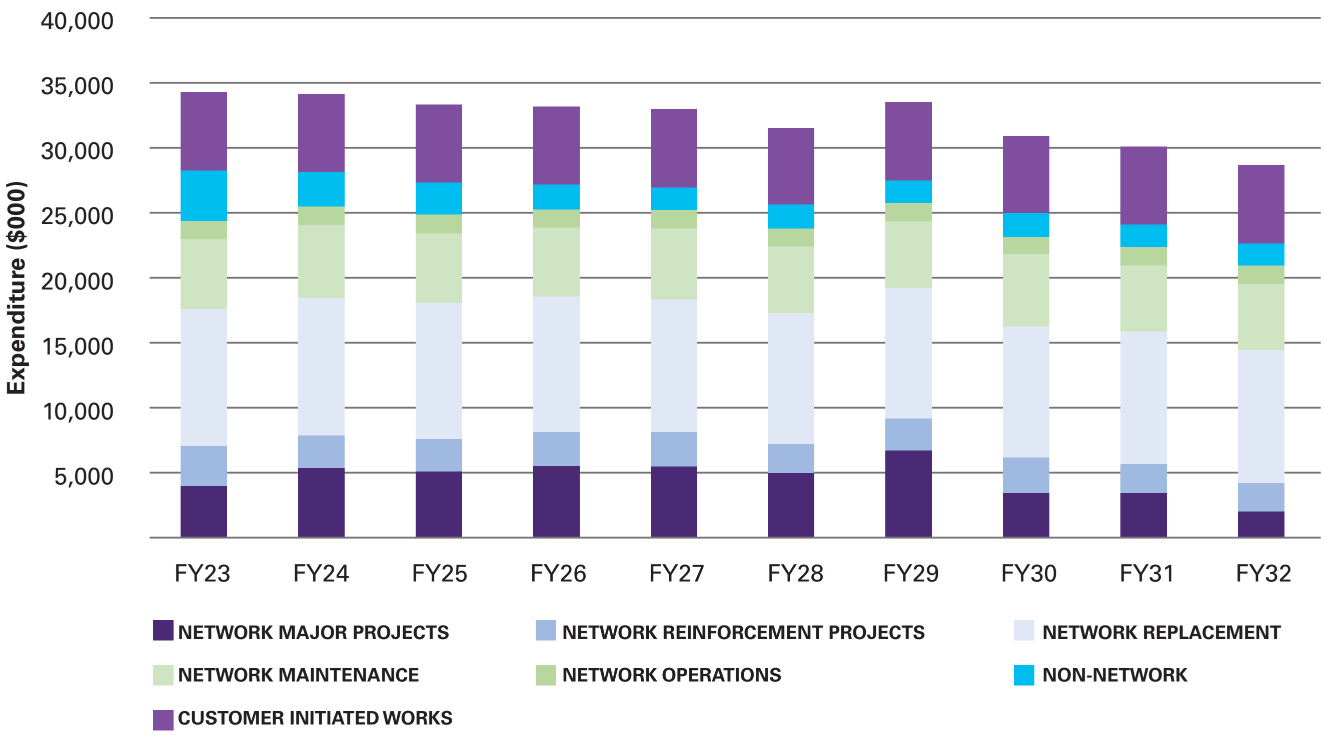



*Figure 8.1: Network Expenditure Forecast FY23-FY32*

# 8.2 Network Replacement

## 8.2.1 Network Replacement Expenditure

| Asset Portfolio | Expenditure ($000) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| Overhead Network | 7,300 | 7,265 | 7,230 | 7,195 | 7,160 | 7,125 | 7,100 | 7,065 | 7,030 | 7,000 |
| Kiosks and Building Substations | 1,100 | 1,122 | 1,020 | 1,200 | 1,250 | 1,055 | 1,020 | 1,020 | 1,020 | 1,020 |
| Transformers | 375 | 381 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 370 |
| Switchgear | 320 | 300 | 310 | 315 | 345 | 300 | 265 | 316 | 316 | 315 |
| Secondary Systems | 295 | 435 | 360 | 280 | 60 | 185 | 355 | 330 | 550 | 550 |
| Underground Network | 715 | 675 | 746 | 628 | 568 | 568 | 568 | 568 | 560 | 550 |
| Network Property | 120 | 114 | 62 | 62 | 75 | 61 | 61 | 61 | 61 | 61 |
| Network Management | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| Corrective Replacement | 275 | 275 | 265 | 250 | 240 | 230 | 200 | 195 | 190 | 185 |
| **Network Replacement Subtotal** | **10,625** | **10,692** | **10,498** | **10,434** | **10,203** | **10,029** | **10,074** | **10,060** | **10,233** | **10,176** |

*Table 8.2: Network Replacement Expenditure Summary*

# 8.3 Network Maintenance

## 8.3.1 Network Maintenance Expenditure

| Asset Portfolio | Expenditure ($000) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
| Overhead Network | 1,865 | 1,902 | 1,902 | 1,740 | 1,612 | 1,612 | 1,606 | 1,606 | 1,606 | 1,606 |
| Zone Substations | 594 | 974 | 574 | 590 | 974 | 613 | 548 | 1,018 | 628 | 628 |
| Kiosks and Building Substations | 544 | 544 | 544 | 544 | 544 | 544 | 544 | 544 | 544 | 544 |
| Transformers | 318 | 295 | 279 | 256 | 305 | 318 | 295 | 279 | 256 | 305 |
| Switchgear | 326 | 303 | 291 | 326 | 303 | 291 | 326 | 303 | 291 | 327 |
| Secondary Systems | 143 | 143 | 143 | 143 | 143 | 143 | 143 | 143 | 143 | 143 |
| Low-Voltage Network | 279 | 172 | 374 | 374 | 374 | 374 | 374 | 374 | 374 | 374 |
| High-Voltage Cables | 161 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 |
| Network Property | 26 | 26 | 26 | 26 | 26 | 16 | 16 | 16 | 16 | 16 |
| Network Management | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 100 | 95 | 90 |
| Vegetation | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| **Network Maintenance Subtotal** | **5,361** | **5,623** | **5,396** | **5,262** | **5,544** | **5,173** | **5,115** | **5,542** | **5,111** | **5,191** |

*Table 8.3: Network Maintenance Expenditure Summary*

# 9. CAPACITY TO DELIVER

MainPower has adopted a lifecycle asset management process structured on a total lifecycle cost of asset ownership. The framework has its foundation in the activities that occur during the lifetime of the physical asset. These activities are outlined in Figure 9.1.

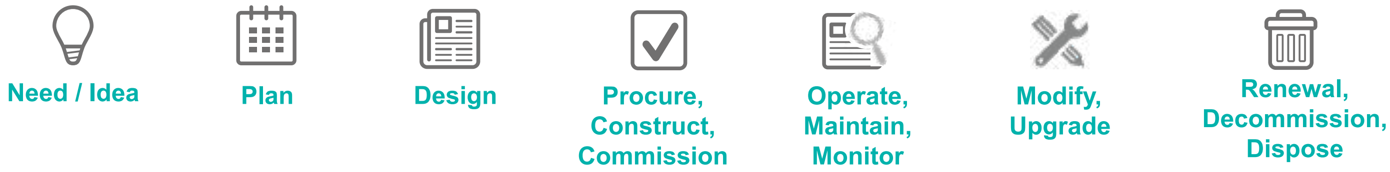



*Figure 9.1: Asset Lifecycle Planning*

The interaction of the roles throughout the asset lifecycle activities are detailed in Figure 9.2. Clear definitions of the roles are translated into position descriptions for relevant individuals. Where there is a gap between the role requirements and the competencies of the individual, a personal development programme is required to address the gap.

