Nelson Electricity Ltd
Asset Management Plan

April 2021 – March 2031

April 2021

Nelson Electricity Ltd central Nelson city view

Public Safety

Nelson Electricity uses accredited public safety auditors
Telarc to comply with NZS 7901 for Public Safety

Director Certification

In accordance with the Commerce Act
Electricity Distribution Information Disclosure Determination 2012

Nelson Electricity Limited - Asset Management Plan 2021-2031

SCHEDULE 17
Certification of Year-beginning Disclosures

Clause 2.9.1

We, Tim Cosgrove and Olivia Kearney, being directors of Nelson Electricity Limited certify that, having made all reasonable inquiry, to the best of our knowledge:

a) The following attached information of Nelson Electricity Limited prepared for the purposes of clauses 2.4.1, 2.6.1, 2.6.3, 2.6.6 and 2.7.2 of the Electricity Distribution Information Disclosure Determination 2012 in all material respects complies with that determination.

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

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

Signed	[signature]	Signed	[signature]
Date	24 March 2021	Date	24 March 2021

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Compliance Summary

Nelson Electricity Limited (NEL) continually improves the Asset Management Plan where areas of weakness have been identified.

To maintain the Asset Management Plan to a high standard, NEL reviews other lines companies Asset Management Plans and makes changes where improvements can be identified.

This Plan is also peer reviewed by qualified electrical engineers with all comments considered.

SECTION 1 - Summary of Asset Management Plan

This Asset Management Plan is prepared as the key internal asset planning document for NEL. It is also designed to meet Electricity Information Disclosure Requirements. The Plan contains sufficient information that will demonstrate to stakeholders that NEL's asset management processes are in line with best practice.

This Plan was approved by the Board of Directors on 31 March 2021.

1.1 Background and Objectives

NEL's goals are to:

- Have network reliability and performance consistent with other networks of similar kind in New Zealand;
- Manage and configure the assets efficiently, including responding to customer requests for additional reliability where those customers are prepared to enter into appropriate contracts;
- Ensure commercial returns to its shareholders.

This Asset Management Plan is written in support of these goals and outlines:

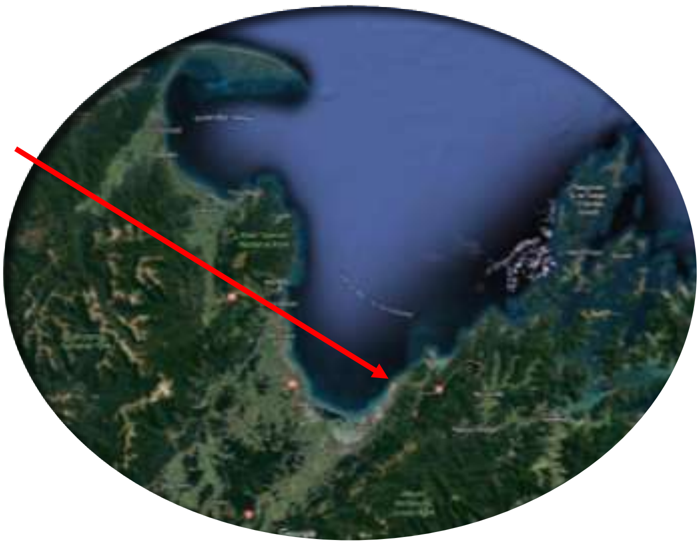
- The current state of the assets;
- The role of risk modelling and Asset Performance Standards;
- The tools for planning and executing continuous improvement;
- Stakeholder interests;
- Service levels;
- Asset maintenance;
- Network development.

This Plan, which will be treated as a dynamic document, covers the 10-year period from 1 April 2021 to 31 March 2031, and will next be updated 31 March 2022. The Plan represents the best estimates, according to current criteria and known events, and may be subject to change if different circumstances prevail. The focus is on the current years projects and works identified as more certain. Beyond this The Plan is more indicative and subject to change as new requirements are identified.

1.2 Assets Covered

The NEL network comprises approximately 9,300 connections in a concentrated area of 24 square kilometres in the central Nelson city area. The connections are largely CBD, industrial and dense urban. NEL has a peak loading of 33.5MW, during winter months and distributes 145GWh annually through the network.

The distribution system has four 33kV feeders supplying one 33kV Zone Substation. Thirteen 11kV feeders radiate to ultimately supply 198 11kV/400V transformer sites that feed the 400V network.



1.3 Service Levels

All assets are maintained in line with good industry practice and the results are reflected in NEL's system reliability statistics. NEL has the goal to seek reliability and performance statistics consistent with other networks of similar kind in New Zealand while also meeting consumer expectation.

NEL has long term targets of:

- SAIDI 45.0
- SAIFI 0.9
- CAIDI 50.0

Overall Nelson Electricity SAIDI Statistics (Class B & C)

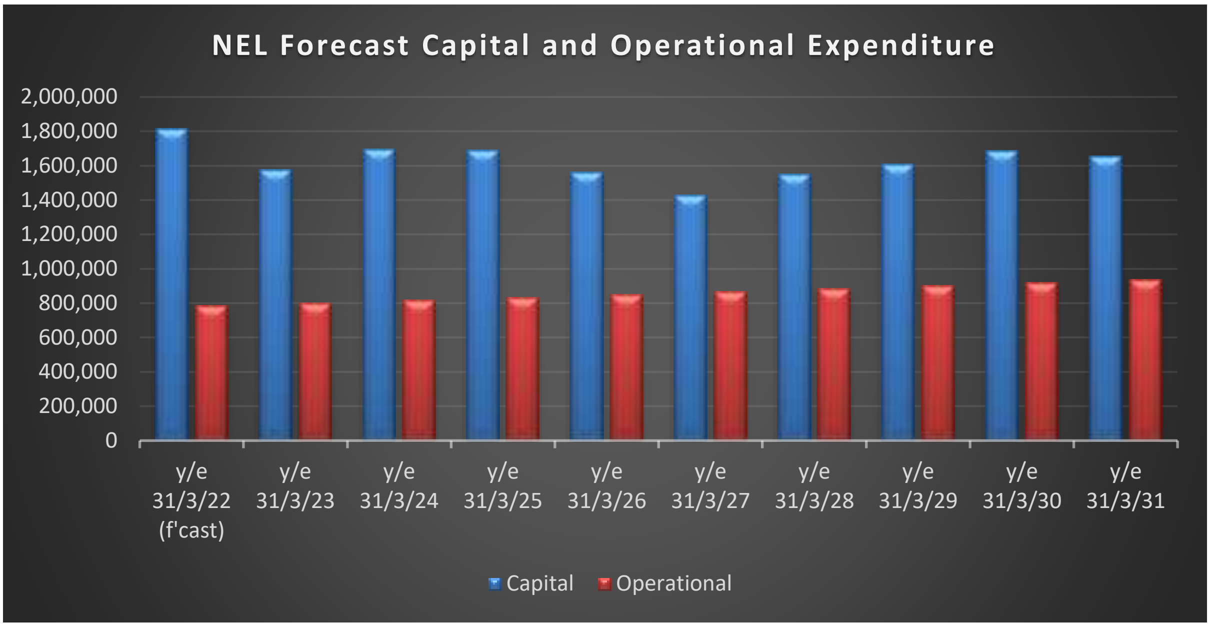
To achieve its goal, NEL continually monitors its asset management and operational processes and carries out ongoing asset life cycle auditing.

1.4 Network Development and Life Cycle Asset Management Planning

Risk modelling and ongoing life cycle audits are the focus for asset management and development within constraints resulting from the regulated environment. Modelling assets against their performance standard defines areas of weakness and is the key driver for the condition driven maintenance programme. Areas of risk are being continually identified and improvement/reinforcement scheduled.

Data obtained from planned preventative maintenance, load surveys, risk modelling and life cycle auditing will influence the direction of the Asset Management Plan.

The capital expenditure for 2022-2025 is dominated by asset replacement and renewal focusing on under rated and aged 11kV cables, security of supply, resilience enhancements and the continuation of an 11kV oil filled RMU switchgear replacement programme.



1.5 Asset Information Management

All asset and business information is contained in the Office Management System which provides computerised control of information and workflows. This system uses Microsoft Office software and manages all information crucial to the execution of NEL's business. The main component for assets is the Access (Asset) Database which provides storage, updating and retrieval of information. System forms and reporting facilities provide for continuous improvement and accountability for staff and contractors. The Office Management System is complemented by GIS software.

1.6 Risk Assessment

Risk assessment is the risk of failure of assets causing non supply to consumers as well as consumer and worker safety. The assessment process is NEL's key driver for maintenance and the continual improvement of operation and development of the network. An asset risk model is utilised to assess the performance of an asset against a given Asset Performance Standard. This is used to determine the adequacy of the asset and whether replacement or upgrade is required.

The Asset Performance Standard takes into consideration the aspects of the impact and probability of asset failure. Asset condition audits provide accurate information on each individual asset and its life cycle performance. The audit results are input to the Access (Asset) Database and the asset modelled for its own asset performance ranking compared to the appropriate standard.

Asset Performance Standards are also used for evaluating capital work and modelling corrective action contingencies for the most appropriate solution for non-complying assets.

1.7 Evaluation of Performance

The NEL Asset Management Plan is a dynamic document and can be changed at any stage during the year when issues are identified, or changes needed. It is based on best industry practise and is peer reviewed prior to disclosure.

NEL's costs are relatively stable even with pressures coming from areas such as compliance with regulation and local government conditions for digging in streets. It is expected NEL can continue to maintain direct and indirect costs at current levels.

Reliability has improved significantly since the completion of major project works in 2013-2014 contributing to the reduction in Class C (unplanned) outages. While the focus of capital expenditure has now returned to asset replacement and renewal of under rated and aged 11kV cables and security of supply enhancements, careful planning and network flexibility have contributed to Class B outages (planned) remaining well within target.

The number of faults on the network as of 1 February 2021 for the 2020-2021 period is zero per 100 kilometres of line. NEL has set a target of four faults per 100 kilometre of line given only approximately 10% of the network is overhead. Initiatives put in place to reduce the impact of cable strikes, mainly during the UFB rollout, have contributed to the improved overall fault rate in recent years. While the UFB programme is complete, NEL continues to educate contractors on the risks associated with digging near or around cables and implemented a rigorous vegetation management programme to reduce the fault rate on the overhead sections of the network.

The flattening of peak demand and reduction of kilowatt hour consumption since 2008 has reduced the capacity utilisation and load factors to below target. The lowering of consumption has not meant a removal of transformer capacity as the reduction has been across the network rather than any large individual consumer disconnecting from the network. These factors are unlikely to improve over the short to medium term given the forecast continued decline in consumption due to energy efficiency and energy conservation throughout the network.

NEL does not have many issues with fluctuating voltage or with harmonics and interference. Any issues with these are investigated promptly and dealt with if an issue is identified.

NEL records are continually being updated and input into the Office Management System and GIS software. Historical as-built cable records remain on hand drawn plans and in field books. NEL is still looking at options to economically convert these into electronic or GIS records.

The Office Management System and Risk Model system are both flexible systems easily modified in accordance with NEL's continual improvement philosophies.

All staff are involved in evaluating the performance of the Asset Management Plan and business in general. Regular meetings are held to review and discuss improvements to the Office Management System, Risk Model, Asset Management Plan and Business Plan. The Improvement Form is the tool for invoking improvements and solutions to the network and its management.

Gap analysis is the process of the Office Management System identifying the gaps in the system and reporting them to management. The results are then portrayed by the Improvement Form or scheduled on an internal staff Planner for corrective and, if necessary, preventive action.

1.8 Expenditure Forecasts and Reconciliations

A review of progress against the financial portion of the Asset Management Plan 2020–2030, shows NEL forecast to meet both Capital Expenditure and Operational Expenditure budgets in the year ending 31 March 2021.

Expenditure for year ending 31 March 2020

Expenditure	Actual 31 Mar 2020	Budget 31 Mar 2020	Variance % 31 Mar 2020
Total Capital Expenditure	$1,754,890	$1,552,000	14%
Total Operational Expenditure	$684,000	$589,000	16%

⇒ Capital Expenditure for the year ending 31 March 2020 was $1,754,890.

⇒ Network Operational Expenditure for the year ending 31 March 2020 was $684,000.

⇒ Non-Network Expenditure was $1,394,000 compared to budget of $1,535,000.

Expenditure for year ending 31 March 2021

Expenditure	Estimate 31 Mar 2021	Budget 31 Mar 2021	Variance % 31 Mar 2021
Total Capital Expenditure	$1,256,927	$1,517,000	-17%
Total Operational Expenditure	$639, 000	$613,000	4%

Forecast Capital Expenditure for 2020-2021 is $1,255,000 which will be under the disclosed estimate in the 2020-2030 Asset Management Plan Update of $1,500,000. The year-end estimate is 16% below budget primarily due to the disruptive business year resulting in the deferment of an 11kV switchboard replacement project and Nelson City Council infrastructure projects where NEL co-ordinates works to minimise civil costs.

Network operating expenditure forecast for 2020-2021 is $639,000 which will be $26,000 over the budget of $613,000.

Non-Network Expenditure is forecast to be in-line with the budget of $1,550,000.

SECTION 2 - Background and Objectives

Nelson Electricity Limited (NEL) is a limited liability company registered under the Companies Act 1993 and is jointly owned by Network Tasman and Marlborough Lines. NEL owns and operates the electricity distribution network in the central Nelson city area.

NEL's principal mission is to –

> **"own and operate the electricity network within the central Nelson area commensurate with appropriate standards of maintenance and reliability of supply whilst maximising shareholder value and providing a return at least equal to weighted average cost of capital."**

This Asset Management Plan is prepared as the key internal asset planning document for NEL. It is also designed to meet Electricity Information Disclosure Requirements. The Plan contains sufficient information that will demonstrate to stakeholders that NEL's asset management processes are in line with best practice.

2.1 Objectives

The objective of this Plan is to describe the strategies that will ensure NEL meets the needs of its stakeholders through a reliable and compliant network. The Plan outlines methods of ensuring customer and response standards are met; that all maintenance and development of the network and its assets are carried out utilising resources efficiently and economically; that Asset Risk Management is the key to condition and performance of the network; and that customer requests for alternative combinations of supply, quality and price are adequately considered.

NEL's business goals and objectives are the key drivers influencing this Asset Management Plan. These are listed below.

- ***Statement of Corporate Intent***
  In accordance with the Section 39 of the Energy Companies Act, NEL submits a draft Statement of Corporate Intent to shareholders for the coming financial year. This gives a high-level overview of the business and the direction it is heading. The principal objectives of the Statement of Corporate Intent are considered throughout the Asset Management Plan development process:

  - To operate as a successful business in the distribution of electricity and other related activities;
  - To have regard, among other things, the desirability of ensuring the efficient use of electricity;
  - To ensure that all services and responses to maintenance and fault requirements are provided with an appropriate standard of customer service;
  - To maintain existing reliability and efficiency levels;
  - To adopt non-discriminatory pricing and network access policies for all network users ;
  - To ensure that all resources, financial, physical and human are utilised efficiently and economically;
  - To seek to provide an appropriate rate of return to shareholders not less than "weighted average cost of capital" and to seek to maximise the longer term value of shareholders' funds;
  - To provide for future development of the network through investigation and the acquisition of land and physical assets as is appropriate;
  - To ensure the company complies with all legislative requirements including health and safety legislation, and all industry initiatives in respect of safety in the workplace;
  - To be a good employer providing;
    - ✦ Remuneration consistent with performance,
    - ✦ A safe, satisfying and stimulating work environment,
    - ✦ Equal employment opportunities.

- Contracts such as:

  - Use of System Agreements;
  - Default Distributor Agreements;
  - 24 Hour Fault Service Contracts.

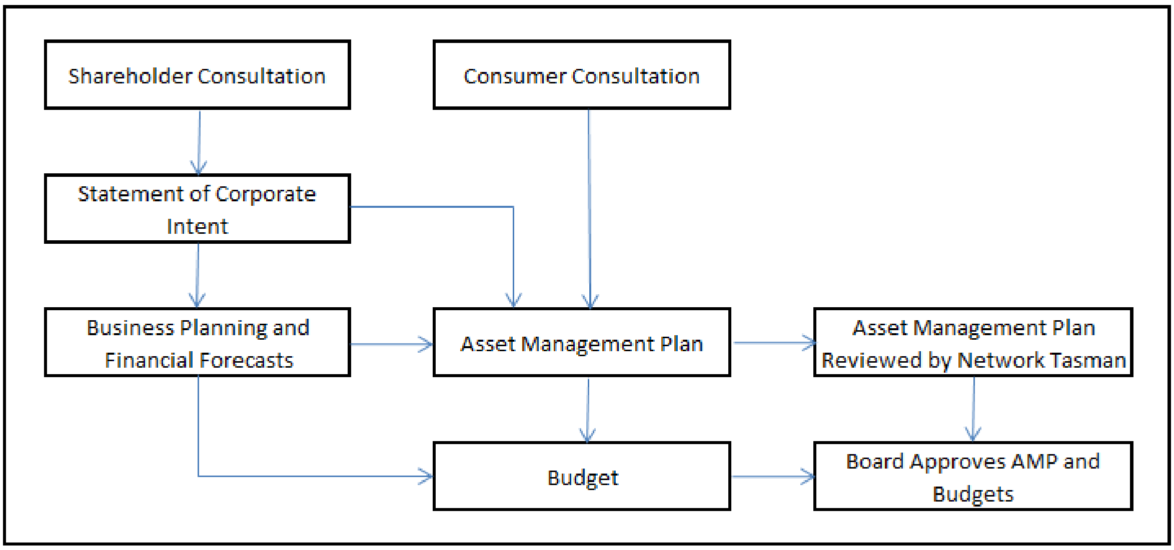
- Design standards and policies such as:

  - NEL Network Extension and Design Standards 2010;
  - NEL Network Code 2000;
  - NEL Risk Management Policy.

- Legislation to ensure the company complies with all industry legislative requirements such as:

  - Electricity (Safety) Regulations 2010
  - Electricity Act 1992 and Amendments;
  - Commerce Act 1986
  - Injury Prevention, Rehabilitation and Compensation Act 2001;
  - Electricity Reform Act 1998;
  - Electricity (Hazards from Trees) Regulations 2003;
  - Health & Safety at Work Act 2015;
  - NZ Electrical Codes of Practice;
  - Resource Management Act 1991;
  - Building Act;
  - Local Government Act;
  - Public Bodies Act;
  - Public Works Act;
  - Human Rights Act 1993;
  - Employment Relations Act 2000;
  - Privacy Act 1993;
  - Electricity Information Disclosure Requirements 2008;
  - AS/NZS 3000 2007;
  - Civil Defence Emergency Act 2002.

2.2 Planning Process



NEL engages various stakeholders when compiling the Asset Management Plan.

- **Shareholders**
  NEL's two shareholders (Network Tasman and Marlborough Lines) being Electricity Distribution Businesses, have some input into the asset management process. Both companies have significant expertise that can assist in the development of plans that are in accordance with the requirements. Network Tasman has an additional role as part of their provision of engineering services with NEL.

- **Retailer Feedback**
  NEL does engage electricity retailers on a regular basis as they have a direct contractual relationship with NEL's electricity consumers and hold their metering information. Retailers have a better grasp on the consumption trends of their customers which NEL can leverage off and take into consideration when asset planning.

- **Consumer Consultation**
  NEL engages its consumers on a regular basis. The methods used are:

  - Surveys included in NEL newsletters;
  - Phone survey of major consumers;
  - Phone survey of mass market consumers;
  - When applying for new/changed connection;
  - Tariff options.

  Feedback and survey results are taken into consideration in the asset management planning process.

- **Budgets**
  The asset management process provides expenditure level requirements for both capital and operational. These budgets are approved by the NEL Board as close to the beginning of the financial year as possible. The financial year is aligned with the Regulatory Disclosure year 1 April 2021 to 31 March 2022.

- **Business Plan**
  The major focus for NEL is the asset management planning process and the subsequent completion of the Asset Management Plan. The works programme and actions identified in the Plan are used as the basis of the Network Business Plan.

2.3 Planning Period

This Plan covers the 10-year period from 1 April 2021 to 31 March 2031. The Asset Management Plan will be reviewed on an annual basis based on the financial year to incorporate up to date information and improvement. Given the Plan covers a 10-year period, there is greater accuracy in the first five years of the planning period compared to the last five as there is more uncertainty and potential for change into the future.

The date of Version 20 is 1 April 2021 and was approved by the Board of Directors on 31 March 2021. The next review date for the Asset Management Plan is 1 April 2022.

As this is a planning document, projects may be included but may alter significantly or not proceed at all due to a change in operational requirements. As such the document is dynamic and subject to annual review. It can also be amended part way through the 2021-2022 year if circumstances make changes to the Asset Management Plan necessary.

2.4 Issues for NEL Asset Management Consideration

The Asset Management Plan is a comprehensive plan that encompasses the entire asset management process. While every attempt is made to ensure the performance of the network remains high and reliability is consistent with that of other similar networks whilst also meeting consumer expectation, there are issues that may conflict with this.

- Previously NEL has sought to achieve best practice and to be the best network in the country for an adequate return but the potential for conflicting requirements arising from Use of System Agreements, Electricity Act, Energy Company's Act, and the Commerce Commission requirements may create another outcome. Over time it can be expected that unless the company can invest within the network, reliability will diminish.

- Service forecast levels are set to be maintained at current levels into the foreseeable future rather than incremental improvements. The cost associated with improvement in reliability of an already efficient network is high. NEL in 2011 increased line charges to assist in the funding of an additional 33kV feeder and Zone Substation replacement. These projects have now been completed.

- The capital Asset Management Plan is based on a minimalist approach because of the uncertainties created by the price path requirements of the Commission. The changes from using the ODV criteria to actual cost has assisted with the capital expenditure planning although there are still some projects that have not proceeded unless there is additional funding from other parties, eg; overhead to underground conversion projects typically only proceed if they have a significant portion paid by Nelson City Council by way of road excavation and reinstatement. All safety projects are proceeding as per normal on an expedited basis.

- Network assets are long-term assets that require long-term planning. Long-term investment within the network is dependent upon the company having the flexibility to invest and receive an appropriate return.

As part of a continuous improvement process an independent audit of NEL's asset management process was conducted in 2017-18. The audit covered a good practice review of current network asset management practices and a field audit of the current asset fleet. The consulting firm reported directly to the General Manager and the NEL Board in early 2018. In summary, the report concluded NEL's overall management processes for identifying and correcting network maintenance and defects, was comprehensive and gave a good degree of assurance that serious safety risk outcomes would not go uncorrected. The defect pool of work determined from field condition inspection, is that it is closely tracked throughout the year, in close co-operation with Service Providers.

Overall, the impression gained during the review was the network was in reasonable condition, was monitored/inspected regularly and that several identified risk issues have been either addressed or are scheduled in the 10-year asset plan to carry out remedial work. Seven recommendations were provided from administrative improvements to the acceleration of an equipment replacement programme which was subsequently included in the Asset Management Plan.

2.5 Stakeholder Interests

The main drivers of the principal mission, objectives, Statement of Corporate Intent and ultimately the Asset Management Plan are the interests of the key stakeholders, expressly the NEL Board, electricity consumers and retailers. Feedback from all stakeholders through surveys, direct communication and the complaints process is used to establish objectives, plans and specifically target levels of service.

NEL also enters into contracts with end use customers that determine level of service drivers for this Asset Management Plan. The NEL Board agrees NEL's overall intentions and objectives and on performance targets and other measures in relation to its objectives through the Statement of Corporate Intent process.

The Asset Management Plan recognises the following stakeholders with interests in NEL's asset management:

Stakeholder	Interests
Contractors	Contractors have an interest in asset management to the extent that it sets out network policy, standards and criteria and impacts on physical work undertaken on the system.
Electricity Customers and Retailers	Delivery of a safe, reliable, efficient and sustainable supply of electricity at minimum cost.
Government (Ministry of Economic Development, Commerce Commission, Electricity Commission)	Legislate and control compliance of statutory requirements and economic efficiency.
Insurers	NEL ensures all substations on the network (except pole mounted substations), including the main Zone Substation at Haven Road. NEL uses insurance brokers Marsh Ltd for all insurance requirements.
Landowners	Landowners with NEL assets on their property have interests in safety, easements and access requirements.
NEL Employees	NEL employees have interests in health and safety and career opportunities.
Property Developers	Property developers wish to ensure that connection policies and costs are fair and that network expansion plans are timely.
Shareholders	Achievement of an adequate return on investment and good corporate citizenship.
Territorial Local Authorities	Territorial authorities have interests in minimising environmental impacts, development of underground power systems, local economic development and in the control of assets in road reserves.
Transit NZ	Transit NZ is interested in controlling assets in road reserves.
Transpower	NEL relies on the Transpower grid to deliver electricity through to the NEL network and Transpower relies on the NEL network to deliver the electricity to end use customers.

Stakeholder interests have been identified and accommodated in the asset management practices of NEL through the following processes:

- The NEL Board of Directors agrees to an annual Statement of Corporate Intent which details corporate strategy with respect to asset management planning.

- Corporate organisational goals and objectives support the establishment and completion of asset management projects consistent with corporate vision.

- Meetings and discussions with customers, developers and landowners help to establish asset management policy and practices regarding levels of service, charging regimes and network planning including the price/quality trade-off.

- Regular surveys of residential, commercial and large user customers provide valuable feedback on security and reliability of supply which assists in network planning, and on the price-quality trade-off.

- Government and territorial authority legislation provide a key input into the way that asset management work is designed, planned and undertaken.

- Customer complaints provide valuable feedback on quality of supply and influence the development plan.

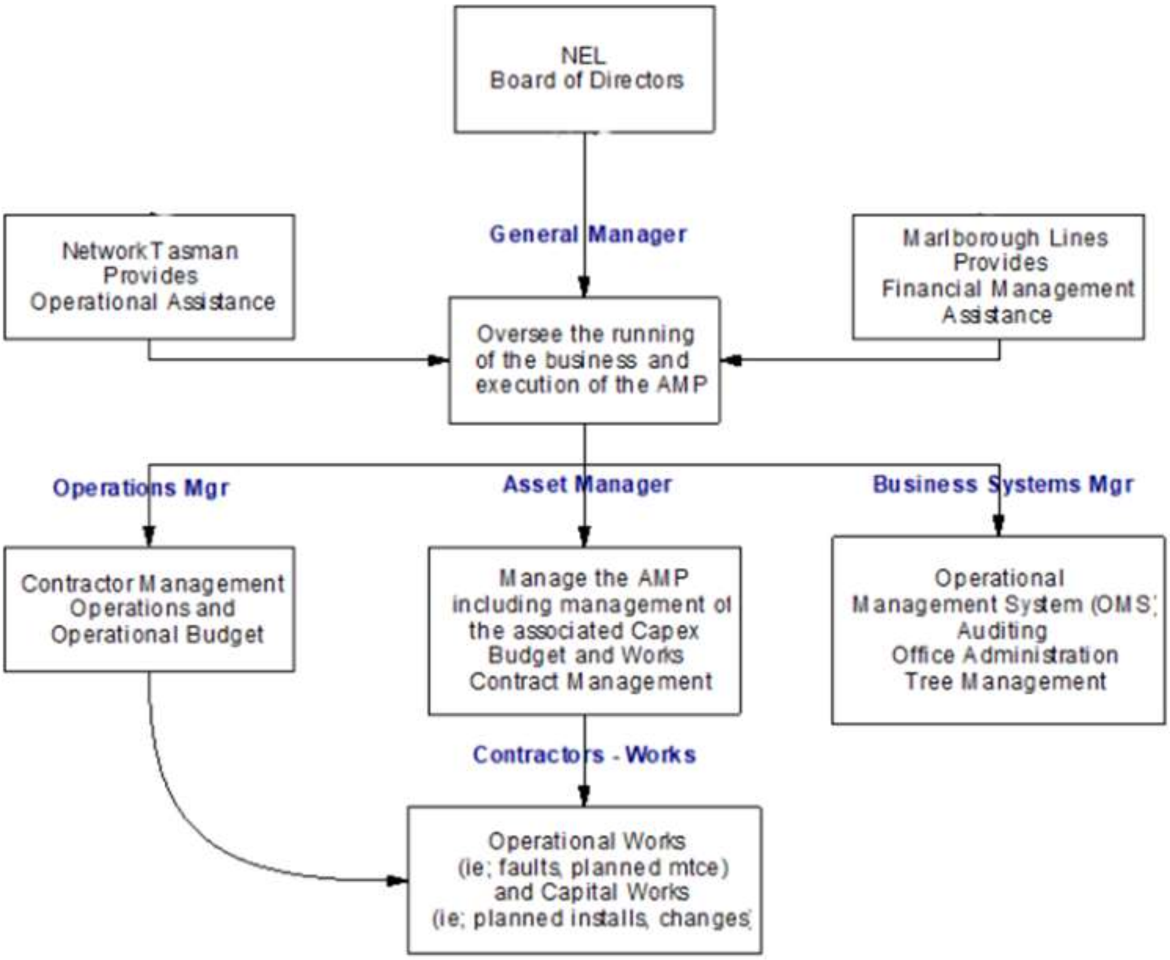
- Consultation with interested parties over specific projects ensures that they are included in the Asset Management Plan as early as possible to allow sufficient planning to be undertaken.

- Project performance reporting is provided to the Board of Directors monthly and includes contractor performance, project management performance and financial performance. This is used to establish future Asset Management Plan programmes and to compare progress against targets in each annual Asset Management Plan.

Any conflicting stakeholder interests are managed by systems that ensure that appropriate levels of separation, accountability and authority are in place. Decisions are normally made based on the asset management drivers detailed in the following section, in order of priority as listed below. If these criteria fail to provide a solution, a decision is made by the Board.

2.6 Responsibilities

Accountabilities and responsibilities in respect of network operations and management are summarised in the chart below.



NEL Board of Directors

The Board consists of four Directors: two appointed by each shareholder Network Tasman and Marlborough Lines. The Directors have the overall governance role of the company and are legally accountable for the company. The Asset Management Plan and budgets are approved by the Board of Directors. Projects exceeding $150,000 require separate Board approval.

The Board meets every two months as well as being provided with financial performance reports monthly. The Board meeting agenda includes:

- Financial Reports (performance versus budget);
- Operational Reports (including health and safety, outage statistics, capital project updates, retailer performance, kilowatt hours and network losses);
- Capital Expenditure Proposals.

General Manager

The General Manager is directly responsible for reporting to the Board and attending Board meetings. He has the responsibility for the day-to-day management of the company and its assets and for implementing company policy. The General Manager is permitted to approve projects up to $100,000.

Network Manager

The Network Manager is directly responsible to the General Manager. He is responsible for the preparation of the Capital Works Budget. The Network Manager is also responsible for preparation of the Asset Management Plan in conjunction with other staff members. The key role in this position is ensuring the network can cater to the load requirements and ensuring that the network meets the appropriate security of supply standards. The Network Manager also prepares and lets tender documents for all projects estimated to have a cost higher than a value fixed by the Board.

Operations Manager

The Operations Manager is directly responsible to the General Manager. He prepares the Operational Budget for inclusion in the Asset Management Plan as well as being involved in the Asset Management Plan development process. The Operations Manager is also responsible for the day-to-day operation and performance of the network including the management of electrical contractors working on the network. NEL has contracts with electrical contracting companies to cover all physical work undertakings including electrical faults, planned maintenance, renewals and new works. The Operations Manager is responsible for administering these contracts.

Business Systems Manager

The Business Systems Manager is directly responsible to the General Manager. She has the key responsibility of ensuring the Information Technology requirements of the company are met as well as maintaining information systems and the associated data. The Business Systems Manager edits and ties together the individual inputs which go to form the final Asset Management Plan, then prepares the document for publication and listing on the website. The Business Systems Manager attends and provides editorial and logistical comment at Asset Management Plan meetings.

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Provision of Additional Resources

NEL operates with a staff of four to manage the operation of the network. To achieve this and to ensure that the network operates efficiently in terms of network performance and operational efficiency, there is a need to call upon additional resources and skills from time to time. NEL has achieved this by having agreements in place with both shareholding companies for these requirements. The responsibilities of both shareholding companies are summarised below.

- **Network Tasman**
  Network Tasman provides engineering and other technical advice. The responsibilities include review of the Asset Management Plan, review of capital and operational budgets, policy development and review, advice on commercial and contractual issues, provide backup staffing resources and help with investigations into major projects from time to time. Network Tasman reports to the General Manager and also to the Board on some issues.

- **Marlborough Lines**
  Marlborough Lines provide supervision and management of the financial and administrative functions of NEL. The responsibilities include internal control, management of accounting requirements, payment of salaries, management of PAYE and GST, treasury function, relevant executive reporting to Board, assistance in setting budgets and provision of back-up staffing resources. Marlborough Lines reports to the General Manager and also to the Board.

Electrical Contractors

NEL contracts out all network development, replacement and maintenance to electrical contractors. The main day to day activities are fault response and repair contract as well as our planned preventative maintenance contract. All electrical contracting companies must hold an Authorisation Holder Contract with trained staff who have appropriate Class Approvals for the type of work they perform. The main contracts are negotiated with the General Manager and the day-to-day management of the contracts are managed by the Operations Manager.

Delegations

Document approvals and levels of expenditure delegation are in the following table:

Document/Expenditure Level	Approval Authority
Statement of Corporate Intent	Shareholders
Asset Management Plan	Board
Budgets	Board
Expenditure > $150,000	Board
Expenditure < $150,000	Chairman
Expenditure < $100,000	General Manager

2.7 Asset Management Justification

The Asset Management Plan has several drivers and processes in place to enable NEL to deliver a reliable supply of electricity and high-quality service now and into the future.

Audit and Maintenance Programme

This programme exists to inspect, test and, if required, maintain all assets on a regular basis to ensure that the safety, reliability and risk assessment goals for the network are met.

Network Development

The development of the network is driven primarily by customer demand. Other significant drivers are the requirement for safety compliance, security of supply and minimal environmental impact.

Performance Measurement

Performance is based primarily on quality of service, which includes safety, power quality, reliability, efficiency and environmental impact. Examples of these are; lost time injury, harmonics, SAIDI statistics, fault response and oil spills, respectively. Financial performance is also significant.

2.8 Information Management

NEL utilises an integrated Office Management System to provide the key drivers to achieve a safe, compliant and efficient network. This system uses Microsoft Office software and cloud-based products which manage all electronic information and documents crucial to the execution of NEL's business.

The implementation and continuing development of the GIS using the current version of ArcView, is amalgamating all asset information into a user-friendly data information and analysis tool. The data which is progressively being linked is:

- 400V Network Schematics;
- 11kV Network Schematics;
- 33kV Network Schematics;
- Connection point and consumer site information;
- Asset condition, location and history;
- Underground cable location plans and field books;
- Asset valuation and ODV;
- Ductline location plans.

2.9 Office Management System Key Drivers

One of the main information systems used by NEL is the Office Management System which controls the following aspects of the business by:

- Providing an interface between the company and its contractors;
- Providing the infrastructure to ensure the Health and Safety of staff, contractors and the public;
- Facilitating continuous improvement;
- Providing individual accountability;
- Reporting on processes, task scheduling, audit requirements, financial statistics;
- Managing stock control;
- Managing asset information;
- Detailing the Risk Model;
- Analysing network data;
- Encompassing the financial system;
- Providing fault history.

2.10 Office Management System Inputs

The inputs to the Office Management System are provided by the following:

- Work Permits;
- Planned Maintenance forms;
- Audit Sheets;
- Fault Sheets;
- Commissioning Sheets.

An Access Database is utilised for the Office Management System and records the asset type, location, condition, components, size, maintenance and auditing records which are acquired from the input data.

The computerised forms used for inputting data has been designed with built-in procedures to assist with the completion of each project.

An example of an Office Management System input is the Work Permit which is a form that is essential for tasks to be undertaken by contractors. The Work Permit, along with other forms, covers the following:

- Outlines parameters of a task;
- Responsibilities - who carries out the work, authorises the work, audits the work;
- Asset addition/change/removal information;
- Asset numbering;
- Timing - advises start and completion dates, date of auditing/payment date. Any task or work not completed by due date appears on the reports produced fortnightly and followed up by staff and management;
- Stock updates - records stock item used and updates stock system;
- Defect liability periods;

- Financial allocations and pricing - records quotes and pricing and budget allocation;
- Auditing - records date of works audited and any non-conformances. Non-conformance details are then recorded on the Improvement Form along with the suggested corrective/preventive action and issued to contractor for correction and sign off;
- Safety and hazard identification;
- Fault Forms also include: fault type; timing; fault cause.

2.11 Office Management System Outputs

From the input data, reports are generated monthly or as required which advises staff and management of:

- Works completed for a set period;
- Works or tasks not completed by their due date;
- Asset information;
- Works for auditing;
- Fault history;
- Contractor works approved weekly report.

Staff and management then follow up these reports especially if deadlines have not been met.

The Task Planner specifies all tasks and works to be carried out by staff and contractors and is issued to staff monthly. The Planner contains details of the task, responsibility for the task and the proposed completion date. Individual monthly planners are issued to staff for execution of scheduled tasks.

The Audit Programme covers a 10-year period. A list of audits is issued to the Operations Manager with the monthly Planner. A copy of the current Audit Programme is in **Appendix A**.

The Improvement Form is the tool to achieve continuous improvement for the business. This form is utilised for:

- Recording non-conformances;
- Organising and recording corrective actions;
- Recording measures to prevent recurrences;
- Requests or recommendations for any improvements to any aspect of the business eg; improve a procedure.

Improvement forms are reported on fortnightly for completion date met and auditing of the improvement.

2.12 Geographic Information System (GIS)

The GIS provides valuable information to staff and contractors alike. The GIS plans were converted from Geo-Schematic AutoCad drawings and now reside on ArcView software. The plans consist of separate layers for the 33kV, 11kV and 400V networks overlaid on a DCDB map of Nelson city. Assets included in the system are substations, conductors, poles, link boxes, spare duct lines and pillar boxes as well as customer connection point attributes. The asset information in the GIS is kept as up to date and as accurate as possible. The source for additions, deletions and modifications is from the work permits for the works from the office management system.

2.13 Geographic Information System (GIS) Inputs

The Network Manager is responsible for all editing of the GIS. The inputs for the system come from field audits and network extension/alteration as-built data on a regular basis.

Links have been established between the Access (Asset and ICP) Databases and GIS to enable semi-automatic updates to be made to the GIS and for comparative checks made between the three systems to ensure that they are synchronised. An aerial photographic layer of the city improves asset location accuracy and operational efficiency.

2.14 Geographic Information System (GIS) Outputs

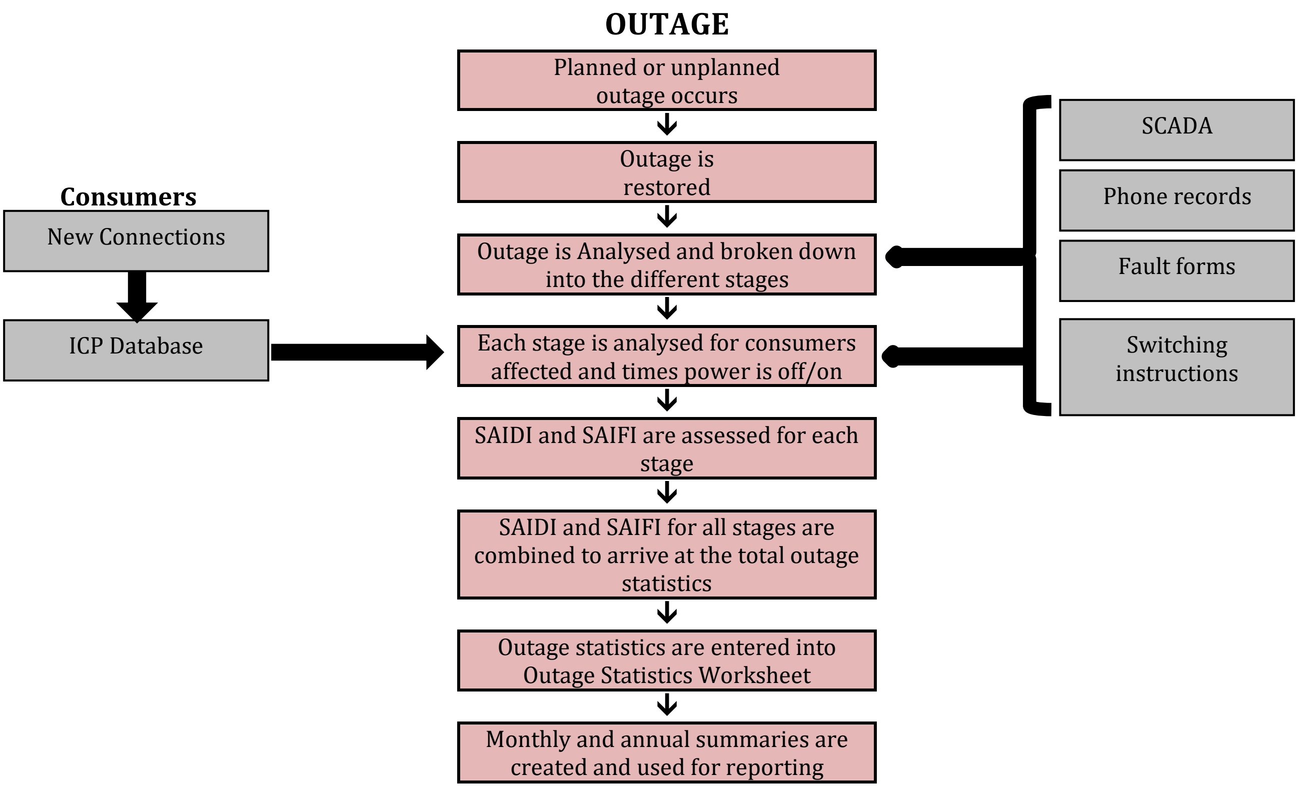
All staff members have access to the GIS via ArcReader software although only "read only". On a monthly basis the latest version of the system is provided to Authorisation Holder certified contractors working on the network. Geo-schematic drawings of the 33kV, 11kV and 400V networks are printed in hardcopy and displayed on separate wall maps in the Zone Substation Control Room for operational purposes. These maps are updated monthly.

A computer containing ArcReader resides in the Control Room so Operators are able to access live and up to date 11kV and 400V network data for operational, fault and switching information.

2.15 Outage Statistic Management

NEL is required to collect and record accurate information regarding all transmission, sub-transmission and 11kV outages. The methods and information used must be robust as the information is used in the disclosure of both SAIDI and SAIFI statistics as part of the Quality Threshold disclosure. Overleaf is a flow chart on the collection and management of outage information.

Outage Statistics Reporting Flow Chart



2.16 Key Assumptions

The Asset Management Plan is a document with a planning period of 10 years. The Plan is based on known information about the network and the environment but there are assumptions made about many aspects of the business. This section outlines some of the major assumptions made to complete this Plan.

This section is also written in a format that complies with the Electricity Distribution Information Disclosure Determination 2012.

The Electricity Distribution Information Disclosure Determination introduces new requirements in relation to Asset Management Plan information. In addition to the information included in the Asset Management Plan, each assumption combines the requirements where applicable:

- All significant assumptions, clearly identified in a manner that makes their significance understandable to electricity consumers, and quantified where possible;
- A description of changes proposed where the information is not based on the Distribution Business's existing business;
- The basis on which significant assumptions have been prepared, including the principal sources of information from which they have been derived;
- The factors that may lead to a material difference between the prospective information disclosed and the corresponding actual information recorded in future disclosures;
- The assumptions made in relation to these sources of uncertainty and the potential effect of the uncertainty on the prospective information.

Regulation and Legislative Requirements

Existing external regulatory and legislative requirements are assumed will remain unchanged throughout the planning period. Thus, the external drivers which influence reliability targets and design, environmental, health and safety standards and industry codes of practice are constant throughout the Asset Management Plan's period.