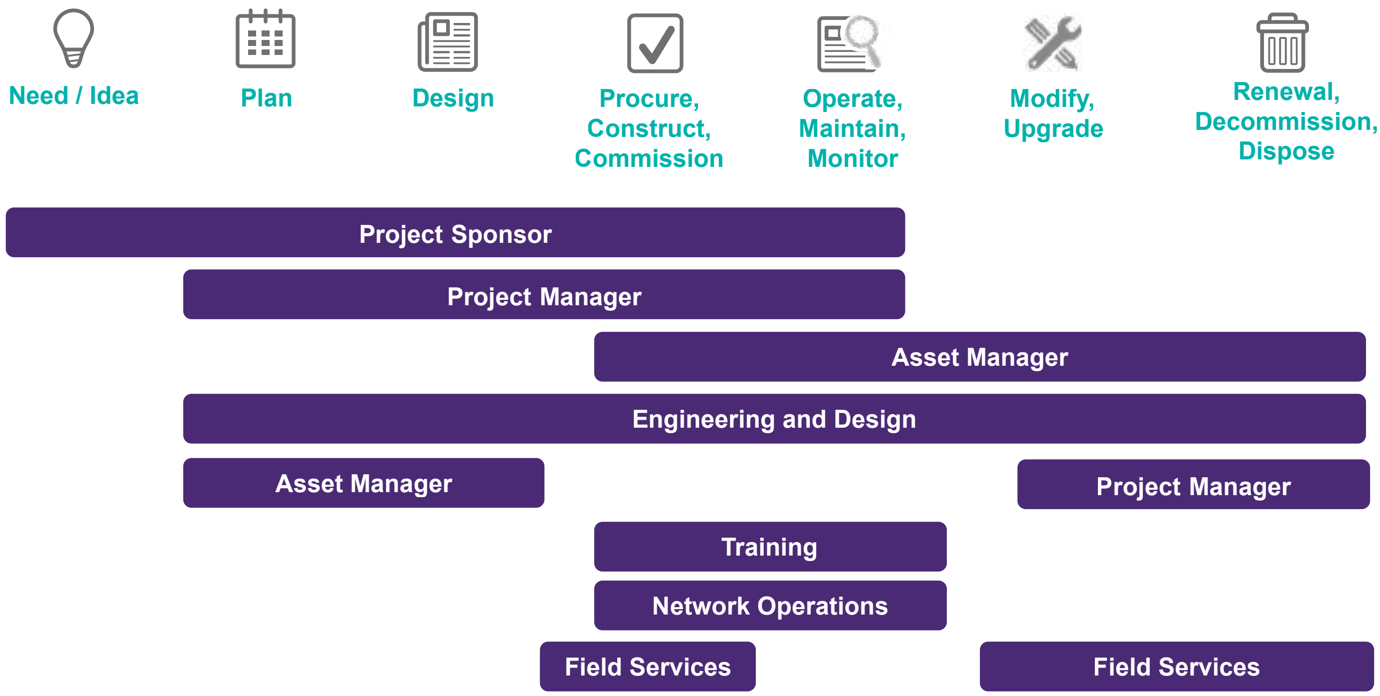



*Figure 9.2: Alignment of Roles and Responsibilities against Lifecycle Activities*

These positions cover the following responsibilities:

- **Project Sponsor:** Person with a business need (e.g. renewal of asset, procurement of infrastructure). Project sponsor completes the sponsor's brief and steers the project to completion (practical completion including hand over).
- **Project Manager:** Delivers the project in accordance with the business project delivery framework or Project Delivery System. The project management resource pool also includes Works Planning and Scheduling Resources.
- **Asset Manager:** Ensures all assets are maintained, using the minimum of resources, so they remain fit for purpose and enable the business to achieve is strategic intent. This resource pool also includes the Asset Data, GIS and Records Team.
- **Engineering and Design:** Involved in the development and approval of all designs, including safety by design.
- **Network Operations & Control Centre (NOCC):** MainPower control room resources for the safe operation and network release for working groups.

# 9.1 Resourcing Requirements

Resourcing is defined for network development, maintenance and renewals, based on typical project resourcing models and rate card information that define labour, materials, plant and outsourcing across all workstreams over time.

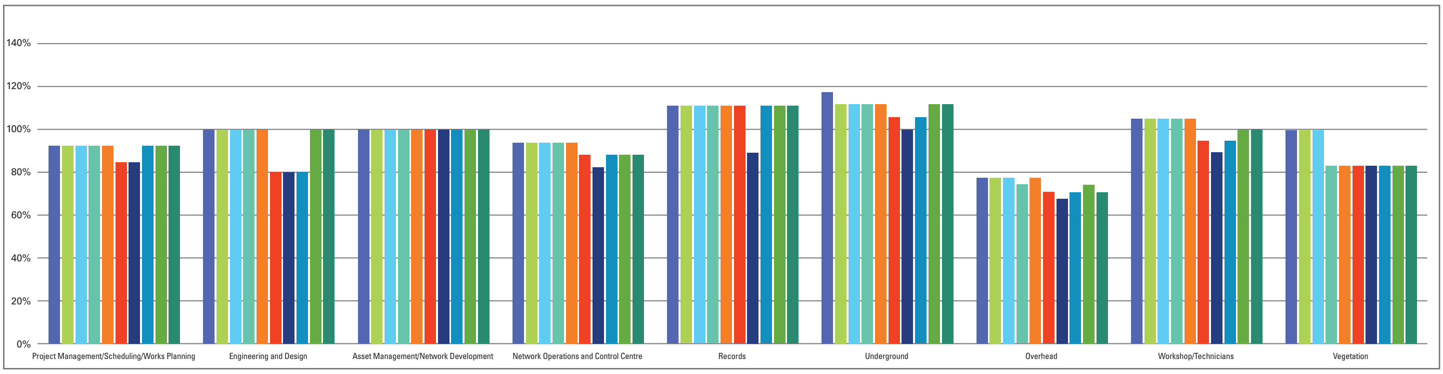



*Figure 9.3: Resourcing Model*

Linking asset lifecycle management resources with the 10-year work programme indicates that MainPower's internal resources for the management and planning of works is adequately resourced (Figure 9.3). There appears to be a deficit in overhead resources and, in later years, in resources for managing vegetation. This is consistent with existing trends where MainPower outsources the work where a resourcing gap is apparent. It is also likely that project management will be outsourced for growth-related projects (reinforcements and major projects). It is anticipated with the delivery of the ADMS that the resource deficit in the NOCC will be addressed through better planning of works and the automation of the network systems and processes.

# Asset Management Plan 2021–2031

## Appendices

This section provides additional information to support MainPower's Asset Management Plan, including our information disclosure schedules.

# Appendix 1 – Glossary of Terms and Abbreviations

| Term or Abbreviation | Definition |
|---|---|
| **ADMS** | advanced distribution management system |
| **AHI** | Asset Health Indicator |
| **AMP** | Asset Management Plan |
| **AMMAT** | Asset Management Maturity Assessment Tool |
| **CBRM** | condition-based risk management |
| **CDEM** | civil defence emergency management |
| **CIMS** | coordinated incident management system |
| **CIS** | customer information system |
| **CMMS** | computerised maintenance management system |
| **Distribution Network** | The power lines and underground cables that transport electricity from the national grid to homes and businesses |
| **EDB** | electricity distribution business |
| **EEA** | Electrical Engineers' Association |
| **ERP** | enterprise resource planning |
| **EV** | electric vehicle |
| **FY** | fiscal year |
| **GIS** | geographic information system |
| **GWh** | gigawatt-hours |
| **GXP** | grid exit point – a point at which MainPower's network connects to Transpower's transmission network |
| **HRC** | high rupturing capacity |
| **ICP** | installation control point |
| **IT** | information technology |
| **kV** | kilovolt |
| **kVA** | kilovolt-ampere |
| **LCT** | low-carbon technology |
| **Master Plan** | long-term network capacity development plan |
| **MVA** | mega-volt ampere |
| **MW** | megawatt (1 megawatt = 1,000 kilowatts = 1,000,000 watts) |
| **MWh** | megawatt-hours |
| **N-1** | An indication of power supply security that specifically means that when one circuit fails, another will be available to maintain an uninterrupted power supply |
| **NOCC** | Network Operation & Control Centre |
| **OMS** | outage management system |
| **Opex** | operational expenditure |
| **RMU** | ring main unit |
| **SaaS** | software as a service |

| Term or Abbreviation | Definition |
|---|---|
| **SAIDI** | System Average Interruption Duration Index |
| **SAIFI** | System Average Interruption Frequency Index |
| **SCADA** | supervisory control and data acquisition |
| **SF6** | sulphur hexafluoride |
| **Statement of Corporate Intent** | An annual document that outlines the overall intentions of the company and the objectives which the Directors and Trustees have agreed |
| **Sub-transmission** | An intermediate voltage used for connections between transmission connection points/bulk supply substations and zone substations – also used to connect between zone substations |
| **Transmission** | The high-voltage transmission network that connects areas of generation with towns and cities across New Zealand |
| **Substation** | A collection of equipment at one location, including any necessary housing, used to convert or transform electric energy and connect between two or more feeders |
| **XLPE** | cross-linked polyethylene |
| **Zone Substation** | A substation that converts energy from transmission or sub-transmission voltages to distribution voltages |

# Appendix 2 – Description of Asset Management Systems

| System | Definition |
|---|---|
| **Accounting Systems** | • The TechnologyOne software platform, an enterprise resource planning (ERP) system, is used to integrate financial, works and asset management information.<br>• Capital and maintenance expenditure is managed using a comprehensive financial system. |
| **Asset Register** | • The asset management suite within the TechnologyOne platform is the principal source of data related to MainPower assets. |
| **GIS** | • MainPower uses GE Digital's Smallworld platform (a geographic information system) for the management of spatial asset information.<br>• The TechnologyOne software platform has been integrated with the GIS system. |
| **Infrastructure** | • MainPower's hardware and server software is continually updated, consistent with modern high-capacity hardware platforms.<br>• Information security management includes maintaining offsite backup facilities for stored information for protection from a security breach or disaster. |
| **Works Management System** | • The works management system issues and tracks jobs through the TechnologyOne software platform. It also maintains cost and quality information.<br>• A comprehensive job-reporting system provides managers with detailed information about progress of the work plan, work hours and cost against budget. |
| **SCADA and Load Management Systems** | • Invensys Wonderware "Intouch" SCADA system:<br>o Displays voltage, current, and status information in real time from remote points on the network;<br>o Receives instantaneous information on faults; and<br>o Remotely operates equipment from the control centre.<br>• We operate Landis & Gyr ripple injection plants and On Demand load management software to control:<br>o Customer water heaters, to limit system peak loads and area loading constraints (mainly during winter months);<br>o Street lighting; and<br>o Electricity retailer tariffs. |
| **AutoCAD** | • Detailed substation plans, standard construction drawings and many subdivision plans are prepared and stored in AutoCAD.<br>• Where applicable, these are linked to assets within TechnologyOne.<br>• Network details such as cable locations in trenches, boundary offsets, and GPS location are stored in AutoCAD to be viewed without complicating the GIS system. |
| **Customer Information System (CIS)** | • This system is used to issue and maintain installation control points (ICPs) with retailers.<br>• It also manages customer information, lines tariff and consumption data.<br>• Outage information is imported from the outage management system (OMS) and stored against each customer.<br>• The CIS is linked to the GIS for customer location information.<br>• The CIS is maintained daily from event changes notified by retailers and new connections.<br>• The CIS is an important tool for MainPower's revenue protection. |
| **Communication Systems** | • Voice radio system for communication to field staff.<br>• Digital radio network for communicating with zone substations and other field equipment.<br>• Sophisticated telephony system for general land-based and mobile communication. |
| **Human Resource Systems** | • MainPower's human resource information was transferred to the TechnologyOne platform using an iterative, incremental approach during 2016. It includes employment contracts, competency and skill set information, and safety and training records. A succession plan exists within each section. |
| **Inventory Systems** | • All stock and supply chain details are managed through the TechnologyOne software platform as a single entity.<br>• MainPower maintains a separate storage facility for its own stock. |
| **Outage Management System (OMS)** | • Traces across the GIS to identify all affected customers and switching points.<br>• For unplanned outages, all relevant fault information is entered into the GIS after the event.<br>• Reports are run from the GIS to generate outage statistics as required. |
| **MACK CRM** | • Customer relationship management system to manage customer enquiries and jobs.<br>• Includes registry integration. |

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**CERTIFICATE FOR YEAR-BEGINNING 1 APRIL 2022 DISCLOSURE**

Pursuant to Clause 2.9.1 of Section 2.9 of the Electricity Distribution Disclosure Determination 2012 (consolidated December 2021)

We, ANTHONY CHARLES KING and STEPHEN PAUL LEWIS, being Directors of MainPower New Zealand Limited, certify that, having made all reasonable enquiry, to the best of our knowledge:

a) The following attached information of MainPower New Zealand Limited prepared for the purposes of clauses 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; and

b) The prospective financial or non-financial information included in the attached information has been measured on a basis consistent with regulatory requirements or recognised industry standards.

c) The forecasts in Schedules 11a, 11b, 12a, 12b, 12c and 12d are based on objective and reasonable assumptions which both align with MainPower New Zealand Limited's corporate vision and strategy and are documented in retained records.

| | |
|---|---|
| ________________________ | ________________________ |
| Anthony Charles King | Stephen Paul Lewis |
| Tony King 02/17/2022 10:05 NZDT | Stephen Lewis 02/16/2022 12:07 NZDT |
| Date | Date |

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# Appendix 4 – Schedule 11a: Report on Forecast Capital Expenditure

## 11a(i): Expenditure on Assets Forecast

| | | 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 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 | 31 Mar 28 | 31 Mar 29 | 31 Mar 30 | 31 Mar 31 | 31 Mar 32 |
| | | **$000 (in nominal dollars)** | | | | | | | | | | |
| | Consumer connection | 5,000 | 6,000 | 6,195 | 6,340 | 6,479 | 6,621 | 6,759 | 6,899 | 7,037 | 7,179 | 7,323 |
| | System growth | 6,564 | 3,246 | 3,820 | 5,028 | 5,529 | 6,091 | 5,632 | 7,761 | 4,105 | 4,188 | 2,441 |
| | Asset replacement and renewal | 11,629 | 11,575 | 12,381 | 11,620 | 11,268 | 11,258 | 11,297 | 11,583 | 11,799 | 12,243 | 12,421 |
| | Asset relocations | - | - | - | - | - | - | - | - | - | - | - |
| | Reliability, safety and environment: | | | | | | | | | | | |
| | Quality of supply | 474 | 1,152 | 1,454 | 1,283 | 1,779 | 2,142 | 1,600 | 2,343 | 2,850 | 1,984 | 1,540 |
| | Legislative and regulatory | - | - | - | - | - | - | - | - | - | - | - |
| | Other reliability, safety and environment | 250 | 1,584 | 1,509 | 1,202 | 1,525 | 726 | 991 | 532 | 375 | 648 | 1,164 |
| | **Total reliability, safety and environment** | 724 | 2,735 | 2,963 | 2,485 | 3,305 | 2,869 | 2,591 | 2,874 | 3,225 | 2,632 | 2,705 |
| | **Expenditure on network assets** | 23,917 | 23,556 | 25,358 | 25,473 | 26,581 | 26,839 | 26,280 | 29,117 | 26,167 | 26,242 | 24,890 |
| | Expenditure on non-network assets | 2,941 | 3,359 | 2,781 | 2,714 | 2,288 | 2,062 | 2,105 | 2,149 | 2,192 | 2,236 | 2,281 |
| | **Expenditure on assets** | 26,858 | 26,915 | 28,139 | 28,187 | 28,869 | 28,901 | 28,385 | 31,266 | 28,359 | 28,478 | 27,171 |
| *plus* | Cost of financing | - | - | - | - | - | - | - | - | - | - | - |
| *less* | Value of capital contributions | 2,500 | 3,500 | 3,613 | 3,698 | 3,780 | 3,862 | 3,943 | 4,024 | 4,105 | 4,188 | 4,272 |
| *plus* | Value of vested assets | - | - | - | - | - | - | - | - | - | - | - |
| | **Capital expenditure forecast** | 24,358 | 23,415 | 24,526 | 24,489 | 25,090 | 25,039 | 24,442 | 27,242 | 24,254 | 24,290 | 22,899 |
| | Assets commissioned | 18,019 | 28,845 | 20,448 | 25,070 | 26,116 | 24,156 | 22,471 | 26,954 | 27,480 | 24,889 | 25,340 |