Network Growth

Network Peak Demand has been flat since 2009 and kilowatt hour consumption had been flat to declining in the same period. The 2018 Asset Management Plan had forecast demand (for planning purposes) to remain the same level and kilowatt hour growth to decline 1% per year. After further analysis of the network, consumer behaviour and other New Zealand network experiences, NEL has determined that the flat demand will continue for the short to medium term, and longer term begin to increase again predominantly due to increases in electric vehicle charging and decarbonisation of energy use.

There is considerable uncertainty for NEL to determine an accurate growth forecast with the added uncertainty of the short and longer term impacts of Covid-19 on different load groups. Metering information is showing flat consumption heading into 2021 after a year when Covid-19 impacted on businesses predominantly. Peak demand, whilst flat, is held up by less use of load control in the winter months. The real uncertainty comes from the mix of variables that has an influence on this being;

- Covid-19
- weather,
- economy,
- shift to more energy efficient appliances,
- more appliances in households,
- change to more efficient heating options,
- subsidies for retrospective insulation installation, and
- solar PV installations.
- EV charging installations (public and household)
- Decarbonisation of Energy Use in NZ

Current consumption trends will change, and it is prudent for Asset Management purposes that NEL, until such time as more evidence suggests, consider growth rates to remain flat and be used for years 1–5 of the planning period and small growth in years 6-10. The change from a "flat" to "positive" growth has meant the need to signal some growth-related projects will come into the 5–10 year planning period.

Assets are replaced or upgraded based on several factors although a key factor is growth. There are three types of growth for the network; ***Connections***, ***Demand*** and ***Consumption***. The key type is Demand. This is typically the deciding factor on whether to replace an asset based on growth. The timing of the maximum demand is typically mid-morning during the peak of winter.

- ***Connections*** are the number of consumers connected to the network. Historically the growth rate of connections has been between 0.5% and 1.0%. While the connection numbers have been flat in recent years it is anticipated that the growth trend will return for the entire planning period. The current number of connections is approximately 9,300 so the Plan will allow for the lower end of the scale at 30 new connections a year.

- ***Demand*** is the increase in peak demand on the network. This typically occurs during the peak of winter during weekday mornings. The historical long term growth rate had typically been between 1.0 % and 1.5% per year. The increases had been due more to consumers using more electrical appliances and switching to cleaner more efficient heating options. Since 2009 peak demand has flattened off and it is apparent that on a per consumer basis consumers are using more efficient appliances and less energy is being used on heating because of improved insulation and more efficient heating options. Current maximum demand is 33.3MW, which is the same as 2019, maximum demand in 2009 was 33.5MW. The Plan assumes the peak demand growth rate remaining flat at 33.3MW for the planning period.

- ***Consumption*** is the number of kWh used. There is some connection between demand and consumption. The historical growth rate for consumption up to 2008 has been between 1.0% and 1.5%. Between 2009 and 2014 annual consumption has declined by 1.5% per year on average and between 2014 and 2019 has been relatively flat. The 2020 year was impacted by Covid-19 and consumption has reduced 2.9% compared to 2019. At the time of writing this Plan, consumption is looking to flatten, which may indicate consumption could be returning to a flat line. For the purposes of asset management, it is forecast consumption remain flat for the first 5 years of the planning period, then increasing by 1.0% per year for the remainder of the planning period.

If there is a fundamental change from forecast in c**onnections**, **demand** and/or **consumption** then this could have an impact on the timing of the capital expenditure programme either by advancing projects or deferment.

Decarbonisation of Energy

The Government has committed to reaching net zero emissions of long-lived gases by 2050. Transformational and lasting change across society and the economy will be needed. New Zealand will need to maximise the use of electricity. This means generating and using lower emission electricity for vehicles and for process heat.

It is anticipated in the medium to long term (5–10 years) that consumption and demand will be impacted through the increase of electric vehicles as well as the decarbonisation of heating as the transition starts to take off. This increased change will put pressure on the low voltage network initially resulting in a need to increase load control for network purposes, then advancing to network asset replacements for growth as non-network solutions become impractical. There has been an allowance of $500k spread over years 5–10 of this Plan to consider these impacts.

Expenditure Projections

All projections of expenditure are presented in New Zealand dollars as at the disclosure date of this Asset Management Plan. This includes the effect of exchange rates for overseas sourced equipment.

The Operational Expenditure, on an annual basis, has been relatively stable except for occasional targeted spending in topical areas eg; 2014 – Overhead Line Compliance, 2015 – Vulnerable Underground Cables - 2016 removal of wooden poles on the 11kV network. There has also been variance due to the availability of appropriate electrical or civil contractors to undertake the work. This Plan assumes there will be a smooth flow of work provided to electrical contractors who will have the appropriate staff to undertake the work in a timely manner.

It is also assumed that in the auditing process there will be 2% asset replacement from service box and link box audits based on the last two years audit/replacement results. It is assumed this percentage will be maintained over time given NEL is now in a regular cycle of audits meaning fewer assets should fail the condition assessment.

Any asset replacements due to growth have been deferred unless due to a known specific development. If, however, technology or consumer behaviour changes then this could result in a review and accelerate or delay some projects depending on the outcome.

Asset Condition

Another key assumption underpinning this Plan is the assumption of asset condition. Asset condition of overhead lines can be visually seen but 90% of the network is underground and so condition assessments are much more difficult and costly.

Given that NEL cannot dig and check cable condition everywhere, NEL has assumed that cable condition will be based on the age and type of cable unless it has been uncovered previously or there is fault history that supports a change on condition assessment. To date any site cable condition assessment has shown condition to be better than assumed. This is supported by sample excavations, visual inspections and tests of cables in varying soil types as part of the independent Network Asset Management Systems and Condition Status Review carried out in 2017-18. However, it remains expected that there will be areas where this may not be the case.

Load Control

NEL now primarily utilises load control to minimise transmission costs through minimising its contribution to the upper South Island peaks Regional Coincident Maximum Demand (RCPD). The 2016 year saw a change from transmission charges being based on the average of 12 largest peaks for the year to the average top 100 peaks. The implications were that load control would be used more extensively as the timing of the top 100 peaks occurred in the shoulder months of winter as well as summer.

Load control is also an important tool to maximise the efficiency and performance of the network as required. NEL has a pricing structure that encourages the utilisation of controllable loads, the biggest being water heating. This Plan assumes that the consumer’s utilisation of load control will continue for the planning period. Future developments in smart metering and more retailer control on load are issues which will be monitored. Currently the assessed benefit of load control is 3MW approximately 10% of total maximum demand.

Load Profiles

Grid Exit Point and 11kV feeder load profile patterns remain consistent with historical trends. The main time any change in pattern is an issue is during the coldest days of winter when NEL has its highest electricity consumption peaks. If the historical load patterns were to shift, then this could bring forward asset replacement or network upgrade works. Any load changes outside the winter months of June, July and August will not have any significant effect at all.

Embedded Generation

It is assumed that increasing levels of embedded generation will be commissioned during the planning period. With the improved economic viability of photo voltaic panels, it is expected there will be a gradual but steady growth in the number of embedded generation sites in both residential and commercial areas. This will have a material impact on the Asset Management Plan in the longer term.

If the cost of technology continues to decrease further and photo voltaic embedded generation becomes even more viable, there could be large changes which could impact on future planning for the network and administering these connections would also become important from a safety perspective. Currently there are 185 sites with embedded generation on the network of which nine are 10kW or more. NEL has implemented systems and procedures for new embedded generation connections and the ongoing management of existing connections from a safety management, operational and quality of supply perspective.

Potential issues identified:

- Over voltage;
- Inverters shutting down due to high voltage;
- Harmonics;
- Quality of electricity injected into network;
- Safety of network during outages (prevention of embedded generation injecting into network during a network fault).

There are also limits to the level of photo voltaic saturation that the existing network can support. In late 2019 NEL engaged the services of a specialist consultant to carry out a study of the Network Hosting Capacity for both PVs and EVs. This study modelled the full NEL network identifying potential congestion points related to varying penetration levels of both EV charging and PV hosting. NEL will continue to monitor photo voltaic and EV charging installations on its network and where network capital works become necessary to support incremental installation, then capital contributions may become necessary from consumers installing photo voltaic in line with the capital contributions policy.

It is assumed that the introduction of more photo voltaic embedded generation will not have any significant impact on the network peak demand. The peak demand times are in the winter months when cloud cover would significantly limit the effectiveness of solar panels and, as such, there would still be a high reliance on the distribution network to supply electricity during those peak demand times.

Any larger installations (diesel generators) will predominantly be installed for the benefit of the consumer in emergency situations but back-feeding into the network always needs to be considered. It is assumed there would not be any embedded generation installed for the sole purpose of selling of electricity in the central Nelson City area.

Transmission

Transpower continues to provide sufficient capacity to meet NEL's requirements at the Stoke Grid Exit Point. Transpower completed its planned 33kV switchboard and transformer changes at Stoke during 2013. Nelson Electricity connected its fourth 33kV feeder to Stoke around the same time.

Consumers

Consumer expectation on reliability and quality of supply remains unchanged for the planning period. Most are happy with current quality and reliability and are unwilling to pay more for improvement.

Natural Disaster

While it is assumed neither the NEL network nor the local transmission grid will be exposed to a major natural disaster during the planning period, all capital work considers elements of resilience as part of the design process to mitigate identified risks associated with a natural disaster. However, should any significant event of this nature occur a complete review of the asset management process, priority and type of works could result in significant change.

It is also assumed the NEL network is exposed to normal climatic variation over the planning period including temperature, wind and rain variances consistent with experiences since 2000.

The Emergency Recovery Plan is used to cater to any major emergency event. This takes into consideration additional important learning from the Christchurch earthquakes and Civil Emergency's in the Nelson region during December 2011 and April 2014.

Climate Change
Nelson Electricity is aware of the impacts of climate change on the network. Much of the central Nelson city is low lying and will be impacted by:

- Sea level rise - there are already small areas of Nelson city that flood during spring tides coupled with rain events.

- Increased risk of high intensity rain events in the eastern hill catchments increasing inundation risk.

While the Nelson Electricity network is not currently impacted by climate change, the asset management planning includes consideration for these impacts. An example is the new Zone Substation built in 2014 which considered sea level rise and inundation risk before finalising floor levels.

It is assumed the impacts of climate change will only be realised outside of the planning period of this Asset Management Plan, but all asset management planning will consider the future impacts.

NEL Ownership
NEL ownership and management structure is maintained as is currently.

No changes are proposed to the existing business of NEL and, thus, all prospective information has been prepared consistent with the existing NEL business ownership and structure.

Local Government
Generally zoning for land use purposes remains unchanged during the planning period except for special housing areas identified by Nelson City Council. The Council entered a Housing Accord with Government allowing aspects of the city's resource management plan to be bypassed. Three of these areas fall within the NEL network area which could create 160 new homes in a relatively short time frame.

The Nelson City Council application of the National Code of Practice for Utilities Access to the Transport Corridors does not increase costs to work in the Nelson city area but can have a significant impact on costs of digging in streets.

Inflation
Inflation has been assumed based on Statistics New Zealand NZIER forecasts. This is about as accurate as Nelson Electricity can obtain from outside sources. It is forecast to be within the 1.0% to 2.0% range. The expenditure plans are based on today's monetary value and inflation is not considered.

Interest Rates
Interest rates will remain around 3.0% and lift to 5.0% over the next few years. NEL will continue to pay off debt for the two major capital expenditure projects completed in 2013. Any increases above forecast will have an influence on the debt servicing costs. NEL will minimise this effect by entering into fixed interest rate arrangements where appropriate.

2.17 Capability to Deliver

Asset Management Plan Realistic and Achievable
NEL has developed the Asset Management Plan which has been fully reviewed and is now reasonably stable in nature and the works deriving from this Plan are undertaken in a sustainable manner principally using the resources available.

The objectives set can be achieved in the timeframes unless there is a need to review based on changed assumptions.

Organisation Structure and Process for Authorisation

Refer to **Section 2.6** which describes the organisational structure and responsibilities and decision-making accountabilities for NEL.

SECTION 3 - Assets Covered

3.1 Introduction

NEL has just under 9,300 connections in a concentrated area of 24 square kilometres. The area is of central Nelson city and includes most of the Port area, Port Hills, Victory Square, Hospital, Brook, Wood, Nelson East, Nelson South and the central business district. Refer to **Appendix B** for a map of the supply area.

There are approximately 318 kilometres of circuits and a total 11kV distribution transformer capacity of 99MVA with a capacity utilisation of 33.5%.

Four feeders are installed from the Grid Exit Point to supply a single 33kV/11kV Zone Substation at Haven Road, Nelson. Part of the route to the Zone Substation is in aerial lines while the latter portion consists of underground cables (see **Appendix B**).

The four 33kV feeders are configured to supply three 33kV/11kV 16/24 MVA transformer banks. The 11kV is configured into three sections operated as a continuous bus with the capability to be sectionalised for operational or protection reasons.

NEL recognises its vulnerability with all supplies to the city passing through a single substation. There are three 11kV interconnection points between NEL's network and that of neighbouring Network Tasman at North Road, Vickerman Street and Brook Street. This enables approximately 6MW of load to be supplied from one network to the other when the necessity arises through extraordinary circumstances, depending on network demand at the time. The interconnection points are connected to one Network Tasman Zone Substation which has two separate 33kV supplies.

Fourteen key 11kV feeders radiate from NEL's Zone Substation to strategically placed major 11kV switching stations located at the city's load centres. Most of these stations have radio communication links with the SCADA system at the Zone Substation, for remote alarm purposes. The major switching stations are all located within a radius of two kilometres of the Zone Substation. From these stations, a primarily ring-fed 11kV network reticulates the city via other 11kV switching stations and an extensively ring-fed 400V network providing supply at 400 and 230 volts (see **Appendix D**).

NEL supplies several major customers with capacities larger than 1MVA. The most notable are:

- Sealord's - fish processing factory with one connection;
- Port Nelson Limited - port facilities with many connections;
- Nelson Marlborough District Health Board - hospital with six connections;
- Nelson City Council - local government with many connections.

NEL owns a permanently mounted 80kVA generator on site to provide emergency power to the Zone Substation in the event of a total 33kV supply outage and a trailer mounted 60kVA mobile generating plant.

The Nelson Marlborough District Health Board has increased the size of its existing emergency generators to two 1200kW diesel generators. These generators can be used in an emergency to operate and inject back into the network.

The Nelson City Council has a 400kVA generator at their central Trafalgar Street site and a 1000kVA generator at their Neale Park site. While exporting onto the network would be possible if required, this needs to be addressed further with the Council.

NEL has a fibre link between its Zone Substation and Transpower's Grid Exit Point at Stoke for the purpose of monitoring load and for 33kV feeder protection.

NEL has a radio communication system between the Zone Substation and major 11kV switching stations to communicate CB status and alarms on the SCADA. On receipt of an alarm from an out-station or from the 33kV/11kV system at the Zone Substation, a message is generated by the SCADA system and transmitted to NEL's call answering service, currently Call Care, or any other selected receiver.

3.2 Identification of Assets

Identification of Assets by Category

The assets of NEL have been grouped for ease of modelling by the Asset Performance Standard into:

- Sub-transmission Network;
- Zone Substation;
- Distribution Network;
- Distribution Substations and Transformers
- Distribution Switchgear
- LV Network;
- Other Network Assets (includes Communications and SCADA);
- Non-Network Assets

Sub-transmission Network

This group addresses all assets attached to the four 33kV feeders between the Grid Exit Point at Stoke and the 33kV terminals on the 33kV/11kV transformers at NEL's Zone Substation at Haven Road.

Zone Substation

This group covers the Zone Substation at Haven Road which includes all equipment within the substation including the building, 33kV/11kV transformers, 33kV and 11kV Switchgear, protection, generator, etc.

Distribution Network

The assets addressed in this group include all major assets between the outgoing 11kV bushings of the 11kV Zone Substation switchgear and the 11kV bushings on the 11kV/400V distribution transformers throughout the network.

Distribution Substations and Transformers

This group covers the 11kV/400V distribution substation and transformers but excludes Distribution Switchgear.

Distribution Switchgear

This group covers the 11kV distribution switchgear throughout the network.

LV Network

This group addresses the assets in the network contained between the 11kV/400V transformer LV bushing and the customer network connection point.

Other Network Assets

This group includes all assets that are not included in the above categories ie; communications and SCADA.

Non-Network Assets

This group is for all assets that are not used for the direct operation of the network. These include vehicles and office equipment.

See **Appendix E** for Asset Quantities as disclosed in the 31 March 2020 Disclosure Schedule 9a and Regulatory Asset Base Value by Asset Category as disclosed in the 31 March 2020 Disclosure Schedule 4(vii).

3.3 Justification of Assets

Introduction

The selection of 33kV as the supply voltage into the Zone Substation is mainly an historical one which has been largely influenced by the availability of 33kV at the Stoke Grid Exit Point. Because of the density and small area covered by the NEL network, 11kV has served as a more than adequate secondary transmission voltage for the network. The operation of the network at both above voltages has ensured that system losses have been kept to acceptable levels. The configuration of the 11kV network has maintained a high quality and reliability of supply to the end user. The use of a 400V ring-feed network compliments the transmission voltages with enhanced reliability statistics. All assets are provided to meet regulatory voltage requirements under system peak loads while meeting security levels as mentioned in the next section.

Security

NEL assets are in place to provide a reliable power supply to its consumers. The Zone Substation and four 33kV feeders have N-1 capability, therefore, except for short lengths of 33kV cable there is no requirement for NEL to hold spares for these assets for the purpose of an enhanced security of supply.

There is also sufficient spare capacity within the 11kV network to provide N-1 security levels for a single event occurrence.

NEL has strategic emergency spares available to support repair or replacement of failed assets on the network.

Current practice with the NEL network is to plan to provide N-1 where practicable except for the rural and peripheral residential areas. However, this may be compromised in the future by the limitations on revenue because of price path regulation.

NEL will also provide alternative levels of supply security and price for customers who are prepared to enter into appropriate contracts. These areas still meet the Asset Performance Standard and current security level outlined below.

NEL - Current Security Level

Security Level	33kV Network	33kV Transformer	11kV Network	11kV/400V Transformer	400V Network
Urban large business and industrial	N-1	N-1	N-1*	N-1	N-1
Urban small business and residential	N-1	N-1	N-1*	N-1	N-1
Central business district	N-1	N-1	N-1*	N-1	N-1
Rural and peripheral urban residential	N-1	N-1	N*	N	N

***11kV Switchgear, Zone Substation Bus or Bus Coupler Fault** – NEL's 11kV Zone Substation bus meets N-1 criteria. The only exception at the 11kV level is in the event of a bus fault at a first out switching station. Security of Supply level is N, where it will take repair time. Repair time could be extended beyond six hours depending on the severity of fault.

N-1 means that supply to all consumers affected by a single failure event shall be restored by means of switching only (ie; no replacement of in-service equipment).

N means that supply may be restored to consumers affected by a failure event by either replacement or the repair of in-service equipment.

The criteria used to develop the Asset Performance Standards reflect asset performance levels that can be obtained by the N-1 methodology.

Optimisation

NEL gathers data from the network by way of:

- Annual Load Survey;
- Network Asset Auditing;
- Planned Preventive Maintenance;
- Network Load and Temperature Logging.

This information is analysed for the purposes of optimisation and redundancy by:

- Asset Performance Modelling;
- Operational Management System;
- ODV Analysis.

Where NEL identifies assets installed on the network that provide a security and capacity level higher than either the Asset Performance Standards required or customers have specifically contracted for and are deemed as unnecessary or excessive as opportunities arise, NEL either removes these assets from service or downsizes the asset.

3.4 Location, Age and Condition of Assets

Categories

The graph and table below give an indication as to the regulatory asset base value by asset category and average ages.

The total Regulatory Asset Base value above is derived from the ODV and historic cost process. The actual replacement cost, if based 100% on historical cost, would be significantly higher. This demonstrates the inadequacy of the ODV process in reflecting the true costs of networks.

Assets by Age

Asset Category	Average Install Date
Zone Substation	2014
Sub-transmission Network	1995
Distribution Network	1985
Distribution Substations	1985
Distribution Transformers	1999
LV Network	1980

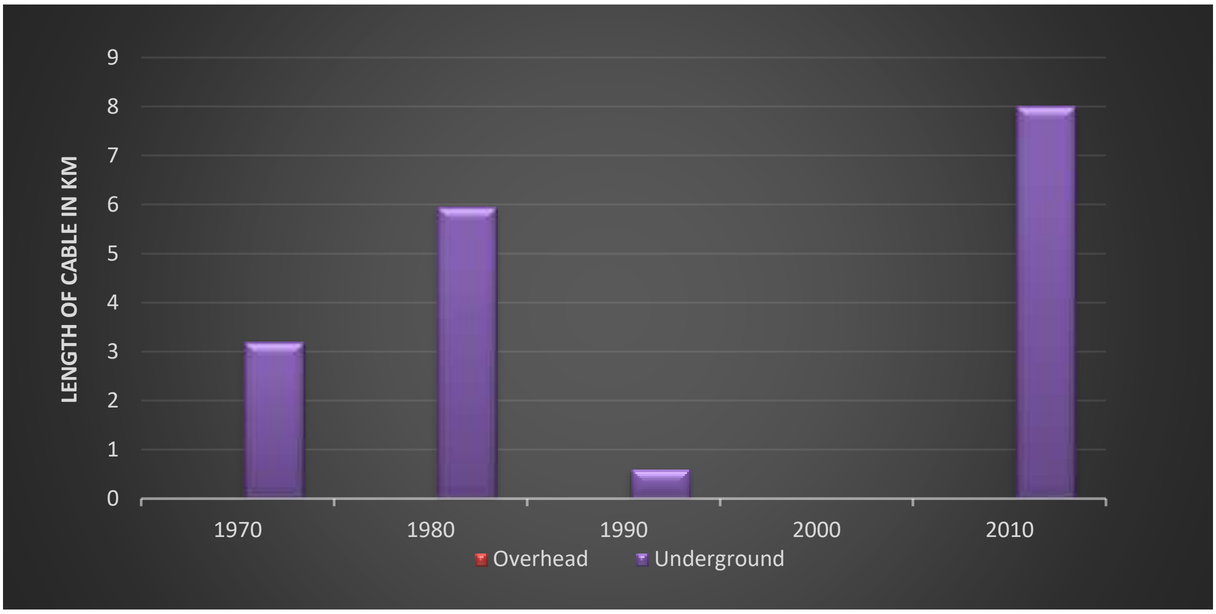
Asset average install date is based on asset data available as of 31 January 2021

Asset Age Profiles

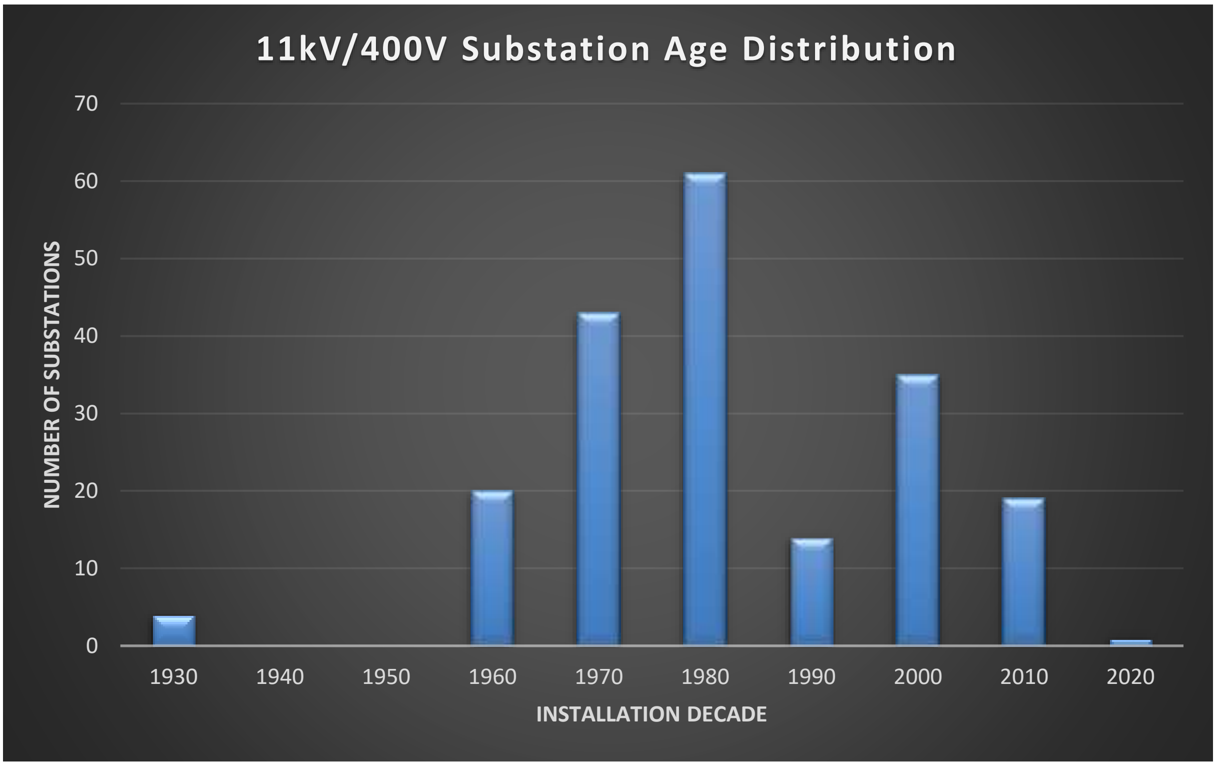
The profiles below are taken from data for the year ending 31 January 2021. The graphs show that the network is 90% underground and has an overall average age of approximately 29 years. The condition of these assets is detailed in the asset maintenance section. The age distribution graphs demonstrate that most assets were installed in the 1960s to 1980s. The 1990s was a period of minimal change with few new assets installed on the network. During the 2000–2010 period there were more asset replacements with some of the aged assets, especially 11kV switches and transformers, being replaced as well as investments due to growth.

The 2021-2031 period will see planned asset replacements generally focused on the end of their useful life coupled with resilience and safety enhancements. Projects scheduled are the replacement of the last 11kV oil filled switchboard, oil filled RMU replacements, cables that will be upgraded to provide a secure backup ring around the network and lowering of the last remaining pole mounted substation supplying multiple consumers to ground. These projects will also replace older assets with assets of higher capacity looking at the longer term.

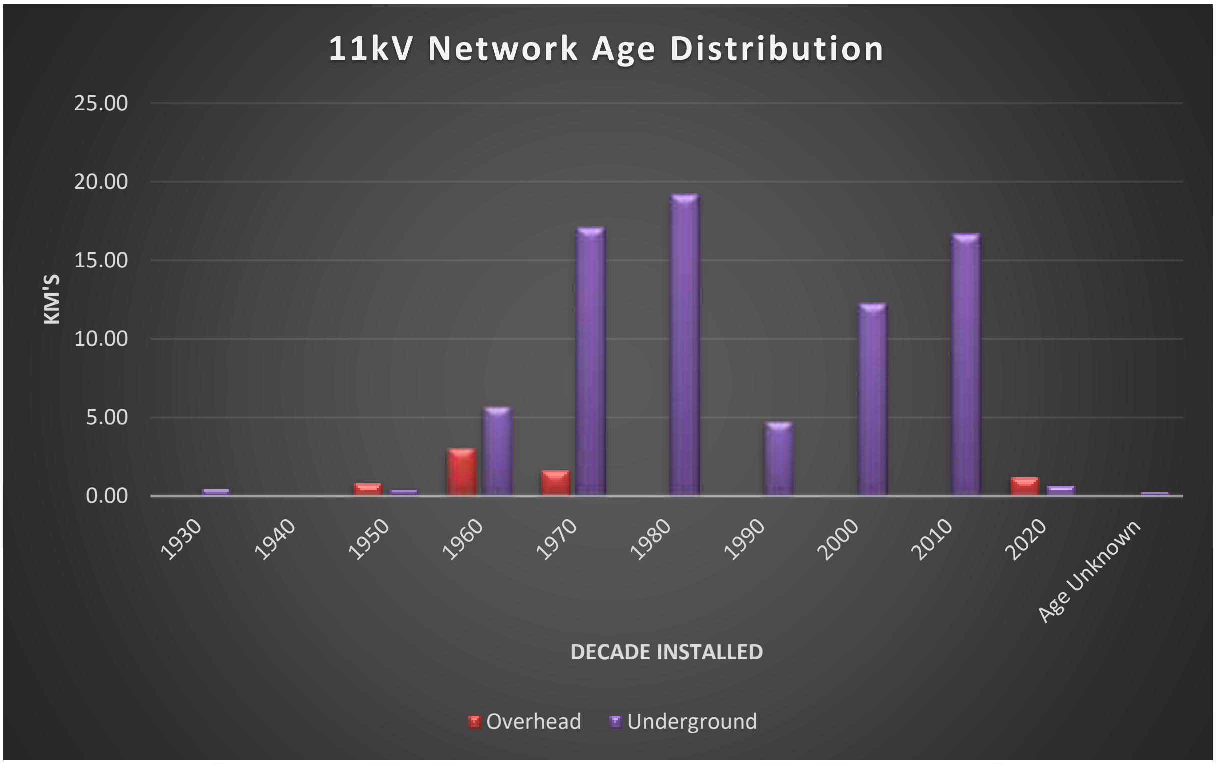
33kV Network Age Distribution



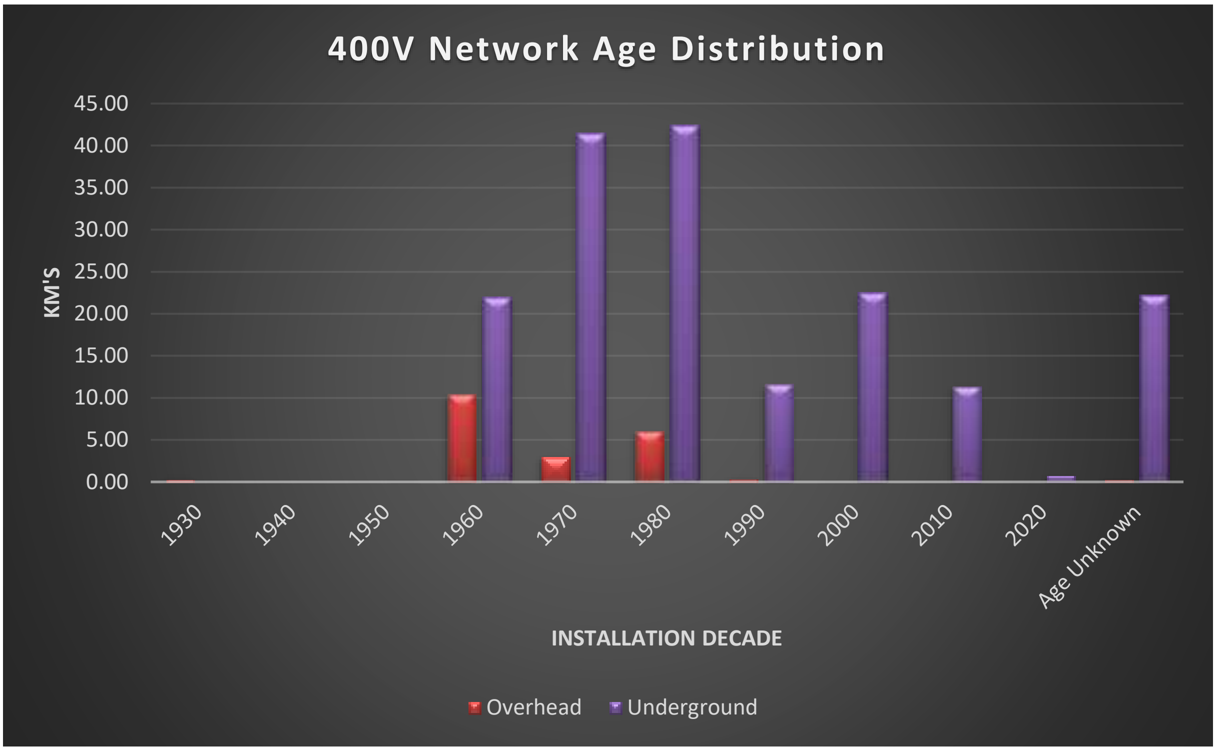
11kV/400V Substation Age Distribution



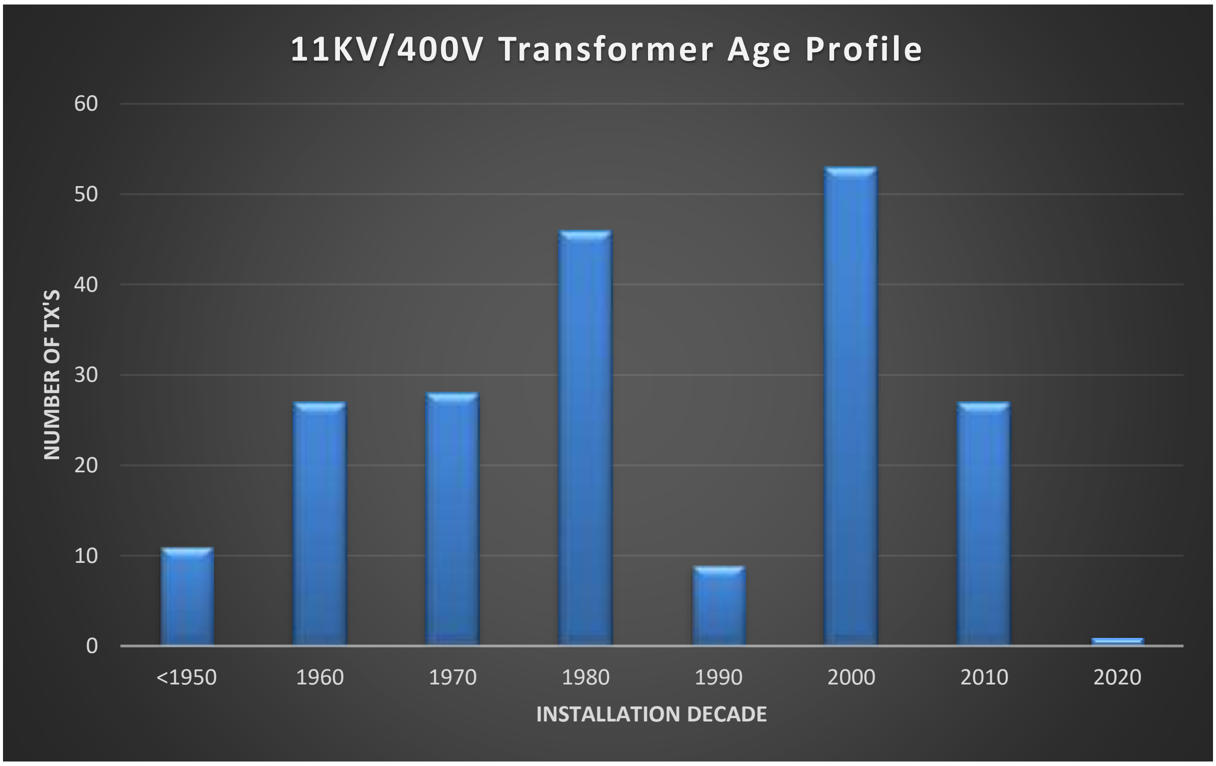
11kV Network Age Distribution



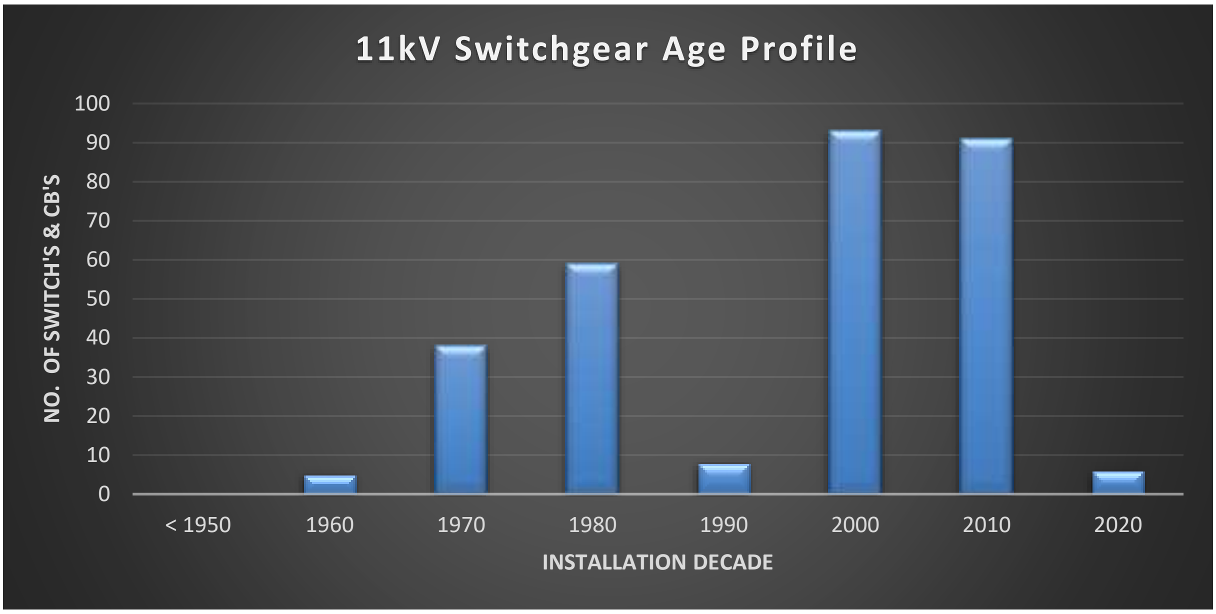
400V Network Age Distribution



11kV/400V Transformer Age Profile



11kV Switch Age Profile



The Auditing Programme and associated risk modelling results identify areas of the network that will require maintenance at various times in the future. The location and age of assets are held in computer databases and AutoCad files. These files are supplemented by office plans, field books and photographs. The GIS amalgamates all asset information into an easy use, information analysis and retrieval system.

3.5 Asset Replacement

NEL has an Asset Replacement Guide to aide in determination of the appropriate time to replace an asset. This guide covers all asset types on the network.

NELSON ELECTRICITY - ASSET REPLACEMENT GUIDE

	Replacement Priority			
Asset Type	*1 - Safety*	*2 - Technical*	*3 - Condition*	*4 - Age*
33kV Supply				
Cables	Depth Public Risk	Load growth	Partial discharge tests Cable inspection Cable fault history	XLPE Cable - 50 years PI Cable - 77 years
Overhead Line	Public Risk	Load growth	Partial discharge tests Thermal imaging	Continually maintained
Zone Substation				
Transformers	Fault issue identified	Load growth Lack of spares Noise	Oil Test Thermal imaging Physical Inspection	66 years
33kV OCB	Fault issue identified	Lack of spares	Oil Test Thermal imaging Physical Inspection Partial discharge tests	44 years
11kV Switchboard	Fault Issue Identified	Lack of spares Load growth Potential fault levels	Oil test Physical Inspection Partail discharge tests	50 years
11kV Network				
Cables	Electromagnetic field Depth Public Risk	Load growth	Partial discharge tests Cable inspection Cable fault history	XLPE Cable - 50 years PI Cable - 77 years
Overhead Line	Electromagnetic field Public Risk	Load growth	Partial discharge tests Thermal imaging	Continually maintained
Distribution Substations				
Transformers	Fault issue identified	Load growth Lack of spares Noise	Oil Test Thermal imaging Physical Inspection	60 years
11kV switches	Fault issue identified	Lack of spares	Oil Test Thermal imaging Physical Inspection Partial discharge tests	44 years
400V Switchboard	Touchproof Fault issue identified	Load growth	Thermal imaging Physical Inspection	44 years
400V Network				
Cables	Depth Public Risk	Load growth	Cable inspection Cable fault history	XLPE/PVC Cable - 55 years PI Cable - 77 years
Overhead Line	Public Risk	Load growth	Thermal imaging	Continually maintained
Service Box/Link Box	Location Risk Touch Proof Issue Earthing	Load growth Condition assessment	Physical inspection	50 years

Primary Assets

NEL has completed several major age-related asset replacements in recent years, however, cable aging still presents an unknown risk. The previous section demonstrated the age profile of NEL assets, therefore, there will be an ongoing upgrade and replacement programme for these aged assets.

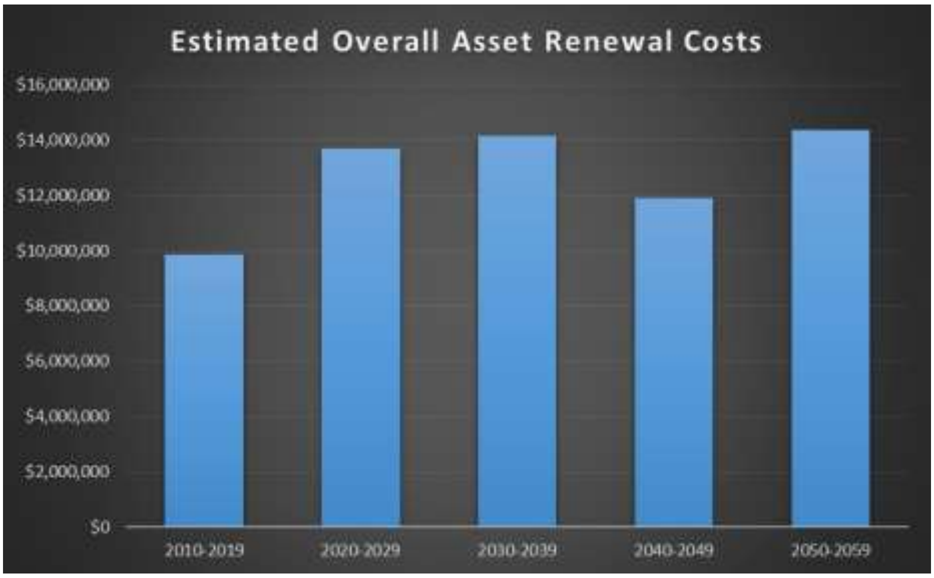
As indicated in this extrapolated graph, significant asset replacement costs are predicted over the next 70 years. The replacement periods are based on the standard physical asset lives as outlined in the Electricity Distribution Services Input Methodologies Determination 2012 and values are based on the Regulatory Asset Base valuation for the various types of network assets. This will require more investment into the network on top of any natural growth that may occur. Because of an ongoing maintenance cycle and testing programme the standard service lives of assets such as transformers and details of the condition assessment of assets is detailed in **Section 6.4** of this document. In broad terms, all asset types are audited or tested on a regular cycle and from the results of that audit a maintenance or replacement programme is formed.

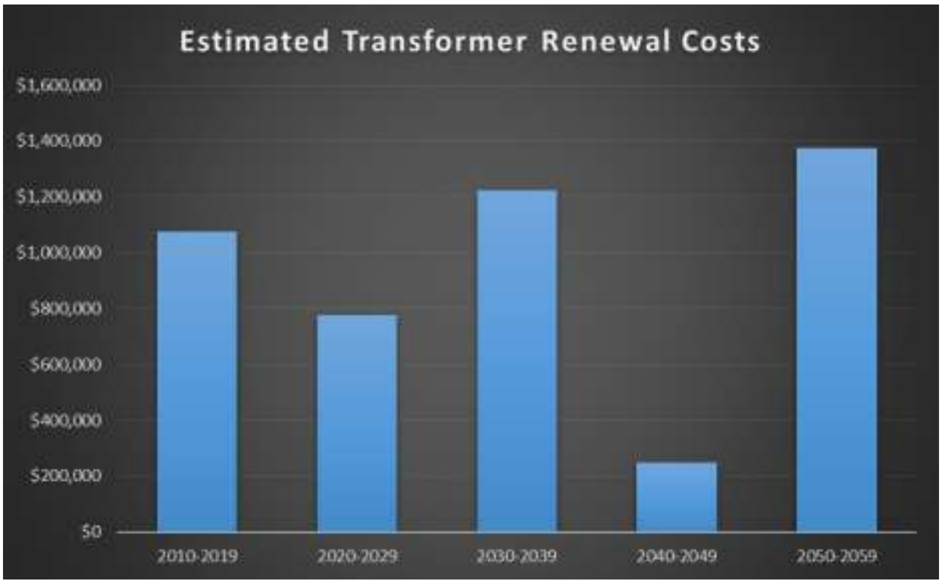
As an example of this programme in action, all series 1 Andelect oil filled Ring Main Units on the network were replaced between 2008 and 2012. Similarly, there are several HV cables nearing their end of service life in the coming years. These will be partial discharge tested and potholed on to determine their condition and if they will last beyond their standard physical asset life.