| | 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 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 | 31 Mar 28 | 31 Mar 29 | 31 Mar 30 | 31 Mar 31 | 31 Mar 32 |
| | **$000 (in constant prices)** | | | | | | | | | | |
| Consumer connection | 5,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| System growth | 6,564 | 3,246 | 3,700 | 4,758 | 5,120 | 5,520 | 5,000 | 6,750 | 3,500 | 3,500 | 2,000 |
| Asset replacement and renewal | 11,629 | 11,575 | 11,992 | 10,998 | 10,434 | 10,203 | 10,029 | 10,074 | 10,060 | 10,233 | 10,176 |
| Asset relocations | - | - | - | - | - | - | | | | | |
| Reliability, safety and environment: | | | | | | | | | | | |
| Quality of supply | 474 | 1,152 | 1,409 | 1,214 | 1,648 | 1,942 | 1,420 | 2,038 | 2,430 | 1,658 | 1,262 |
| Legislative and regulatory | - | - | - | - | - | - | | | | | |
| Other reliability, safety and environment | 250 | 1,584 | 1,461 | 1,138 | 1,412 | 658 | 880 | 462 | 320 | 542 | 954 |
| **Total reliability, safety and environment** | 724 | 2,735 | 2,870 | 2,352 | 3,060 | 2,600 | 2,300 | 2,500 | 2,750 | 2,200 | 2,216 |
| **Expenditure on network assets** | 23,917 | 23,556 | 24,562 | 24,108 | 24,614 | 24,323 | 23,329 | 25,324 | 22,310 | 21,933 | 20,392 |
| Expenditure on non-network assets | 2,941 | 3,359 | 2,694 | 2,569 | 2,119 | 1,869 | 1,869 | 1,869 | 1,869 | 1,869 | 1,869 |
| **Expenditure on assets** | 26,858 | 26,915 | 27,256 | 26,677 | 26,733 | 26,192 | 25,198 | 27,193 | 24,179 | 23,802 | 22,261 |

### Subcomponents of expenditure on assets (where known)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Energy efficiency and demand side management, reduction of energy losses | - | | | | | | | | | | |
| Overhead to underground conversion | - | | | | | | | | | | |
| Research and development | - | | | | | | | | | | |

| for year ended | Current Year CY 31 Mar 22 | CY+1 31 Mar 23 | CY+2 31 Mar 24 | CY+3 31 Mar 25 | CY+4 31 Mar 26 | CY+5 31 Mar 27 | CY+6 31 Mar 28 | CY+7 31 Mar 29 | CY+8 31 Mar 30 | CY+9 31 Mar 31 | CY+10 31 Mar 32 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Difference between nominal and constant price forecasts** | $000 | | | | | | | | | | |
| Consumer connection | - | - | 195 | 340 | 479 | 621 | 759 | 899 | 1,037 | 1,179 | 1,323 |
| System growth | - | - | 120 | 269 | 409 | 571 | 632 | 1,011 | 605 | 688 | 441 |
| Asset replacement and renewal | - | - | 389 | 623 | 834 | 1,055 | 1,269 | 1,509 | 1,739 | 2,011 | 2,244 |
| Asset relocations | - | - | - | - | - | - | - | - | - | - | - |
| Reliability, safety and environment: | | | | | | | | | | | |
| Quality of supply | - | - | 46 | 69 | 132 | 201 | 180 | 305 | 420 | 326 | 278 |
| Legislative and regulatory | - | - | - | - | - | - | - | - | - | - | - |
| Other reliability, safety and environment | - | - | 47 | 64 | 113 | 68 | 111 | 69 | 55 | 106 | 210 |
| **Total reliability, safety and environment** | - | - | 93 | 133 | 245 | 269 | 291 | 374 | 475 | 432 | 489 |
| **Expenditure on network assets** | - | - | 796 | 1,365 | 1,967 | 2,516 | 2,951 | 3,793 | 3,857 | 4,309 | 4,497 |
| Expenditure on non-network assets | - | - | 87 | 145 | 169 | 193 | 236 | 280 | 323 | 367 | 412 |
| **Expenditure on assets** | - | - | 883 | 1,510 | 2,136 | 2,709 | 3,187 | 4,073 | 4,180 | 4,676 | 4,909 |

## 11a(ii): Consumer Connection

| for year ended | Current Year CY 31 Mar 22 | CY+1 31 Mar 23 | CY+2 31 Mar 24 | CY+3 31 Mar 25 | CY+4 31 Mar 26 | CY+5 31 Mar 27 |
|---|---|---|---|---|---|---|
| *Consumer types defined by EDB** | $000 (in constant prices) | | | | | |
| Residential | 2,907 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| Irrigation | 1,233 | 1,400 | 1,400 | 1,400 | 1,400 | 1,400 |
| Large User | 366 | 500 | 500 | 500 | 500 | 500 |
| Streelights | 149 | 150 | 150 | 150 | 150 | 150 |
| Other | 346 | 450 | 450 | 450 | 450 | 450 |
| **include additional rows if needed* | | | | | | |
| **Consumer connection expenditure** | 5,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| *less* Capital contributions funding consumer connection | 2,500 | 3,500 | 3,500 | 3,500 | 3,500 | 3,500 |
| **Consumer connection less capital contributions** | 2,500 | 2,500 | 2,500 | 2,500 | 2,500 | 2,500 |

## 11a(iii): System Growth

| for year ended | Current Year CY 31 Mar 22 | CY+1 31 Mar 23 | CY+2 31 Mar 24 | CY+3 31 Mar 25 | CY+4 31 Mar 26 | CY+5 31 Mar 27 |
|---|---|---|---|---|---|---|
| Subtransmission | 350 | 200 | - | - | 1,870 | 770 |
| Zone substations | 4,980 | 2,820 | 3,700 | 4,250 | 3,250 | 4,750 |
| Distribution and LV lines | - | 226 | - | 508 | - | - |
| Distribution and LV cables | 1,080 | | | | | |
| Distribution substations and transformers | 154 | | | | | |
| Distribution switchgear | - | | | | | |
| Other network assets | - | | | | | |
| **System growth expenditure** | 6,564 | 3,246 | 3,700 | 4,758 | 5,120 | 5,520 |
| *less* Capital contributions funding system growth | - | | | | | |
| **System growth less capital contributions** | 6,564 | 3,246 | 3,700 | 4,758 | 5,120 | 5,520 |

## 11a(iv): Asset Replacement and Renewal

| for year ended | Current Year CY 31 Mar 22 | CY+1 31 Mar 23 | CY+2 31 Mar 24 | CY+3 31 Mar 25 | CY+4 31 Mar 26 | CY+5 31 Mar 27 |
|---|---|---|---|---|---|---|
| | $000 (in constant prices) | | | | | |
| Subtransmission | 500 | 250 | 800 | - | - | - |
| Zone substations | - | 200 | 500 | 500 | - | - |
| Distribution and LV lines | 7,595 | 7,800 | 7,265 | 7,230 | 7,195 | 7,160 |
| Distribution and LV cables | 818 | 715 | 675 | 746 | 628 | 568 |
| Distribution substations and transformers | 1,528 | 1,475 | 1,503 | 1,400 | 1,580 | 1,630 |
| Distribution switchgear | 276 | 320 | 300 | 310 | 315 | 345 |
| Other network assets | 912 | 815 | 949 | 812 | 717 | 500 |
| **Asset replacement and renewal expenditure** | 11,629 | 11,575 | 11,992 | 10,998 | 10,434 | 10,203 |
| *less* Capital contributions funding asset replacement and renewal | - | | | | | |
| **Asset replacement and renewal less capital contributions** | 11,629 | 11,575 | 11,992 | 10,998 | 10,434 | 10,203 |

## 11a(v): Asset Relocations

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 |
| *Project or programme** | $000 (in constant prices) | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| **include additional rows if needed* | | | | | | |
| All other project or programmes - asset relocations | - | | | | | |
| **Asset relocations expenditure** | - | - | - | - | - | - |
| *less* Capital contributions funding asset relocations | - | | | | | |
| **Asset relocations less capital contributions** | - | - | - | - | - | - |

## 11a(vi): Quality of Supply

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 |
| *Project or programme** | $000 (in constant prices) | | | | | |
| [Description of material project or programme] | 474 | 1,152 | 1,409 | 1,214 | 1,648 | 1,942 |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| **include additional rows if needed* | | | | | | |
| All other projects or programmes - quality of supply | - | | | | | |
| **Quality of supply expenditure** | 474 | 1,152 | 1,409 | 1,214 | 1,648 | 1,942 |
| *less* Capital contributions funding quality of supply | - | | | | | |
| **Quality of supply less capital contributions** | 474 | 1,152 | 1,409 | 1,214 | 1,648 | 1,942 |

## 11a(vii): Legislative and Regulatory

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 |
| *Project or programme** | $000 (in constant prices) | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| **include additional rows if needed* | | | | | | |
| All other projects or programmes - legislative and regulatory | - | | | | | |
| **Legislative and regulatory expenditure** | - | - | - | - | - | - |
| *less* Capital contributions funding legislative and regulatory | - | | | | | |
| **Legislative and regulatory less capital contributions** | - | - | - | - | - | - |

## 11a(viii): Other Reliability, Safety and Environment

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 |
| *Project or programme** | $000 (in constant prices) | | | | | |
| [Description of material project or programme] | 250 | 485 | 420 | 360 | 460 | - |
| [Description of material project or programme] | - | 1,099 | 1,041 | 778 | 952 | 658 |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| **include additional rows if needed* | | | | | | |
| All other projects or programmes - other reliability, safety and environment | - | | | | | |
| **Other reliability, safety and environment expenditure** | 250 | 1,584 | 1,461 | 1,138 | 1,412 | 658 |
| *less* Capital contributions funding other reliability, safety and environment | - | | | | | |
| **Other reliability, safety and environment less capital contributions** | 250 | 1,584 | 1,461 | 1,138 | 1,412 | 658 |

## 11a(ix): Non-Network Assets

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** |
| **Routine expenditure** | | | | | | |
| *Project or programme** | **$000 (in constant prices)** | | | | | |
| Asset Management Systems & Software | 590 | 2,023 | 1,125 | 1,000 | 550 | 300 |
| Computer hardware | 885 | 232 | - | - | - | - |
| Building improvements & office furniture | 325 | 432 | - | - | - | - |
| Plant & equipment | 159 | 555 | - | - | - | - |
| [Description of material project or programme] | - | - | - | - | - | - |
| **include additional rows if needed* | | | | | | |
| All other projects or programmes - routine expenditure | 982 | 117 | 1,569 | 1,569 | 1,569 | 1,569 |
| **Routine expenditure** | 2,941 | 3,359 | 2,694 | 2,569 | 2,119 | 1,869 |
| **Atypical expenditure** | | | | | | |
| *Project or programme** | | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| [Description of material project or programme] | - | | | | | |
| **include additional rows if needed* | | | | | | |
| All other projects or programmes - atypical expenditure | - | | | | | |
| **Atypical expenditure** | - | - | - | - | - | - |
| **Expenditure on non-network assets** | 2,941 | 3,359 | 2,694 | 2,569 | 2,119 | 1,869 |

# Appendix 5 – Schedule 11b: Report on Forecast Operational Expenditure

| | 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 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 | 31 Mar 28 | 31 Mar 29 | 31 Mar 30 | 31 Mar 31 | 31 Mar 32 |
| **Operational Expenditure Forecast** | **$000 (in nominal dollars)** | | | | | | | | | | |
| Service interruptions and emergencies | 1,100 | 1,000 | 1,027 | 1,046 | 1,064 | 1,081 | 1,098 | 1,115 | 1,132 | 1,149 | 1,166 |
| Vegetation management | 1,000 | 1,000 | 1,032 | 1,057 | 1,080 | 1,103 | 1,126 | 1,150 | 1,173 | 1,196 | 1,221 |
| Routine and corrective maintenance and inspection | 4,575 | 4,361 | 4,773 | 4,645 | 4,602 | 5,014 | 4,701 | 4,732 | 5,327 | 4,918 | 5,116 |
| Asset replacement and renewal | 103 | - | - | - | - | - | - | - | - | - | - |
| **Network Opex** | 6,779 | 6,361 | 6,832 | 6,748 | 6,746 | 7,199 | 6,926 | 6,997 | 7,632 | 7,263 | 7,502 |
| System operations and network support | 6,304 | 9,700 | 10,015 | 10,249 | 10,475 | 10,703 | 10,927 | 11,153 | 11,377 | 11,606 | 11,839 |
| Business support | 7,354 | 4,200 | 4,336 | 4,438 | 4,536 | 4,634 | 4,731 | 4,829 | 4,926 | 5,025 | 5,126 |
| **Non-network opex** | 13,658 | 13,900 | 14,351 | 14,687 | 15,011 | 15,338 | 15,658 | 15,982 | 16,303 | 16,631 | 16,966 |
| **Operational expenditure** | 20,436 | 20,261 | 21,183 | 21,435 | 21,756 | 22,536 | 22,584 | 22,979 | 23,935 | 23,895 | 24,468 |

| | 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 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 | 31 Mar 28 | 31 Mar 29 | 31 Mar 30 | 31 Mar 31 | 31 Mar 32 |
| | **$000 (in constant prices)** | | | | | | | | | | |
| Service interruptions and emergencies | 1,100 | 1,000 | 995 | 990 | 985 | 980 | 975 | 970 | 965 | 960 | 955 |
| Vegetation management | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Routine and corrective maintenance and inspection | 4,575 | 4,361 | 4,623 | 4,396 | 4,262 | 4,544 | 4,173 | 4,115 | 4,542 | 4,111 | 4,191 |
| Asset replacement and renewal | 103 | | | | | | | | | | |
| **Network Opex** | 6,779 | 6,361 | 6,618 | 6,386 | 6,247 | 6,524 | 6,148 | 6,085 | 6,507 | 6,071 | 6,146 |
| System operations and network support | 6,304 | 9,700 | 9,700 | 9,700 | 9,700 | 9,700 | 9,700 | 9,700 | 9,700 | 9,700 | 9,700 |
| Business support | 7,354 | 4,200 | 4,200 | 4,200 | 4,200 | 4,200 | 4,200 | 4,200 | 4,200 | 4,200 | 4,200 |
| **Non-network opex** | 13,658 | 13,900 | 13,900 | 13,900 | 13,900 | 13,900 | 13,900 | 13,900 | 13,900 | 13,900 | 13,900 |
| **Operational expenditure** | 20,436 | 20,261 | 20,518 | 20,286 | 20,147 | 20,424 | 20,048 | 19,985 | 20,407 | 19,971 | 20,046 |