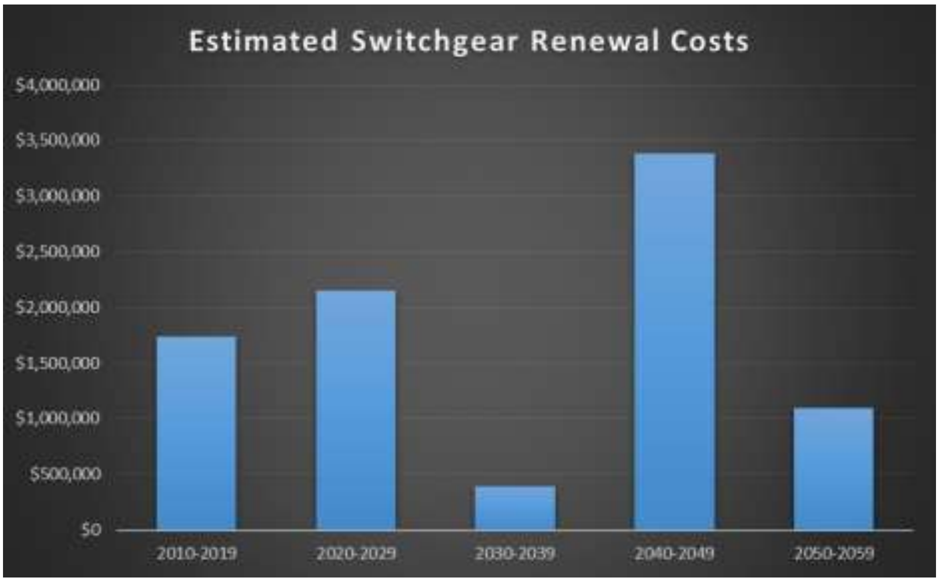
Standard Physical Asset Life Table

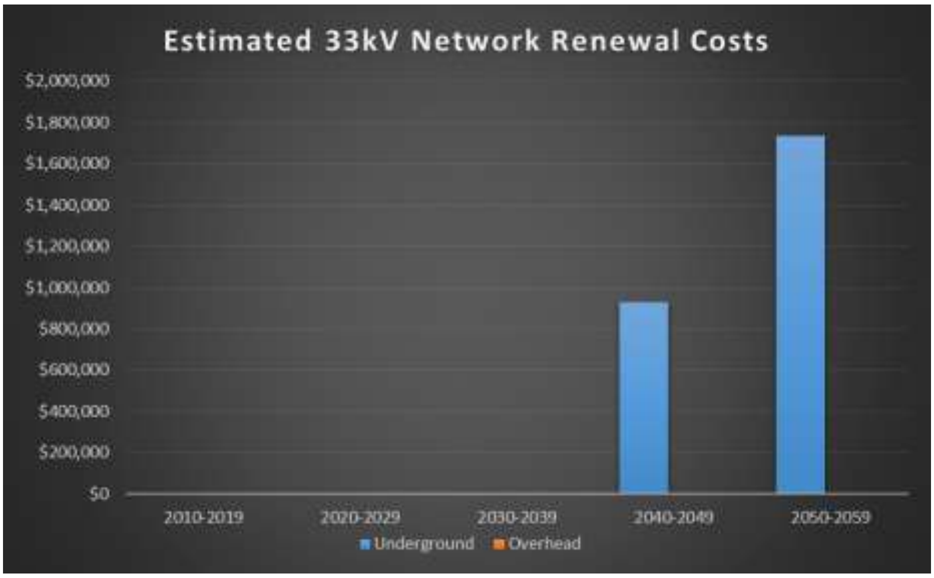
(Electricity Distribution Services Input Methodology Determination 2012)

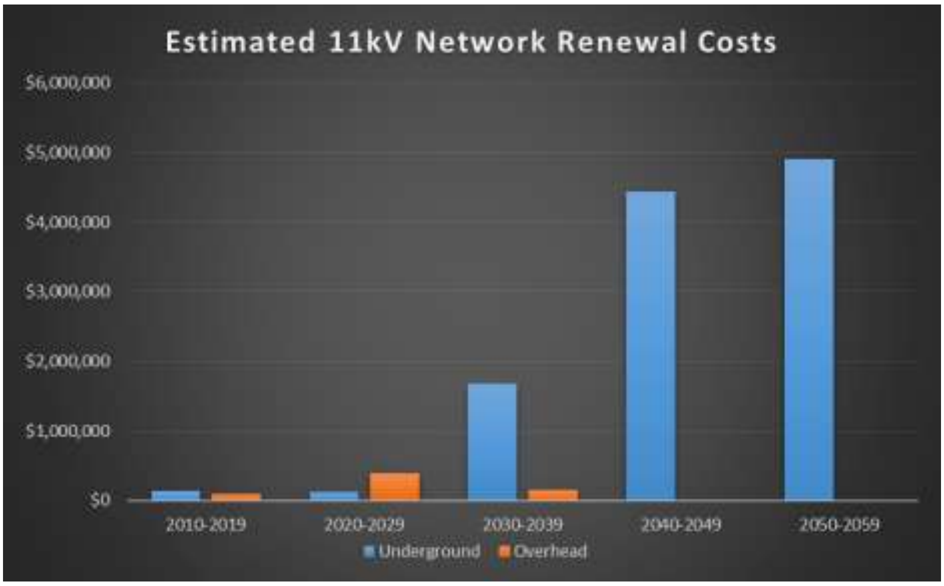
Asset Type	Standard Life (Years)
Transformers	45
HV Switches	40
Sub-transmission Cables – XLPE (Pre 1985/Post 1985)	45/55
Sub-transmission Cables - PILC	70
Distribution Cables – XLPE (Pre 1985/Post 1985)	45/55
Distribution Cables - PILC	70
Distribution Lines - Wood	45
Distribution Lines - Concrete	60
LV Cables – XLPE (Pre 1985/Post 1985)	45/55
LV Cables - PILC	70
LV Lines - Wood	45
LV Lines - Concrete	60

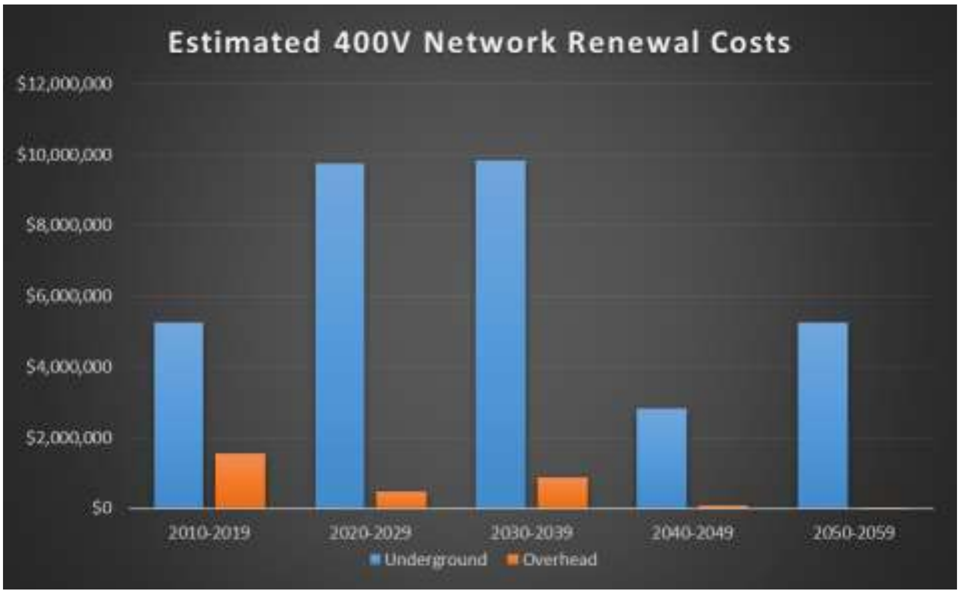

Estimated Overall Asset Renewal Costs
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
2010-2019
2020-2029
2030-2039
2040-2049
2050-2059


Estimated Transformer Renewal Costs
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
2010-2019
2020-2029
2030-2039
2040-2049
2050-2059


Estimated Switchgear Renewal Costs
$4,000,000
$3,500,000
$3,000,000
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
2010-2019
2020-2029
2030-2039
2040-2049
2050-2059


Estimated 33kV Network Renewal Costs
$2,000,000
$1,800,000
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
2010-2019
2020-2029
2030-2039
2040-2049
2050-2059
Underground
Overhead


Estimated 11kV Network Renewal Costs
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
2010-2019
2020-2029
2030-2039
2040-2049
2050-2059
Underground
Overhead


Estimated 400V Network Renewal Costs
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
2010-2019
2020-2029
2030-2039
2040-2049
2050-2059
Underground
Overhead

Secondary Assets

Also, of significant importance to the operation of the network are Secondary Assets such as buildings, SCADA, Ripple Generators and Switchyards. These assets are also audited on a regular basis and, where required, maintenance or replacements are scheduled. The overlay to the life cycle of these assets is based on the standard physical asset lives as outlined in the Electricity Distribution Services Input Methodologies Determination 2012.

Standard ODV Asset Life Table

Asset Type	Standard Life (Years)
Ripple Injection Plant	20
SCADA	15
Switchyard Structure - Concrete	60
Buildings	70

Ripple Injection Plant – The two rotating ripple generators were replaced with a single static ripple injection system in the 2014-2015 financial year.

SCADA – The present system is reasonably new and being gradually extended to provide more feedback from the network operations.

Switchyard –The 33kV outdoor switchyard was replaced with a new indoor Zone Substation at Haven Road in 2014.

Buildings – The oldest of the existing buildings was constructed in the late 1950s and generally is in sound condition. Additional earthquake bracing was installed in this building in 2009. Earthquake bracing identified at block distribution substations was completed in 2018.

3.6 Non-Asset Solutions

Evaluation of appropriate non-asset solutions is a key strategy in the deferment, minimization or elimination of capital and maintenance spend otherwise required in the acquisition of assets for maintaining, reinforcing or extending the existing network.

The objectives of this policy statement are to ensure:

- Integration of non-asset options in long term asset development planning;
- Evaluation of non-asset options in the day-to-day implementation of network operations;
- That the non-asset solutions contribute to the achievement of Key Performance Indicators.

Application of the above criteria reinforces a discipline in lateral thinking and enhances the end objective of a best-cost solution for network investment decisions by the network management team and company directors.

NEL assesses non-asset solutions on a case-by-case basis. Many of the options introduced are within the network but there are some that include consumer involvement. Given the network is dense urban, there is limited opportunity for some solutions like distributed generation.

The following solutions have been implemented and continue to be reviewed as an option for the future:

- **<u>Load control is used to reduce demand peaks</u> -** This is being used to not only minimise transmission costs but also to maximise the utilisation of existing assets and deferring the need for asset replacement. It is also used through differential pricing to provide incentives for consumers to minimise peak demand loads which can remove the need for consumer capacity upgrades or provide additional spare capacity to be used elsewhere.

  Load control has been used in New Zealand extensively and still proves the most cost-effective way to manage electricity peaks at a distribution network level.

- **<u>The introduction of power factor pricing</u>** has encouraged larger consumers to improve power factor on their sites further increasing the performance of not only their supply but also the NEL network. Power factor charges have been implemented into the line charges for Time of Use consumers to encourage large consumers with poor power factor to improve, thus improving the performance of the network and potentially delaying some infrastructure upgrades.

- **<u>Demand Side Management</u> -** In addition to load control, NEL has agreements in place with select major consumers in the event of a major outage during peak winter times to minimise/reduce load. This provides additional capability to maintain supply to the entire NEL network. This non-network solution has been used to minimise the overall network peak or constraint but consideration for this option for internal network constraint is also an option, but it is likely there will be limited opportunity. Given this is a contractual situation it is not considered a viable long-term solution.

- **<u>Some capacity upgrades have also been deferred by load shifting across the network</u> -** Something as simple as shifting breakpoints on the HV or LV system depending on where the potential constraint is. This option is looked at on an annual basis by balancing load across transformers or 11kV feeder catchments. This has proven to be effective to ensure the N-1 security of supply standard is maintained on the 11kV network.

Non-network opportunities will continue to be looked at as an alternative to investment in the network.

3.7 Distributed Generation

NEL recognises the value of distributed generation in the following ways:

- Reduction of peak demand at Transpower Grid Exit Points (only if used for generation at peak times);
- Reducing the effect of existing network constraints;
- Avoiding investment in additional network capacity;
- Contributing to supply security;
- Making better use of local primary energy resources thereby avoiding line losses;
- Decreased line losses through smaller generation closer to load;
- Avoiding the environmental impact associated with large scale power generation.

NEL also recognises that distributed generation can have the following undesirable effects:

- Increased fault levels requiring protection and switchgear upgrades;
- Potential stranding of assets, or at least part of an asset's capacity, if significant levels of generation are installed.

Despite the potential undesirable effects, NEL will facilitate the development of distributed generation that will benefit both the generator and NEL.

3.8 Environmental Considerations

Consideration for any distributed generation option must be given to any environmental impacts in the area ie; noise, air pollution, visual impacts.

3.9 Connection Terms and Conditions (Commercial)

- Connection of distributed generation up to 10kW to an existing connection will not incur any additional line charges. Connection of distributed generation greater than 10kW to an existing connection may incur additional costs to reflect network reinforcement, which can be either on a full, up-front basis or over time. Costs charged under either method are likely to be capped by Regulation.

- Distributed generation that requires a new connection to the network will be charged a standard connection fee and may also be charged a fee to reflect reinforcement of the network back to the next transformation point.

- An annual administration fee will be payable by the connecting party to NEL.

- Installation of suitable metering (refer to technical standards below) shall be at the expense of the distributed generator and its associated energy retailer.

- NEL is happy to recognise and share the benefits of distributed generation in reducing its own costs (such as transmission costs or deferred investment in the network) provided the distributed generation is of sufficient size to provide real benefits.

- Those wishing to connect distributed generation must satisfy NEL that a contractual arrangement with a suitable party is in place to consume all injected energy.

3.10 Safety Standards

- A party connecting distributed generation must comply with any and all safety requirements promulgated by NEL.

- NEL reserves the right to physically disconnect any distributed generation that does not comply with such requirements.

3.11 Technical Standards

- Metering capable of recording both imported and exported energy must be installed. If the owner of the distributed generation wishes to share in any benefits accruing to NEL, such metering may need to be half-hourly.

- NEL may require a distributed generator of greater than 10kW to demonstrate that operation of the distributed generation will not interfere with operational aspects of the network, particularly such aspects as protection and control.

- All connection assets must be designed and constructed to technical standards not dissimilar to NEL's prevailing asset management standards.

3.12 Re-deployment and Upgrade of Existing Assets

NEL has a policy of re-deploying assets into functions matching each assets dimension. In particular, NEL re-deploys distribution transformers to better match rating with maximum demand.

3.13 Acquisition of New Assets

The acquisition of assets (materials, equipment or apparatus) for network expansion, renewal or maintenance requires careful optimization of capital resources. To optimize the investment decisions, formal evaluation criteria shall be used that applies dollar values to a standard formula or framework. The basis of, and the ground rules for these assumptions, require definition and valuation within an appropriate financial model.

The economic evaluation process will enable full consideration of conventional and nebulous economic factors which are often difficult to place a dollar value on. For example, quality, reliability, life, costs of non-supply, customer impacts, SAIDI, risks liability (such as wind return periods, likelihood of a given incident occurring, etc). The results will be output to standardized formats evaluating net present value and economic value added for capital and maintenance investments.

This policy is supported by life cycle costing models for inclusion in the overall economic evaluation process, which considers the following issues:

- Remaining life strategies for aging network equipment;
- New equipment total life cycle costs as part of materials procurement;
- New technology;
- Project tender evaluations.

Application of the above criteria reinforces a discipline in lateral thinking and enhances the end objective of a best-cost solution for network investment decisions by the network management team and company directors.

3.14 Adoption of New Technology

Because NEL is a very small business and because of the Commerce Commission's revenue constraints, NEL seeks to avoid the exposure of adopting leading edge technologies, preferring instead to adopt only proven technologies that are used by other network utilities for vendor support to be maintained in New Zealand. Where appropriate, NEL takes advantage of the advice and recommendations from its shareholders Network Tasman and Marlborough Lines regarding asset type selection.

3.15 Disposal of Existing Assets

Assets deemed unsuitable for redeployment because of condition, capacity or technology will be disposed of in an environmentally sensitive manner.

SECTION 4 - Service Levels

4.1 *Reliability and Performance*

NEL's goal is to have a network reliability and performance consistent with other networks of similar kind in New Zealand while also meeting consumer expectation.

The aim is for continual improvement of network reliability and performance even with the restrictions and limitations of a regulated environment. NEL has selected target levels which it believes are acceptable for the size of the network.

Consultation through a recent customer survey indicates that the present service levels are acceptable and that changes to charges to improve the level are not necessary. All stakeholder interests in reliability versus the costs to improve the reliability of the network - the Unplanned Target - is reviewed annually and altered accordingly.

The NEL network is dense urban and predominantly underground. Fault response times are set and monitored utilising a fault response contract with a service provider for the network. Fault diagnosis and restoration is minimised due to the meshed type 11kV and 400V system allowing for back-feeding of areas affected by a fault. The performance levels are set taking this into account.

Although the NEL service levels are acceptable this can be expected to decline unless replacement of aging assets and maintenance levels continue. NEL will seek to do this within any pricing limitations imposed by the Commerce Commission.

Reliability and performance are gauged by the following standard industry measures.

NOTE 1: The forecasted figures do not include Transpower related interruptions as NEL does not have any influence over them.

NOTE 2: Year end is 31 March 2019 for "actual" figures and 31 March 2020 for "forecast" figures.

It will be noted that the actual figures for planned interruptions (Class B) was significantly lower than the target figures in 2015 and 2016. This was while the focus was on completing the 33kV Zone Substation replacement and the installation of a fourth 33kV feeder from Transpower's Stoke Substation. Together this resulted in an improved overall SAIDI performance. The years 2012-2014 were typically normal and from 2017 onward are expected to be closer to target regarding planned interruptions undertaken.

Justification for Target Levels of Service

NEL has extremely high levels of reliability compared to the industry but considers them to be in line with other networks of similar kind. The network is dense urban and predominantly underground. As such there is an expectation of high reliability. Most networks in New Zealand have a significant proportion of rural overhead lines and so it is difficult to directly compare network reliability statistics.

NEL believes the levels, as outlined, are a fair measure when compared to the dense urban portions of networks throughout New Zealand as these areas typically have more back-feed options, more automation and are closer to where the fault staff are based. NEL does constantly review its target figures based on network performance over recent years whilst considering extreme events and any particular planned projects that may have unduly distorted annual figures.

The average SAIDI figures (excluding Transpower related) for the last six years of operation show that the Planned Interruptions (Class B) were 9.6 and the Unplanned Interruptions (Class C) were 9.25. The Class B figures have been influenced by significant projects, therefore, it is believed that the target of 15.00 remains appropriate. Targetted improvements in the network over recent years has reduced the number and impact of unplanned events. The Class target has been reviewed and halved to 15 minutes.

The average NEL SAIFI Class C figure for the last six years was 0.18, the target is 0.6. The combined Class B and C figure is 0.21.

Consumer surveys indicate that they are mostly happy with current reliability and do not want to pay more for increased reliability and conversely do not want to pay less for a less reliable supply. These findings have to be tempered by the fact that consumers do not differentiate between retailer, electricity networks or transmission. To them a power outage is a power outage.

We believe that the target levels of service generally satisfy both the consumer expectation and the comparison of dense urban parts of other networks.

Continual Improvement

NEL aims to continually improve the Asset Performance Standards with assistance from:

- Shareholders;
- Energy traders;
- Major customers;
- Other stakeholders.

A full description of Asset Performance Standards is covered in **Section 7.5**.

In the Standard Use of System Agreement, the supply to the consumer's point of supply will only be interrupted intentionally for reasons of:

- Planned outages;
- Inspections, maintenance or alterations;
- Safety;
- Protection of NEL's or other networks;
- Protection of the consumers quality of supply;
- Transpower instruction;
- Providing remote signal services;
- Response to an event of Force Majeure.

Where supply to the consumer's point of supply is to be interrupted NEL shall:

- Where possible, give seven days' notice to retail companies for planned shutdowns;
- Advise the energy trader of the duration time and consumer affected in the event of unplanned outages;
- Consult with the energy trader where Transpower requests an interruption;
- Act in accordance with good industry practice always.

The Use of System Agreement requires that the consumer's equipment or demand does not interfere with the supply to other network users.

NEL has a target of supplying all consumers with a quality of supply that meets or exceeds the standards set in the Electricity Regulations and in other industry codes of practice and, furthermore, will provide alternative levels of supply, quality and price for customers who are prepared to enter into commercial contracts. Measures of quality of supply are voltage magnitude, harmonic level and interference.

During times of peak loading in winter voltage checks are made throughout the network at substations and end of line boxes and poles. Data gathered is entered into the Office Management System, the results analysed and identified problems are rectified.

The likelihood of a new connection to the network causing interference to other users is assessed at the time of application. Guidelines, which address harmonics and interference, are contained in the NEL Network Code. Harmonics and interference are typically reported by the consumer, resulting in testing and recordings being made at the consumer's premise and on the network.

4.2 SAIDI - System Average Interruption Duration Index

SAIDI is the measure of the number of minutes that a customer on the network is without power per year. The formula is outlined below.

$$\frac{\text{Sum of [No. of Interrupted Consumers x Interruption Duration]}}{\text{Total Number of Connected Consumers}}$$

Over the last five years (including the disclosure year 2020-2021) the NEL network has had an average of 43 minutes interruption of supply per consumer per year. It should be noted that one outage has a significant impact on the SAIDI minutes given the size of the NEL network as can be seen by the Unplanned Transpower outage in 2018. The industry average for 2020 was 299.

NOTE: As the year end 31 March 2021 is incomplete, a 2021 forecast figure has been entered below.

SAIDI

	Year End	Transpower Planned	Transpower Unplanned	Transpower Total	NEL Planned	NEL Unplanned	NEL Total	Overall SAIDI
Actual	2003	0.00	0.00	0.00	27.00	72.00	99.00	99.00
Actual	2004	0.00	0.00	0.00	7.00	46.00	53.00	53.00
Actual	2005	0.00	0.00	0.00	12.00	39.00	51.00	51.00
Actual	2006	0.00	101.00	101.00	12.00	10.00	22.00	123.00
Actual	2007	0.00	215.00	215.00	9.00	16.00	25.00	240.00
Actual	2008	0.00	0.00	0.00	5.00	12.00	17.00	17.00
Actual	2009	0.00	70.00	70.00	29.00	87.00	116.00	186.00
Actual	2010	0.00	90.00	90.00	54.00	25.00	79.00	169.00
Actual	2011	0.00	0.00	0.00	9.00	106.00	115.00	115.00
Actual	2012	0.00	0.00	0.00	9.00	54.00	63.00	63.00
Actual	2013	0.00	0.00	0.00	10.24	34.00	44.24	44.24
Actual	2014	0.00	39.59	39.59	1.77	20.61	22.38	61.97
Actual	2015	0.00	0.00	0.00	2.55	17.39	19.94	19.94
Actual	2016	0.00	0.00	0.00	0.57	10.39	10.96	10.96
Actual	2017	0.00	0.00	0.00	8.83	27.44	36.27	36.27
Actual	2018	0.00	116.79	116.79	6.86	9.55	16.41	133.2
Actual	2019	0.00	0.00	0.00	16.79	7.55	24.34	24.34
Actual	2020	0.00	0.00	0.00	11.46	0.56	12.02	12.02
Forecast	2021	0.00	0.00	0.00	15.0	0.00	15.0	15.0
Industry 2019 Average								**229**

The forecasted targets have been reviewed and, given the network development undertaken in recent years assisted to reduce the probability and impact of a single fault. While the planned portion of 15 minutes remains appropriate to ensure asset replacement projects can occur safely, the unplanned will be halved from 30 minutes to 15 minutes. The current target of 45 minutes has been lowered for 2022 onwards and is now 30 minutes. This low target is at an achievable level given the predominantly dense urban network.

4.3 SAIFI - System Average Interruption Frequency Index

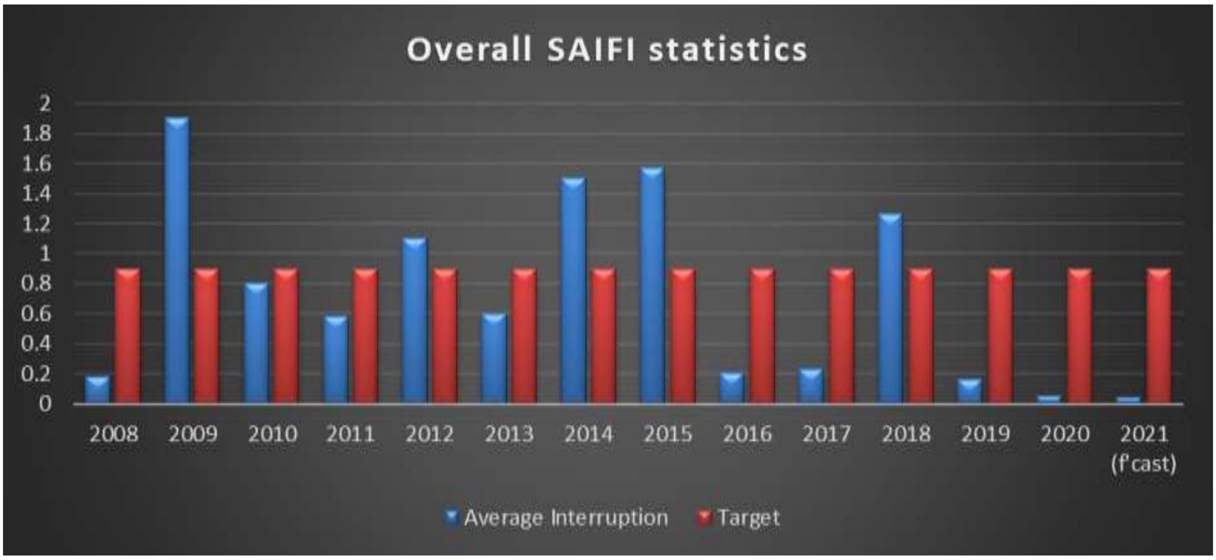
SAIFI is the average number of interruptions of supply that a consumer experiences per year. The formula is outlined below.

$$\frac{\text{Sum of [No. of Interrupted Consumers]}}{\text{Total Number of Connected Consumers}}$$

The NEL network has an average of 1.74 interruptions of supply per consumer over the past five years. The industry average for 2019 was 2.05.

SAIFI

	Year End	Transpower Planned	Transpower Unplanned	Transpower Total	NEL Planned	NEL Unplanned	NEL Total	Overall SAIFI
Actual	2008	0.00	0.00	0.00	0.03	0.15	0.18	0.18
Actual	2009	0.00	1.00	1.00	0.20	1.70	1.90	2.90
Actual	2010	0.00	1.00	1.00	0.18	0.58	0.76	1.76
Actual	2011	0.00	0.00	0.00	0.042	0.54	0.58	0.58
Actual	2012	0.00	0.00	0.00	0.05	1.05	1.1	1.1
Actual	2013	0.00	0.00	0.00	0.05	0.51	0.56	0.56
Actual	2014	0.00	1.00	0.00	0.21	0.29	0.5	1.50
Actual	2015	0.00	0.00	0.00	0.90	0..67	1.57	1.57
Actual	2016	0.00	0.00	0.00	0.002	0..21	0.21	0.21
Actual	2017	0.00	0.00	0.00	0.07	0.17	0.23	0.23
Actual	2018	0.00	1.00	1.00	0.04	0.22	0.26	1.26
Actual	2019	0.00	0.00	0.00	0.05	0.11	0.16	0.16
Actual	2020	0.00	0.00	0.00	0.04	0.01	0.05	0.05
FORCAST	2021	0.00	0.00	0.00	0.04	0.00	0.04	0.04
Industry 2019 Average								**2.05**



NEL has a low number of faults on the network due to the high proportion being underground cabling. In past years, a 33kV feeder fault would severely impact on numbers of consumers affected. With this risk alleviated due to the fourth 33kV feeder and the new Zone Substation, NEL should be able to maintain a SAIFI below 0.9 (excluding Transpower related faults).

4.4 CAIDI - Customer Average Interruption Duration Index

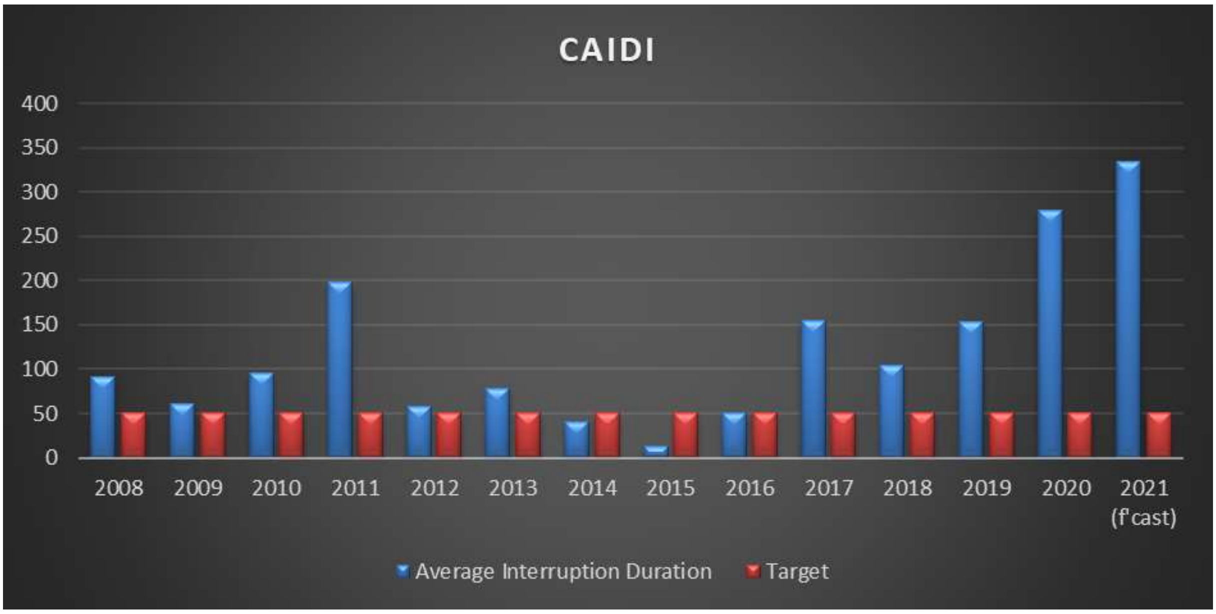
CAIDI is the average duration of an interruption of supply for consumers who experienced an interruption of supply in a year. The formula is outlined below.

$$\frac{\text{Sum of [No. of Interrupted Consumers x Interruption Duration]}}{\text{Sum of [Number of Interrupted Consumers]}}$$

The NEL network average interruption duration is 206 minutes over the last five years (including the current year). The industry average was 112 for 2019.

CAIDI

	Year End	Transpower Planned	Transpower Unplanned	Transpower Total	NEL Planned	NEL Unplanned	NEL Total	Overall CAIDI
Actual	2008	0.00	0.00	0.00	159.00	79.00	91.80	91.80
Actual	2009	0.00	70.00	70.00	134.00	52.00	61.00	64.00
Actual	2010	0.00	90.00	90.00	300.00	43.00	104.00	96.00
Actual	2011	0.00	0.00	0.00	214.00	197.00	198.00	198.00
Actual	2012	0.00	0.00	0.00	201	51.00	58.00	58.00
Actual	2013	0.00	0.00	0.00	213.00	65.00	78.00	78.00
Actual	2014	0.00	39.57	39.57	8.59	70.34	44.88	41.34
Actual	2015	0.00	0.00	0.00	2.82	25.98	12.68	12.68
Actual	2016	0.00	0.00	0.00	371.2	48.07	50.33	50.33
Actual	2017	0.00	0.00	0.00	134.05	164.22	155.69	155.69
Actual	2018	0.00	116.72	116.72	189.18	43.35	232.53	105.95
Actual	2019	0.00	0.00	0.00	349.76	68.75	154.19	154.19
Actual	2020	0.00	0.00	0.00	307.65	100.31	280.49	280.49
Forecast	2021	0.00	0.00	0.00	334.72	0.00	334.72	334.72
Industry 2019 Average								112.00



CAIDI is impacted more by Planned Outages. NEL planned outages are generally managed to ensure outage time is at a minimum. This is, however, typically more than an hour. With our dense urban network most unplanned outage areas can be back-fed from another supply reducing the duration. The balance of the planned (low numbers of consumers, long duration) and unplanned (high numbers of consumers, shorter duration) make the targets achievable, however, extra planned outages in recent years have significantly affected this.

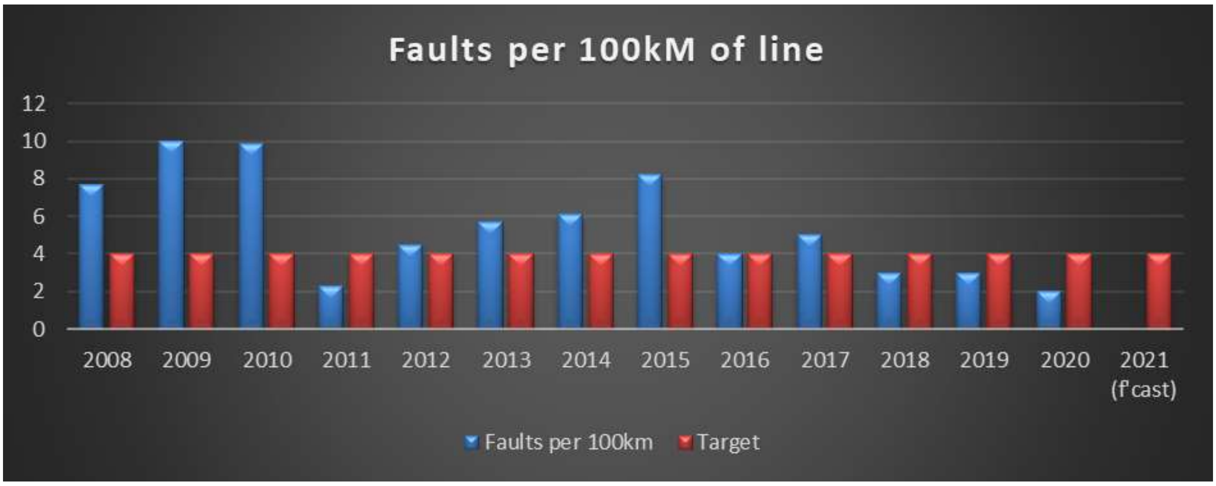
4.5 Number of Faults per 100 Kilometres of Network

This is a measure of the number of faults in relation to the total length of the network.

In the last five years NEL has had an average of 2.6 faults per 100 kilometres of line per year. The industry average was 17.2 per 100 kilometres of line for 2019.

Faults per 100 km of network

	Year End	Total
Actual	2004	9.80
Actual	2005	13.60
Actual	2006	4.40
Actual	2007	8.90
Actual	2008	7.70
Actual	2009	9.96
Actual	2010	9.94
Actual	2011	2.27
Actual	2012	4.54
Actual	2013	5.7
Actual	2014	6.1
Actual	2015	8.2
Actual	2016	4.0
Actual	2017	5.0
Actual	2018	3.0
Actual	2019	3.0
Actual	2020	2.0
Forecast	2021	0.0
2019 Industry Average		**17.2**



NEL is a small network, and any fault has a severe impact on the faults per 100 kilometre statistic. In previous years, the performance levels have been affected by cable strikes associated with contractors carrying out works for other utility operators or Nelson City Council. An awareness campaign on safe digging techniques was implemented reducing the number of these types of cable faults.

The target of four faults per 100 kilometres of line is based on the theoretical best performance of an underground network. To maintain this target, in addition to other maintenance or capital expenditure initiatives, NEL will continue to educate contractors and the public on electricity network risks.

4.6 Asset Performance

NEL's asset performance is in line with typical failure rates of assets throughout New Zealand. The table below is a summary from the "Electricity Engineers Association Guidelines for Security of Supply in New Zealand Electricity Networks" August 2013.

As NEL is a small network a single failure has a significant effect on failure statistics and trends must be taken by comparing at least five years of failures. Currently, NEL averages two 11kV/400V transformer failures per year but has had no 11kV switch failures in the last five years. The cable and line failure rates are also in line with the table.

Typical Failure Rates of Assets

Item	Typical Failure Rate	
	Rate	Per
33kV Pole Lines	5.0	100 cct km/year
11kV Pole Lines	10	100 cct km/year
33kV Cables	2	100 km/year
11kV Cables	4	100 km/year
Power transformers 2.5 – 300MVA	30	1000/units/year
Distribution transformers	2	1000/units/year
11kV Indoor switchgear (zone substation located)	1	1000/units/year
11kV Indoor switchgear (network located)	1	1000/units/year
11kV Outdoor switchgear (network located)	1	1000/units/year

4.7 Financial Performance

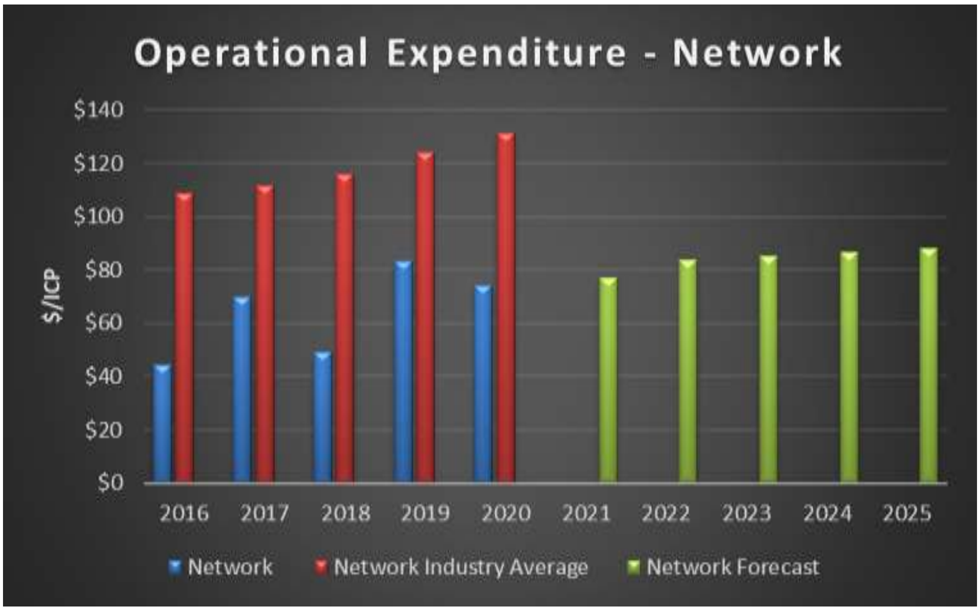
Operational Expenditure per ICP	Industry Average 2020	2016	2017	2018	2019	2020	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast
Network	$118	$44	$70	$49	$83	$74	$77	$83	$85	$86	$88
Non Network	$169	$148	$149	$159	$150	$151	$153	$154	$154	$153	$153

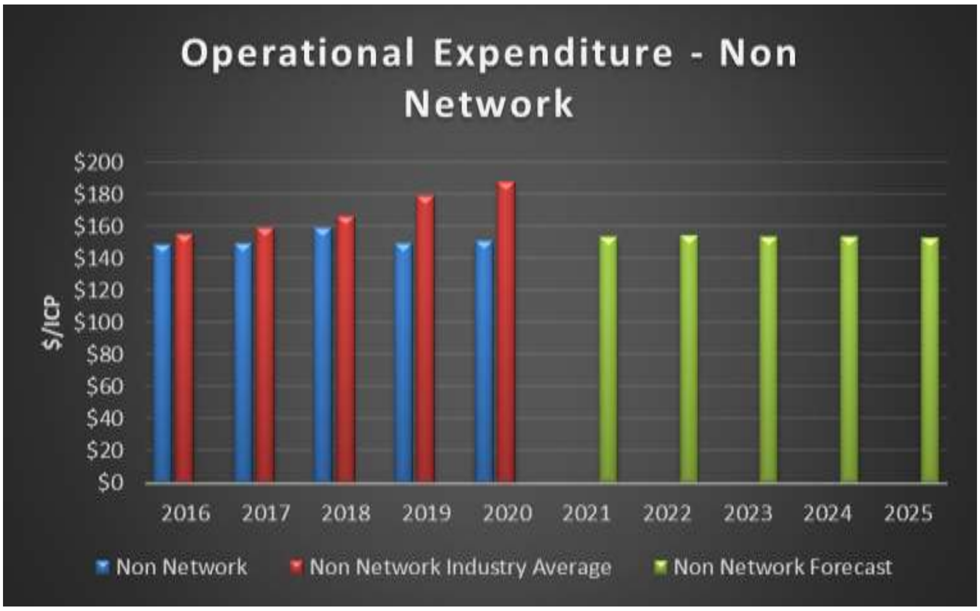
Capital Expenditure per ICP	Industry Average 2020	2016	2017	2018	2019	2020	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast
Network	$460	$51	$84	$102	$192	$189	$130	$193	$168	$180	$179
Non Network	$108	$5	$11	$1	$36	$12	$0	$3	$13	$3	$3

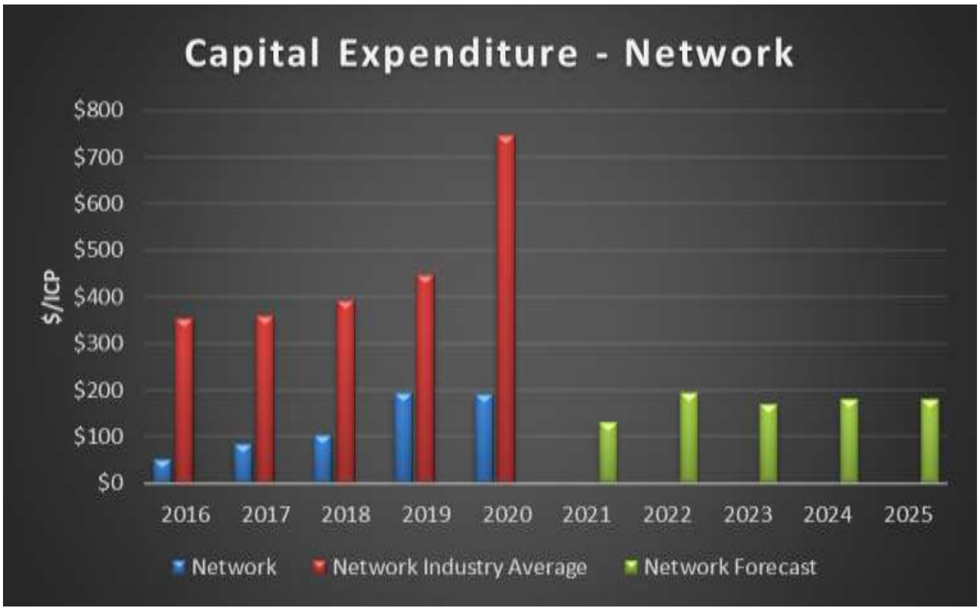
The most appropriate financial target measures for NEL are the Operational Expenditure and Capital Expenditure split into Network and Non-Network per connection point. It is, however, difficult to compare financial network performance with other networks given these measures vary greatly depending on the type of network.

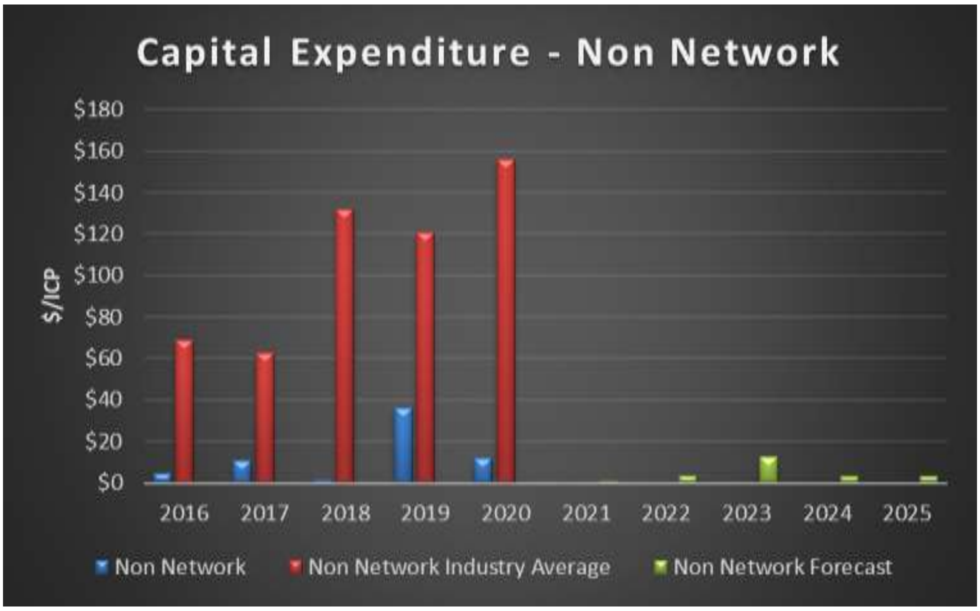
Operational costs per ICP are overall in line with targets for 2020. NEL has forecast costs increasing at 2% per year. This factors in the expected additional costs regarding compliance information technology support.

Capital Expenditure Costs per ICP are relatively constant given the maturity of the Capital Expenditure plan and the predictable works flowing from it. There is, however, an increase of up to 15% as Nelson Electricity increases expenditure in the Low Voltage network as growth/renewal works resulting from electric vehicle loads and decarbonisation of energy starts to gain momentum. The five-year plan predominantly focuses on safety, security of supply and asset renewal.


Operational Expenditure - Network
$/ICP
$140
$120
$100
$80
$60
$40
$20
$0
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Network
Network Industry Average
Network Forecast


Operational Expenditure - Non Network
$/ICP
$200
$180
$160
$140
$120
$100
$80
$60
$40
$20
$0
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Non Network
Non Network Industry Average
Non Network Forecast





4.8 Improvements

As shown above, NEL has a reasonably high reliability and performance level compared to the industry average, however, the results can be significantly affected by Transpower related faults as demonstrated in 2009, 2010 and 2017. Excluding Transpower related faults the major projects completed in 2013-2014 have resulted in a significant improvement in the reliability and performance of the Nelson Electricity network. In addition, several initiatives have been implemented to maintain the improved performance:

- **33kV Improvements**
  NEL has completed the replacement of the Zone Substation at Haven Road and the installation of a fourth 33kV feeder from Transpower's grid exit point at Stoke Substation resulting in full N-1 capability on the 33kV network.

- **11kV Reinforcement**
  NEL is continually planning to improve the 11kV supply by investigating the following:

- Backup supply;
- Ring feeds;
- Reducing risk of failure;
- Minimising interruption times;
- Addressing excavation contractor issues;
- As part of the 33kV cabling project, NEL took the opportunity to lay spare ductlines for future underground 11kV reinforcement and extensions.

- **400V Improvement**
  NEL is progressively improving the flexibility of the 400V network by:

  - Installing LV Bus Isolators on 11kV/400V substation LV Boards;
  - Installing easy break sectionalisers on 400V lines;
  - Installing NCP fusing in ground mounted boxes where possible;
  - As part of the 33kV cabling project, NEL took the opportunity to lay spare ductlines for future underground 400V reinforcement and extensions.

- **Reducing Cable Faults**
  NEL continues to identify, audit and model cable performance and any cable not meeting standard or approaching overload will be scheduled for replacement or reinforcement.

  NEL has had several faults over several years attributable to cable damage caused by excavation contractors. Such incidents reduce the reliability and integrity of the network due to additional cable joints and cable repairs. To reduce the likelihood of such incidents authorised Cable Location Contractors perform all cable locations on the NEL network. As part of this function, the Contractors are required to meet the excavation contractor on site prior to any excavation near a NEL cable. If there is either a 33kV cable or an 11kV cable present, the Cable Location Contractors will encourage the excavation contractor to request that an Approved Observer is on site while the excavation is being carried out. NEL policy means that an Observer is provided for free of charge for excavations of two-hour duration. NEL also keeps in contact with excavation contractors to ensure they are aware of any concerns NEL may have.

  Incidents, accidents and near misses are recorded internally in NEL's InControl health and safety database and reported to Worksafe if required. A report is obtained from the contractors involved in the incident and remedial action implemented to prevent a re-occurrence of the event.

- **Reducing Planned Interruption Numbers and Duration**
  NEL is seeking to reduce the frequency and/or duration of planned interruptions and is continually looking at ways to minimise the numbers and duration of interruptions by the following:

  - An audit is carried out prior to any shutdown to identify any additional works to be performed taking advantage of the shutdown. The result will give NEL maximum benefit from any network shutdown, possibly reducing the requirement of future planned interruptions;
  - Implement procedures, which will either eliminate the requirement for interruption or reduce the duration;
  - Ensure maximum resources are allocated to the shutdown;
  - Improvement of back feed options;
  - Use of approved contractors for live HV and LV work (1).

  (1) Live line work introduces a safety risk and is more expensive to undertake. Live line work is avoided where possible and kept to an absolute minimum.

- **Asset Life Cycle Audits**
  NEL strives to improve the asset life cycle audit process. Ongoing communication with other network companies will ensure processes are in line with best industry practice. This will ensure NEL's ability to determine the best approach to asset management and ultimately reduce the possibility of interruption. Refer Audit Programme <u>**Appendix A**</u>.

Assets are audited at different frequencies depending on the type of asset:

- 33kV main substation – monthly;
- Substations (including transformers and OCBs/switches) – six monthly;
- 11kV and 400v wood poles – three yearly;
- 11kV and 400v concrete poles – five yearly;
- Link boxes – two yearly visual safety, five yearly internal audit;
- Service boxes – two yearly visual safety, five yearly internal audit.

NEL has comprehensive maintenance and development programmes which continue to aid in the improvement of the network. These plans attempt to maintain or improve the network security of supply.

- **Communication Links**
  NEL has installed radio links between its major switching stations and the Zone Substation to enable accurate status reports to be available on the SCADA system. Where suitable circuit breakers are installed, these links have been utilised to allow remote switching at the major sites.

4.9 Quality of Supply

NEL has a target of supplying all consumers with a quality of supply that meets or exceeds the standards set in the Electricity Regulations and in other industry Codes of Practice. Additionally, NEL will meet alternative standards of reliability and price for customers who are prepared to enter into contracts. The qualities of supply that are measured or monitored are:

- Voltage;
- Capacity utilisation;
- Load factor;
- Distribution losses;
- Power factor;
- Harmonics;
- Interference.

Voltage

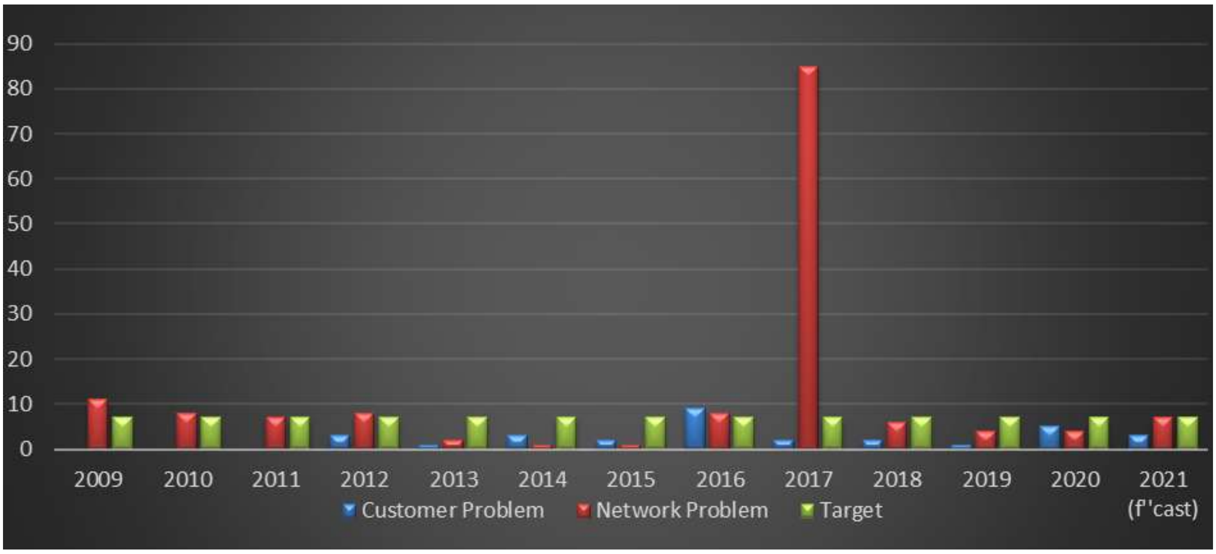
During times of peak winter loading, voltage snap shots are taken across the entire network. Voltage and load checks are made at all substations and recordings are made at substations and end of line boxes. Data is gathered at these points, entered for analysis into the Office Management System and any voltage or overload problems are scheduled for rectification. Additionally, NEL has installed smart meters and network monitors at key locations throughout the network. These units continually monitor the network voltage at source and provide an alert to possible issues.

Fluctuating Voltage

Regulations require voltage supplied to consumers to be 230 volts ∓6%. The network is designed to meet this requirement. There are, however, times where load changes can cause consumers to experience voltages outside of the requirements. Any complaints are investigated and, if proven, changes to the network are made to remedy the situation.

Nelson Electricity's target is to have no more than seven proven complaints received per year.

A comparison between target and the customer and network problems is shown in the table below.



If the network problem cannot be identified and rectified at the time of the complaint, a voltage recorder is installed at the Network Connection Point for a 24-hour period. Although voltage variations are sometimes detected by the recorder, they very seldom fall outside the tolerances allowed by the industry.

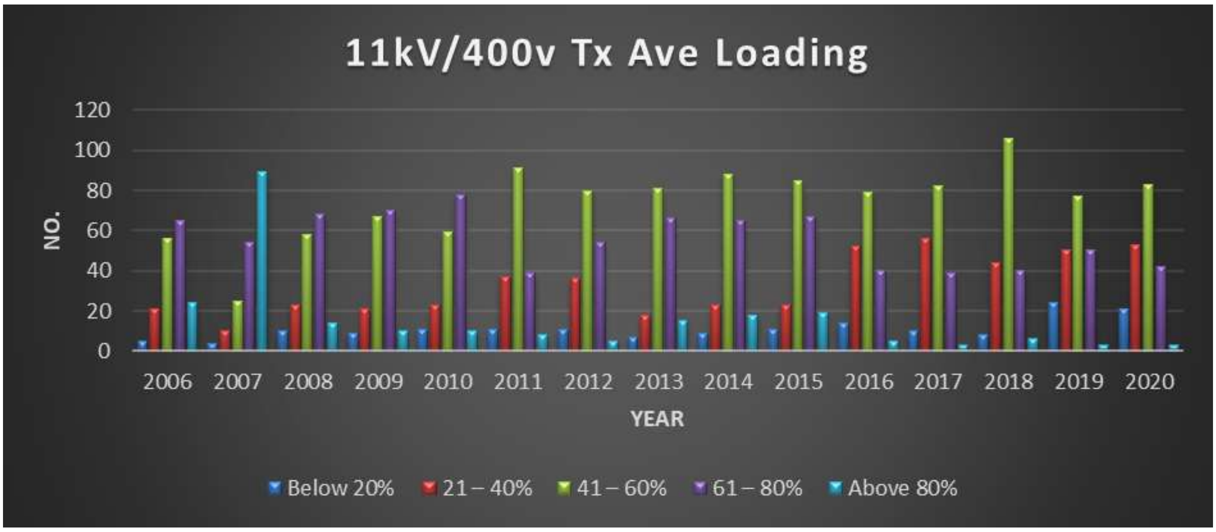
NEL regularly checks the LV voltage throughout the network during routine maintenance, at fault response callouts, continuously at key locations with the use of smart devices and recording of the LV voltage at pre-determined locations during annual winter load surveys. Identified issues are rectified preventing possible events from occurring. A fault in 2017 relating to a failed termination at a substation, resulted in 80 consumers being affected by abnormal voltages in one event and there have been several events related to customer service main termination points at the NCP and LV neutral connections in recent years.

Capacity Utilisation

NEL generally relies on Maximum Demand Indicators and monitoring the key 11kV feeder loads via the SCADA system to record the loadings on key sections of the network. Smart meters have been installed at key locations and portable loggers are often installed temporarily at substations that are showing high loadings on the transformer or network cabling.

The figures indicated in the graph below are derived from the average Maximum Demand Indicator reading across the three phases at each 11kV/400V distribution transformer.

In conjunction with load recording, transformer temperatures are typically monitored as part of the Planned Maintenance programme. Where high temperatures are reported a portable logger is installed to provide more accurate information about the temperature and associated load of the transformer. If overheating is detected the transformer will be programmed for replacement.



The key 11kV feeder loadings are logged every 30 minutes. It should be noted that the ratings of key feeder capacities have been downgraded to reflect the rating of cables partially installed in ducts rather than direct buried. Refer to the 11kV Feeder Loadings graphs in the Network Development section (**Section 5.1**).

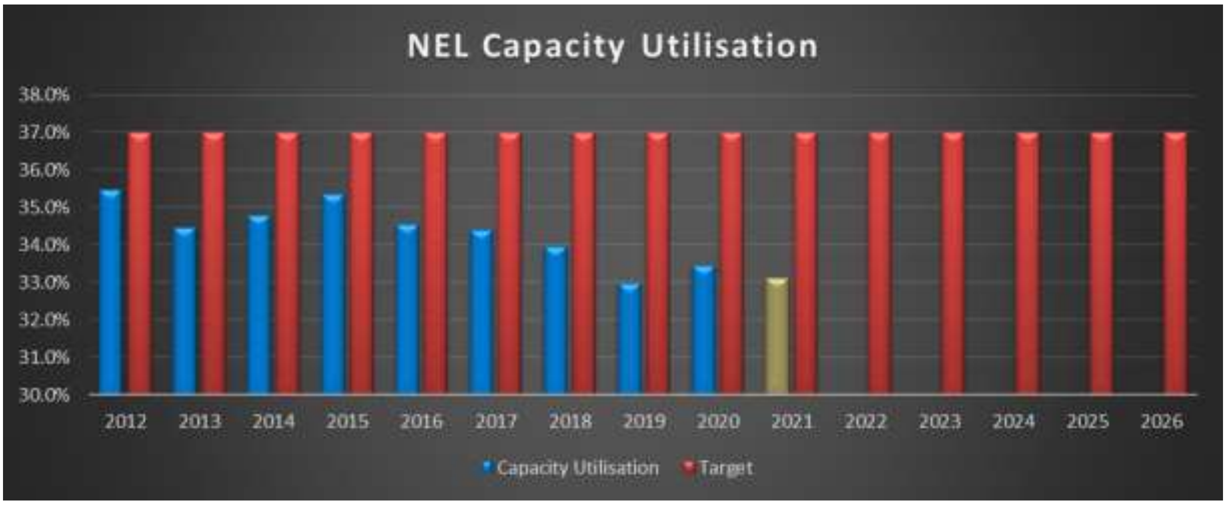
Overall network capacity utilisation is 33.1%. This is above the industry average of 28%. The current level of capacity utilisation is considered satisfactory although slightly below target. This figure is affected by several factors:

- **Load control** – Use of load control in winter to only manage transmission peaks can result in local network peak demand being higher thus reducing capacity utilisation.
- **Optimisation of transformer capacity** – Reducing transformer size where there is excess capacity. This is only undertaken when it is cost effective to do so.
- **Developer related projects** - Where the consultants over-estimate the supply requirements meaning larger transformers than necessary being installed. This reduces capacity utilisation.

It may take some time to increase capacity utilisation back to the target of 37%.

Capacity utilisation is calculated by the following formula:

$$\frac{\text{Maximum Demand}}{\text{Transformer Capacity}}$$



Load Factor

NEL's load factor is currently 50% which is 10% below industry average. Key reasons for this level are as follows:

- With 9,300 consumers located in an area of only 24 square kilometres, NEL does not benefit from as much diversity as the larger network companies do;
- NEL has a high proportion of business consumers with higher day time loads;
- High seasonal differences between summer and winter.

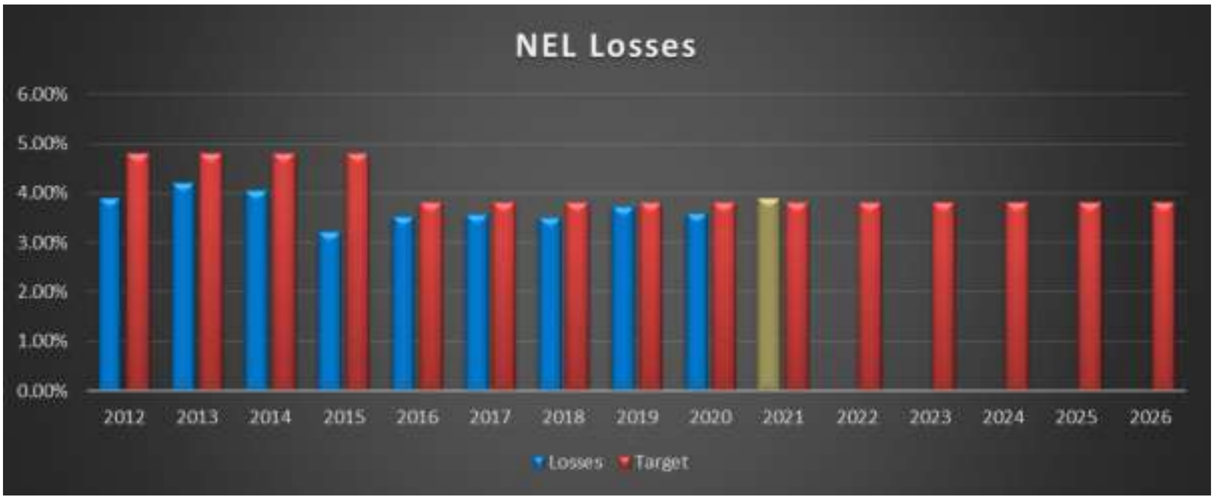
It would be difficult to improve load factor without compromising or seriously affecting the level of load control already utilised. This could result in less hot water heating and increasing consumer dissatisfaction. The target set for the planning period is 54%.

The load factor is calculated by the following formula:

$$\frac{\text{GXP kWh}}{\text{Maximum Demand x hours in the year}}$$

Distribution Losses

The actual loss ratio for the year ending 31 March 2020 is estimated at 3.9%. This is considered satisfactory given the type of network. It is expected that network losses are within the range of 3.5% - 4.0%.



The 12 monthly losses have some variability due to the reliance of retailer billing information to obtain kilowatt hours consumers have used. The distribution loss forecast was lowered from 2016 once the effect of the new additional 33kV feeder and the new Zone Substation had been in operation for a full 12 months. NEL calculated the technical losses at 3.6%. This is significantly lower than other networks given the high customer density (consumers per kilometre of line).

Non-technical are those losses that cannot be explained eg; unbilled electricity or theft. This has been estimated is at 0.2%. The total losses forecast for the planning period are 3.8%.

Power Factor

Current average power factor is assessed at 0.94 - 0.96. The target is to have an average power factor greater than 0.95. Where sites of poor power factor are located NEL recommends the installation of power factor correction. This is further encouraged by the Power Factor Charges that applies to larger consumers who have a power factor of less than 0.95.

NEL has a winter target for the planning period of power factor greater than 0.98.

Harmonics and Interference

The Network Code, which is available to contractors and public, contains guidelines which address harmonics and interference. Typically, harmonic and interference problems are reported by consumers, which results in testing and recordings being made at the consumer's premises. Such reports are entered and tracked through the Office Management System until the problem is resolved and signed off.

The target level of service for harmonics and interference is that there should be no more than one proven non self-inflicted complaint received per year.

Environmental

NEL cares for the environment. Measures are in place to minimise any effect NEL has on the environment. Examples are:

- Oil spill kit on hand at the Zone Substation in case of any spills on the network;
- Fully bunded Zone Substation at Haven Road and bunding systems at block construction substations throughout the network.

All assets are assessed for negative environmental impact and are remedied if an issue is identified.

NEL has a target level of service of zero oil spills on the network per year and zero fires causing damage to third parties resulting from distribution assets.

Safety

NEL is committed to providing a safe network and healthy work environment for all staff, contractors and public. NEL takes all practical steps to ensure network safety and if issues are identified they are then remedied within an appropriate timeframe. Issues regarding public safety take priority and are addressed on every Capital Works project.

NEL has a target level of service of no loss time injuries from staff and contractors working on the network. All assets that have been identified as being a safety risk to public (for example following asset damage, break in) are required to be attended to by fault contractors within 30 minutes of receiving notification.

4.10 Customer Service

NEL distributes electricity to approximately 9,300 customers and communicates with customers by way of newsletters and radio advertising covering pricing and issues relevant at the time. Consumers generally address their enquiries to their retailer or in the case of a fault, to NEL's fault call provider.

When dealing with customer service the issue of quality is defined as the quality of the electrical supply a customer receives. This includes any issue that has an impact on the customer's perceived level of supply from NEL. For example voltage, frequency, reliability, backup supply, alternative supply options and dedicated assets.

Customer engagement is part of normal business process. NEL's asset management decisions, in relation to price and quality trade-offs, are compiled from engagements with customers.

For the purposes of this section, the customer is an electricity customer connected to the NEL network.

Advising Customers about Price-Quality Trade-Offs

- **Delivery Price Options**
  NEL properly advises its customers of direct line price and quality trade-offs by publishing delivery prices and associated quality in The Nelson Mail newspaper and on the NEL website (refer www.nel.co.nz) in accordance with the Electricity Disclosure Regulations. The delivery prices provide direct price and quality trade-offs through, for example, controlled and uncontrolled prices.

  Pricing options and other network issues are periodically published on the NEL website, print media and radio.

  NEL is also reliant on Electricity Retailers to appropriately advise their customers on the most best pricing options. Retailers are in contact with the customer monthly as part of the billing process. Retailers also have account managers for the larger customers who are typically skilled in issues relating to quality of supply and price.

  Electricity Retailers are informed of any changes to the NEL delivery prices so they can properly advise their customers of the options available to them.

- **Major Customer Survey**
  In 2009 and 2014 major customer surveys provided the largest 20 customers with the opportunity to broadly consider price and quality trade-offs. Four broad options were presented to each customer:

  - Pay a bit less to receive a bit less reliability;
  - Pay about the same to receive about the same reliability;
  - Pay a bit more to receive a bit more reliability;
  - Pay a lot more to receive a lot more reliability.

  Most of these 20 largest customers indicated a preference to continue paying about the same to receive about the same reliability.

- **Mass Market Telephone Survey**
  Two hundred random customers were surveyed in 2012 and again in November 2016 and of those only 6% surveyed would be prepared to pay more for an improved reliability of supply compared to 8% in 2012. Only 11% would be prepared to pay less for a less reliable supply. The evidence suggests that the price / quality balance remains at an appropriate level.

- **New and Changed Connections**
  NEL provides specific price and quality information to customers in response to new or changed connection enquiries. The types of price quality considerations include; capacity, how to configure the network for the connection cost of options, consideration for joint benefit options, etc.

Consultation with Customers about the Quality of Goods and Services they require with Reference to Price

- **Major Customer Consultation**
  NEL engaged an engineering consultant to consult with customers about price quality trade-offs in 2009 and 2014. The top 20 largest customers were interviewed in 2009 and 2014. The 20 customers represented a broad cross-section of the larger customer base from 18GWh down to 500,000kWh per year. The smallest of the 20 were supermarkets, hotels and retirement villages.

- **Mass Market Telephone Survey**
  Two hundred random customers were surveyed in 2012 and again in November 2016. Price quality trade off type questions were included in the survey.

- **Delivery Price Options**
  NEL has provided mass market customers the opportunity to consider price and quality trade-offs via publishing of delivery prices in The Nelson Mail newspaper and the NEL website. The newspaper and website provide the opportunity for customers to directly contact NEL with any issues or requests on the price and quality information included.

- **Contractual Relationship with Retailers**
  NEL engages the Electricity Retailers in many ways.

  NEL has a signed Use of System Agreement (UoSA) with retailers and, as part of this Agreement, provides them with price and quality information. NEL had to negotiate the terms of the UoSA with the retailers including price and quality of supply. There is also consultation currently being undertaken regarding the new Default Distributor Agreement, with most of the discussions around operating terms.

  There have been discussions with retailers on the network regarding pricing and contractual agreements. The methods of discussion vary from face to face to phone conversations. Indirectly these discussions can have an influence on the price quality trade-off. The issue for NEL is that its reliability has always been excellent, and that the customer is used to this level of reliability.

  There is a low level of community understanding over the difference between actual delivery prices and what retailers repackage them as. Informal discussion with most customer type's show that many cannot differentiate between line prices and the retailers delivered prices.

- **New and Changed Connections**
  NEL consults with Electricity Retailers, developers, electrical contractors and customers in response to new or changed connection enquiries through meetings, telephone calls and written communications. NEL has a vested interest in ensuring the network is configured in a manner that can provide the appropriate capacity for new loads while not reducing the security of supply to existing connections.

Consideration of the Views Expressed by Customers

- **Tariff Options**
  Informal feedback, because of the price and quality information from the mass market, indicates customers have lost touch with the role a Line Company plays in the electrical industry since the separation of Line and Energy companies in 1999. The mass market customer only considers the total electricity bill value without separating out delivery costs. The perception to them is that electricity prices are always increasing and have little regard to the fact that delivery prices have remained the same or at similar levels while retail electricity prices have increased (up until recent times). Consequently, it is difficult in some instances to discuss and demonstrate price versus quality trade-offs.

  The findings of a telephone survey in 2016 of 200 mass-market customers showed that half only correctly identified Nelson Electricity as their Line Company. Most, however, indicated they were happy with the current system of reliability. Customer's impressions are industry impressions and do not differentiate between generation, transmission, distribution and retail.

- **Major Customer Survey**
  A review of consultation with major customers in 2014 revealed that only two of the 20 largest customers were willing to consider alternative price and reliability options (specifically receiving increased reliability). Many of the remaining customers in the survey were satisfied with current levels of reliability. From the survey, improvements have been made in providing a point of contact, improvements of planned and unplanned outage information on the NEL website and also keeping telephone messages on outages up to date and accurate including restoration of power times where possible.

- **Mass Market Telephone Survey**
  A review of the survey is that customers do not want to pay more for an improved quality of supply. There are some findings that have been introduced which include more safety advertising and to get the NEL name more in the media including improvement in utilisation of radio when larger outages occur to convey relevant information with likely restoration times to customers. The NEL website is now used to convey planned and unplanned outage information. NEL has used radio advertising for safety and operational matters regularly since 2013.

- **New and Changed Connections**
  In agreeing to new or changed connections, NEL has implicitly considered the views and requirements of the customer in terms of quality and quantity. Typically, NEL will receive a Network Connection Application with a requested capacity and then will investigate what or any alterations to the network are required to supply the requested capacity. In some situations, NEL may suggest options whereby both parties can benefit. In the example of a new substation supplying a new building, NEL may offer the capacity at a reduced price if a larger transformer can be installed on their premise and have excess capacity available for the network.

  NEL will evaluate the dollar contribution required for the new load to connect to the Network on a case-by-case basis.

Taking Customers Views into Account when Making Asset Management Decisions

NEL is in a good position where it can demonstrate an excellent reliability track record while providing average delivery prices to customers.

At a high level NEL has adopted the following processes for acting on customer responses:

- NEL's Asset Management Plan includes the customer/stakeholder consultation phase in all major decisions concerning capacity and supply security;

- NEL remains responsive to approaches from customers about service levels;

- NEL takes into consideration any feedback it receives from customers;

- The Asset Management Plan is designed and caters for the input of customers views. There are two parts to this;

  - Where a specific customer wants an enhanced quality of supply and is willing to enter into an appropriate commercial contract with NEL to achieve this. Currently, NEL does not have any arrangements with any customers for an enhanced quality of supply.

  - Where large numbers of customers demand a price quality trade-off that differs from that currently provided.

- **Delivery Price Options**
  Through informal feedback received from customers, NEL has identified that customers do not currently have sufficient information about the network to enable it to effectively consult on price and quality trade-offs. Whilst this directly affects delivery price options its implications in relation to price and quality are broader.

  NEL is considering several mechanisms to better inform customers of its role. One such process currently being undertaken is through safety advertising on the radio, where part of the advertisement outlines who Nelson Electricity is and what we do. Any consumer communication where appropriate includes information on industry structure and NEL's function within that structure.

  From the 2016 phone survey only 5% of respondents would call NEL if they had a supply interruption. This demonstrates that the survey responses were an industry wide response. Many of the larger customers and mass market customers are happy with current prices and system reliability. Neither group has supported increasing prices for an increase in reliability.

  It should be noted that only 6% of mass market customers indicated they would be happy to pay more for a more reliable electricity supply. NEL will continue to monitor this as there may be a change in customer perception in the future and the drive for improved system reliability. The customers who support paying more for a more reliable electricity supply are spread throughout the network and so it is difficult to cater to their specific needs without upgrading the whole network for the benefit of all.

- **Major Customer Survey**
  NEL intends to meet with customers who are willing to consider different price quality options on a one-on-one basis to discuss the customer's particular requirements and then assess the feasibility of entering into a commercial agreement for NEL to provide a different quality of supply (and hence price) for that customer.

Customer Service Summary

NEL has one of the best electricity network reliabilities in New Zealand. The service levels, as outlined in the Asset Management Plan, also reflect this. The forecast SAIDI for year ending 31 March 2021 is 15 minutes. The target level is 45 minutes. This has been achieved in part by the greater reliability of the 33kV network following major projects in 2013-2014 and continuous improvement of the 11kV network as outlined in the Asset Management Plan.

It must be noted that given the small network size of NEL, only one outage could result in exceeding the target. This is illustrated by the figures for 2009, 2011, 2012 and 2018 where one or two significant outages per year can cause the figures to exceed target.

It is also salient that NEL has aging assets and over time even if existing levels of reliability are to be maintained, increased levels of investment will be required.

The customers are predominantly satisfied with NEL’s current system reliability performance. We do have to be realistic when we survey customers on reliability, they do not necessarily differentiate between whether an issue is a Retailer, Distributor, Transmission or Generator issue. The important issue for them is what they experience at their premise.

NEL has comprehensive maintenance and development programmes which continue to aid in the improvement of the network. These plans attempt to maintain or improve the network security of supply.

Refer also to Asset Performance Standards under Risk Management.

SECTION 5 - Network Development

5.1 Planning Criteria

The Office Management System is the key source of information required for network development planning. The data is gathered from the following sources:

- Planned Preventive Maintenance;
- Annual Load Survey;
- Life Cycle Audits;
- Known future growth;
- Asset Performance Standards;
- SCADA.

Planning Periods

NEL has different planning periods for different asset types. The planning periods adopted reflect the useful life of the asset and the ability to change or upgrade. As an example, a cable will have an expected life of 45 to 70 years. This type of asset cannot be upgraded and as such will have a longer planning period. A transformer at a substation can be changed to a higher capacity transformer easily so planning periods used will be shorter. There is also limitation imposed by the ODV Handbook as to an acceptable planning period allowing for load growth. These are also taken into consideration.

The classifications and planning periods used are:

- 33kV feeder cabling - 15 years;
- Zone substation - 10 years;
- 11kV feeders – 10 years;
- Distribution transformers – five years;
- 11kV switches – five years;
- 400V reinforcement – 10 years.

The Planning Periods are used to determine the capacity of new assets. Factors which impact on the planning for changes of the various asset types are safety, asset condition, operating life and operating capacity. Measurements and assessments of these factors are gathered from regular testing, recording and audit programmes. The prioritisation of works is governed by safety in the first instance then by the quality of supply to the end user and the number of end users affected. Any network upgrades have to be financially justified and approved.

Planned Preventive Maintenance

NEL has a Planned Preventive Maintenance programme in place which requires each of its 198 11kV/400V substations and 33 11kV Link Boxes to be audited every six months. The programme is designed to carry out visual internal and external checks of the substation and associated assets, record any defects, record maximum demand indicator readings, and to carry out basic dusting and cleaning. Each asset type is audited against a pre-printed check sheet and the data gathered is entered into Office Management System.

The maximum demand information gathered is the first pointer to possible overload. It allows areas of perceived overload to be identified and so lends weight to decisions made regarding network alterations or upgrades. Once possible sites have been identified, loggers are installed to assess the timing and duration of peak loadings. The logged data is compared to manufacturer recommendations for the equipment and a decision is then made on whether to replace the equipment.

Annual Load Survey

During times of peak loading between May and September each winter, a load survey is carried out on areas of the network. In this survey, the load on the transformer, time of day, air and transformer temperature, individual LV feeder loads and end of line voltage on the longest LV leg connected to each substation is recorded as a snapshot. The data gathered is entered into the Office Management System and analysed and further site recordings are carried out if required. Where load/voltage problems are identified data loggers are again utilised. The output of this data forms the basis for any decisions taken to reinforce or alter the network. Remedial action is taken immediately if voltages outside the limits of those specified in the Electricity Act are logged. Similar action is taken with equipment or cables that are found to be overloaded.

Life Cycle Audits

As outlined in the Risk Management section (**Section 7**), NEL is continually condition auditing its assets. Typical causes for remedial action are service boxes not meeting the industry's touch-proof requirements, wooden poles failing below ground tests, cables showing excessive partial discharge and evidence of partial discharge in HV switches.

Known Growth

NEL encourages network designers, property owners, electricity owners, property developers and promoters of distributed generation to advise of future projects as early as possible, so that advanced planning can be put in place to ensure that the development can be supplied with the capacity requested. Data gathered through the three previous processes above is implemented to manage the network growth.

Asset Performance Standards

Refer Risk Management (**Section 7**).

SCADA

The SCADA system is now used to log current flow every 10 minutes for the key 11kV feeders, so more accurate load diversity and duration data can be gathered for each feeder.

The 33kV/11kV transformer temperatures, currents and voltages are now monitored on the SCADA system.

Other Planning Considerations

At the Zone Substation, the 33kV/11kV transformers are continuously monitored via the SCADA system. Any abnormalities are recorded in the Office Management System. Monthly reports are produced for the Operations Manager for any necessary action.

A portable data logger is used to log the loadings of distribution transformers that have indicated higher maximum demand readings. This information is vital to assess the necessity of upgrading.

Criteria for Determining New Assets

Based on the information gathered in the Planning Criteria, decisions then need to be made on the capacity and type of replacement asset. The new asset may not necessarily be an identical replacement of the original asset as the requirements of the asset may have changed significantly since the original asset was installed, perhaps some 50 years ago. The selection of the new asset may be influenced by several aspects which are listed below.

- **<u>The predicted future growth in that part of the network</u> -** This will typically be faster in commercial situations, however, future residential subdivisions may need to be catered for and particularly inner city apartment projects.

- **<u>The type of load to be serviced</u> -** The area may have been re-designated from residential to commercial or commercial to residential meaning variable growth rates are likely.

- **<u>The type of role the new asset must perform</u> -** 11kV cabling installed around the CBD has formed a sizeable "back-bone" for transferring load from one substation to another. This "back-bone" is now being extended towards critical customers like hospitals.

- **<u>The type of asset to be installed</u> -** Typically the 11kV switches and transformers utilised have been mineral oil filled but the recent emergence of vacuum switchgear and the replacement of oil filled switchgear manufacture with SF6 is influencing the choice of switch to be installed. Paper insulated 11kV cables have typically been preferred over the use of cross-linked polyethylene (XLPE) but the cessation of production of paper insulated cable within New Zealand and the improved performance of the modern generation of the latter has forced a change to predominantly XLPE for new works.

Prioritisation of Projects

NEL has a relatively simple process for the prioritisation of projects. Firstly, the processes are broken into two distinct types of projects.

- **<u>Developer or consumer initiated</u>** eg; residential subdivision or commercial building. Often in this type of project there may be involved the installation of new assets to supply a new load on the network. The project will often be driven by demands external to NEL. There will be a capital contribution required from the developer/consumer for work like this to proceed and the timing will typically be for whenever the developer requires the supply.

- **<u>Network related</u>** eg; 11kV cable replacement, transformer change, service box replacement.

  NEL prioritises most of the projects undertaken on the network based on the risk ratings of an asset as detailed in **Section 7.** This rating considers all aspects of asset performance including:

  - Safety;
  - Asset condition;
  - Loading on the asset;
  - Asset fault history;
  - Restoration time if failure occurs;
  - Environmental considerations of failure and location;
  - Number of consumers;
  - Public response if there is an outage;
  - Cost due to failure;
  - Asset life expectancy.

The timing or priority of projects is based on the risk ratings which typically have been in line with the Asset Replacement Guide in **Section 3.5**. Projects are prioritised with the highest priority being:

- **<u>Safety</u>:** Assets that have been identified as having a safety issue with the public, staff and contractors working on or near assets take top priority. Examples are the replacement of Andelect Series One switchgear and additional touch proofing of LV boards in distribution substations.

- **<u>Technical</u>:** Assets needing replacement or additional assets installed due to load growth and lack of spares to maintain existing assets.

- **<u>Condition</u>:** Asset condition from auditing shows assets need to be replaced.

- **<u>Age</u>:** If an asset is beyond its life expectancy.

There are often projects of similar weighting or priority. These are assessed and prioritised with the projects with the best financial outcome being first. This could be due to project cost, minimising of maintenance costs or timing with another project.

5.2 Predicted Network Demand Growth

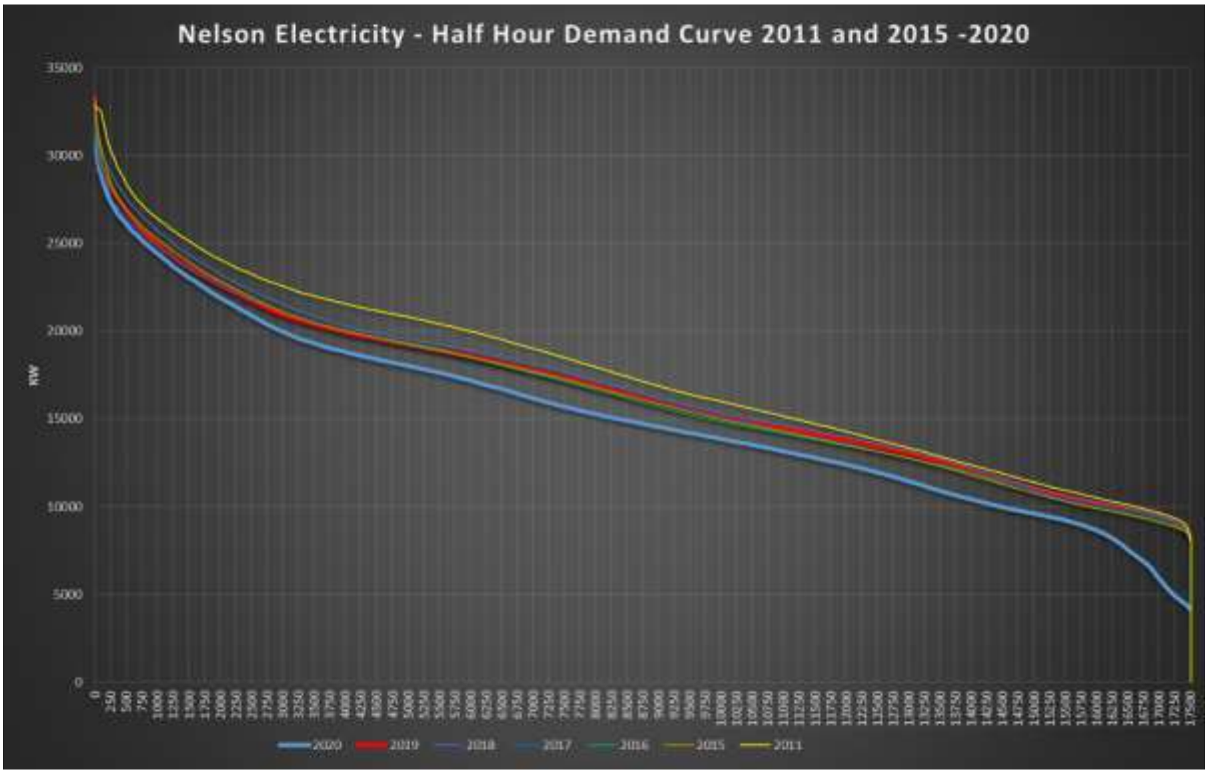
The load on the Zone Substation up until 2008 had shown a slow but steady demand growth in the order of 1.0% - 1.5%. This has since plateaued because of a combination of the economic downturn in 2008 combined with warmer weather, especially during the winter months, greater energy efficient appliances, improved energy conservation and the installation of solar PV on rooftops. The network peaks during the winter period show a considerable sensitivity to the ambient temperature and extent or type of cloud cover.

Nelson Electricity 33kV Network Peaks

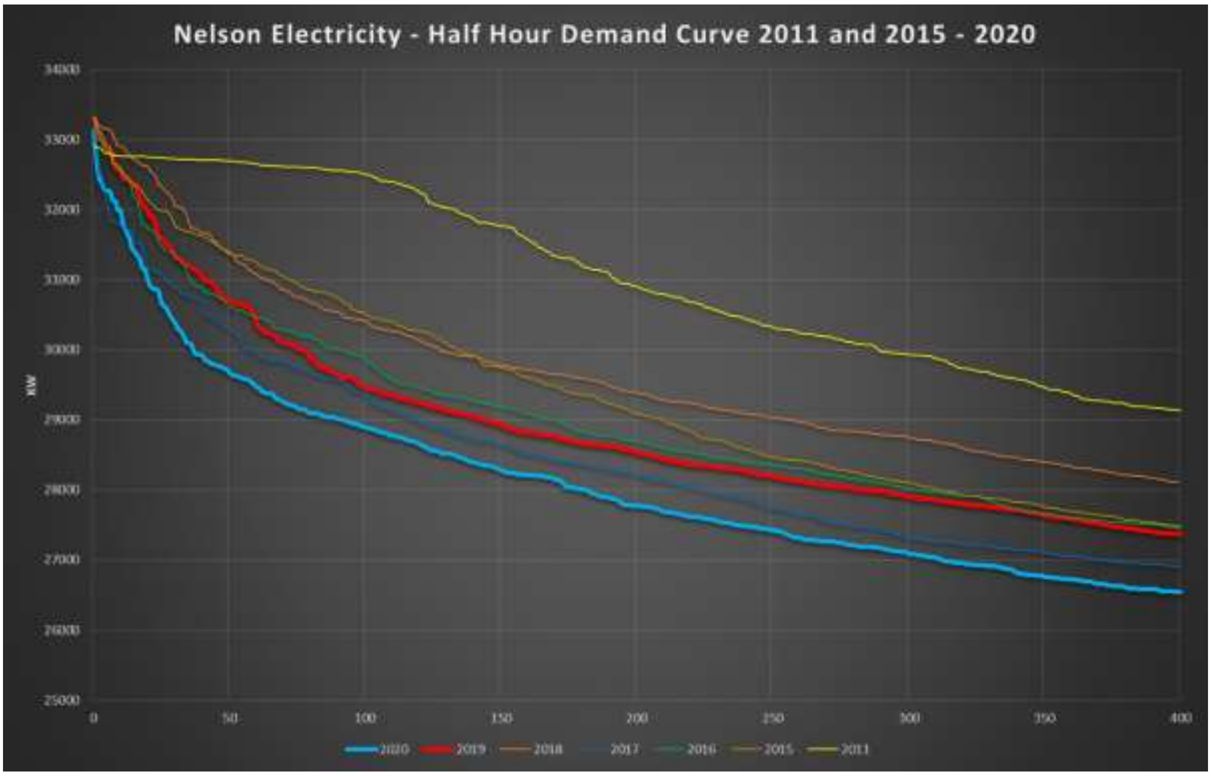
Year	Controlled Peak (MW)	Month	Comment on Winter
1995	28.100	July	Medium
1996	28.095	July	Medium
1997	28.185	July	Medium-cold
1998	28.185	July	Warm
1999	28.225	July	Warm
2000	28.800	September	Warm
2001	30.470	July	Cold
2002	29.800	July	Medium
2003	29.800	July	Medium
2004	30.130	August	Cold
2005	31.066	June	Medium
2006	31.699	June	Cold
2007	34.230	July	Cold
2008	32.800	July	Medium
2009	33.530	July	Cold
2010	32.750	July	Warm
2011	32.933	July	Medium
2012	32.040	July	Medium
2013	33.000	July	Warm
2014	34.100	July	Warm
2015	33.318	July	Cold
2016	33.176	August	Cold
2017	33.248	June	Wet
2018	33.332	July	Medium
2019	33.300	August	Cold
2020	33.116	July	Medium and Covid-19 Impact

The peak demand, as shown in the table above, includes the influence of ripple injection load controlling through the winter months. Since the installation of the new Haven Road Zone Substation, there has only been a need to use ripple control to manage transmission peaks only and not for local network constraints and, as such, the peaks from 2014 onwards will be higher in comparison to previous years as a result and masks the actual potential peak demand decline.