**Subcomponents of operational expenditure (where known)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Energy efficiency and demand side management, reduction of energy losses | - | - | - | - | - | - | - | - | - | - | - |
| Direct billing* | - | - | - | - | - | - | - | - | - | - | - |
| Research and Development | - | - | - | - | - | - | - | - | - | - | - |
| Insurance | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 |

** Direct billing expenditure by suppliers that direct bill the majority of their consumers*

| | 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 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 | 31 Mar 28 | 31 Mar 29 | 31 Mar 30 | 31 Mar 31 | 31 Mar 32 |
| **Difference between nominal and real forecasts** | **$000** | | | | | | | | | | |
| Service interruptions and emergencies | - | - | 32 | 56 | 79 | 101 | 123 | 145 | 167 | 189 | 211 |
| Vegetation management | - | - | 32 | 57 | 80 | 103 | 126 | 150 | 173 | 196 | 221 |
| Routine and corrective maintenance and inspection | - | - | 150 | 249 | 341 | 470 | 528 | 616 | 785 | 808 | 924 |
| Asset replacement and renewal | - | - | - | - | - | - | - | - | - | - | - |
| **Network Opex** | - | - | 215 | 362 | 499 | 675 | 778 | 911 | 1,125 | 1,193 | 1,356 |
| System operations and network support | - | - | 315 | 549 | 775 | 1,003 | 1,227 | 1,453 | 1,677 | 1,906 | 2,139 |
| Business support | - | - | 136 | 238 | 336 | 434 | 531 | 629 | 726 | 825 | 926 |
| **Non-network opex** | - | - | 451 | 787 | 1,111 | 1,438 | 1,758 | 2,082 | 2,403 | 2,731 | 3,066 |
| **Operational expenditure** | - | - | 665 | 1,149 | 1,610 | 2,112 | 2,536 | 2,993 | 3,528 | 3,924 | 4,421 |

# Appendix 6 – Schedule 12a: Report on Asset Condition

| | | | | 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% | - | 7% | 28% | 65% | | 3 | 0% |
| All | Overhead Line | Wood poles | No. | 1% | 28% | 43% | 18% | 10% | - | 3 | 6% |
| All | Overhead Line | Other pole types | No. | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Line | Subtransmission OH up to 66kV conductor | km | - | 0% | - | 52% | 48% | - | 2 | 0% |
| HV | Subtransmission Line | Subtransmission OH 110kV+ conductor | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG up to 66kV (XLPE) | km | - | - | 41% | 2% | 54% | 3.2% | 3 | - |
| HV | Subtransmission Cable | Subtransmission UG up to 66kV (Oil pressurised) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG up to 66kV (Gas pressurised) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG up to 66kV (PILC) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG 110kV+ (XLPE) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG 110kV+ (Oil pressurised) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG 110kV+ (Gas Pressurised) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission UG 110kV+ (PILC) | km | - | - | - | - | - | | [Select one] | |
| HV | Subtransmission Cable | Subtransmission submarine cable | km | - | - | - | - | - | | [Select one] | |
| HV | Zone substation Buildings | Zone substations up to 66kV | No. | | | | 67% | 33% | - | 3 | 5% |
| HV | Zone substation Buildings | Zone substations 110kV+ | No. | - | - | - | - | - | | [Select one] | |
| HV | Zone substation switchgear | 22/33kV CB (Indoor) | No. | - | - | 61% | - | 39% | - | 2 | - |
| HV | Zone substation switchgear | 22/33kV CB (Outdoor) | No. | - | - | 100% | - | - | - | 2 | |
| HV | Zone substation switchgear | 33kV Switch (Ground Mounted) | No. | - | - | - | - | - | | [Select one] | |
| HV | Zone substation switchgear | 33kV Switch (Pole Mounted) | No. | 4% | 20% | 16% | 11% | 49% | - | 2 | 7% |
| HV | Zone substation switchgear | 33kV RMU | No. | - | - | - | - | - | | [Select one] | |
| HV | Zone substation switchgear | 50/66/110kV CB (Indoor) | No. | - | - | - | - | - | | [Select one] | |
| HV | Zone substation switchgear | 50/66/110kV CB (Outdoor) | No. | - | - | 33% | 67% | - | - | 2 | |
| HV | Zone substation switchgear | 3.3/6.6/11/22kV CB (ground mounted) | No. | - | 28% | 72% | - | - | - | 3 | |
| HV | Zone substation switchgear | 3.3/6.6/11/22kV CB (pole mounted) | No. | - | 38% | 48% | 14% | - | - | 3 | |

| Voltage | Asset category | Asset class | Units | Asset condition at start of planning period (percentage of units by grade) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 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. | - | 15.0% | 15.0% | 47.0% | 23.0% | - | 3 | - |
| HV | Distribution Line | Distribution OH Open Wire Conductor | km | - | 0.2% | 0.2% | 51.2% | 48.4% | - | 2 | 0% |
| HV | Distribution Line | Distribution OH Aerial Cable Conductor | km | - | - | - | - | - | | [Select one] | |
| HV | Distribution Line | SWER conductor | km | - | - | 12.2% | 81.8% | 5.9% | 0.1% | 2 | - |
| HV | Distribution Cable | Distribution UG XLPE or PVC | km | - | - | 3.1% | 16.8% | 78.6% | 1.50% | 2 | 0% |
| HV | Distribution Cable | Distribution UG PILC | km | - | - | - | 70.5% | 29.5% | - | 2 | - |
| HV | Distribution Cable | Distribution Submarine Cable | km | - | - | - | - | - | | [Select one] | |
| HV | Distribution switchgear | 3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers | No. | 5.0% | - | 10.0% | 8.0% | 77.0% | - | 2 | 5% |
| HV | Distribution switchgear | 3.3/6.6/11/22kV CB (Indoor) | No. | 2.3% | 5.8% | 5.8% | 16.3% | 69.8% | - | 2 | 5% |
| HV | Distribution switchgear | 3.3/6.6/11/22kV Switches and fuses (pole mounted) | No. | 0.4% | 3.1% | 18.5% | 17.1% | 40.7% | 20.20% | 2 | 4% |
| HV | Distribution switchgear | 3.3/6.6/11/22kV Switch (ground mounted) - except RMU | No. | - | - | - | - | - | - | [Select one] | |
| HV | Distribution switchgear | 3.3/6.6/11/22kV RMU | No. | 5.2% | 3.0% | 34.4% | 18.5% | 38.9% | - | 3 | 8% |
| HV | Distribution Transformer | Pole Mounted Transformer | No. | - | 18.8% | 25.8% | 24.5% | 30.9% | - | 2 | 5% |
| HV | Distribution Transformer | Ground Mounted Transformer | No. | - | 30.5% | 37.0% | 19.0% | 13.5% | - | 2 | 5% |
| HV | Distribution Transformer | Voltage regulators | No. | - | - | 19.2% | 65.4% | 15.4% | - | 3 | - |
| HV | Distribution Substations | Ground Mounted Substation Housing | No. | 0.1% | 10.0% | 23.7% | 37.3% | 28.9% | - | 2 | 3% |
| LV | LV Line | LV OH Conductor | km | 0.1% | 4.6% | 61.2% | 19.4% | 14.7% | - | 2 | - |
| LV | LV Cable | LV UG Cable | km | - | - | 7.7% | 17.7% | 74.5% | 0.10% | 2 | - |
| LV | LV Streetlighting | LV OH/UG Streetlight circuit | km | - | - | 0.1% | 38.9% | 58.7% | 2.30% | 2 | - |
| LV | Connections | OH/UG consumer service connections | No. | - | 3.2% | 6.8% | 18.9% | 43.6% | 27.5% | 1 | - |
| All | Protection | Protection relays (electromechanical, solid state and numeric) | No. | 1.0% | 19.0% | 2.0% | 39.0% | 39.0% | | 2 | 7% |
| All | SCADA and communications | SCADA and communications equipment operating as a single system | Lot | 0.5% | 24.7% | 14.0% | 40.9% | 20.0% | - | 2 | 5% |
| All | Capacitor Banks | Capacitors including controls | No. | - | - | - | - | - | | [Select one] | |
| All | Load Control | Centralised plant | Lot | - | - | 12.5% | 50.0% | 37.5% | - | 2 | - |
| All | Load Control | Relays | No. | 1.3% | 17.7% | 8.0% | 22.2% | 20.6% | 30.20% | 1 | - |
| All | Civils | Cable Tunnels | km | | | | | | | [Select one] | |