The Nelson Electricity half hour demand curve comparison graph below compares the 17,520 half hour demands for 2011 and 2015 through to 2020. This shows overall consumption has reduced since 2011 and that 2015 to 2019 were at similar levels and the impact of Covid-19 on 2020 was significant.



When reviewing the top 400 peaks for each of the years 2011 and 2015 through to 2020, the graph below shows the 2011 year influenced more by load control compared with 2015 through to 2020. The 2011 top peaks flatten off where the 2015 to 2020 peaks do not. In 2011 the network was constrained at the Sub-Transmission and Zone Substation level so load control was used extensively during the winter months. The 2015 to 2020 years have less use of load control at peak times due to the additional Sub-Transmission feeder and new Zone Substation in service eliminating the previous supply constraints.



Analysis of electricity consumption of consumer groups undertaken to determine growth levels, indicates that the flat to negative growth experienced since 2009 is a combination of several things including the economic downturn following the 2009 global financial crisis and a change in consumer electricity usage behaviour. All consumer groups on a per consumer basis are using less kilowatt hours. The mass market has shown this trend since 2009 and only since 2013 have the Time of Use consumers shown a reduction.

The larger customers are more influenced by economic downturn whilst the mass market consumers will use electricity on an as needed basis. The mass market (particularly residential) is also influenced by the types of energy efficient appliances being purchased as well as changes to more efficient heating options, increased retrofitting of improved insulation and now installation of solar photo voltaic (PV) panels.

Nelson City Council have confirmed a combination of planned subdivision development and infill housing. The key areas are Toi Toi Valley with 100 homes, Paru Paru Road with 40 homes, several large inner city apartment developments and several building redevelopments following the removal of the requirement to provide onsite parking. The waterfront area around Wakefield Quay is slowly being developed with apartment construction. Although the apartment building trend is still in its infancy this could make a significant contribution to NEL's future growth.

Nelson City Council is well down a path of air quality improvement in the city. Their plan aimed to improve Nelson air quality by 2020. One significant factor is the encouragement to shift to non-polluting heating options as electricity is the most environmentally friendly option. The initial indication highlighted an increase in household load as they converted to electrical heating, however, this did not occur due to reduction of other non-efficient electrical heating options over the same time. Much of the heating load will be in evenings so will have a lesser impact than if the additional load coincided with the winter morning peaks. To date the conversion to electrical heating has not shown sign of additional load on the network.

Another Nelson City Council initiative is facilitating the increasing utilisation of solar for hot water heating and PV panels. Currently there are 190 solar PV connections totalling 759kW and survey results show 5% of residential consumers have solar water heating of some kind. This will have some impact on kilowatt hour consumption but minimal impact on peak demand as the NEL network peaks on miserable, cold, cloudy, winter mornings which will not assist solar devices. In most cases these sites will rely on the NEL network as a backup.

Latest kilowatt hour consumption figures have been impacted by Covid-19 and does not necessarily assist in providing a good base to make forecasts from. As a result, the 2019 year has been used as a base for the NEL forecasts as consumption patterns since August 2020 are in alignment with the previous year's consumption.

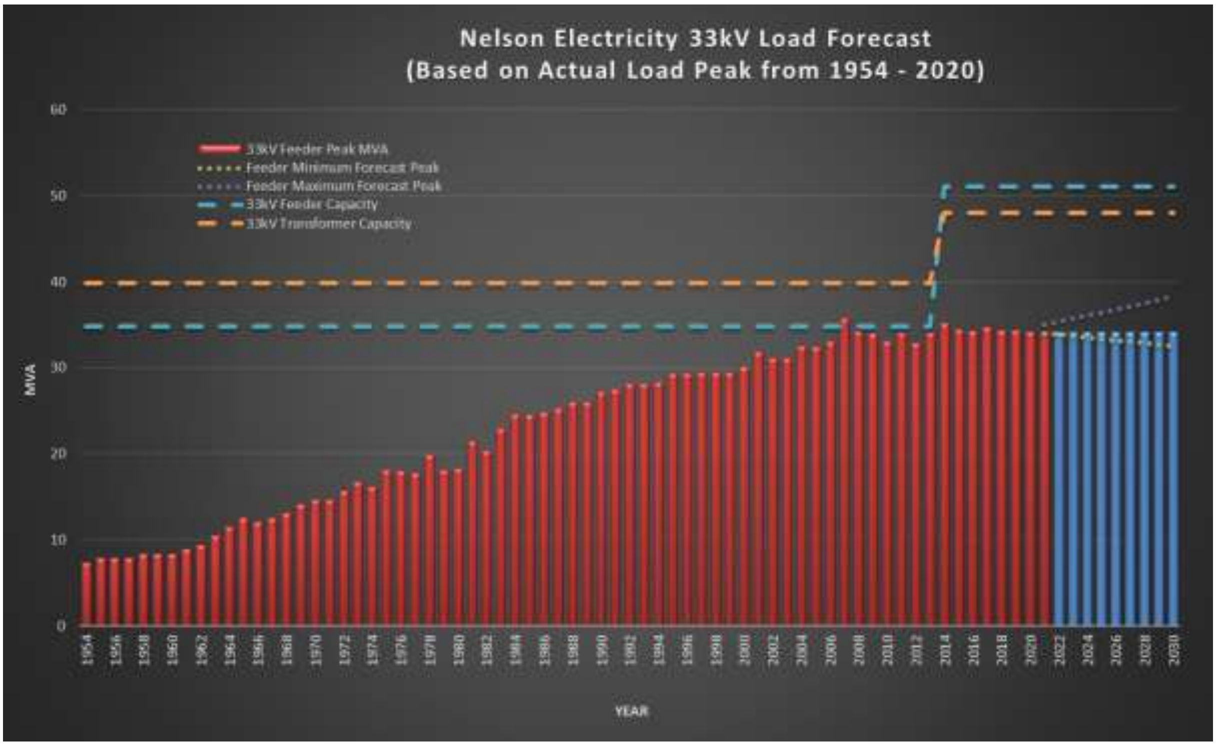
NEL does utilise load control to minimise peaks using its ripple control system. This can be used not only to reduce highest demand peaks on the network but also minimise transmission charges by assisting in reduction of the Stoke Grid Exit Point peak demand and the Upper South Island peak demand. Since the completion of the new Haven Road Zone substation load control is predominantly only used to minimise transmission charges as the new substation has increased network capacity.

This loading forecast has to date been expressed in the form of active power or MW, but it is critical to the rating of much of the equipment supplying the load that the element of power factor be considered. This is currently in the region of 0.94 - 0.98 for the combined loads at Stoke for Network Tasman and NEL depending on time of day and year. If related to the load at Haven Road it places extra strain on the 33kV lines, cables and 33kV/11kV transformers to supply the active load without exceeding design MVA ratings.

The previous table shows the actual peak loadings on the system at Haven Road for the past 25 years. This is as well as other information used as a base for the following years demand forecast. The setting of the forecast is difficult given the demand and consumption figures have been flat or in decline and there is enough uncertainty as to the effects of all the variables as mentioned in this section.

For this Asset Management Plan, NEL has had to assume that 2021-2022 peak demand will remain flat at 33MW and consumption also remain flat (excluding the Covid-19 impacts in 2020) at 2019 levels.

Network Demand Growth Forecast



NEL's load growth predictions were based very much on historical growth and then other known or perceived influences are included to arrive at a final predicted figure for that year. The graph above demonstrates the load pattern since 1954 - peak demand and kilowatt hour growth followed closely with gross domestic product (GDP). There has, however, been a departure from the pattern with consumption and peak demand reducing since 2008.

- Moving forward, peak demand is assessed at being flat with no growth. NEL has had a steady growth rate of 1.5% per year over a long period of time but since 2008 the peak has dropped due to economic downturn and other reasons as described in the previous section.

- For the purposes of the planning period, it is estimated that growth would remain flat for years 1–5 and increase 1% per year for the years 6-10, recognising there is significant consumption uncertainty which could result in significant re-forecasting once more consumption behaviour evidence becomes apparent.

- The forecast includes the impact of load control. This is in the order of 3MW during peak demand times in the winter. It is assumed, for the load forecasting period, that this level of load control will continue to be utilised.

- Given the limited opportunity for distributed generation, there has not been an allowance made, although an increase in solar PV installations less than 10kW in capacity has been noted with the reduction in cost of PV panels. This is expected to increase over the coming years.

- There is an upper and lower forecast line included in the forecast to allow for the uncertainties including annual climate and seasonal differences. The Asset Management Plan is designed, and/or contingencies designed, around the maximum forecast level to provide N-1 security of supply. The lower forecast is set at no growth at all for the planning period.

- The effect of the Nelson City Council air quality targets is also included in the forecasts. In the longer-term distributed generation and other forms of load management are expected to impact on the growth demand pattern but this influence, although expected to be significant, is too unpredictable to judge at this stage. To date the effect has not been noticeable in the overall demand growth.

- One technology that will have an impact on peak demand and kilowatt hour growth in the future is the charging of electric vehicles either at home or at charging stations. Currently the number of electric cars in the region is low and so there is minimal impact on the network. Electric vehicle sales in the region are increasing and so this is an area to monitor closely for impacts from about five years out and beyond. The first step is introducing a pricing strategy that will incentivise the charging of vehicles outside of peak demand times.

Network MWh Growth

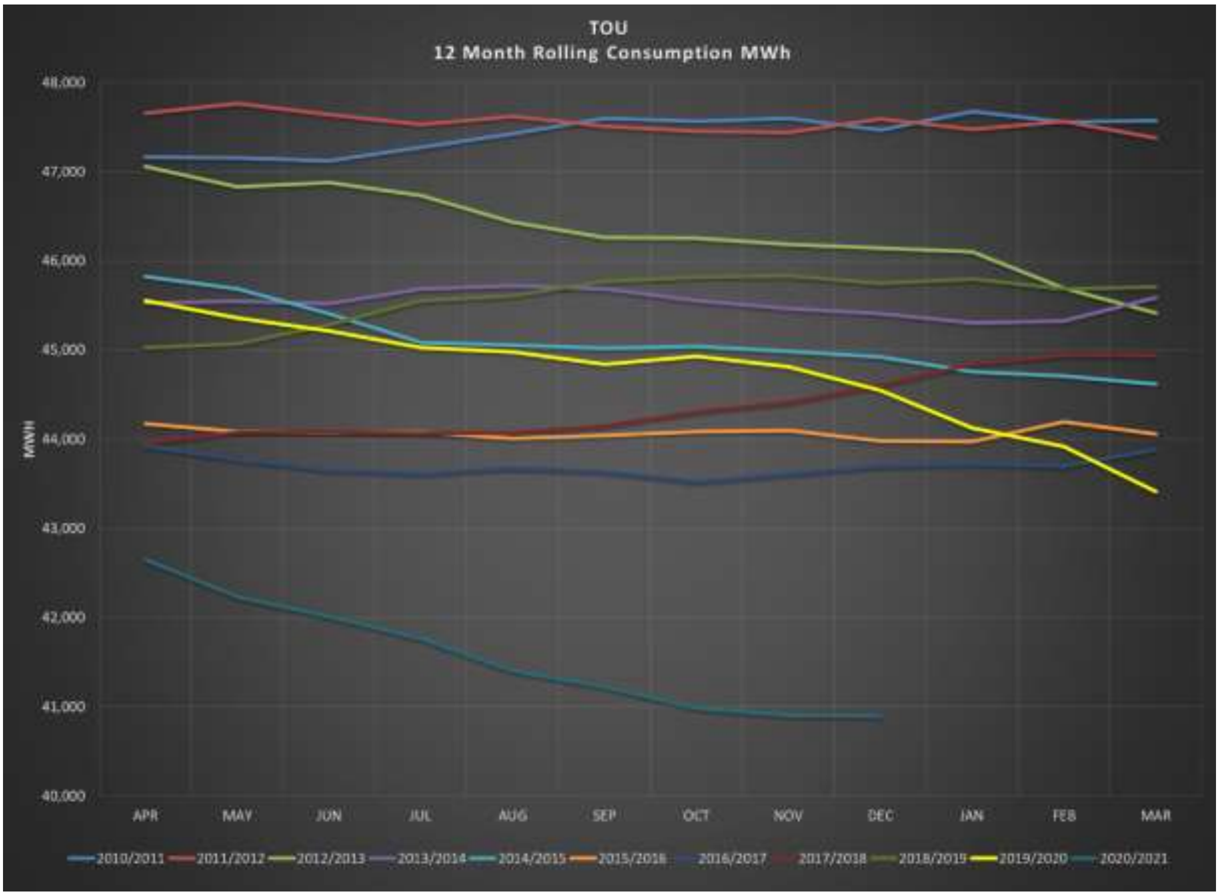
Up until 2008 NEL had shown a steady increase of approximately 1.5% growth in electricity consumption on the network in line with the demand growth. Since then, there have been three events that have reduced demand and consumption. In 2008 there was the "low lake level electricity crisis" and immediately following that was the effect of the economic downturn. The economic downturn coupled with warmer weather has also reduced it further.

Average kilowatt hour consumption per consumer has shown to reduce since 2008. The table demonstrates the average residential consumer in 2020 was using 6,900 kilowatt hours per year down from 7,392 in 2008 - a drop of 13%. The small increase between 2016 and 2020 of 2.3% demonstrates that most of the energy efficiency gains in residential areas have been made plus Covid-19 did have a minor impact with increased electricity use during the Lockdown 3 and 4 periods. Average consumption is likely to remain around this level for the short to medium term. Business consumers are also using 6.7% less on a per consumer basis since 2016. This was impacted by Covid-19and will likely lift back to around the 2016 level.

Average Annual Consumption Change per ICP

Group	2008	2012	2016	2020	% Change in 4 years
Group 1 and 2 Residential	7,392kWh	7,135kWh	6,727kWh	6,883kWh	2.3%
Group 2 Business	24,365kWh	24,308kWh	22,041kWh	20,568kWh	-6.7%

The larger Time of Use consumers have had a reduction in kilowatt hour consumption since 2012. Generally, there has been a focus on cost for larger consumers with reductions in consumption and connected capacity. Covid-19 has impacted this Load Group with accommodation providers and hospitality being hit hardest. There have also been some larger customers altering their operations which has reduced their consumption. The consumption is expected to plateau and possibly increase in 2021-2022 given the likelihood of new Time of Use connections and improved economic conditions for Nelson.



NEL, as a prudent electricity distribution business, has taken a forecasting approach that protects the effectiveness of the Asset Management Plan. The Plan caters for a consumption to remain flat for period 2021–2026 and then increase at 1% for the period 2027-2031. This Plan recognises there is significant consumption uncertainty which could result in significant re-forecasting once more consumption behaviour evidence becomes apparent.

Forecasted MWh Consumption						
	2017	**2018**	**2019**	**2020**	**2021 Est**	**2022 Est**
Stoke GXP MWh	144,787	145,516	148,023	144,469	141,622	143,865
MWh Billed	139,607	140,342	142,767	139,613	136,209	139,000
Losses	3.73%	3.71%	3.74%	3.59%	4.05%	3.50%

33kV Configuration for Load Growth Requirements

The new configuration of four 33kV lines has full N-1 capacity of 52.5MVA at NEL. It is expected that at the upper end peak demand forecast will not reach 35MVA so there is plenty of spare capacity available in the event of a failure or future load growth.

The maximum load NEL can draw from any three of the four 33kV feeders from the Stoke Grid Exit Point is 48MVA. The current contingency for a multiple 33kV feeder outage occurring during a winter peak demand time that is more than forecast and higher than 35MVA demand, is to arrange for major consumers to shed load. The required reduction would likely be in the region of 0.5MW. There is more than 2.5MW of load shedding and distributed generation available to utilise in an emergency (excluding benefits of 3.0MW of ripple control).

Although no longer required for load control for peak demand, load control will still be utilised for managing transmission costs and emergency load management situations.

The four 33 kV line and cable combination ratings are as shown in the table below:

Component	Feeder: Rutherford St	Feeder: Vanguard St	Feeder: St Vincent St	Feeder: Waimea Road
Line	Dog Rating: 305/365 A (17.5/21 MVA)	Dog Rating: 305/365 A (17.5/21 MVA)	Dingo/Weka Rating: 330/370 A (19/21.2 MVA)	N/A
Cable	330A (17.5 MVA)	330A (17.5 MVA)	330A (17. 5MVA)	400A (23MVA)
Overall assigned continuous rating	17.5 MVA	17.5 MVA	17.5 MVA	23MVA
Total capacity: 75.5 MVA				

Note - the overhead line sections Rutherford Street, Vanguard Street and St Vincent Street are owned, operated and maintained by Network Tasman, whilst NEL has sole utilisation of them for supplying its network. NEL owns the Waimea Road feeder cable from Transpower's grid exit point at Stoke Substation to the new Haven Road Zone Substation.

33kV/11kV Transformer Configuration for Load Growth Requirements

The existing configuration of 33kV/11kV transformers at Haven Road Substation is three banks of three phase 16/24 MVA ONAF transformers installed in 2013/14 as part of the Zone Substation replacement project. This provides for 48MVA at an N-1 security of supply level.

11kV Feeder Configuration for Load Growth Requirements

NEL has 14 main 11kV Feeders that link the 33kV/11kV Zone Substation with key 11kV/400V switching stations on the network. These 11kV feeders all have N-1 security level.

Over a number of years, the 11kV feeders have gradually been replaced due to age or capacity with the remaining two 11kV feeders planned to be replaced in the next 10 years. These are Snows Hill and Victory Square, both due to capacity constraints for wider network flexibility. Most other 11kV requirements involve upgrading further out in the network. There are also various new and upgraded 11kV lines linking the existing 11kV feeders out in the network which are planned to simplify back-feeding of supply in the event of an 11kV outage.

11kV Feeders from Haven Road Substation

The 11kV feeders are a critical part of the network. They radiate out from the single Zone Substation and provide backup capacity for the neighbouring feeders in the event of another 11kV feeder outage. The following are individual 11kV feeder forecasts out to 2021. They also give an indication as to the forecasted loadings of all feeders as they will be set up for the winter of 2021. Also, there is a table demonstrating the assessed capacity and N-1 backup support for other 11kV feeders. Note, the tables and graphs in this section target the peak demand times during the winter and do not take into consideration the different diversity characteristics of each 11kV feeder. These then represent a worst-case scenario.

There is some flexibility in changing of 11kV break points in the network to alter feeder loads. Break point locations are reviewed annually to optimise the network efficiency and back up support capability.

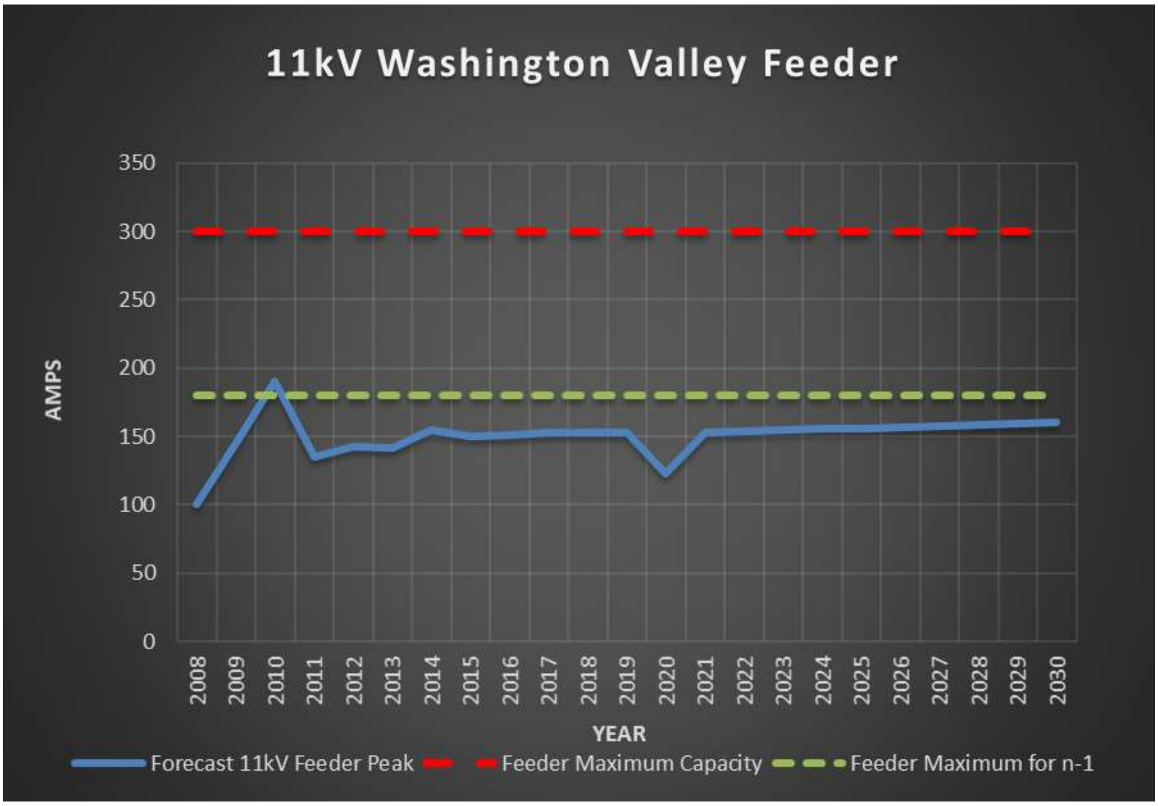
The table below and feeder N-1 assessment graphs have been adjusted for any time periods when back-feeding of feeders or part thereof occurred so to determine the business-as-usual situation for 2020.

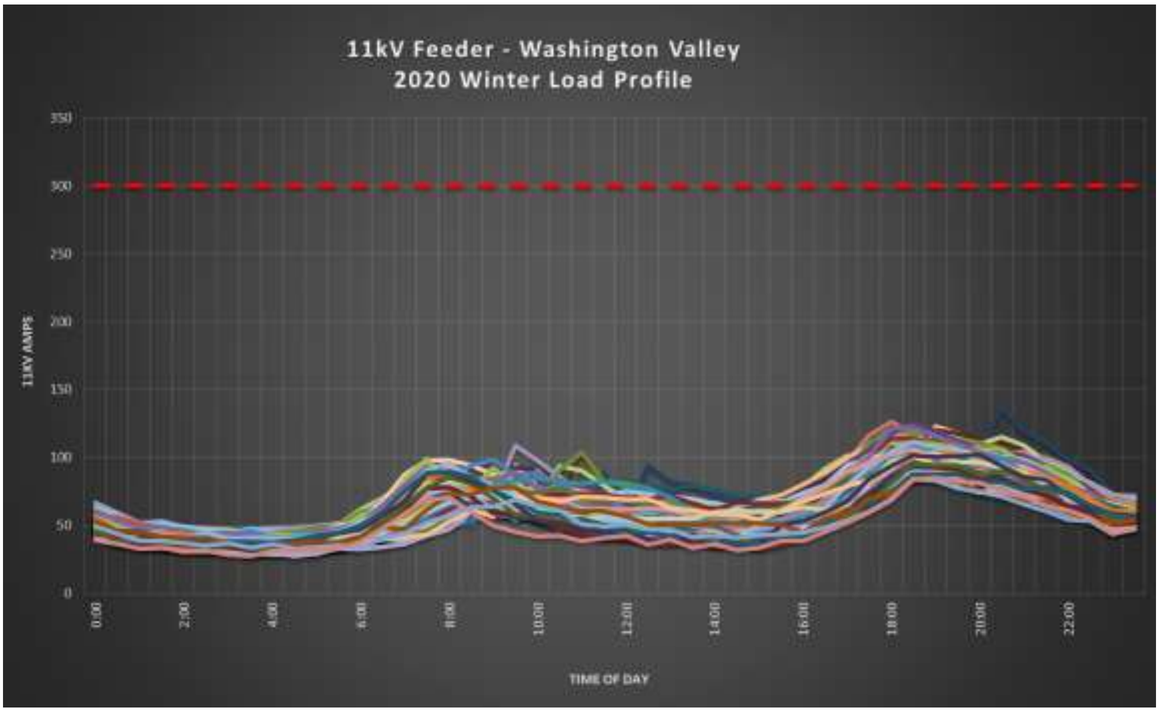
The forecasted feeder peaks for 2021 onwards uses 2019 peak data as a base and excludes the impacts on demand during 2020 and any ongoing impacts due to Covid-19.

Nelson Electricity 11kV Feeder Backup Capacity

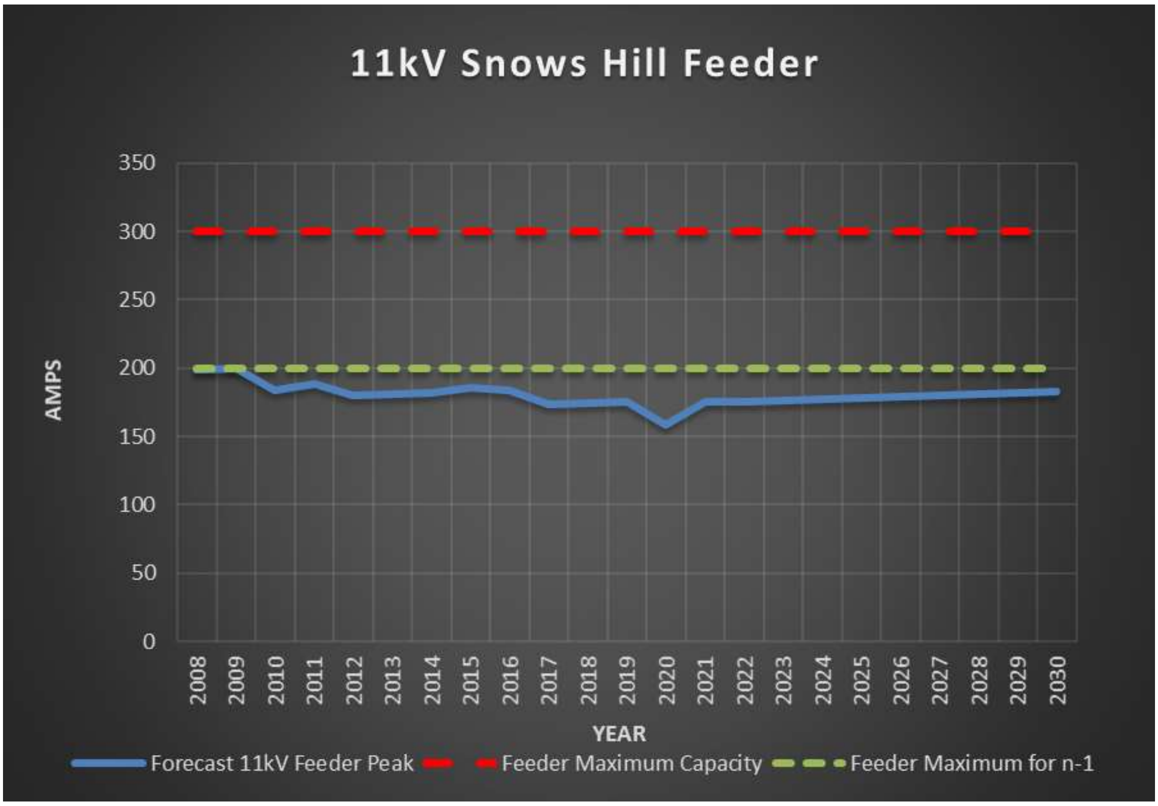
(Based on 2017 Winter Load Profiles)

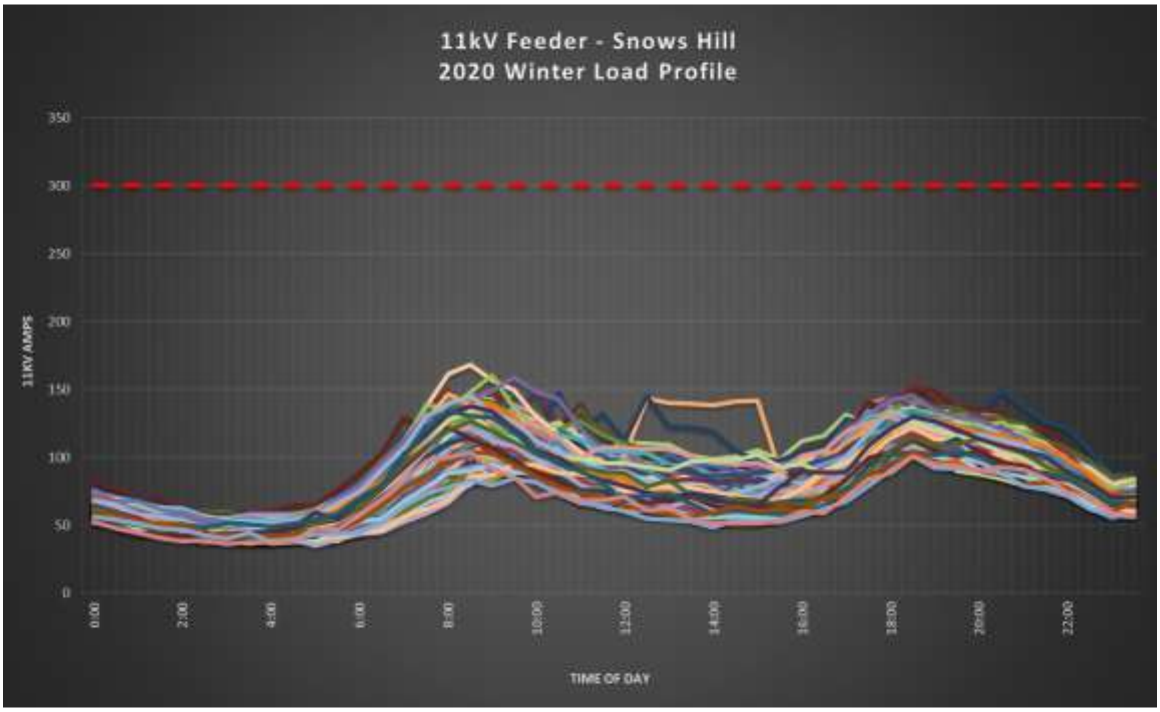
			N-1 Support for 11kV Feeders (Amps)															
Feeder	Rating	2020	GPO	Anzac Park	New St	Alma St	Bank Lane	Snows Hill	Victory Square	Emano Street	Wash Valley	Port	Vick Street	Sealord	Traf Centre	N-1 Support	Feeder Max Load Level	Reserve Capacity 2020
Washington	300	123								120		120				120	180	177
Snows Hill	300	159		100		100	100		100							100	200	141
GPO	300	225		50	50		50									50	250	75
Sealord	300	161											100		100	100	200	139
Victory Sq	300	190		90				90		90						90	210	110
Bank Lane	300	140	120	120		120		120								120	180	160
New St	350	160	150			150										150	200	190
Traf Centre	300	54											200	125		200	100	246
Port	350	96									135		140			140	210	254
Emano St	300	154							120		120					120	180	146
Anzac Park	350	188	100				100	100	100							100	250	162
Alma St	350	202			120		120	120								120	230	148
Vickerman	300	71										130		185	130	185	115	229
Total Backup Capacity			370	360	170	370	370	430	320	210	255	250	440	310	230			
Total Spare Backup Capacity			145	172	10	168	230	271	130	56	132	154	369	149	176			



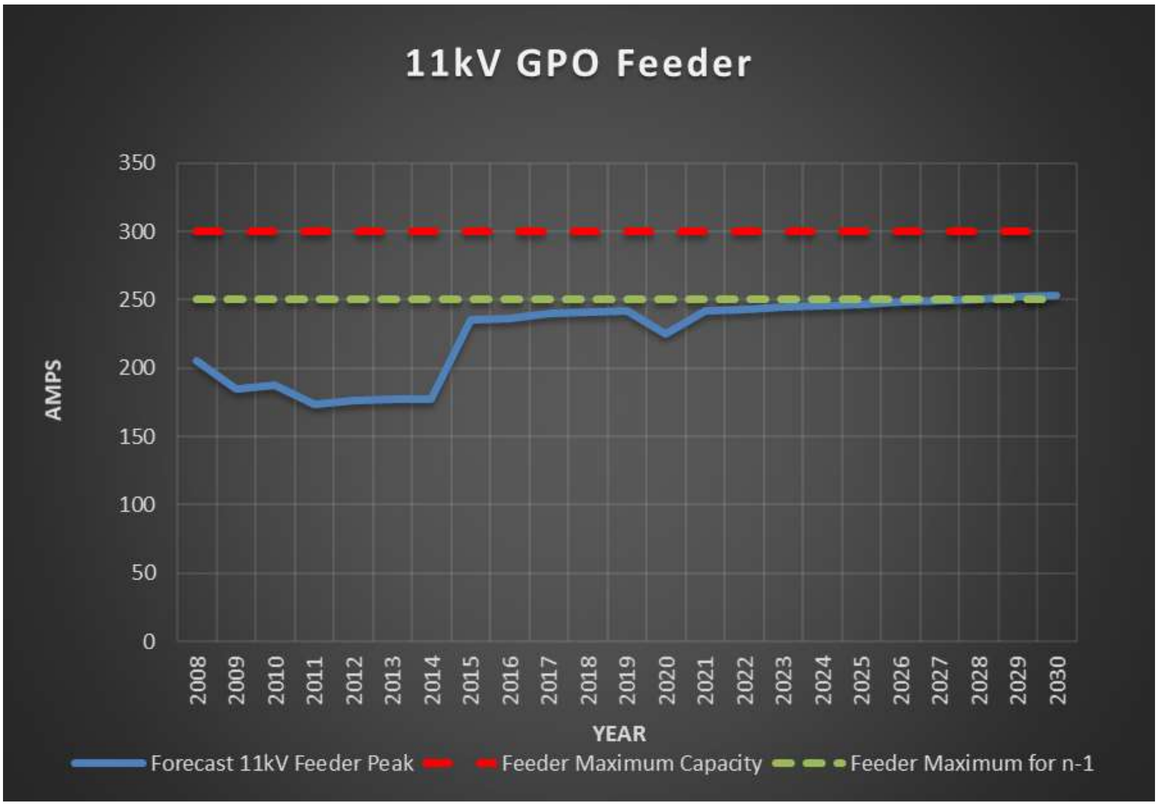


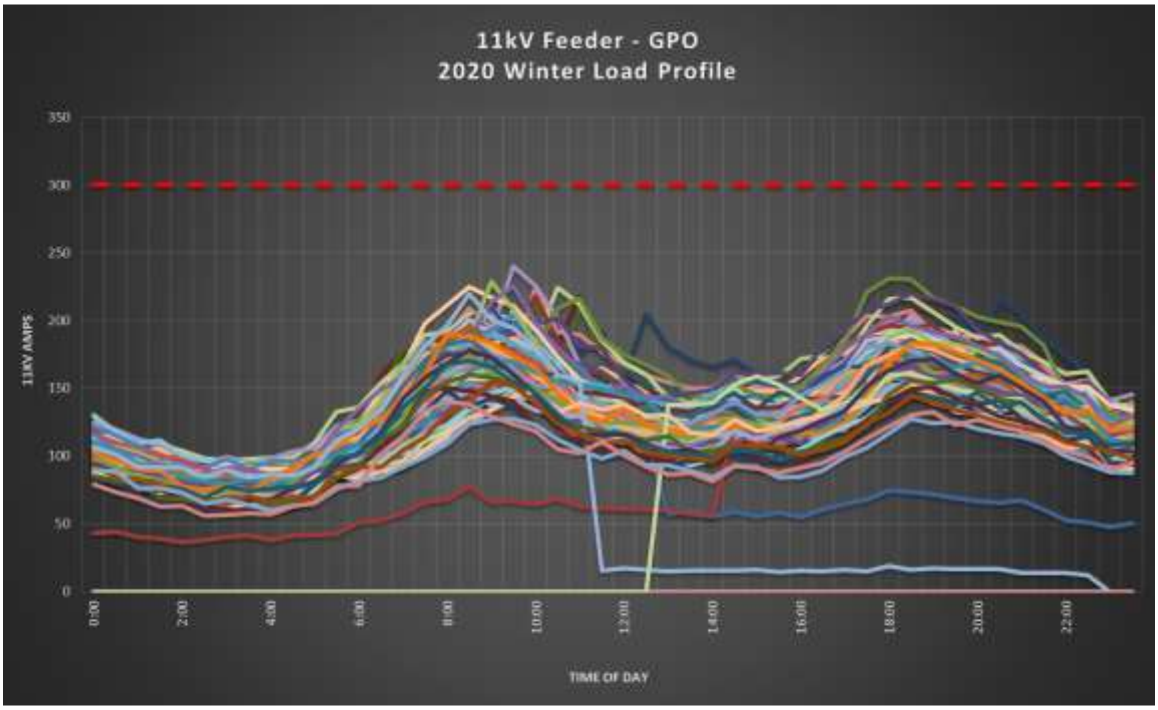
The Washington Valley feeder supplies the Washington Valley and Port Hills areas. Load is mostly domestic. This feeder provides backup supply to the Port and Emano Street feeders.



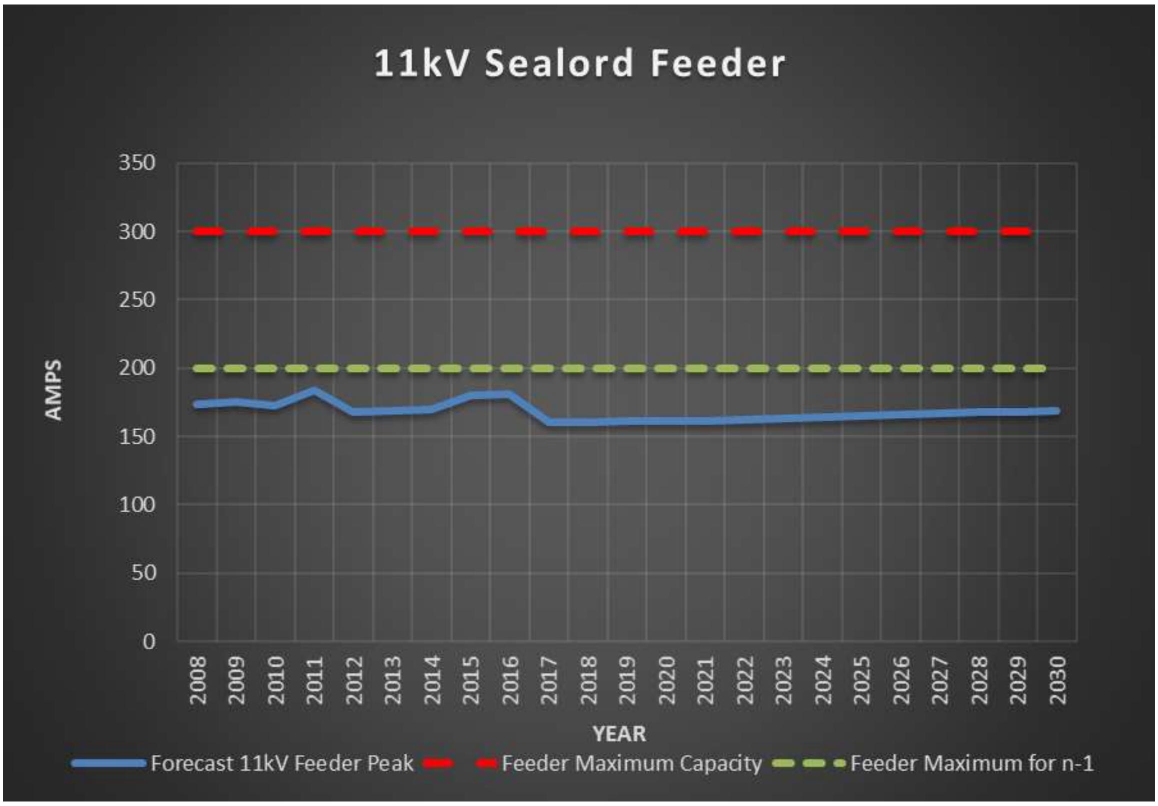


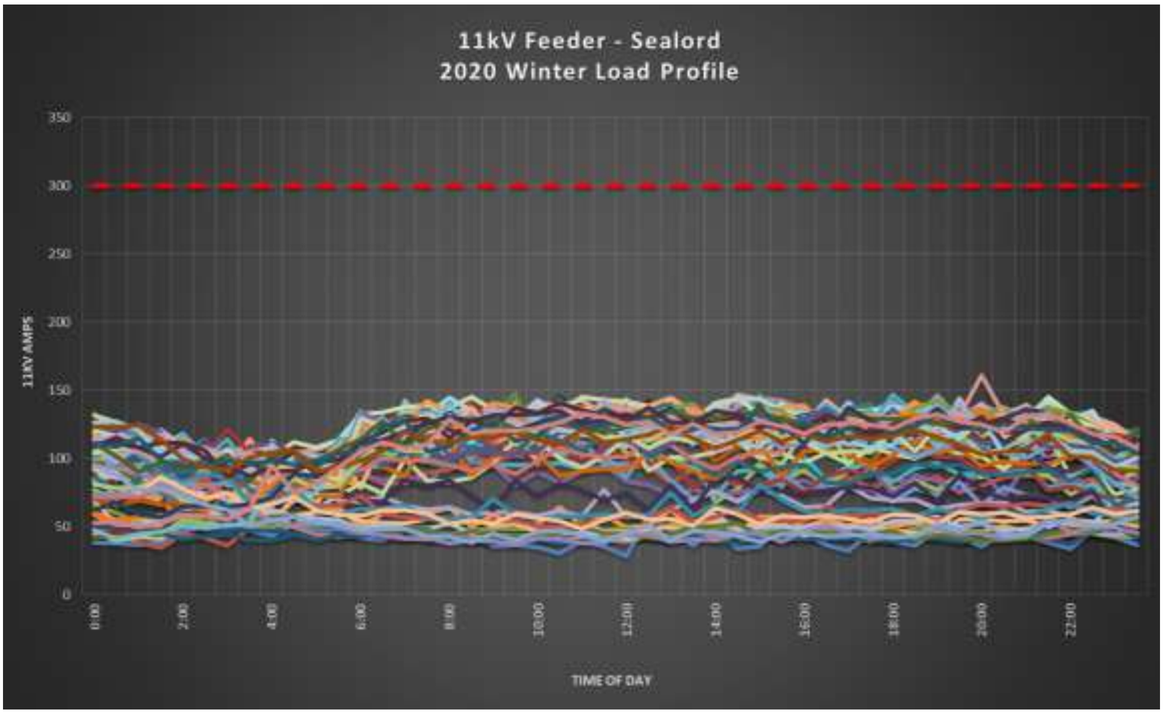
The Snows Hill feeder supplies the south eastern side of town including; the colleges and Mount Street areas. The loading is mostly domestic as well as school load.



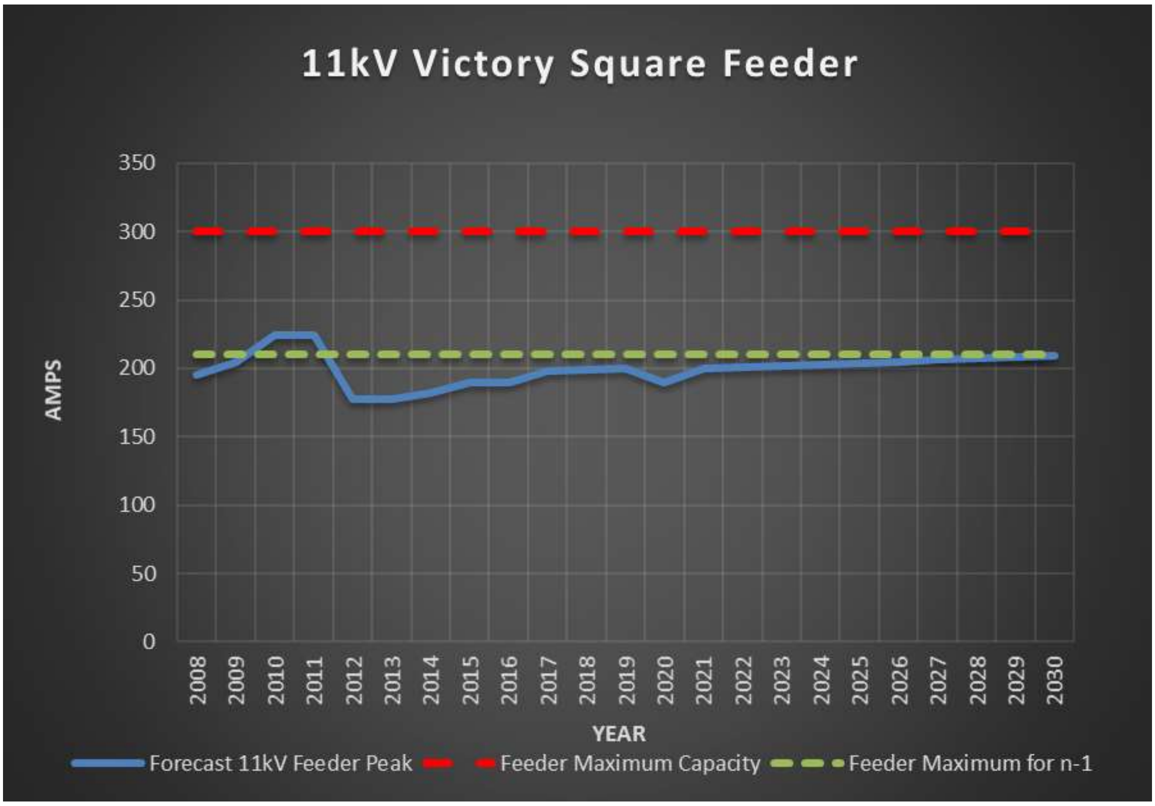


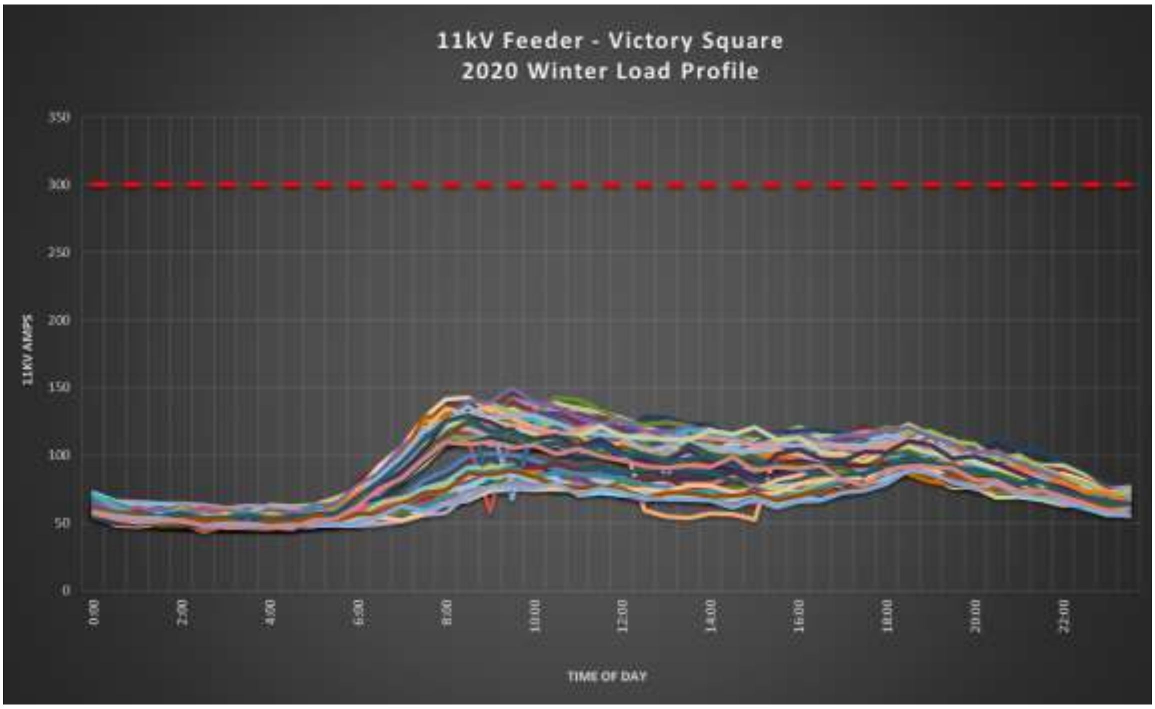
The GPO feeder supplies the northern end of town including Halifax Street (CBD) and the Wood suburb. The load is a mixture of commercial and domestic. This feeder is also an important back-feeding option for the central business district and New Street feeder.





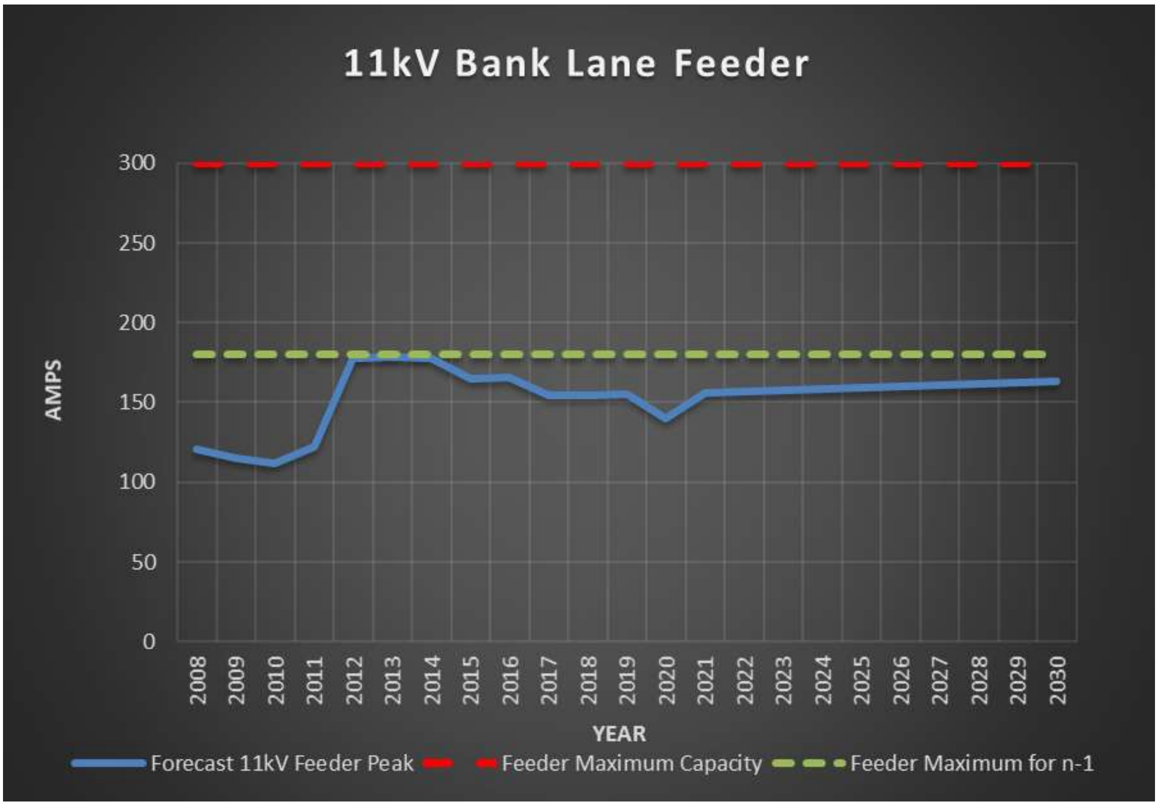
The Sealord feeder supplies the Sealord fish processing factory at the Port area. This feeder is also used as a back-feeding option for the Port area.

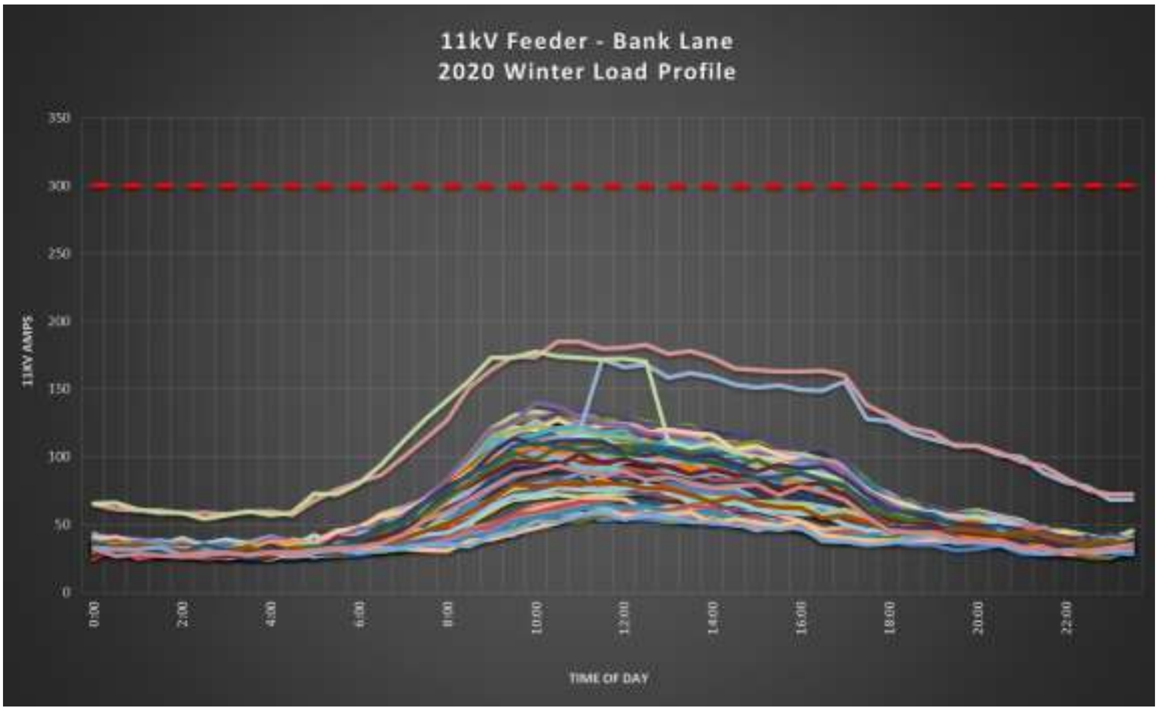




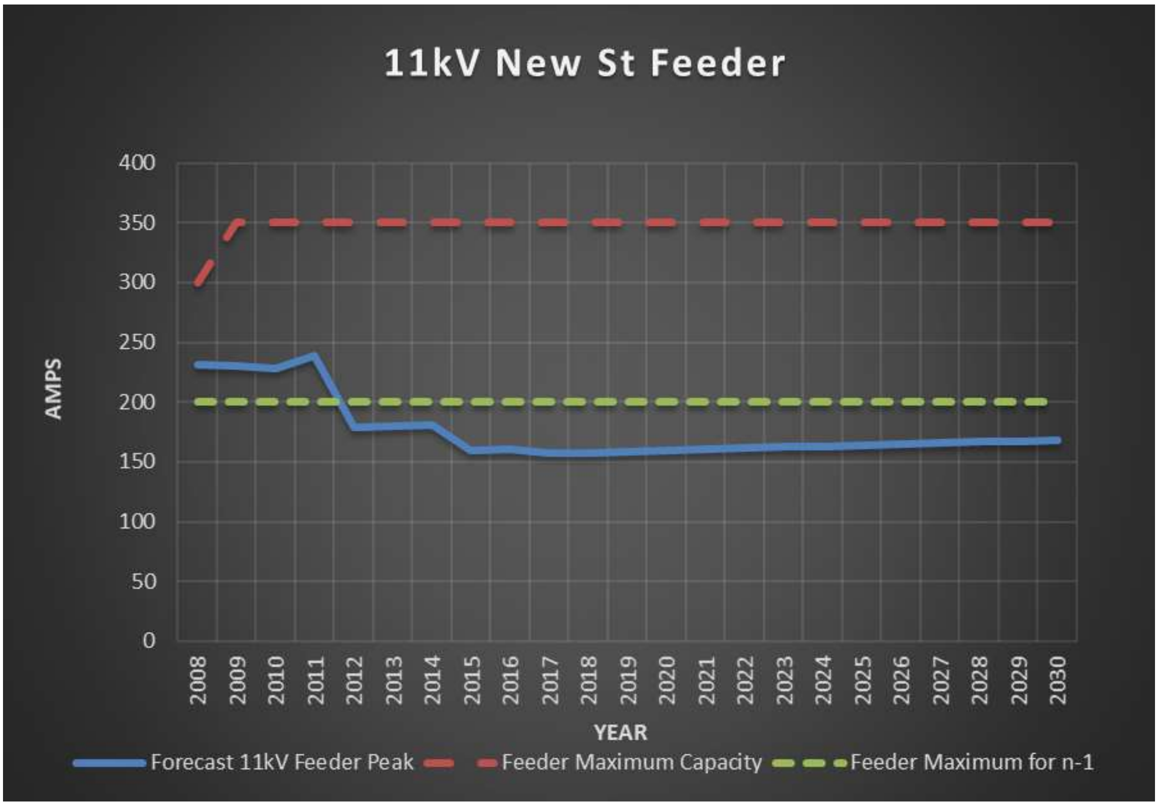
The Victory Square feeder supplies the southern end of town including; Victory Square, Toi Toi Valley, Intermediate and Hospital areas. The supply is a mixture of domestic, light industrial and Hospital load.

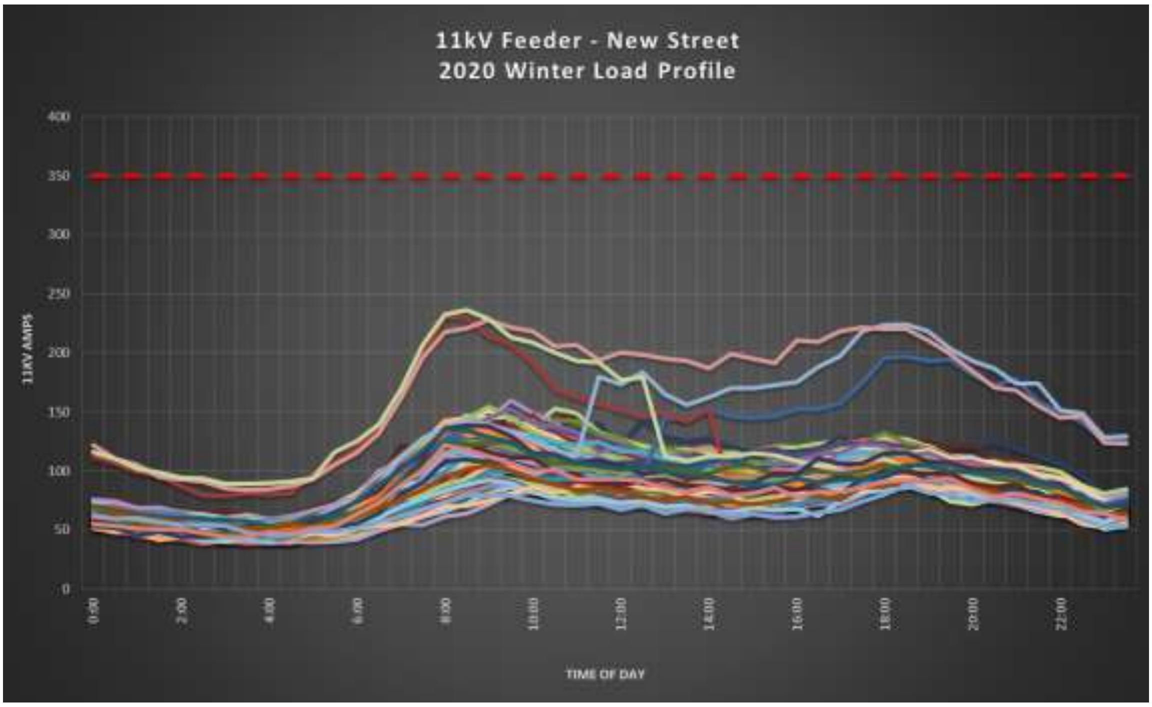
The Victory Square feeder peak load was reduced by 40amps through the winter of 2020 due to a problem with an 11kV switch in Totara Street. This load was transferred onto Emano Street feeder. The forecasted 11kV peak load has been adjusted to include the load transferred to Emano Street feeder.



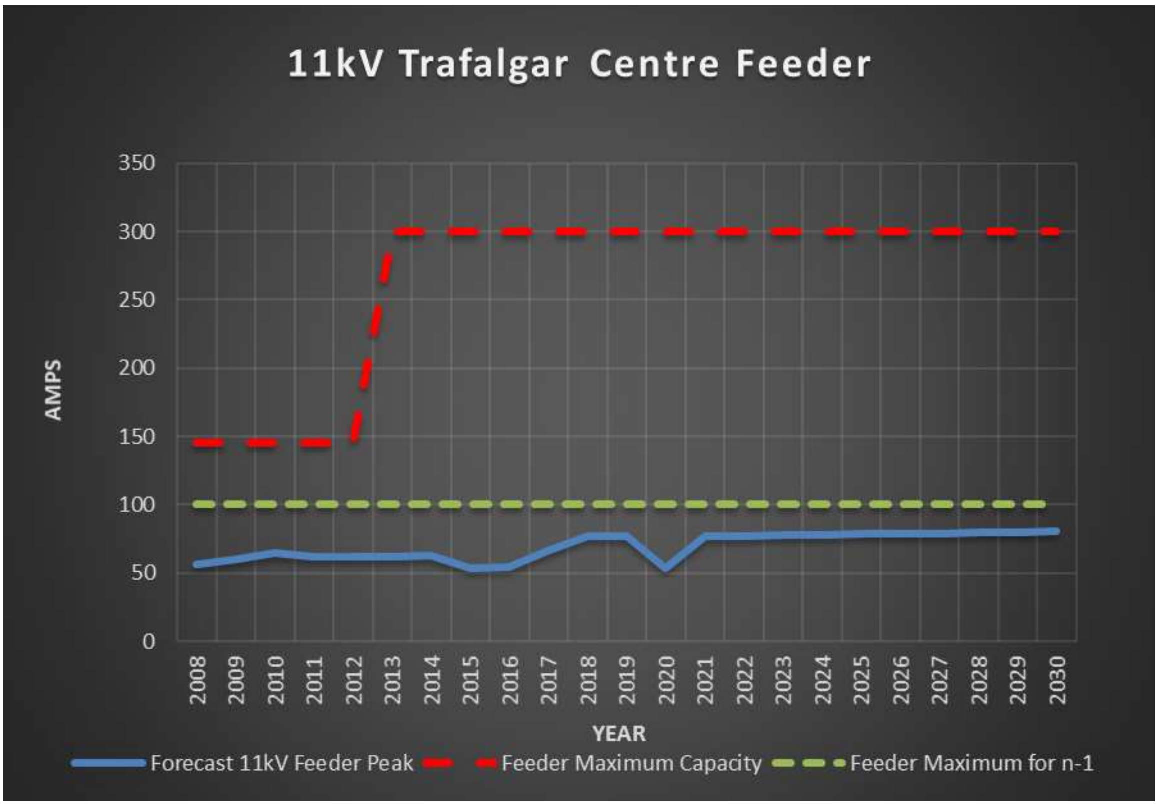


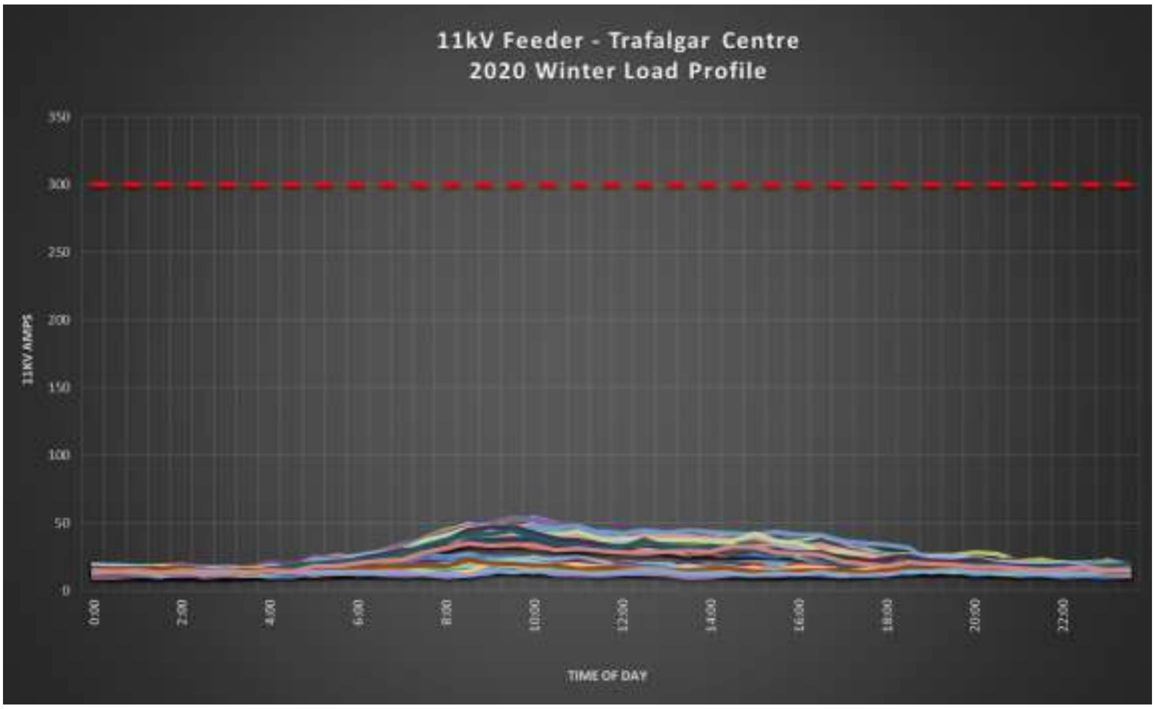
The Bank Lane feeder supplies the inner Nelson central business district. Its loading is commercial. It also provides a necessary 11kV back-feed option for Alma Lane, GPO and Snows Hill feeders. There is a two-day time period in August 2020 where the Bank Lane feeder was used to back-feed part of the GPO feeder catchment.



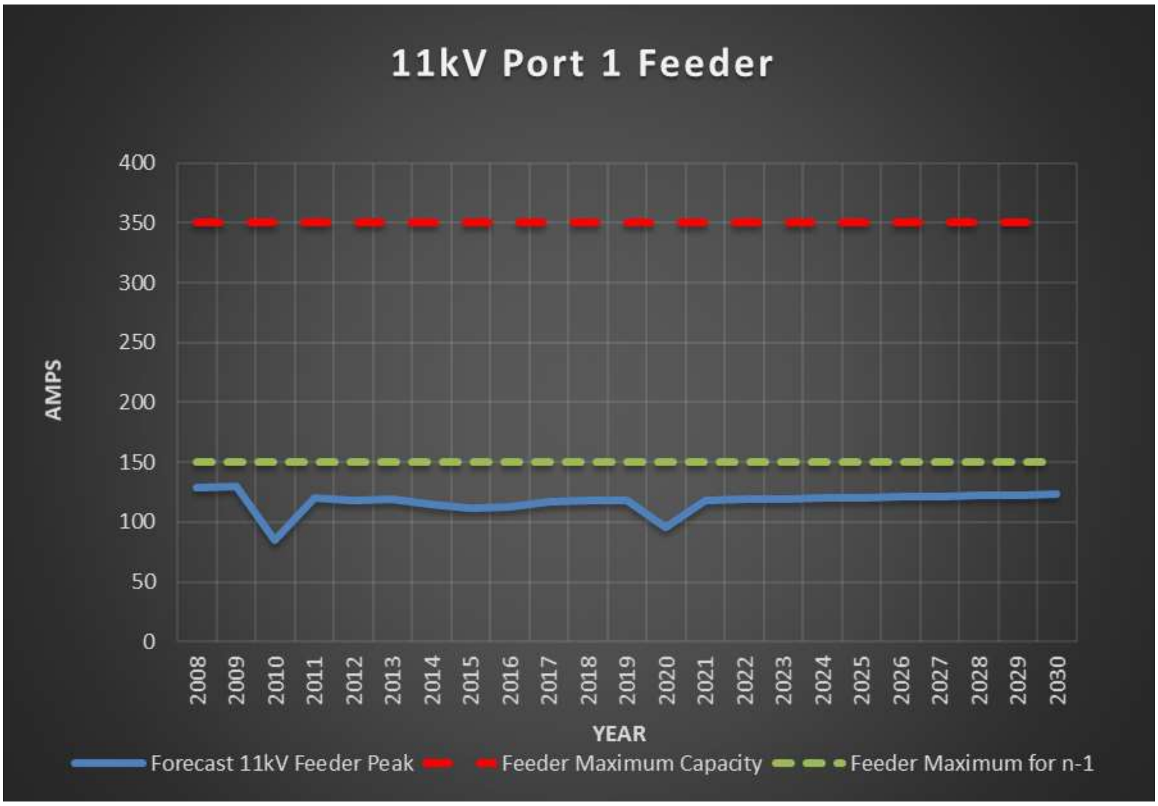


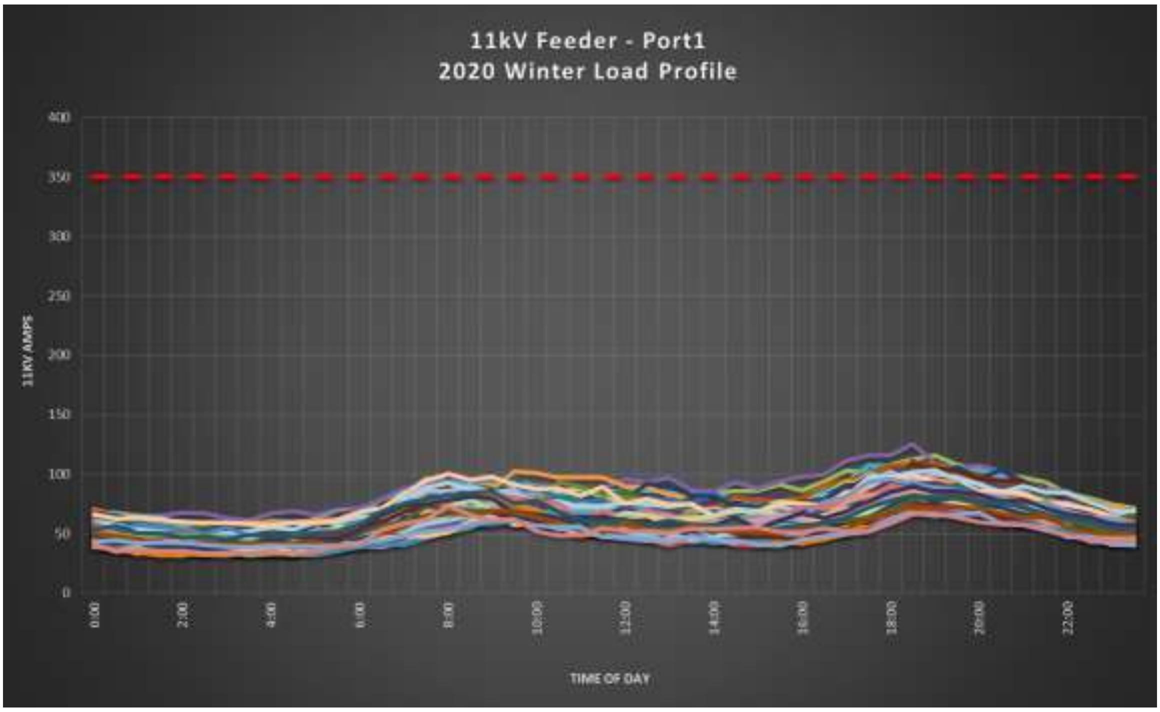
The New Street feeder supplies the north eastern Nelson central business district, Botanics and Maitai areas. Load is a mixture of commercial and domestic. This feeder was replaced in 2009 to provide additional N-1 backup capacity at 11kV feeder level. There was a three-day period in August 2020 when the New Street feeder was used to back-feed part of the GPO feeder catchment.



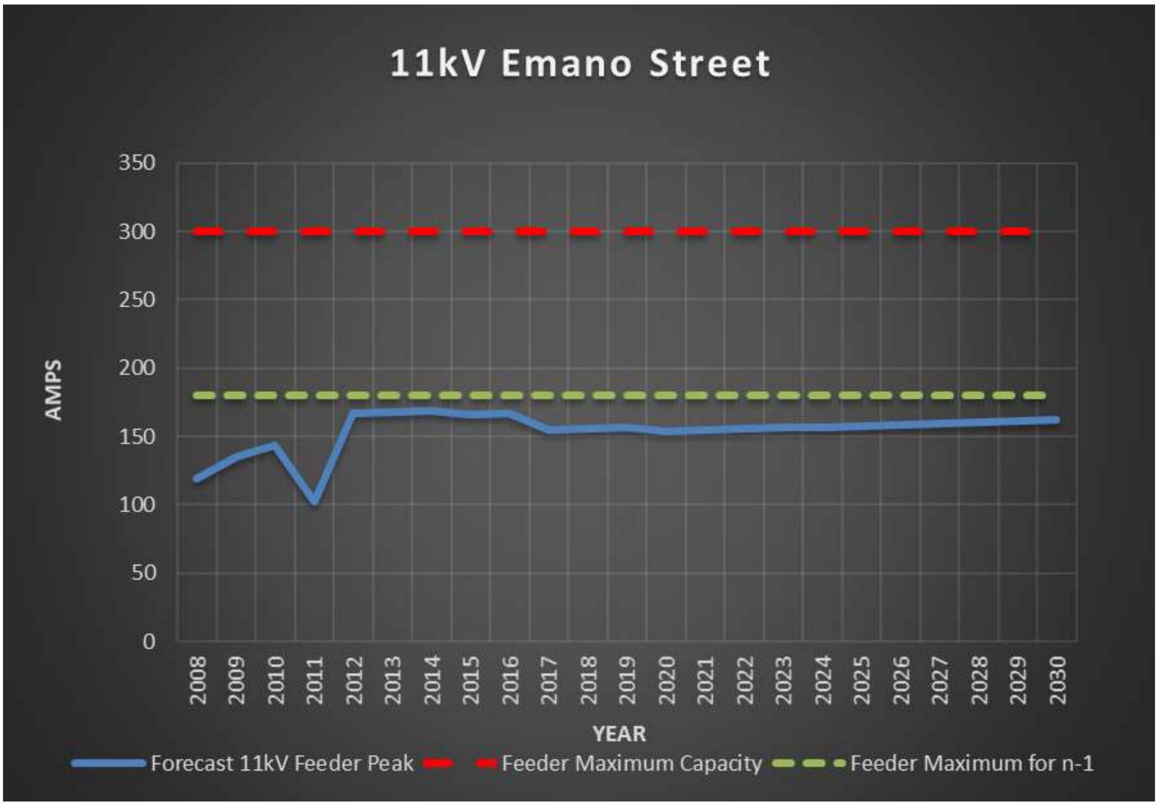


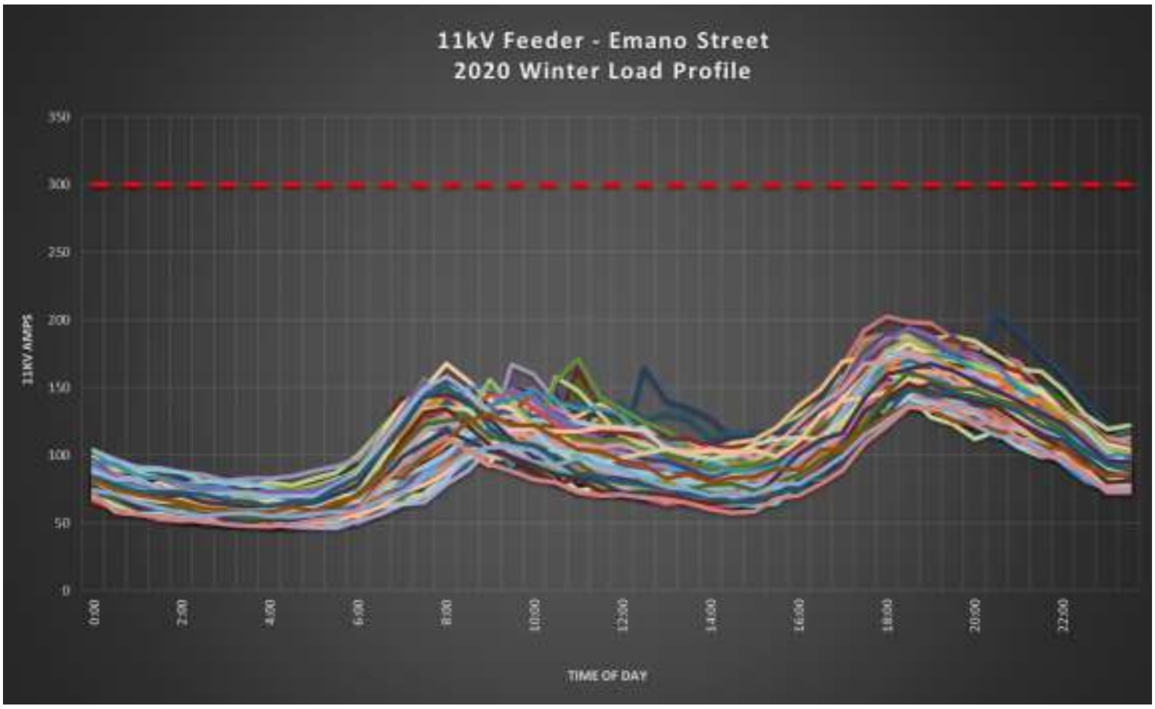
The Trafalgar Centre feeder supplies the Haven Road area and eastern Port area. The load is mostly light industrial and commercial.





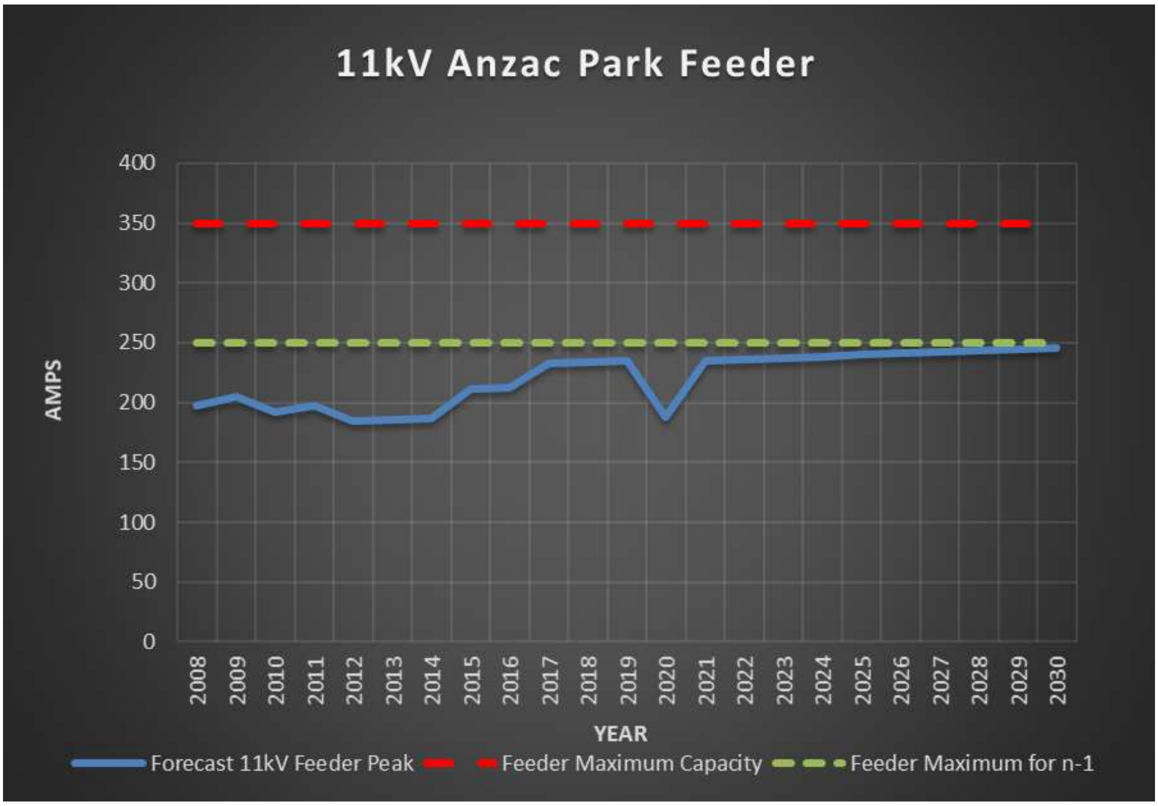
The Port 1 feeder supplies the western end of the Port and Wakefield Quay areas. The load is mostly commercial and light industrial. This feeder provides additional backup supply to the Washington Valley feeder.

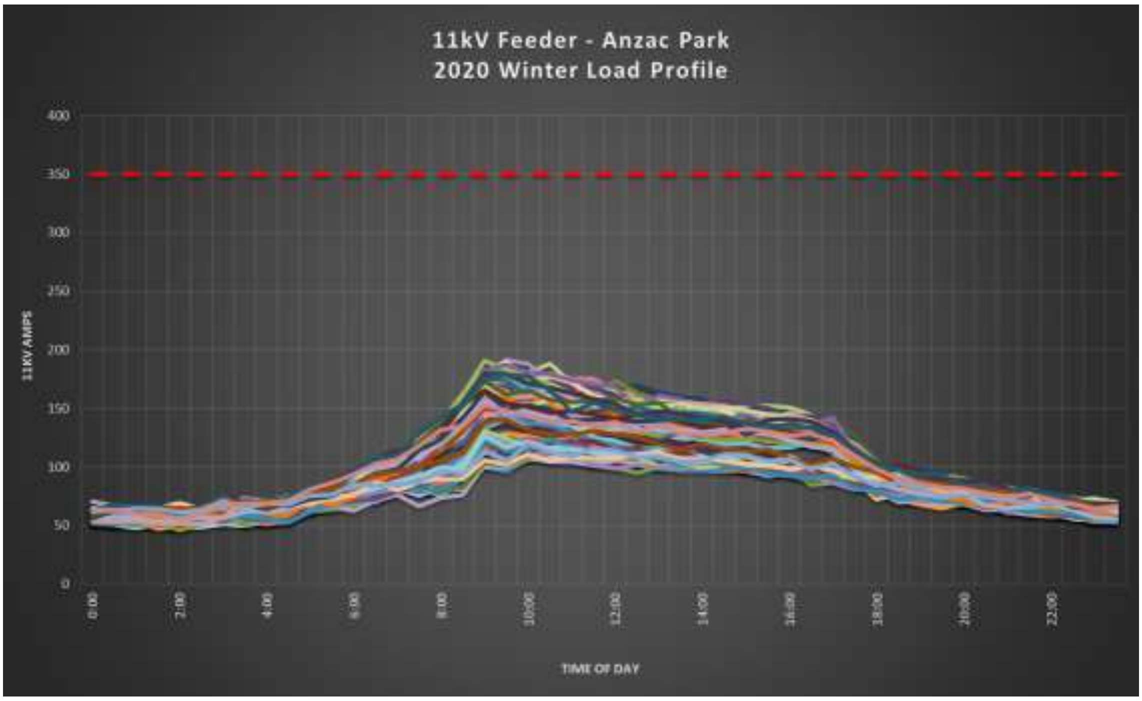




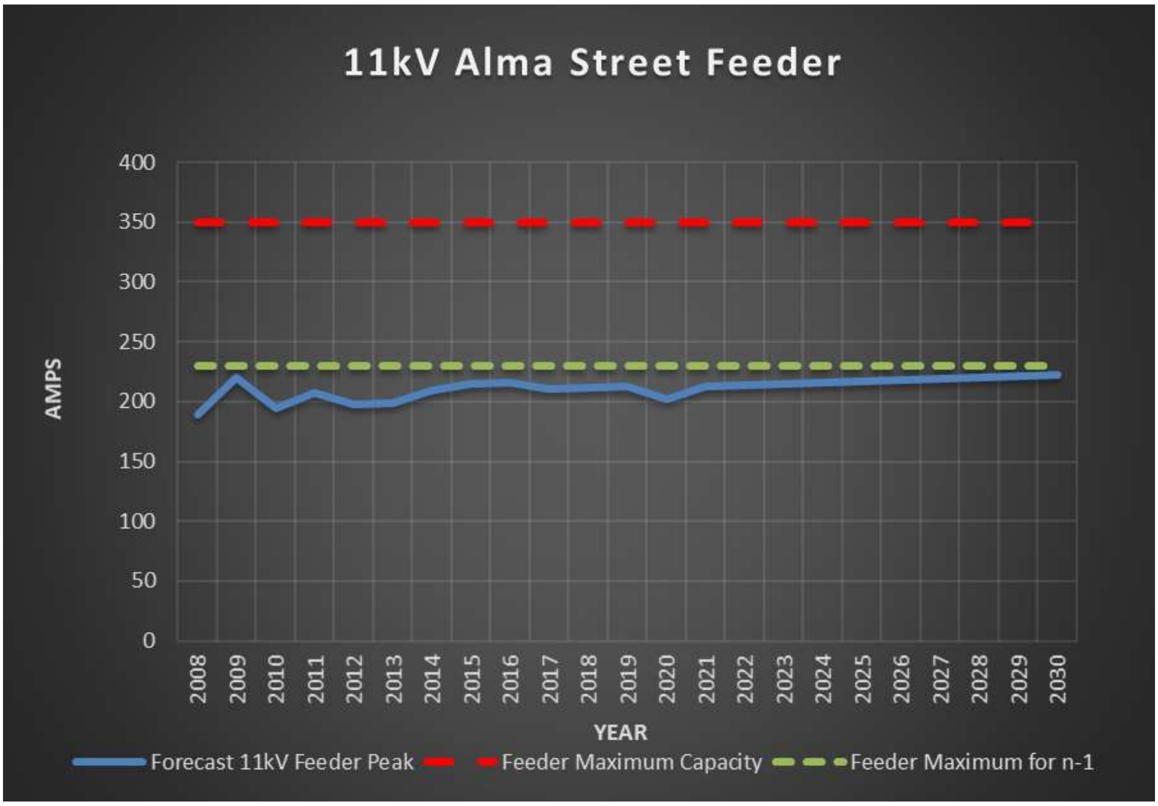
The Emano Street feeder was installed for the beginning of winter of 2005. The demand on this feeder has relieved the load on the Victory Square, Snows Hill and Washington Valley feeders.