### 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 |
|---|---|---|---|---|---|---|---|---|---|
| Southbrook | 25 | 40 | N-1 | 2 | 62% | 40 | 87% | No constraint within +5 years | |
| Burnt Hill | 16 | 23 | N-1 switched | 6 | 68% | 23 | 72% | Other | |
| Swannanoa | 16 | 23 | N-1 switched | 6 | 67% | 23 | 71% | No constraint within +5 years | |
| Amberley | 6 | 4 | N-1 switched | 2 | 140% | 20 | 34% | No constraint within +5 years | |
| MacKenzies Rd | 3 | - | N | 2 | - | - | 63% | Transformer | |
| Greta | 1 | - | N | 1 | - | - | 38% | [Select one] | |
| Cheviot | 3 | - | N | 2 | - | - | - | [Select one] | |
| Hawarden | 4 | - | N-1 switched | 3 | - | - | 115% | [Select one] | |
| Ludstone | 6 | 6 | N-1 switched | - | 95% | 6 | 110% | Transformer | |
| Leader | 2 | - | N | | - | - | 90% | Transformer | |
| Oaro | 0 | - | N | - | - | - | 2% | Transformer | |
| Mouse Point | 16 | 13 | N | 2 | 122% | 13 | 122% | No constraint within +5 years | |
| Hanmer | 4 | 3 | N-1 switched | - | 176% | 8 | 69% | Transformer | |
| Lochiel | 0 | - | N | - | - | - | 33% | Transformer | |
| Marble Quarry | 0 | - | N | - | - | - | 100% | No constraint within +5 years | |
| [Zone Substation_17] | | | | | - | | | [Select one] | |
| [Zone Substation_17] | | | | | - | | | [Select one] | |
| [Zone Substation_18] | | | | | - | | | [Select one] | |
| [Zone Substation_19] | | | | | - | | | [Select one] | |
| [Zone Substation_20] | | | | | - | | | [Select one] | |

[1] *Extend forecast capacity table as necessary to disclose all capacity by each zone substation*

# Appendix 8 – Schedule 12c: Report on Forecast Network Demand

## 12c(i): Consumer Connections

*Number of ICPs connected in year by consumer type*

| | Number of connections | | | | | |
|---|---|---|---|---|---|---|
| | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* |
| for year ended | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** |
| *Consumer types defined by EDB** | | | | | | |
| Residential | 650 | 650 | 650 | 650 | 650 | 650 |
| Irrigation | 30 | 30 | 30 | 30 | 30 | 30 |
| Large User | 1 | 1 | 1 | 1 | 1 | 1 |
| Streelights | 2 | 2 | 2 | 2 | 2 | 2 |
| Other | 120 | 120 | 120 | 120 | 120 | 120 |
| **Connections total** | 803 | 803 | 803 | 803 | 803 | 803 |

**include additional rows if needed*

### Distributed generation

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of connections | 211 | 221 | 232 | 244 | 256 | 268 |
| Capacity of distributed generation installed in year (MVA) | 1 | 1 | 1 | 1 | 1 | 1 |

## 12c(ii) System Demand

| | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* |
|---|---|---|---|---|---|---|
| **Maximum coincident system demand (MW)** — for year ended | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** |
| GXP demand | 115 | 116 | 117 | 118 | 119 | 120 |
| *plus* Distributed generation output at HV and above | 4 | 6 | 6 | 6 | 6 | 6 |
| **Maximum coincident system demand** | 118 | 122 | 123 | 124 | 125 | 126 |
| *less* Net transfers to (from) other EDBs at HV and above | | | | | | |
| **Demand on system for supply to consumers' connection points** | 118 | 122 | 123 | 124 | 125 | 126 |
| **Electricity volumes carried (GWh)** | | | | | | |
| Electricity supplied from GXPs | 654 | 655 | 656 | 666 | 675 | 687 |
| *less* Electricity exports to GXPs | | | | | | |
| *plus* Electricity supplied from distributed generation | 35 | 43 | 52 | 52 | 52 | 53 |
| *less* Net electricity supplied to (from) other EDBs | | | | | | |
| **Electricity entering system for supply to ICPs** | 689 | 698 | 708 | 718 | 727 | 740 |
| *less* Total energy delivered to ICPs | 653 | 662 | 672 | 681 | 691 | 701 |
| **Losses** | 36 | 36 | 36 | 37 | 36 | 39 |
| **Load factor** | 67% | 65% | 66% | 66% | 66% | 67% |
| **Loss ratio** | 5.2% | 5.1% | 5.1% | 5.1% | 4.9% | 5.3% |

# Appendix 9 – Schedule 12d: Report on Forecast Interruptions and Duration

| | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* |
|---|---|---|---|---|---|---|
| for year ended | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** |
| **SAIDI** | | | | | | |
| Class B (planned interruptions on the network) | 178.2 | 153.7 | 148.8 | 144.2 | 139.9 | 135.9 |
| Class C (unplanned interruptions on the network) | 145.1 | 126.8 | 122.8 | 119.0 | 115.5 | 112.2 |
| **SAIFI** | | | | | | |
| Class B (planned interruptions on the network) | 0.65 | 0.43 | 0.42 | 0.41 | 0.40 | 0.38 |
| Class C (unplanned interruptions on the network) | 1.58 | 1.61 | 1.56 | 1.51 | 1.46 | 1.42 |