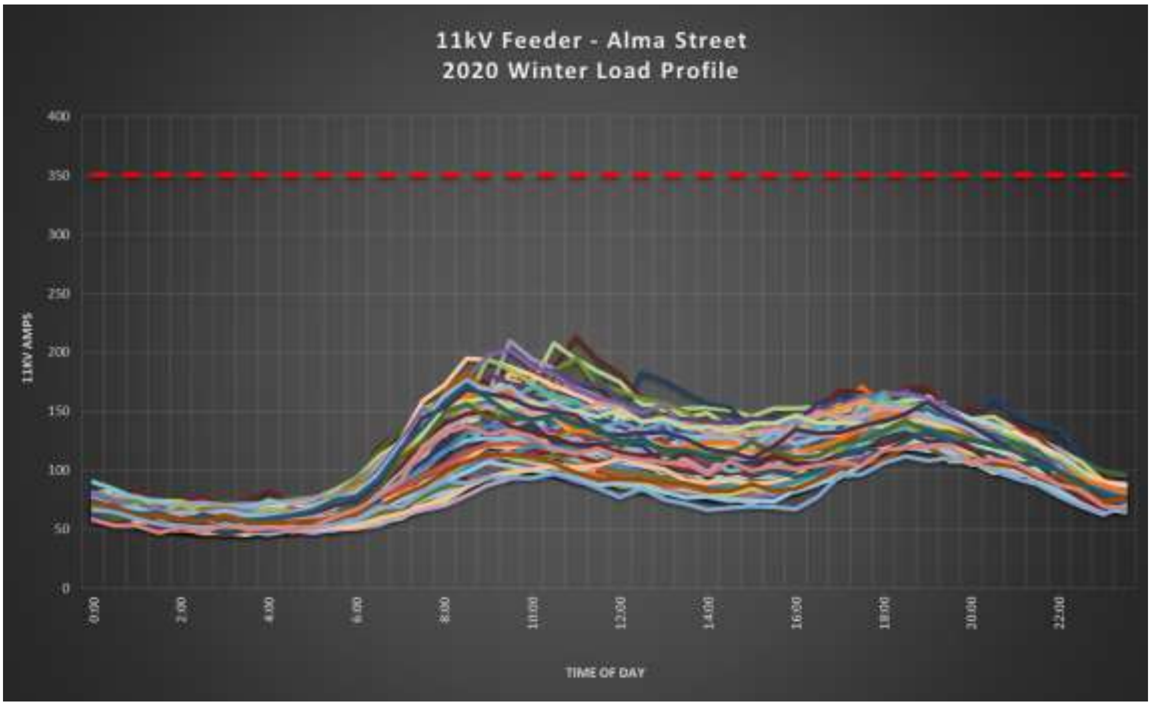
The Emano St feeder included an additional 40amps of peak load from Victory Square feeder through the winter of 2020 due to a problem with an 11kV switch in Totara Street. The forecasted 11kV peak load has been adjusted to exclude the additional load.



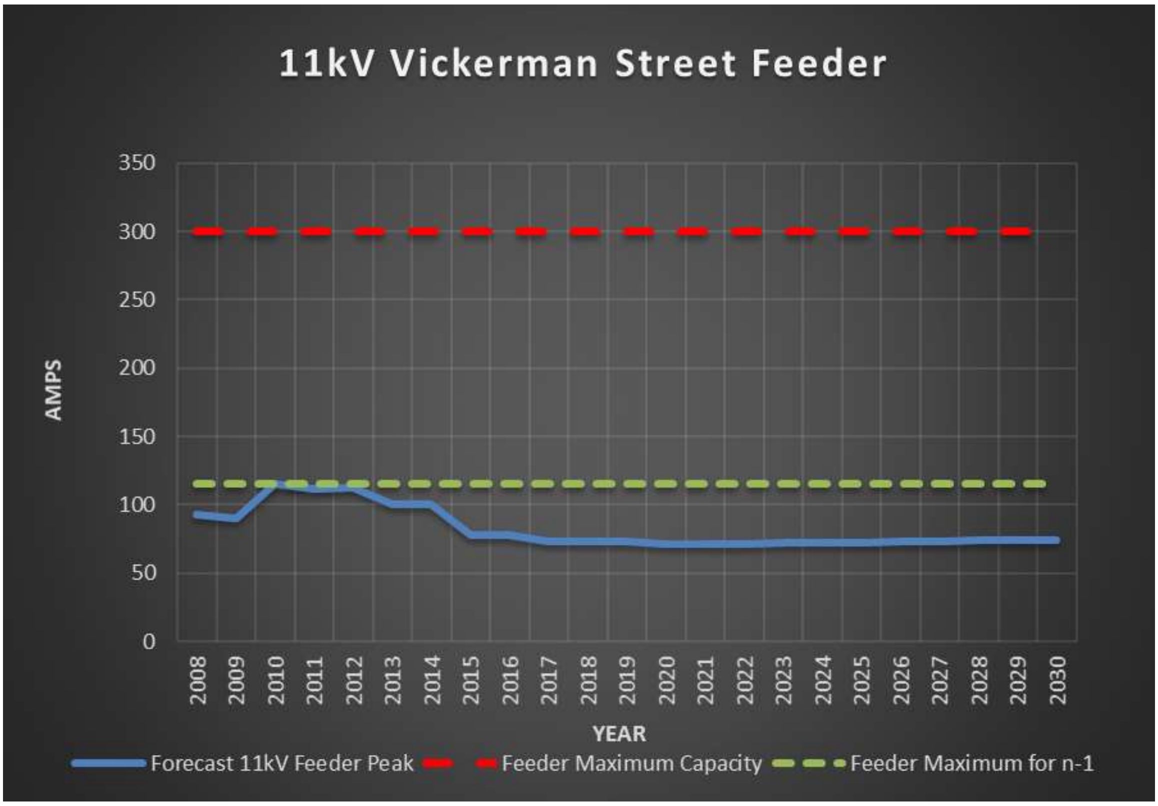


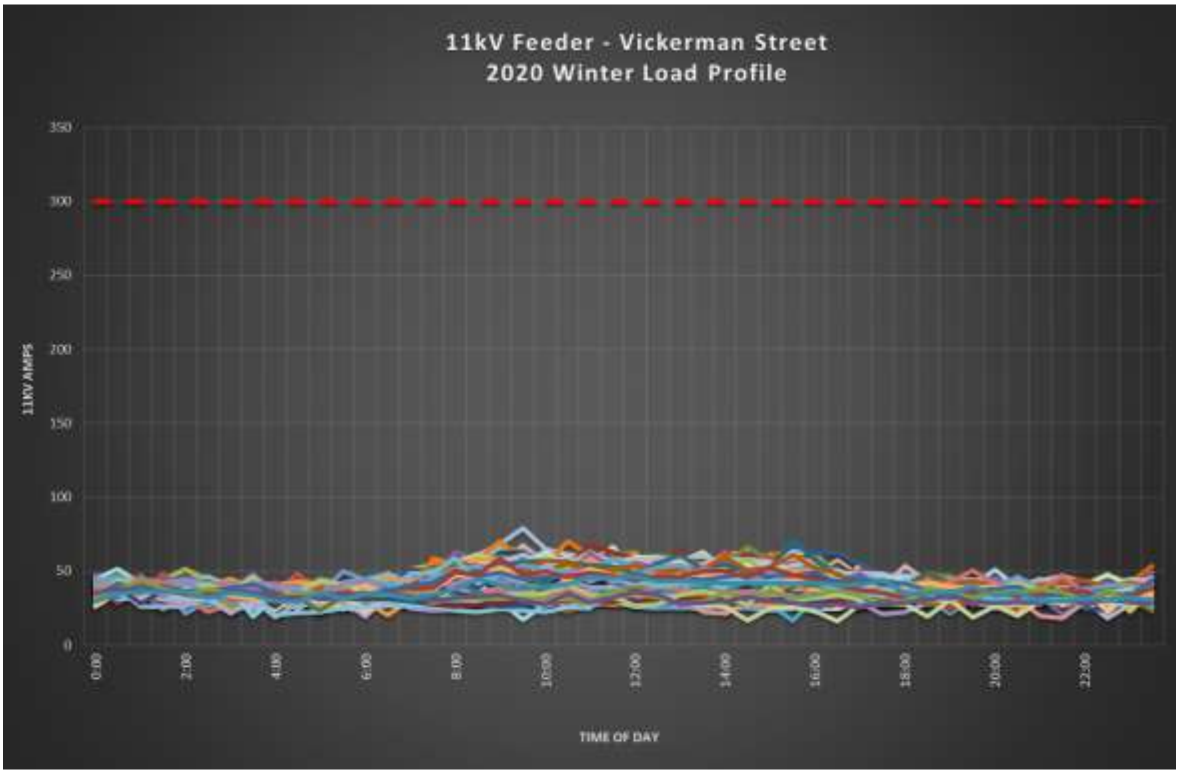
The ANZAC Park feeder supplies the western side of the Nelson central business district and lower Vanguard Street areas. The load is commercial and light industrial. This feeder is also an important back-feeding option for the central business district, Snows Hill and Victory Square areas.





The Alma Street feeder supplies the south eastern Nelson central business district, Nelson Marlborough Institute of Technology and Brook areas. It has a mixture of commercial and domestic load.





The Vickerman Street feeder supplies the Port area. The load is mostly industrial. This feeder is an important back-feeding option for Sealord's and the rest of the Port areas.

Distribution Transformers

NEL is continually monitoring capacity utilisation and will relocate transformers, particularly larger units, within the network to balance demand with capacity as the opportunity arises or, where requested, by consumers. Replacement of aging transformers continues as appropriate and will require the procurement of new spare stock over the 2021-2022 year.

Alternative Solutions

Refer to **Section 3.6** – Non-Asset Solutions and 3.7 – Distributed Generation. These sections outline possible methods of reducing peak demand and avoiding additional network investment.

Transpower

NEL is supplied from Transpower's Stoke Substation seven kilometres from the Haven Road Zone Substation. Transpower have undertaken significant work in recent years to ensure the load growth in the top of the South Island is met by the transmission system. The significant addition was a third 220kV line from Kikiwa to Islington and replacement of its aging 220/33kV supply transformers.

Network Tasman and NEL share the load at Stoke Substation at the 33kV level. Stoke Substation has an N-1 capacity at 33kV of 141MVA due to transformer capacity. There is currently no apportionment or limit of capacity between the two networks. NEL currently derives its transmission services indirectly through Network Tasman through three 33kV feeders (half of the route being overhead and owned by Network Tasman) as well as directly to Transpower through its own 33kV feeder. The peak demand at Stoke Substation is forecast to exceed n-1 capacity in winter 2022 without any additional mitigation. The transformer overloading issue can be managed by NEL and Network Tasman operational measures and in the longer-term by a possible new grid exit point for Network Tasman at Brightwater.

NEL's 33kV transformers arriving in Jan 1960

Both networks utilise load control systems to minimise system peaks. The main use of load control for both Network Tasman and NEL is to minimise the upper South Island (including Christchurch area) transmission peak. This system has worked well and has been in place since 2009. NEL was able to target more effectively its load control times to provide better service for consumers while being able to minimise future transmission costs.

Refer to Transpower's Annual Planning Report –

https://www.transpower.co.nz/sites/default/files/publications/resources/TPR2020.pdf

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5.3 Development Plan

The drivers for development and replacement on the network have been covered in more detail in the Planning Criteria section of this document.

NEL has structured its Development Plan based on the following criteria:

- Network Growth;
- Network Improvement (Reliability, Safety and Environment);
- Network Replacement and Renewal.

In many of the projects planned for the next 10 years, the criteria of Growth, Improvement and Renewal overlap and a single project may well address more than one of these criteria. Therefore, the projects as listed under Capital Expenditure may be equally applicable under another heading. The aspects of the criteria are governed by ongoing and regular indicators such as asset performance and asset audits.

Plans for future ***Network Growth*** or reinforcement are developed from information received of known or planned industrial, commercial or residential growth. Typically, NEL finds there is very little advanced warning of imminent growth especially in the industrial and commercial sector which can often occur in less than 24 months.

A key driver for ***Network Improvement*** is asset age. Over 88% of the network is installed underground and much of that underground network was installed in the 1960s and 1970s. This means that over the planning period many cables will come to or exceed the end of their theoretical life span.

Areas of ***Network Renewal*** are identified from planned maintenance records, annual load surveys, condition monitoring audits and risk assessment.

Network Growth

There is an indicative steady, although small, continuous growth occurring on the network as a result of customer development and capacity requests. However, this has not resulted in actual load growth in recent years. A load forecast for the network is used to identify future capacity constraints and solutions are developed from that information. Financial and technical options are analysed to identify the best long-term solution and then a project planning programme is developed.

Network Improvement

Network Improvement encompasses the areas of reliability, security, safety and environmental issues. Projects concerning safety especially public safety are always treated as top priority. As they are identified, network security and environmental issues are added to the Capital Expenditure plan.

Network Renewal

This criterion covers assets requiring upgrade due to growth or performance and replacement due to age or condition. Renewal projects can often be predicted quite accurately and often condition and age are the prime drivers for the project.

5.4 Capital Expenditure Planning

There is considerable resource put into the development of the capital plan. It is broken down into; growth, improvement and renewal as described above in **Section 5.3**. The Plan is also split into various network categories from 33kV feeder to 400-volt network. The major planning decisions or directions are described below.

It must be recognised that NEL is a small network by comparison to other networks in New Zealand. The detail of each project outlined is considered appropriate. Detailed descriptions of projects are provided for projects valued over $200,000. Smaller projects are described as summary only.

11kV Feeders

Of the fourteen 11kV feeders that exit the Zone Substation the majority have been upgraded over the past 20 years and have a rating of 300 amps or above so growth on the network is well covered in this area. The Capital Works programme addresses the replacement of the remaining two aging cables on these feeders within the next 10 years.

11kV Cabling

The age of the 11kV cabling ranges from 1938 to the present time with the bulk of underground network being installed between the 1960s and 1980s. The 11kV cabling is a combination of paper insulated and cross-linked polyethylene cables and so the technical end of life for most of the latter will occur within the next 10 years.

The Asset Management Plan addresses the aspects of growth, improvement and renewal on the 11kV network partly through single links between substations or a continuous interconnected number of links. An example of the latter is an 11kV Outer Ring which at present consists of cables rated at less than 150 amps and has been found to be operationally inadequate in the event of 11kV failures when substantial capacity needs to be back-fed, so is planned for replacement.

11kV Transformers

As the 11kV network was converted from an overhead to underground network, previously pole mounted transformers were refurbished and recycled as ground mounted transformers. This trend continues today and where possible in areas of growth, larger pre-used transformers are utilised to replace those with less capacity. With the continuing growth on the network the requirement for higher rated transformers continues and the number of 100 and 200kVA transformers is now significantly reduced. Nowadays the requirement for 500kVA, 750kVA and even 1MVA transformers is much more common. The Capital Expenditure plan includes the replacement of one remaining multiple consumer overhead substation transformer with a ground mounted transformer and uprates expected over the planning period.

11kV Circuit Breakers and Switches (Ring Main Units)

Following replacement of older 11kV oil filled CBs to more modern switching technology as part of the Zone Substation upgrade, the average age of this part of the network reduced considerably. A programme was developed, and is substantially complete, to replace the remaining oil filled circuit breakers in the first-out substations. Only one oil filled 11kV CB switchboard remains which will be replaced in the early part of planning period. For the short term, NEL deliberately retained older oil type switches (RMU's) on the distribution network while investigating vacuum or SF6 as alternatives types. Options remain limited for vacuum RMU's so a programme of replacing higher risk units with SF6 devices has been developed and is incorporated in the planning period. NEL may introduce vacuum units in the future if more options become available.

400V Network

Approximately 10% of the 400-volt network remains as overhead reticulation and the remainder is installed underground. The underground network dates from 1937 to the present and, as with the 11kV network, the bulk of the 400-volt network was installed underground between the 1960s and 1980s. Any recent new 400-volt underground projects, apart from subdivisions, have required rigorous cost justification and therefore they were usually only approved when the installation was part of a cost-share project, usually with the Nelson City Council.

Much of the existing 400-volt network is adequately sized for the load it is supplying, however, in areas where in-fill housing has been prolific some undersized cables are approaching maximum capacity. The other area of concern is the Central Business District where the age and capacity of the existing network will require reinforcement soon. To defer immediate expenditure in this area, the existing network is being progressively sectionalised to maximise the existing available capacity. However, an ongoing replacement programme for the 400-volt underground network has been established and is outlined below.

At the present time NEL has 135 kilometres of 400-volt underground network which consists of a combination of XLPE and Paper Insulated cables with ODV life spans 45 and 70 years respectively. Based on this data, a replacement programme of 60 years has been allowed to replace the existing 135 kilometre of cable which means 2.2 km of cable needs to be replaced each year. The average metre cost for cable replacement has been based on a combination of the new cable being installed in a dedicated trench, a shared trench or an existing ductline. Projects in years one to three have been identified while those previously individually identified in the four to 10 year timeframe have been moved into an LV cable replacement programme category. Each year a review of the category will identify and prioritise with more certainty those cables to be replaced in the one to three year timeframe. Where a cable reaches its theoretical end of life, it will be clearly identified in the planning period so opportunities for cost share replacement can be explored with third parties.

Capital Expenditure Plan

The Capital Expenditure for the next 10-year period is shown as **Appendix F (Schedule 11A)** and demonstrates NEL's development, reinforcement and renewal of the network. The classification section expands and explains the breakdown by asset category.

The regulatory requirements financial summary for the capital expenditure plan is referred to in **Section 9.1** of this document.

Classifications

The Development Plan has been divided into six distribution classifications and each has been addressed separately. The classifications are: • 33kV feeders; • 33kV Zone Substation; • 11kV feeders; • 11kV cabling • 11kV transformers; • 11kV switches; • 400V network	The Capital Expenditure Summary is broken into the following classifications to tie up with disclosure requirements and Appendix F (Schedule 11A); • Growth • Replacement and Renewal • Relocations • Reliability, safety and environment

Major Projects

There are no major projects planned in the foreseeable future.

Growth Projects

Transformer Change Programme

NEL has a transformer replacement programme in place. The need to replace transformers is typically influenced by load changes on the network or transformer maintenance criteria. Long-range change projections often require alteration if the conditions which apply to either of these criteria change. Typically, replacement transformers are installed on the ground and in most cases the only choice considered as the product to be used at a site. Confirmed transformer changes, due to growth and replacement of overhead substations with ground mounted substations, have been included in the Capex Forecast with several changes being investigated at time of writing.

High Density Housing Initiative – Washington Valley (Growth)
A subdivision development has been approved by Council in Washington Valley and widely publicised. A staged construction programme was expected to be undertaken from 2017-2018 but start date has been delayed and now expected to start in 2021. Council is planning enablement works beginning in the first year of the planning period and spread over several years. NEL will co-ordinate extension and upgrade work with Council to minimise civil costs.
A customer contribution will apply to this project
Timing 2021-2024

Inner City Apartment Development (Growth)
NEL continues to receive enquiries regarding inner city development both residential and commercial. While the number of enquiries remains high, developments have not progressed as expected so provision for LV reinforcements and 11kV upgrades based on the information held have been included from the current year relative to the timelines previously provided.
Customer contributions apply to each project
Timing Ongoing

Commercial and Industrial (Growth)
Several enquiries have been received for business relocations and start-ups over the 2020 year. Provision has been made for existing substation upgrades at Vanguard Central 1 and St Vincent St North. New substation installations in both consumer connections and system growth categories based on the information received to date have been included but remains subject to final confirmation from developers.
Customer contributions apply to each project

* * * * *

Replacement and Renewal Projects

Due to the changing priority of cable replacement projects, those previously identified in the five to 10-year timeframe have been moved into an HV cable replacement programme category. Each year a review of the category will identify and prioritise with more certainty those cables approaching the end of their theoretical life and/or requiring a capacity increase and provide ample opportunity to align projects with multiple drivers including third party requirements.

Mount Street North - Konini Street 0.0225 HV PI cable replacement (Renewal)
Konini Street Substation is supplied from a single 0.0225 PI cable with a fault rating below the network fault level. The existing cable installed in 1968 traverse's private property with difficult access should the need arise. Upgrade is planned to re-route the cable through a road reserve corridor along with replacing one of the few remaining pole mounted substations with a ground mounted substation. The project timing is reliant upon a key Council project and a part of it has been completed. The remaining works will be undertaken in conjunction with Council's road upgrade works deferred until 2021-2022
Timing 2020/2022

Powerhouse - Poynters Crescent HV PI cable (1965) I rating upgrade and LV (Renewal)
The installation date of the existing HV cable at this site was May 1965. The cable is also rated at only 160 amps on a section of waterfront network where several commercial premises and apartment buildings have now been developed. It is proposed to uprate this HV link with a substantial rated cable. As this project is totally upgrading an existing HV cable between two existing substations along the waterfront road and on a State Highway road, no other route option exists. This project has been brought forward two years to facilitate an underground substation relocation and HV switch replacement project as part of the network resilience targets and to ensure completion ahead of major redevelopment work by NZTA. Provision will be made for future LV replacement.
Timing 2021/2022

Poynters Crescent to Rocks Road via Wakefield Quay HV XLPE cable (1979) I rating and age related upgrade (Renewal)
This is one of the last lower capacity cables in an otherwise uprated circuit and an alternative back-feed backbone to the developed waterfront and Port Hills area. The cable was installed in 1979 and is rated at 160 amps. This project has been brought forward two years to facilitate an underground substation relocation and HV switch replacement project as part of the network resilience targets and to ensure completion ahead of major redevelopment work by NZTA. An LV circuit upgrade will form part of the project in this section of the network.
Timing 2021/2022

Braemar – Boys College HV XL Cable (1978) I rating upgrade and age related replacement (Renewal)
This cable forms part of a circuit that provides an alternative supply route to Nelson Hospital. The route of the existing cable has had minor relocations and jointing over several years. It is an early generation XL cable that is approaching the theoretical end of life. This project is to replace the early generation XL cable and increase the capacity of the circuit.
Timing 2021/2022

Van Dieman Street – Ngatitama Street HV XL Cable (1978) I rating upgrade and age related replacement (Renewal)
This cable forms part of a circuit that provides an alternative supply route to Nelson Hospital. It is an early generation XL cable that is approaching the theoretical end of life. This project is to replace the early generation XL cable and increase the capacity of the circuit.
Timing 2021/2022

Rata Street – Larges Lane HV XL Cable (1972) age related replacement (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The cable is a section of the single circuit supplying Brook Valley with no alternative supply options available. A replacement cable will be installed along with spare ducts to facilitate a security of supply project planned for 2027.
Timing 2022/2023

McDonald's - Hardy West HV PI Cable (1966) replacement, current rating upgrade and switch alteration (Renewal)
The existing HV cable from McDonald's Substation to Kirkpatrick's Substation is rated at only 145 amps on a section of fringe central business district network which is used as an alternative supply route into the central business district and beyond. This project is to upgrade the capacity of the circuit. HV Switch alterations will be required at Hardy West Substation. The optional route for the replacement cable has been adopted in this case. Provision will be made for future LV replacement.
Timing 2022/2023

Hardy Street West - Kirkpatrick's HV PI Cable (1966) replacement and current rating upgrade (Renewal)
The existing paper insulated cable which was installed in 1966 is rated at only 145 amps on a section of fringe central business district network which is used as an alternative supply route into the central business district and beyond. This project is to upgrade the capacity of the circuit. There is no optional route for the 178 metre length of cable.
Timing 2022/2023

Scotland Street – 56 Bronte Street HV XL Cable (1978) replacement and spare duct (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The cable is a spur circuit from Scotland Street HV RMU (located in Willow Walk) to the Scotland Street Substation with no alternative supply options available. A portion of the cable route covers a planned future HV link to Brook Street. This project creates the opportunity to combine the cable replacement with the installation of part of the duct line between Scotland Street and Brook Street via Seymour Avenue.
Timing 2022/2023

Waimea Road South – Campbell Street HV XL cable (1978) age related replacement (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The cable forms part of a ring circuit to Nelson South.
Timing 2022/2023

Zone Substation - Snows Hill HV PI cable (1963) replacement and current rating upgrade (Renewal)
The existing cable was installed in 1963. Previous excavation and relocation of the cable showed some deterioration to the outside sheath of the cable. The performance and condition of the cable is monitored. This major feeder supplies the Nelson south area including the College areas and southern fringes of the CBD. It also provides an important back-feed option to Victory Square (which includes the Nelson Hospital) and Alma Lane feeders. The cable is rated at 280 amps. The N-1 security of supply level for this cable is close to this limit. This project is to improve the back-feeding capacity of the circuit and reinforce supply to the 11kV CBD outer ring. The project is ongoing over several reporting years with initial works being duct installations along part of the cable route and across busy intersections to align with Council works in 2020/22.
Timing 2023/2024

Kirkpatrick's to Gloucester Street 0.0225 HV PI Cable (1969) replacement (Renewal)
Gloucester Street Substation is a highly loaded 750kVA substation supplied from a single 0.0225 PI cable with a fault rating below the network fault level. Previously planned to be replaced in 2015-2016 an alternative LV reinforcement project has allowed this project to be deferred until at least 2023-2024 to obtain the use of a higher rated decommissioned cable asset following the replacement of the Snows Hill feeder.
Timing 2023/2024

Snows Hill - Rutherford 130 Link Box HV PI cable (1959) replacement and I rating upgrade (Renewal)
Most of this circuit was installed in 1959 and provides a back-feed link to the fringe of the CBD network via the Snows Hill feeder. The capacity of the cable is now considered too small for this purpose. The timing of the project has been brought forward to align with a Council services upgrade project ahead of the theoretical end of life of the cable.
Timing 2023/2024

Nile Street Bridge - Cleveland Terrace via Mayroyd Terrace HV XL cable (1979) age related replacement
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit is a spur line with limited LV back feed capacity. There is no alternative route for the roughly 500 metre length cable.
Timing 2023/2024

Nile Street Bridge – Nile Street East HV XL cable (1979) age related replacement
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit is a spur line with limited LV back feed capacity. There is no alternative route for the roughly 270 metre length cable.
Timing 2023/2024

First out distribution substation 11kV OCB replacement (Renewal)
A programme to replace Reyrolle OCBs with VCBs in six "first out" substations is ongoing with five of the six switchboards replaced to date. The last switchboard, at Sealord's Port Nelson, has been deferred until 2024-2025 due to the low operational cycles, condition and location. Spare parts from previously decommissioned switchboards have been retained to ensure any issues that may arise in the short term can be addressed.
Timing 2024/2025

Zone Substation – Victory Square HV XLPE Cable (1981) replacement (Renewal)
The existing mixed 185 mm Ali and 0.2 mm Cu cable circuit is one of the last remaining circuits from the Zone Substation not adequately sized to provide the capacity that could be required at Victory Square Substation under fault conditions as an N-1 back-feed path. This project has been scheduled for the end of theoretical life of the cable and to coincide with replacement of the cable between ABC Substation and Victory Square minimising disruption and maximising asset life.
Timing 2024/2025

ABC – Victory Square HV XLPE Cable (1981) replacement (Renewal)
The Victory Square to ABC Substation is a mixed cable circuit of 0.06 Cu and 70mm Ali cable installed in 1981. Upgrading the link between ABC Substation and Victory Square Substation will provide a higher capacity supply route to an increasingly commercial but also industrial and residential customer base and provide an alternative back feed circuit via the ANZAC Park feeder. The project is timed at the theoretical end of life of the existing cable and to coincide with the Zone Substation to Victory Square cable replacement project to minimise disruption and maximise benefit.
Timing 2024/2025

Park Street – McDonald's HV PI Cable (1972) replacement and current rating upgrade (Renewal)
The existing HV cable from Park St substation to McDonalds consists of a mixture of 185 mm Ali, 95mm Ali, 35 mm cu and 0.06 cu and subsequently is rated at only 135 amps on a section of central business district network which is to be used to create an alternative supply route into the central business district and beyond. It is proposed to uprate this HV link. The timing of this project has changed on several occasions to align with a proposed Council project to refurbish Church Street which has now been put on hold indefinitely. The project will now be completed in sections over several years.
Timing 2024/2026

Nile Street East – Mill Street HV XL cable (1980) age related replacement (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit is a spur line with limited LV back feed capacity. There is no alternative route for the approximately 410 metre length of cable.
Timing 2024/2025

Milton Street Central - Grove Street HV XL cable (1980) age related replacement (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit is a spur line with limited LV back feed capacity. There is no alternative route for the approximately 120 metre length of cable.
Timing 2024/2025

Ngatitama Street – joint at 280 Hampden Street HV XL cable (1980) age related replacement (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit forms part of a spur line to Allan Street Substation with limited LV back-feed capacity. There is no alternative route for the approximately 70 metre length of cable.
Timing 2025/2026

Robinson Road – joint at 193 Brook Street HV XL cable (1980) age related replacement (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit forms part of a spur line to Brook Valley with limited LV back feed capacity. There is no alternative route for the approximately 130 metre length of cable.
Timing 2025/2026

Trafalgar Road – Trafalgar Street North Link Box HV XL cable (1980) age related replacement and current rating upgrade (Renewal)
The existing HV cable is early generation XL and is approaching the theoretical end of life. The circuit forms part of an alternative ring circuit to Nelson North and an upgrade to a larger capacity cable at the end of life of the existing cable would enhance the security of supply to this area. There is no alternative route for the approximately 190 metres length of cable.
Timing 2025/2026

<u>Hampden Street Link Box – Alfred Street HV XLPE cable (1983) replacement and I rating upgrade (Renewal)</u>
This circuit became the main source of supply to the Nelson Hospital 11kV network as part of a network reconfiguration and load balancing exercise some years ago. While marginally undersized for that purpose, alternative back feed options allow the replacement and upgrade to be scheduled for theoretical end of life of the cable.
Timing 2025/2026

<u>Service Box / LV Link Box replacements (Renewal)</u>
A full audit of all existing LV Service Boxes and the bulk of any replacements was completed as part of a replacement programme in previous years. An on-going audit and replacement programme has been put in place to maintain the safety and reliability of these assets on the network.
Timing Ongoing

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Asset Relocations

<u>AMP and New South Wales Substations (Relocation)</u>
NEL has two substantial underground substations within the CBD. These substations were constructed in the 1960s and now require significant health and safety compliance to access for operational and maintenance purposes. They also present a flood risk in a significant storm event. In 2017 an opportunity became available to locate additional capacity within the CBD so an ongoing replacement project has been developed to decommission both underground substations. Beginning with AMP Substation and co-ordinating with both HV and LV cable replacement projects these substations will gradually be offloaded and eventually decommissioned. The timing of the project is reliant on Council and other NEL projects so will be completed over several years.
Timing ongoing

<u>Wakefield Quay Mini Substation (Relocation)</u>
Wakefield Quay is a mini substation on the waterfront with an underground chamber for the transformer and semi underground cabinet and termination point for the switchgear and cable terminations. The substation contains an aged 11kV switch requiring replacement due to its condition and was also inundated by seawater during Cyclone Gita in 2017-2018. As part of the network cable upgrades planned in 2021-2022 this substation will be relocated to higher ground and upgraded to a modern padmount style to remove the inundation risk.
Timing 2021/2022

<u>Konini Street – replace overhead substation with groundmount unit (Relocation)</u>
Excluding small scale (<20kVA) single consumers, Konini Street Substation is the last pole mounted substation remaining on the network. This substation will be relocated, and ground mounted in conjunction with the 0.0225 HV cable replacement (see asset renewal and replacement projects) and as part of a major Council services and road upgrade project. Timing is reliant on the Council project but is expected to proceed in the 2021-2022 period.
Timing 2021/2022

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Overhead to Underground (Reliability Safety and Environment)

<u>Toi Toi Street underground HV/LV (Overhead to Underground)</u>
This project will be carried out in conjunction with Council's enablement work for a high-density housing initiative in Toi Toi Valley (see growth projects) minimising civil costs and disruption to the public. There are existing spare ducts both sides of the street over the route and some of the dwellings already have underground cables installed to them.
Timing 2021/2022

Arrow Street North - Washington Road HV/LV conversion (Overhead to Underground)
This section of network is the only remaining aerial line on the Washington Road Feeder and being on a busy road and close to the Zone Substation puts the rest of the circuit downstream into the Port Hills and Wakefield Quay at some risk. Council is planning a major infrastructure upgrade along the length of Washington Road and the opportunity will be taken to co-ordinate undergrounding the existing network infrastructure minimising civil costs and disruption to the public. The Council project is planned over three financial years so timing will be reliant on the Council programme.
Timing 2023/2025

* * * * *

Improvement Projects (Reliability Safety and Environment)

Emano Street North Link Box Tripping VCB (Security)
To reduce potential outage durations in this area of the network and maintain or improve overall SAIDI statistics there is a requirement to upgrade the existing non-tripping switch to a tripping type fitted with Over Current and Earth Fault protection at the above site.
Timing 2021/2022

Scotland Street – Seymour Avenue new circuit (Security)
A new higher current rating alternative circuit into Brook Street is required to enhance an existing cable between Bronte Street and Brook Street and in the long term provide a full second circuit into the Brook Valley. In conjunction with the replacement of the aging cable between Bronte Street and Scotland Street Substation, a new cable will be installed between Scotland Street and Seymour Avenue.
Timing 2022/2023

Locking Street – Wellington Street HV link (Security)
It is envisaged that a new link will be installed in the HV network between Locking Street Substation and Wellington Street via an existing ductline. This link will remove an existing HV spur line from a dense residential urban area of the network. As the ductline will be existing by the time of these works, no other practical route has been contemplated.
Timing 2022/2023

Wellington Street new HV Link Box (Security)
To enable more flexibility and efficiency during HV switching operations and to minimise disruption and hence maintain or improve SAIDI statistics and safety, it is proposed to install a ground mounted 3-way HV link box as part of the Locking Street HV Cabling project
Timing 2022/2023

Brook Street – Seymour Avenue to Tantragee HV link (Security)
It is proposed to install a second 11kV cable between these two substations to provide an alternative 11kV supply to the top of Brook Street where significant development has occurred. Stage 1 was completed in 2017 installing ducts in association with a Council project between Hillside Lane and Tantragee access track. Existing spare ducts will be utilised where possible. The balance of the project will be completed as a programme and has been extended over the planning period to co-ordinate with other works.
Timing 2023-2027

Griffins – Nile Street Bridge HV PI circuit I uprate (Security)
The existing circuit is a mixture of 0.1Ali and 0.06 Cu PI cable installed in 1977 and forms a significant back-feed option for the New Street feeder into the spur fed Maitai Valley. As part of the circuit is only rated at 145 amps it is now regarded as under-sized for that purpose.
Timing 2022/2023

Zone Substation - Gloucester Street (via St Vincent St North) – Kirkpatricks new feeder and interconnect (Security)
Following the upgrading of the NEL Zone Substation to Snows Hill feeder, and after appropriate testing, it is proposed to utilise the disused feeder to form a link between the Zone Substation, St Vincent Street North, Gloucester Street and Kirkpatrick's Substations. This would enhance the size of the existing feeder between these substations. In this case an existing asset is being "recycled" to provide a secure feed which is the most practical and economic option as opposed to a new cable. This will be co-ordinated with the Gloucester – Kirkpatrick's cable (Renewal) project.
Timing 2023/2024

Brook Street - Tantragee to Brook Street 504 Sub HV Link (Security)
It is proposed to install a second 11kV cable between these two substations to provide an alternative 11kV supply to the top of Brook Street where significant development has occurred in recent years. Existing spare ducts will be utilised where possible.
Timing 2026/2027

HV Link Box (RMUs) replacement (programme) (Safety)
A 2018 independent asset review of NEL's asset management systems identified oil filled HV RMUs could pose additional operational risk due to fuse failure modes and as a result a program to replace this type of RMU has been implemented. The RMUs have been risk rated and each year a selection of the RMUs will be replaced.
Timing Ongoing

Age related HV cable test program
When HV cables are approaching their theoretical end of life, an HV cable test programme is being developed to assist with the condition assessment of the cables to support the proposed replacement schedule.
Timing Ongoing

LV network monitoring
As the demand on the network changes due to new technology - PV and EV installations - there is a need for greater visibility of the load and voltages on the LV distribution system. Several options are being investigated to install remote monitoring equipment in key locations throughout the network to determine the effects of changing load profiles and the impact of PV and EV installations.
Timing 2021-2023

* * * * *

LV Cable Review and Replacement (programme)
In general, 400V reinforcement applies to existing assets being upgraded resulting in improvements to the existing. Consideration is given in each case to alternatives but in most cases the choices are between the suppliers of a similar product. As cable routes are typically short, few variations are available for consideration and an existing route is typically adopted as the most practical. Ongoing reviews of these projects results in higher priority projects being planned over years one to three and preferably in conjunction with other projects and utility operator works. The ongoing replacement of aging cables will be identified and prioritised in the medium-term planning cycle, therefore, works in the four to 10 year timeframe are categorised as a cable replacement (programme)

* * * * *

Opportunities for Distributed Generation
NEL continues to facilitate, where practical, any opportunities for distributed generation on the network.

Given the dense urban nature of the network it is almost certain that nearly all distributed generation will be small scale solar on residential buildings or a few larger arrays on commercial buildings. Although NEL itself is not planning any distributed generation, it welcomes approaches from promoters of distributed generation that would enhance the value of operations.

SECTION 6 - Life Cycle Asset Management Planning

6.1 Introduction

NEL has adopted a Condition Driven Maintenance approach to its network operations. Condition Driven Maintenance is based on the results of risk modelling against the Asset Performance Standards. Where an asset must be replaced, the removed asset is modelled to determine whether it is to be deployed or suitable for re-deployment elsewhere on the network. The projected Asset Maintenance expenditure breakdown is detailed below. Because the major asset groups have been divided equally to fit the audit period, the projected budget is very much cyclic and apart from major maintenance, like 33kV/11kV transformer overhauls, will remain much the same each year.

As part of a continuous improvement process an independent audit of NEL's asset management process was completed in 2018. The audit covered a review of current network asset management practice and a field audit of the current asset fleet. The outcome of the audit provided Nelson Electricity the necessary assurances that network assets were in good condition and overall asset management processes were appropriate.

Operational Expenditure Forecast

Operational Expenditure Forecast					
Planned Maintenance					
Description	**2021/2022**	**2022/2023**	**2022/2024**	**2022/2025**	**2022/2026**
400V Lines & Cables R & M	$274,313	$279,799	$285,395	$291,103	$296,925
11kV Lines & Cables R & M	$53,991	$55,071	$56,173	$57,296	$58,442
33kV Lines & Cables R & M	$31,916	$32,555	$33,206	$33,870	$34,547
11kV/400V Subs R & M	$106,346	$108,473	$110,643	$112,856	$115,113
33kV/11kV Subs R & M	$29,409	$29,997	$30,597	$31,209	$31,833
Control Room	$18,294	$18,660	$19,034	$19,414	$19,803
Tree Trimming	$35,790	$36,505	$37,236	$37,980	$38,740
Other incl Fixed Contracts	$127,665	$130,218	$132,823	$135,479	$138,189
Total Planned Mtce Costs	**$677,725**	**$691,279**	**$705,105**	**$719,207**	**$733,591**
Unplanned Maintenance					
Description	**2021/2022**	**2022/2023**	**2022/2024**	**2022/2025**	**2022/2026**
Service Fuses	$13,784	$14,060	$14,341	$14,628	$14,920
S/Box Failure/Damage	$13,784	$14,060	$14,341	$14,628	$14,920
400V Line /Cable Fault	$68,921	$70,300	$71,706	$73,140	$74,602
11kV Line /Cable Fault	$20,676	$21,090	$21,512	$21,942	$22,381
33kV Line /Cable Fault	$8,271	$8,436	$8,605	$8,777	$8,952
Transformer Fault	$12,406	$12,654	$12,907	$13,165	$13,428
Total Unplanned Mtce	**$137,842**	**$140,599**	**$143,411**	**$146,279**	**$149,205**
	2021/2022	**2022/2023**	**2022/2024**	**2022/2025**	**2022/2026**
Total	**$815,567**	**$831,878**	**$848,516**	**$865,486**	**$882,796**

The operational expenditure budget is derived based on the expected works from the planned preventative maintenance programme, asset auditing and any unplanned maintenance because of asset failure.

NEL uses the Electricity Distribution Services Input Methodologies Determination 2012 as a guide to life expectancy of an asset. Asset auditing and maintenance is used as a final determination as to when an asset is retired from the network. It is noted that there is a significant difference between the life expectancy between different types of cable XLPE versus PILC. A summary of the 2004 ODV Handbook asset life expectancy is included in **Section 3.3**.

6.2 Maintenance Inputs

The development of the plan is driven by the following key inputs:

- Planned Preventive Maintenance programme;
- Asset Auditing Programme;
- Annual Load Survey;
- Regulatory Compliance;
- Risk modelling against the Asset Performance Standards (refer Risk Management **Section 7**).

6.3 Maintenance Types

Typically, the main types of maintenance are:

- Planned Preventive Maintenance;
- Planned Maintenance;
- Unplanned Maintenance.

Planned Preventive Maintenance

Refer Network Development Planning **-** Planning Criteria (**Section 5.1**).

Planned Maintenance

The Planned Maintenance works program is a result of assets modelled not meeting Asset Performance Standards. The work list is prioritised from worst score to best. Any asset meeting standard will be audited as per the auditing cycle for the asset type.

Unplanned Maintenance

Unplanned maintenance results from faults or outages where there is no warning of an event and may typically be caused by external forces such as storms, contractors or accidents. The emphasis is to restore power as quickly and safely as possible and for follow-up planned maintenance to restore the asset to a condition that meets the Asset Performance Standard.

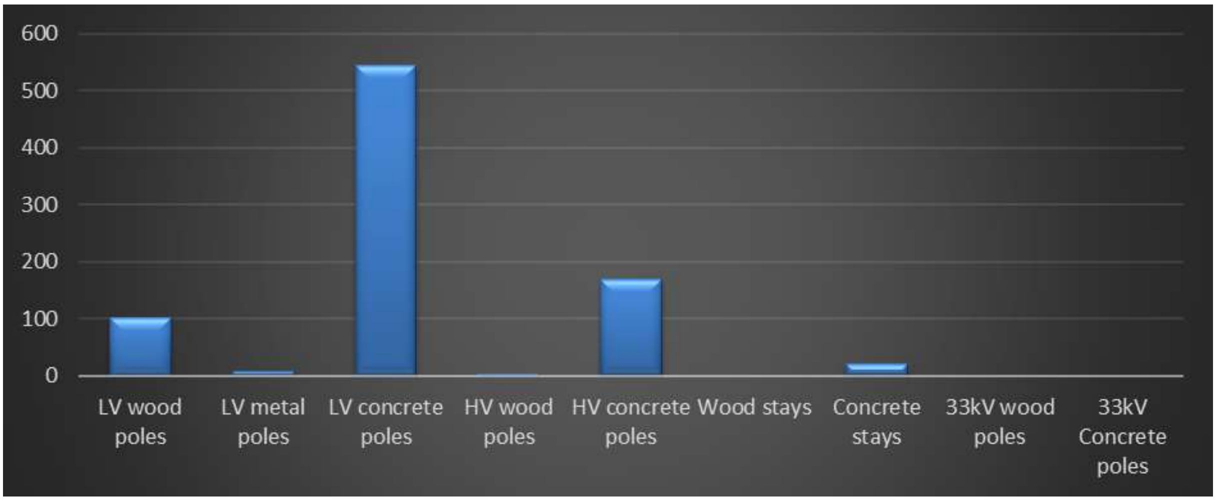
6.4 Auditing and Maintenance by Asset Type

The Auditing and Planned Maintenance checks are carried out by contractors filling out pre-printed sheets with check boxes for each type of asset. On completion of the daily checks, the sheets are returned to the office for punching into the Office Management System. All assets are audited on a longer-term basis, but major assets receive a regular Planned Maintenance check at shorter intervals.

Poles

As of 31 January 2021, the network comprised 90% underground and 10% overhead reticulation. The overhead network consists of 829 poles.