# Appendix 10 – Schedule 13: Report on Asset Management Maturity

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 3 | Asset management policy | To what extent has an asset management policy been documented, authorised and communicated? | 3 | MainPower has an asset management policy that is firmly part of MainPower's approach to asset management. Awareness of the policy is supported within the business through training and regular updates to staff on Asset Management. | | 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. |
| 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 | As demonstrated in the Asset Management Policy there is clear line of sight between asset management polices and the statement of corporate intent, with asset management strategies and policies used to align other organisation documents and initiatives. | | 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. |
| 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 | The main focus of MainPower's approach to asset management is to cover full asset lifecycle including total cost of ownership from Idea to Disposal. | | 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. |
| 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? | 2 | Asset management plans and/or portfolio strategies exist or are currently being developed for all assets. Work remains to further link Asset Management Plans to polices and demonstrate full end-to-end asset life cycle. | | 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). |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 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 Asset Management Plan, work programme and key initiatives are presented to staff annually, from Board of Directors through to Field Staff. This is done via a variety of methods, from small steering group discussions, to larger general information sessions. The document is also provided and staff are encouraged to read it. | | 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. |
| 29 | Asset management plan(s) | How are designated responsibilities for delivery of asset plan actions documented? | 3 | MainPower now has roles specifically designated for delivery of Asset Plan actions, with reporting on progress documented monthly. | | 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. |
| 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)?<br><br>(Note this is about resources and enabling support) | 3 | Asset Management and its importance is reported to all staff on a regular bases through company updates and staff engagement meetings. Delivery of asset management plan works is monitored and reported monthly, covering financial performance as well as work completion. | | 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. |
| 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? | 2 | Incident management processes are well documented and integrated within business activities. Emergency response is managed through the CIMS framework with staff training provided and with mock incidents to further identify improvements. Work is currently underway on developing network contingency plans as well as documenting asset spares. | | 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. |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 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 | MainPower has adopted a Plan, Build, Operate model with key executive leadership team members responsible for ensuring MainPower meets it's asset management strategies, objectives, and that the asset management plan is delivered. | | 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. |
| 40 | Structure, authority and responsibilities | What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management? | 2 | Currently resources, systems and reporting is in place that demonstrates MainPower is completing asset management effectively on its core assets. This needs to be expanded to include more detail across financial performance vs work completed. | | 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. |
| 42 | Structure, authority and responsibilities | To what degree does the organisation's top management communicate the importance of meeting its asset management requirements? | 3 | Asset Management and its importance is reported to all staff on a regular bases through general company updates / staff engagement 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. |
| 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 | Asset Management activities are well defined. Assurance in the form of work/project monitoring and data collection points are used to detail resulting outcomes. Work remains to audit the outcomes; this requirement is agnostic to outsourcing or insourcing. All work outsourced is still overseen by internal project/program managers. | The Construction Specifications and the Standard Construction Drawing Set have been examined (which form a key control mechanism). | 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. |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 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 | Training for the completion of asset management activities that deliver the required outcomes is in place for some assets. Some training is also provided on-the-job. Work remains detailing the training requirements, enabling the requirements on the team skills matrix and ensuring that competent people exist informed by the forward work program. | | 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. |
| 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 | Competency requirements for the completion of asset management activities exist within the Asset Management and Operational plans. Activities are risk assessed and controls developed based on the risk appetite of the business. Work remains in developing a clear link between activities required, competency to complete the work and work authorisation. | | 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. |
| 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? | 3 | All asset management activities are risk assessed and controls developed based on the risk appetite of the business. Work remains to be completed developing a clear link between activities required, competency to complete the work and work authorisation – see section on Risk within the AMP. | | 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. |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 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? | 3 | Pertinent asset management information is communicated to necessary parties to effectively deliver the asset management plan for most assets and workstreams. Work remains to be completed to extend this further, especially with contracted service providers. | | 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. |
| 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 | Currently MainPower, through process maps and an Asset Management System document, describes its approach and asset management framework, including who is responsible and for what part of the process they are responsible. | | 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. |
| 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 | MainPower has committed to improving its asset register and information held in its ERP system. In addition, a new data warehouse has been established linking source data into a business improvement environment to help inform asset management activities. Other Asset Management Information systems are also being reviewed by the organisation so that the organisation can improve its approach to Asset Management. | | 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.<br><br>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. |
| 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 | This is achieved via a well defined, process mapped and documented as-builting process which includes data quality assurance. | | The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale.<br><br>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. |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 64 | Information management | How has the organisation's ensured its asset management information system is relevant to its needs? | 3 | Information requirements are informed by the Asset Management Plan and financial and operational requirements. MainPower has committed to the Technology One ERP, an Asset Management system which supports improving it's maturity in a strategic approach to asset management. | | 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. |
| 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 | Activity risk assessment for asset management activities have been assessed, documented and controls identified (through process mapping and risk bowties). Work remains to be completed detailing the operational risk of all assets (Plant and Equipment Risk Assessments). | | 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. |
| 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? | 2 | Risk assessments are completed and controls identified that inform competency requirements and controls for works. Controls identified for the completion of works forms part of the contractor management framework and network access requirements. The end-to-end process detailing the implementation, monitoring of these controls remains to be completed. | | 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. |
| 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 | Legal statutory risk forms part of the MainPower corporate risk management framework. MainPower also requires staff to complete a ComplyWith survey annually to re-assess compliance against requirements. | | 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 |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 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 | MainPower's asset management, engineering and operational process are well documented in ProMapp. Relevant documents and standards are linked to the ProMapp processes. This includes processes from Asset Creation, Maintenance and Replacement, Engineering and Design, Procurement, Operational activities and as-builting. | | 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. |
| 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? | 2 | Process and procedures are documented that detail how Asset Management plans are implemented. More work is needed to document and demonstrate that current activities fully align with asset mangement strategies and are implemented in a cost effective way. | | 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. |
| 95 | Performance and condition monitoring | How does the organisation measure the performance and condition of its assets? | 2 | Overall performance of the system is measured via SAIDI, SAIFI and other performance metrics documented in the regulatory AMP. This covers analysis of poor performing parts of the network and/or assets with specific projects or initiatives to improve performance. Condition assessments are carried out by field staff and office based experts using data collected from maintenance and inspection programs. | | 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). |
| 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 | Asset failures are investigated depending on criticality including operational incidents. Roles and responsibilities are defined including the implementation of an organisational wide incident reporting, management and investigation system | | 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. |

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 105 | Audit | What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))? | 2 | MainPower engaged external support to help review and further develop it's asset management system documentation in 2021. | | 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. |
| 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 | Incident investigations and corrective actions are undertaken in accordance with MainPower's Incident Reporting and Management operating standard. Asset Management work programmes also include both preventative and corrective components, with the objective of preventative programs resulting in less corrective work. Corrective actions and work are reviewed annually to inform and improve preventative work programmes. | | 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 |
| 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? | 2 | Asset management activities are documented, risk assessed and costed in terms of time, materials, plant and equipment (Rate cards). Rate cards are benchmarked against perceived industry standards. All works are pre-costed using the rate card and maintenance activities are assessed against planned and actual costs. | | 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. |
| 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 | By way of industry forums, conferences and technology presentations, and collaboration with other EDBs. | | 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. |

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| Company Name | MainPower New Zealand Ltd |
| For Year Ended | 31-March-2022 |

## Schedule 14a Mandatory Explanatory Notes on Forecast Information

*(In this Schedule, clause references are to the Electricity Distribution Information Disclosure Determination 2012 – as amended and consolidated 3 April 2018.)*

1. This Schedule requires EDBs to provide explanatory notes to reports prepared in accordance with clause 2.6.6.

2. 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)*

3. 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**
In preparing the capital expenditure forecasts MainPower has used the Westpac Economics Forecast Summary sheet November 2021 for the Inflation (CPI) movements. The annual average inflation forecast for each year to the end of March has been applied to the AMP for the available forecast, and extrapolated at constant CPI for the final four periods of the AMP forecast.

| Year | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
|---|---|---|---|---|---|---|---|---|---|---|
| Index | 1 | 1.03 | 1.06 | 1.08 | 1.10 | 1.13 | 1.15 | 1.17 | 1.20 | 1.22 |

*Commentary on difference between nominal and constant price operational expenditure forecasts (Schedule 11b)*

4. 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**
In preparing the operational expenditure forecasts MainPower has used the Westpac Economics Forecast Summary sheet November 2021 for the Inflation (CPI) movements. The annual average inflation forecast for each year to the end of March has been applied to the AMP for the available forecast, and extrapolated at constant CPI for the final four periods of the AMP forecast.

| Year | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29 | FY30 | FY31 | FY32 |
|---|---|---|---|---|---|---|---|---|---|---|
| Index | 1 | 1.03 | 1.06 | 1.08 | 1.10 | 1.13 | 1.15 | 1.17 | 1.20 | 1.22 |