NEL HV and LV Poles



11kV Poles

Concrete poles are audited every five years and the connections viewed through a heat gun. The audit of the concrete pole is purely visual and covers the pole, cross-arm and fittings. The last HV wooden poles were removed as part of the Fringed Hill circuit refurbishment works in recent years.

400V Poles

Concrete poles are audited every five years and the connections viewed through a heat gun. The audit of the concrete pole is purely visual and covers the pole, cross-arm and fittings. Wooden poles are audited every three years and the connections viewed through a heat gun. The audit of wooden poles includes a below ground test of the pole by driving a spike and a visual inspection of the pole, cross-arms and fittings.

In the event of any pole being rated at a remaining life span of less than five years, the pole will usually be replaced or the next audit will be set for a shorter period. Any resulting repair or replacement will ensure the overhead network meets standard.

Stoke-Nelson transmission line 1954

Aerial Conductors

The aerial network is primarily copper conductor apart from an 11kV feeder which is steel.

NEL is supplied by Network Tasman through 7.0 kilometres of 33kV line back to Transpower's Stoke Substation. Network Tasman carries out the maintenance of the lines at NEL's cost. All of the 33kV lines are well maintained and in good condition.

The 11kV overhead network now totals less than seven kilometres of line. This is all copper conductor apart from a 1.85 kilometre line to Fringed Hill, which has mostly been upgraded to ACSR. Generally these lines are situated in areas that are remote or protected from the direct influence of any salt-laden wind. The most remote and rural portion of the 11kV network is the spur feeder in the Brook Valley. The Fringed Hill line is a spur feed off the Brook Valley feeder and can in certain circumstances, be exposed to falling trees and forest fires, as it runs through a pine plantation and then scrub country. In recent years significant effort has been put into clearing the line of vegetation and maintaining track access. A total of three faults have occurred on the 11kV aerial network in the past five years. One was caused by a bird strike, one by third party interference (car vs pole) and the last by adverse weather. Measuring against the appropriate Asset Performance Standard will ensure these types of faults are kept at acceptable levels.

The 400V aerial network consists of 21 kilometres of lines, which are all copper conductors. The condition of these lines varies throughout the network and although the conductors are in sound condition, in some areas the cambric insulation is separating from the conductors. NEL's approach to this problem has been to strip the insulation off the conductors to improve the aesthetics of the lines. Historically trees have been the main source of outages on these lines but the threat from trees has been monitored and addressed much more stringently in recent years.

Tree Trimming

Approved tree trimming contractor's carry out tree trimming around power lines where required. Although trees historically play only a minor part in outage statistics and the economics of trimming are probably not justified, the issue of public safety always forms a major consideration the company.

A separate database has been formed to track all details pertaining to trees which are of interest to NEL.

Aerial lines are not audited in the technical sense but any deterioration in their visual condition and the proximity to trees to the line is noted as part of the pole audits.

Trees close to powerlines Feb 2007

Underground Cables

As mentioned previously, approximately 90% of the network is underground with a total length of 337 kilometres of cable (including dedicated streetlight cable). The cable conductors are a mixture of copper and aluminium and the insulation used has been primarily paper, PVC and cross-linked polyethylene (XLPE). The underground network is in good condition and the paper insulated cables have given good service. The earliest cables installed were paper insulated, but in the early 1970s PVC and XLPE became the trend and all 11kV and 400V cables installed between that time and 1997 were XLPE, when it was deemed that all new 11kV cables installed were to be paper insulated. However, as of 2015 all cables installed will be XLPE.

The earlier 33kV cable network comprising three feeders was installed between 1979 and 1987 and has given reliable service. A new 33kV feeder was installed in 2013-2014. Health checks are carried out on all the 33kV cables annually. To date no potential problems in the cables and joints have been identified.

NEL operates 77 kilometres of 11kV underground network. The conductors used have been a mixture of aluminium and copper, the preference being mainly driven by cost at the time. Industry information relating to XLPE cables resulted in NEL taking a more cautious approach to the installation, commissioning, testing and fault finding on XLPE cables, resulting in a preference for paper lead cables over a number of years. However, paper insulated cable manufacture within NZ has ceased, therefore, new works will generally utilise XLPE cables.

As with the 11kV network, the 400V cable types have changed from paper insulated to XLPE over the years. The XLPE cables have performed well on the 174 kilometres of 400V underground network and the only technical issues to be addressed have been a change to bi-metal lugs and sleeves at terminations and joints. Some early resin joints and older pitch filled joints have failed over the years but the low numbers and intermittent nature of these faults have not given any cause for alarm.

There has been a problem with aluminium sheathed cables in one area of the network which is subjected to saltwater, however further work has been carried out to identify other areas with similar cable types and environmental conditions and these cables have been found to be in good condition.

<u>33kV Cables PD Testing</u>

This test involves four 33kV feeder cables. To date these cables are audited by way of Partial Discharge testing every two years. Previous discharge test results are then compared to the latest results for signs of degradation and a recommendation for the next test date made.

11kV Cables PD Testing
This test involves thirteen 11kV feeders from the Zone Substation and approximately 20 other cables from the major switching stations. From time-to-time other random samples are tested. To date these cables are audited by way of Partial Discharge testing every two years. Previous discharge test results are then compared to the latest results for signs of degradation and a recommendation for the next test date made.

400V Cables PD Testing
These are not tested or audited in any planned programme.

33kV Zone Substation
The old NEL Zone Substation was replaced in 2013/14 with a modern fully indoor bunded substation. The building fully complies with the latest natural disaster, fire and security building codes. It is a secure environment for the operational equipment and is expected to provide long term reliable service for NEL.

Once commissioning was complete any defects were rectified during the contract defects liability period before being handed over to NEL in 2015. The previous Zone Substation weekly checks have been replaced with a monthly routine inspection. Any defects will be programmed for immediate action. Commissioning tests on all the equipment will be compared with an ongoing monitoring regime to highlight any deviation from expected performance measurements.

The existing building and control room continues to be utilised for operational purposes.

33kV/11kV Power Transformers
The new Zone Substation supplying Nelson Electricity contains three Wilson 16/24 MVA ONAF transformers.

A visual audit of the transformers is carried out as part of the substation monthly checks. Oil tests will be carried out annually.

33kV Switchgear
The new 33kV switchgear is fully enclosed and virtually maintenance free. Visual inspections will be carried out as part of the substation monthly checks.

Zone Substation 11kV switchgear
The new 11kV switchgear is fully enclosed and virtually maintenance free. Visual inspections will be carried out as part of the substation monthly checks.

Zone Substation Protection
The new zone substation protection is high speed, secure, microprocessor based relays with a number of features not previously available on older protection systems. The system is expected to reduce fault clearance times, provide detailed fault related information, improve safety and be maintenance free. Visual inspections will be carried out as part of the substation monthly checks.

11kV Auto Recloser
NEL owns only one auto recloser which is in a rural portion of the 11kV feeder in the Brook Valley and which was replaced with a modern recloser during 2006. The recloser is monitored via the SCADA system and receives a six-monthly check as part of the Planned Preventive Maintenance schedule.

11kV/400V Substations

The 11kV network supplies 204 11kV/400V distribution substations. The rating of these assets ranges from 1500kVA three phase to 5kVA single phase in capacity. All pole-mounted substations have Chance type dropout HV fuses and all ground-mounted substations are connected to a fused switch located locally or remotely. All ground-mounted substations have 400V fuses associated with them and in most cases utility boards with Maximum Demand Indicators or remote monitoring devices mounted on them.

Bronte Street substation 1950 – still in use today

The enclosures for ground-mounted substations include concrete block buildings, underground concrete chambers, padmount enclosures, fibreglass covers, outdoor fenced enclosures and transformer rooms in the case of single customer substations.

Regular monitoring, maximum demand readings and temperature checks of transformers are carried out during Planned Preventative Maintenance. Oil testing of non hermetically sealed 11kV/400V transformer above 100kVA is carried out every five years. Over the past 10 years only two distribution transformers have failed in service. One of the failures was attributed to the substation chamber being flooded during cyclone Gita and the other by loose LV connections within the transformer tank. This signifies that the transformers are in good working condition with generally unforeseen events causing failures.

The substation earths are tested to ensure that they are 10 ohms or less. Where this standard is not met work is scheduled to bring the earthing up to standard. Earths are audited as part of the Auditing Programme. If the 10 ohm standard cannot be achieved, a warning notice is placed on the equipment involved and a similar notice entered onto the asset database.

MDIs or Remote monitoring devices are fitted to 95% of three phase distribution transformers and provide valuable feed-back on the peak loads. Any anomalies detected are checked by installation of a portable data logger. The half-hourly logger information provides the basis for upgrades and network reinforcement.

There are several types of Air, Oil, Vacuum and SF6 HV switches utilised on the network. They provide an interruption point between the rest of the network and the Zone Substation and are linked via alarm circuits to the Zone Substation.

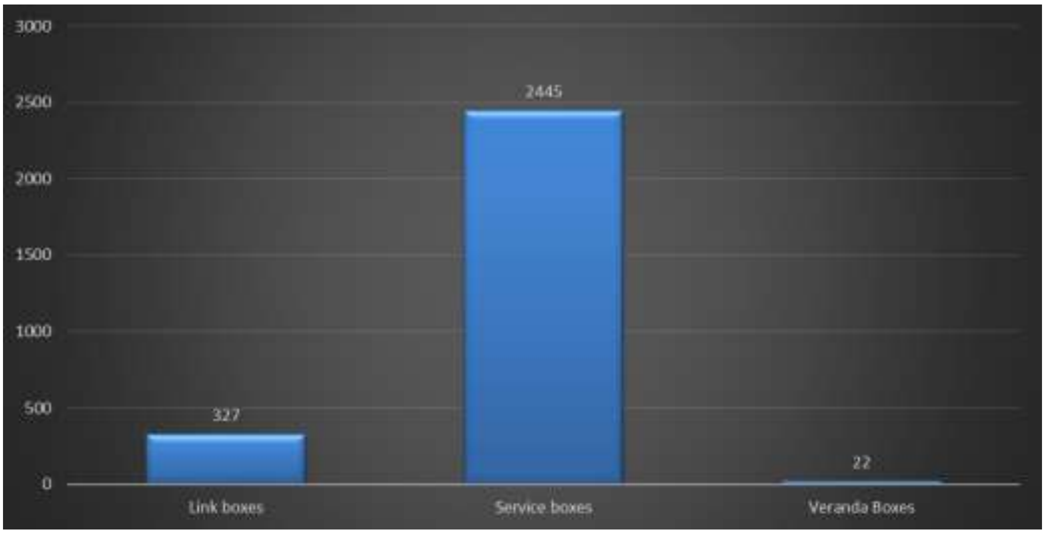
At the other distribution substations a variety of oil, SF6 and air HV switches and fuses are used. These include ABB SD, ABB Safelink 2's, Hazemeyer and Merlin Gerrin switches. The condition of these switches is regularly monitored with the six monthly Planned Preventive Maintenance cycle and five yearly testing programmes.

The 400V fusing at the substations typically utilises ABB, JM, Weber and Effen fuse units. These are reliable and require little maintenance and have fully replaced the older style porcelain J fuse. For installations that only require one or two LV outputs, the three-phase break version of these fuses is being used.

LV Boxes

As of 31 January 2021 NEL, had 2,744 LV boxes on its network. A breakdown of box types is shown.

LV Boxes



All distribution boxes including Link Boxes and Service Boxes receive a two-yearly visual audit and all have five yearly visual and heat gun audits. Consideration will be given to extending or reducing the audit cycle time depending on future asset auditing results.

NEL audits approximately 480 service boxes annually. Those that don't meet the Asset Performance Standard are either repaired or replaced where urgent or scheduled for repair or replacement according to Risk Number.

Ripple Generators

Nelson Electricity has replaced the two rotating Ripple Generators on the network with one static ripple injection plant located at the Haven Road Zone Substation.

Ripple signal tests were carried out as part the new static plant installation indicating there is good strength coverage across the network.

6.5 Network Connection Points

Single-phase residential installations are typically fused at 63 amps. With the possible introduction of new tariff structures through changes in pricing strategy, a wider range of residential and business fuses may have to be considered. These assets are included within the distribution box and pole auditing that is carried out on a regular basis.

Each time a pole fuse is changed the replacement is an HRC fuse.

In the central business district area of the network there are many cases where tee joints on 400V feeders in the road reserve feed directly to the customer's switchboard. This is of concern for network operations. These connection points are being relocated outside into Distribution Boxes as re-development occurs.

6.6 New Technology

NEL has standardised on proven technology and equipment in the construction and maintenance of the network.

As technology changes and equipment is updated, Nelson Electricity analyses the new trends for efficiency and cost effectiveness against current options/practice.

NEL utilises specialist contractors to carry out Thermovision and partial discharge testing on the network as part of the routine maintenance regime.

SECTION 7 - Non-Network Development, Maintenance and Renewal

7.1 Introduction

This section provides a summary of non-network assets. These are material assets that are necessary and used for the purpose of management of the electricity distribution network.

7.1 Non Network Asset Description

Nelson Electricity has several non-network assets that support the management of the network. The material assets (assets greater than book value $5,000) are listed below:

Office Building – 63 Haven Road
Vehicles – One Mazda CX5 and one Toyota Rav

7.2 Non Network Asset Development, Maintenance and Renewal Policies

NEL has three key areas of non-network asset expenditure being accommodation, vehicles and computer hardware/software. There is a practise of ensuring staff are provided with appropriate working conditions and having appropriate equipment to undertake their roles.

Non-network assets are maintained in good working order during their expected economic life. At the end of their economic life, non-network assets are replaced unless they are rendered obsolete or redundant due to a development initiative.

All expenditure must be justified to the NEL Board.

7.3 Description of Material Capital Expenditure or Maintenance Projects

There are no large individual non-network asset capital expenditure projects or significant maintenance projects planned for the next five years.

SECTION 8 - Risk Management

8.1 Introduction

NEL places a high focus on Risk Management as the tool to an efficient, economically maintained network.

The process used for Risk Management is based on AS/NZS ISO 31000:2009. This standard is a generic guide to managing risk. NEL has taken the principals of the standard and applied them in its risk management process as it applies to the Nelson Electricity situation.

The system NEL uses is described in this section. NEL can demonstrate that its processes achieve the objectives of the standard by:

- A confident and rigorous basis for decision making and planning;
- Better identification of opportunities and threats;
- Gaining value from uncertainty and variability;
- Proactive rather than reactive management;
- More effective allocation of resources;
- Improved incident management and reduction in loss and the cost of risk;
- Improved stakeholder confidence and trust;
- Improved compliance with relevant legislation;
- Better corporate governance.

The main components of Risk Management for managing NEL are:

- Risk Modelling;
- Asset Performance Standards;
- Asset Condition Auditing.

8.2 Risk Modelling

NEL uses a Risk Modelling process to determine an asset's current and/or future suitability on the network. The Risk Modelling uses a probabilistic approach in which it uses a series of subjective and objective measures, as outlined in 7.3 and 7.4, to assess the likely condition of an asset. This has proven to be a good asset management tool in planning network changes and configurations. There is also, however, a need to include a deterministic approach as assets need to also comply with the Security of Supply Standards. If an asset does not meet the standard then even though it may be in good operating order, something needs to be done to make it comply.

The risk model NEL utilises was developed in-house to measure asset performance against a Performance Standard which has been formulated for each asset type. The Performance Standard has been calculated based on what is an acceptable Impact and Probability risk using criteria as described in **Section 7.3 and 7.4**. By analysing the Impact and Probability of the failure of an asset on the network, a Risk Number for that asset is calculated. The Risk Number is then compared to the Performance Standard and if it is found to be higher than the Standard then appropriate action will be taken to reduce the risk. If the Risk Number is lower than the Performance Standard then it is deemed to meet the requirements of Nelson Electricity's risk. Risk modelling is also used as an indicator as to whether any work or what type of work is to be undertaken on an asset. It also helps prioritise work.

Although Risk Modelling looks like a black and white process whereby an asset meets or fails a standard, in practise this is not quite the case. It should be noted that a Risk Model is used as a tool to help assess the condition of an asset and, although it is a good indicator, it should only be used in conjunction with good industry practise as sometimes it is possible that criteria weightings may cause slight anomalies when comparing the risk associated with each individual asset.

The charts below illustrate the Performance Standards applied to each category of an asset, based on the main headings of Impact and Probability and respective sub headings listed below.

Risk Standard For Individual 400 Volt Networks	
Restoration Time Hrs	No more than 1 - 3 hours
No consumers affected	No more than 50 customers
Customer Load	%of NEL's total load
Other Party Interaction	3 (1-Excellent to 7-Bad)
Environmental Impact	Insignificant
Costs Due To Failure	No more than $3000
Fault Cause	No worse than unpredictable cause by others
Safety	Insignificant
Average Annual Fault Assumption	1 fault in 15 - 50 Years
ODV Life Expectancy	No less than 5 - 10 Years
Loading % > Full Load	No greater than full load
Environment	No worse than moderate exposure
Deterioration Audits	That reflect a life expectancy of at least 5 - 10 Years
A 400V network is defined as everything beyond the 400V transformer storks.	

Risk Standard For Transformers	
Restoration Time Hrs	No more than 3 - 5 hours
No consumers affected	No more than 100 customers
Customer Load	% of NEL's Total Load
Other Party Interaction	4 (1-Excellent to 7-Bad)
Environmental Impact	insignificant
Costs Due To Failure	No more than $20,000
Fault Cause	No worse thanUnpredictable cause by others
Safety	Insignificant
Average Annual Fault Assumption	1 fault in 15 - 50Years
ODV Life Expectancy	5 - 10 Years
Loading % > Full Load	No greater than full load
Environment	No worse than minor exposure
Deterioration Audits	That reflect a life expectancy of at least 5 - 10 Years
This Standard applies to transformers only	

Risk Standard 11KV Networks	
Restoration Time Hrs	No more than 3 hours
No consumers affected	No more than 800 customers
Customer Load	% of NEL's Total Load
Other Party Interaction	5 (1-Excellent to 7-Bad)
Environmental Impact	insignificant
Costs Due To Failure	No more than $20,000
Fault Cause	Unpredictable cause by others
Safety	Insignificant
Average Annual Fault Assumption	1 fault in 15 - 50 Years
ODV Life Expectancy	10 - 15 Years
Loading % > Full Load	No greater than full load
Environment	No worse than minor exposure
Deterioration Audits	That reflect a life expectancy of at least 10 - 15 Years
This Standard applies to 11KV Networks Only	

Risk Standard 33 / 11KV Transformers	
Restoration Time Hrs	No more than 1 hour
No consumers affected	No more than half of NEL customer base (4250)
Customer Load	No more than 50% of NEL's Total Load
Other Party Interaction	6 (1-Excellent to 7-Bad)
Environmental Impact	insignificant
Costs Due To Failure	>$50,000
Fault Cause	Unpredictable cause by others
Safety	Insignificant
Average Annual Fault Assumption	1 fault in 15 - 50Years
ODV Life Expectancy	10 - 15 Years
Loading % > Full Load	No greater than full load
Environment	No worse than minor exposure
Deterioration Audits	That reflect a life expectancy of at least 10 - 15 Years
This Standard applies to 33KV Transformers Only	

Risk Standard 33KV Networks	
Restoration Time Hrs	Less than 1hour
No consumers affected	No more than half of NEL customer base (4250)
Customer Load	No more than 50% of NEL's Total Load
Other Party Interaction	6 (1-Excellent to 7-Bad)
Environmental Impact	insignificant
Costs Due To Failure	No more than $20,000
Fault Cause	No worse than unpredictable cause by others
Safety	Insignificant
Average Annual Fault Assumption	1 fault in 15 - 50 Years
ODV Life Expectancy	5 - 10 Years
Loading % > Full Load	No greater than full load
Environment	No worse than minor exposure
Deterioration Audits	That reflect a life expectancy of at least 15 Years
This Standard applies to 33KV Networks Only	

Risk Standard For Disaster Recovery	
Restoration Time Hrs	15 - 24 Hours
No consumers affected	No more than 3/4 of NEL customer base (6375)
Customer Load	No more than 75% of NEL's Total Load
Other Party Interaction	7 (1-Excellent to 7-Bad)
Environmental Impact	Moderate
Costs Due To Failure	>50K
Fault Cause	Act of God
Safety	Minor
Average Annual Fault Assumption	1 fault in 100 Years
ODV Life Expectancy	10 - 15 Years
Loading % > Full Load	No greater than full load
Environment	No worse than minor exposure
Deterioration Audits	That reflect a life expectancy of 10 - 15 Years
This Standard applies to Disaster Recovery	

The Impact model addresses the operational side of risk and covers off reasonable restoration times if customers are without supply. The number and type of customers without supply will have an impact on this Standard as well as the expected customer response to an extended outage. Obviously, the impact on environment is an important factor as are the consideration of costs both to business customers and NEL itself. Predictable and preventable causes are addressed along with the important issue of safety to contractors and especially to the public.

The Probability model deals with the likelihood of asset failure. The issues addressed here are any fault history which applies to the asset and the expected remaining service life based on the ODV model. The electrical loading the asset is required to carry and the environment the asset resides in will also impact on the probable failure of the asset. The life cycle of the asset, unlike the service life, is assessed based on actual physical audits and testing of assets rather than a theoretical model.

Overall, it is believed that even though the Risk Model has been developed in-house, it comprehensively addresses the issues of good industry practice and accepted risk practices in the electrical distribution industry in New Zealand.

8.3 Impact

The consequences of an asset failure occurring.

Impact Variables Used for the Model

- ***Restoration Time***
  The time taken to restore power by repair, replace or bypass.

- Number of Consumers Affected

- ***Customer Load***
  Expressed as a percentage of Nelson Electricity's Maximum Demand.

- ***Public Response***
  Ranges from excellent to bad.

- ***Failure Environmental Impact***
  Reflects any adverse effects on the environment caused by a predictable asset fault.

- ***Cost Due to Failure***
  Restoration costs caused by a predictable asset fault.

- ***Likely Fault Cause***
  Ranges from unpredictable and unpreventable to predictable and preventable.

- ***Safety***
  Covers any safety issue associated with the asset.

8.4 Probability

Asset issues that contribute towards the assessment of the probability of failure.

Probability Variables Used for the Model

- ***Fault History***
  Derived from the fault history records for the specific asset type.

- ***Life Expectancy***
  Derived from ODV remaining life of an asset.

- ***Loading***
  Percentage of full working load of the asset.

- ***Environment***
  Environment in which the asset is located.

- ***Life Cycle***
  Information derived from Asset Condition Audits indicating the physical assessment of the remaining life of an asset.

Each element of Impact and Probability, as outlined above, is rated and appropriate weightings are allocated to establish relativity. The summation of impact is multiplied by the summation of probability to calculate an overall risk rating. This rating is then used as a guide to rank the performance of each individual asset and is also used when comparing with Asset Performance Standards.

8.5 Asset Performance Standards

The Asset Performance Standards are set based on experience and knowledge of staff, standards and industry trends. The allocation of a number as a result of multiplying the Impact by Probability, makes it easy to rank assets according to Risk. This is more comprehensive than the simple high/medium/low rankings that some companies use. It is accepted that there is a fine line at times when it comes to an asset meeting or failing the standard and so there is a need for judgement at times. There was, however, considerable investigation and analysis undertaken to ensure that the standards were set appropriately. It is important that the standards are reviewed at least annually to take into consideration latest good industry practise and new legal requirements. The model is similar in structure to that of other companies.

Outages on the network, in many cases based on actual historical events, have been modelled for five categories of assets as listed below:

- 33kV network;
- 33kV/11kV transformers;
- 11kV networks;
- 11kV/400V transformers;
- 400V networks.

NEL is a small network with relatively short lengths of cable and aerial between substations. The policy is to not deliberately overload cables or lines in times of emergency. Consequently, NEL does not aim to operate the network in such a way as to compromise it and cause voltage problems during normal or emergency conditions. Under emergency conditions, the end of line voltage along with other conditions is monitored and if, during the event, the voltage drops below the industry standard, the supply is disconnected to the affected consumers.

Asset standards have been set for the network categories listed above that reflect a minimum acceptable level of performance. Assets are modelled against the asset standard, with the results being used to determine whether assets are compliant with the standard or require maintenance, upgrading or replacement. Modelling of all assets is an ongoing process.

Asset condition audits provide accurate information on each individual asset and its life cycle performance. The audit results are input to the Office Management System and the asset remodelled for its own asset performance ranking compared to the standard.

The assets not complying with the asset standard are prioritised by the risk assessment results and are programmed for repair or replacement.

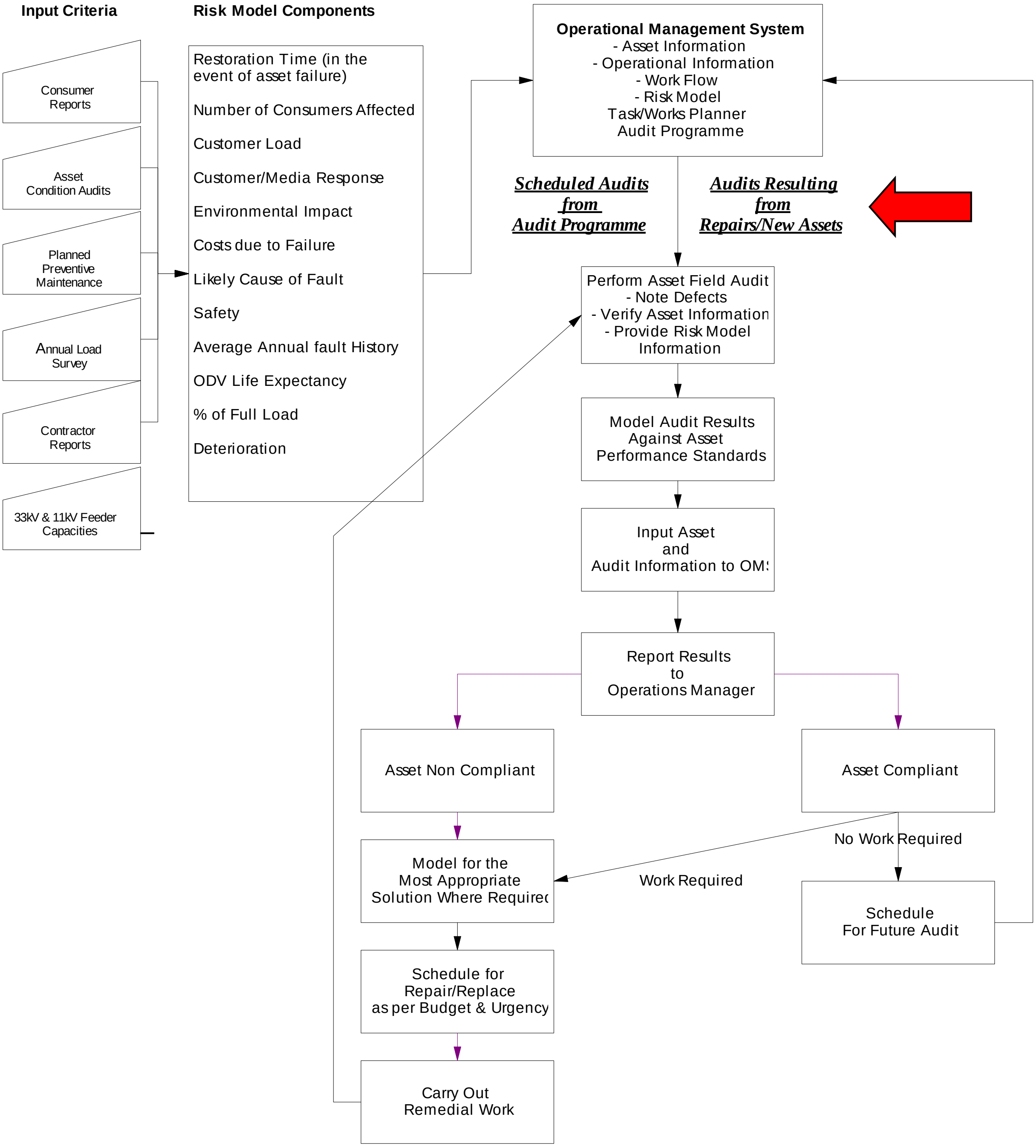
Any asset that has a **safety issue** or **security issue** identified through the risk management process is automatically identified and repairs or replacement undertaken immediately.

Asset Performance Standards are also used for:

- Evaluating capital work;
- Modelling corrective action contingencies for the most appropriate solution for non-complying assets.

The flow chart on the following page outlines the risk management process.

Network Assets - Risk Management



8.6 Auditing Programme

A programme has been implemented for asset condition auditing. This involves each asset being audited and specific information gathered relating to each asset. The data is risk modelled and input to the Office Management System. The content and operation of the Office Management Systems is discussed between **Section 2.8 and 2.12**, but in basic terms it utilises Microsoft Office software to carry out its functions. Prioritised reports generated by the System are given to the Operations Manager on a regular basis for him to analyse and schedule assets for repair or replacement. After repair or replacement, the asset is again audited for its new condition and that information updated in the System.

The GIS which utilises ArcView software is discussed between **Section 2.12 and 2.15** and provides a supporting role to the Office Management System as well as a key role for Faults and Operational Staff and Contractors.

An Asset Database and ICP Database also links to the GIS to provide sources of useful asset management and operational data.

As the auditing programme is undertaken on an ongoing rotational basis on above ground assets between six monthly and five yearly, the accuracy of asset information held is regarded as very accurate. The major area where completely accurate condition data is assessed more than measured is the underground cable network. Even so, partial discharge testing is carried out every two years on all 33kV feeders and key 11kV feeders (refer **Appendix A**) as well as other 11kV cables as required from time to time.

Where the age of HV cables has been assessed as a concern to future reliable service, spot checks have been made on the cables concerned by excavating down and inspecting the physical condition of the cable. The information retrieved is then recorded and filed for future reference with the asset replacement programme. If concerns still exist, a partial discharge test may be scheduled for the cable.

The information on the condition of the 400-volt network is limited. Assumptions have been made on their condition. There have been occasions where NEL has inspected cable condition when cables are exposed. It is planned that NEL will undertake more 400-volt cable testing to ensure the assumptions currently being used are still appropriate.

8.7 Risk Assessment

NEL has identified risk that can be divided into two main areas. These are Catastrophic Risk (refer **Section 8.8**) and Controllable Risk (S**ection 8.10**).

8.8 Exposure to Natural Disasters

Catastrophic Risk

This risk typically involves the forces of nature and third-party interference that can cause multiple asset failures and have serious impact on electricity supply throughout the Nelson city area. The processes for the recovery of an event of this nature are contained within the NEL Emergency Recovery Plan. That plan is reviewed annually.

The effect of the Christchurch Earthquakes has made NEL review the risks associated with any natural disaster. At the time of writing this Plan there have been some areas identified where NEL has taken these into consideration when developing this Asset Management Plan. This section will continue to be developed further as additional information is received.

Main areas being reviewed are around design standards and contingencies for safe restoration of electricity supply. Substation building strength is also a key issue being addressed.

Apart from the actual catastrophic risk, a key issue is to ensure that there are emergency communication options and the ability for staff and contractors to get to where they are needed. All staff have cellphones and handheld radios to be used in an emergency. If there is a problem in being able to get to the NEL Control Room or it is not functional, then NEL will utilise the Network Tasman Control Room.

Below are the events NEL must consider:

- ***Earthquake*** – Nelson, by its location, is extremely susceptible to earthquake. A major fault line runs along the foothills to the east of the city. This means that cables, lines and substations in its close vicinity as well as the whole network would be exposed during a large earthquake. The earthquakes that have occurred in Christchurch in 2010 and 2011 have further highlighted the importance of electricity supply to the community and the slow restoration of predominantly underground networks.

  NEL is continuing to review the impact of an earthquake close to the city and how it could impact on the NEL network both in asset failure as well as business continuity. Although all major assets are seismically braced, there have been some smaller assets and pieces of equipment that have been identified needing to be secured in place, eg; battery banks in some substation buildings, computers and asset spares. The work to remedy these issues has been undertaken.

  Mitigation: Seismic strength assessments have been undertaken on all of NEL's substation buildings. Major assets have subsequently been seismically braced to minimise the damage from an earthquake It is expected that minor identified issues will be factored into the Asset Management Plan and corrective work undertaken.

- ***Liquefaction*** - There is also the risk of liquefaction in the Port, Wood and Maitai River areas. Most of these areas are on reclaimed land and are identified as a risk. NEL only has 11kV and 400V assets in these areas with eight indoor 11kV/400V substations that could be affected. Most of the reticulation in these areas is underground.

  Liquefaction can result in cables being stretched and pulled from their assets and, as such, there can be a lengthy period to restore electricity supply. In both the Port and Wood risk areas there are a number of backup 11kV cable options able to supply the areas. Some research work is being undertaken to see what additional measures that can be undertaken to mitigate the impact of liquefaction not only for the existing assets but for new assets installed in the areas.

  Mitigation: Existing substations are built to Council standards which include minimum foundation requirements. Multiple 11kV feeders are also available into the areas. An additional study has been undertaken to identify areas of liquefaction risk to NEL. This report highlights assets more likely to suffer damage and potentially assist NEL in the future development of the network.

- ***Tsunami*** - Being close to the sea, Nelson is also indirectly exposed to tsunami and large areas of the network, especially in the Port area, and could be inundated if a significant rise in sea level were to occur. Nelson city is protected to a degree by not only a boulder bank but also the North Island and shores of Tasman Bay due to the geographical location. The only negative is that much of the city is built close to sea level meaning the level does not have to raise much to cause damage.

  The risk of a tsunami in Nelson has to be considered as a real threat. The following is a section of a release from the Nelson Tasman Emergency Management Office, 15 March 2011.

  > *"There are three main tsunami sources for Nelson Tasman: distant earthquake sources; local earthquake sources; and other local sources (landslides, undersea slumping, volcanic activity).*
  >
  > *Distant earthquake sources (eg; from South America or Japan) mean any tsunami generated crosses the Pacific Ocean to reach New Zealand. Realistic warning of many hours can therefore be expected for distant source tsunami.*

Moreover, Tasman and Golden bays are less exposed to tsunami arriving from these directions than other parts of New Zealand. While tsunami can come into Tasman and Golden bays from these distant sources some of the wave energy is lost due to travel through Cook Strait and the nature of the geography of the bays.

Local earthquake sourced tsunami is of more concern to Tasman and Golden bays. An example would be an earthquake in the Cook Strait or an undersea slip or earthquake in the Taranaki Basin. The risk is potential for a large wave, and there is likely to be no practical warning from authorities. Such waves could move very quickly – at the speed of a jet liner.

Overall, the Nelson Tasman region faces a modest tsunami risk compared to other parts of New Zealand's coastline. Local earthquake sources are the likely source for the largest tsunami expected in the region. Such larger tsunamis are very infrequent (ie; return period in the order of 2,500 years on average according to GNS).

Not all earthquakes result in tsunami. For example the major earthquakes of 1929 in Murchison and 1968 in Inangahua did not produce tsunami nor did the recent Christchurch earthquakes. It is when earthquakes cause displacement of the sea floor that tsunamis are generated.

There is evidence in Abel Tasman National Park and other local places of large tsunamis having occurred in the past, albeit very infrequently."

Mitigation: The new Haven Road Zone Substation has been designed and located to minimise the impact of a tsunami. This included a raised floor for switchboards and minimum height requirement for any electrical connection.

- ***Flooding*** – Nelson is susceptible to flooding. There are areas identified by the Nelson City Council that could be inundated in the event of localised heavy rainfall. One issue for the city is that it is built close to sea level which makes it difficult for flood waters to escape to the sea at high tide.

  Mitigation: Nelson City Council have, over the last 20 years, minimised the risk of flooding by improving stormwater systems, building flood dams in strategic locations and constructed the Maitai Dam. It is unlikely that Nelson Electricity would have any major consequences other than at the 400V level.

- ***Sabotage*** – NEL, being an important utility to Nelson city, is at risk of sabotage from individuals or terrorism. The likelihood of such an event causing more than minor damage is low. The two scenarios being considered are the demolition of the Zone Substation at Haven Road and 33kV feeder damage.

  Mitigation: Given that Haven Road Zone Substation is critical to the supply to Nelson city, NEL will require the use of the 11kV interconnects to get limited supply from Network Tasman, if possible, until supply (temporary or permanent) is restored. The Zone Substation is monitored by First Security, security cameras and by security alarms monitored by Nelson Alarms.

In the end catastrophic risk events must be managed as they cannot be eliminated.

Climate Change

With Nelson city being located close to sea level the effect of climate change and rising sea levels could in years to come have a huge impact on the network. NEL will be working with the Nelson City Council to make a risk assessment of the potential impacts.

8.9 Exposure to Natural Disasters

Transpower Grid Exit Point - Stoke

NEL takes its 33kV supply via one 33kV feeder from Transpower's Grid Exit Point and three feeders from Network Tasman's Grid Exit Point at Transpower's Stoke Substation. Although Transpower have an extensive seismic protection programme, NEL cannot comment on the likely effect of an earthquake on Transpower's transmission system and Substation at Stoke. There are some national transmission supply issues that could impact on the Nelson, Marlborough and West Coast areas in the future. Transpower have been progressing through upgrade steps to ensure these areas have an adequate transmission system.

Steps completed:

- Installed capacitors at Stoke Substation in 2005;
- Installed a third 220kV line from Islington to Kikiwa in 2006;
- Installed a second 110kV line from Stoke to Blenheim in 2006;
- Installed additional transformer capacity;
- Replaced outdoor 33kV switchyard with indoor switchgear.

NEL has been concerned with the transmission supply to the top of the south and has worked in with other lines companies to ensure concerns are addressed in a timely manner.

Suffice to say, there is, a continued risk to the 220kV supply from Islington to Kikiwa that crosses a significant fault line. There is the potential for a significant outage if the 220kV lines are damaged in a severe earthquake. This would affect the top of the South Island including Buller. The only major generation available to the area would be via Cobb Dam which is a 30MW hydro station. In any transmission failure event NEL would work closely with Network Tasman to manage the outage and restoration.

33kV Feeder Supply

NEL is supplied by four 33kV feeders. Three feeders are aerial lines from the Grid Exit Point at Stoke to the Nelson Electricity boundary where they covert to underground cables and one is by cable directly from Stoke substation. Two of the feeders form a double circuit line and all lines are located near fault lines and so susceptible to damage in an earthquake. Earth movement from slippage or erosion is the only other natural danger to the lines. The severe weather encountered in December 2011 demonstrated this with a slip causing a tree to slide down a hill and ultimately fall onto one of the 33kV overhead lines.

Haven Road Zone Substation Building

The new Haven Road Substation building was built in 2013/14 and meets the earthquake provisions of the new standard AS/NZS 1170.

Haven Road Zone Substation 11kV Switchboard

The 11kV switchboard is a three-bus sectionalised indoor type. It is not anticipated that any significant damage would occur to the switchgear during an earthquake unless there was damage to the Zone Substation building. However, if there was damage which made any switches inoperable, it is likely that some form of bypass would need to be installed.

Haven Road Zone Substation 33kV/11kV Switchyard

The Zone Substation electrical equipment is fully enclosed in its new building. It is not anticipated that any significant damage would occur to the switchgear during an earthquake unless there was damage to the Zone Substation building.

11kV/400V Substations

The 11kV/400V substations consist of a variety of kiosks, underground vaults and padmount structures as well as pole mounted types. It is expected that the ground mounted structures will withstand an earthquake but may be more susceptible to flooding and those near the tidal areas to tsunami and liquefaction. The few remaining pole mounted substations would be susceptible to earthquake.

Mitigation: The transformers in ground mounted substations have been bolted down and those below ground could be sealed against water intrusion. The pole mounted substations are being systemically installed on the ground. All substation buildings have been seismically checked and brought up to appropriate building standard.

Underground Cabling

The underground network is expected to remain intact unless there is significant ground movement in an earthquake or soil erosion in a flood or tsunami. In some areas of reclamation, liquefaction may be an issue.

Given the high proportion of the network being underground it is difficult to alter the risk profile so it becomes more of a managing of the risk. The most appropriate method is by providing alternative backup supply options.

Mitigation: Ensure that as many areas of the network as possible have an alternative route of supply by ring-feeding.

Communications/Control

It is anticipated that cellphones, which are held and operated daily by all staff, should be operational following a disaster but, as a backup, radio telephones operating via simplex would be utilised. The Zone Substation Control Room computer would enable limited computer systems to be utilised for operational purposes. It is anticipated that most operations would be controlled by the Civil Defence/Lifelines Control Centre where an NEL liaison officer would be stationed. Communications would be via cellphone or radio telephone.

Mitigation: An on-site backup generator can provide an electrical supply to the Control Room and essential services for operational purposes.

8.10 Exposure to Physical Risk

Controllable Risk

This is risk that is within the control of the asset owner and can be controlled by adding or removing certain assets to meet the risk standard required. The Asset Management Plan revolves primarily around this risk. NEL plans and makes assessments as to when an asset needs to be replaced, upgraded or removed.

33kV Feeder Supply

Following the major 33kV feeder project NEL is now supplied by one underground and three overhead 33kV feeders. Two of the three overhead feeders are on a double circuit line at a road edge of an increasingly busy road in the Ridgeway (Stoke [Network Tasman] suburb) area. There have been two incidents in past years where cars have hit poles supporting the double circuit. In both incidents there was no damage to the line or loss of supply.

An assessment has been undertaken to forecast traffic volumes with the risk of Nelson Electricity losing supply from the double circuit leaving two 33kV feeders to supply the network with reliance of other contingencies to restore supply to the network.

Haven Road Zone Substation and 33kV/11kV Switchyard

The Zone Substation building is protected by fire and intruder alarms. The new building has been significantly hardened against intruders and sabotage from the previous outdoor substation.

11kV/400V Substations

The 11kV/400V substations consist of a variety of kiosks, underground vaults and padmount structures as well as pole mounted types. It is expected that the ground mounted structures will withstand an earthquake but are more susceptible to flooding and those near the Port to tsunami. The few remaining pole mounted substations would be susceptible to earthquake.

Mitigation: The transformers in ground mounted substations have been bolted down and those below ground could be sealed against water intrusion. The pole mounted substations are being systemically replaced on the ground.

Underground Cabling

The underground network is expected to remain intact unless there is significant ground movement in an earthquake or soil erosion in a flood or tsunami.

Mitigation: Ensure that as many areas of the network as possible have an alternative route of supply by ring-feeding.

Communications/Control

It is anticipated that cellphones, which are held and operated daily by all staff, should be operational following a disaster but, as a backup, radio telephones operating via simplex would be utilised. The Zone Substation Control Room computer would enable limited computer systems to be utilised for operational purposes. It is anticipated that most operations would be controlled by the Civil Defence Lifelines Control Centre where an NEL liaison officer would be stationed. Communications would be via cellphone or radio telephone.

Mitigation: An on-site backup generator can provide an electrical supply to the Control Room and essential services for operational purposes.

8.11 Emergency Plans

NEL has an Emergency Recovery Plan, which is available in electronic form or with hard copies available in-house, with individual staff, NEL control room and fault contractor. Issue is restricted to relevant Lifeline and Civil Defence groups.

The Plan includes:

- Restoration contingencies and procedures with accurate identification of risk areas in the Nelson city and on the network. An example of the type of contingency measure in place is the interconnection switches which will be used to accept supply from Network Tasman in the event of a major 33kV or 11kV feeder failure. Restoration of supply to significant customers is also addressed in the contingency measures.

- Lists detailing contractor contact details and emergency suppliers as well as lists of asset spares.

- NEL will be working closely with Network Tasman and Nelson Tasman Lifelines in the event of an emergency. NEL has identified interdependence with other Lifeline members and continues to attend Lifeline events to form working relationships with these other organisations.

Supplementary Records Information

Records information held at the main substation consist of:

- ***Hardcopy and Scanned***
  Cable location plans, LV schematics, HV schematics.

- ***Computer Files***
  Substation loadings, transformer sizes, cable sizes, asset locations, and AutoCad drawings. All hard copy files are scanned and stored electronically.

Because of the nature of this information, it supplements rather than forms part of the Emergency Recovery Plan. All scanned data is backed up and copies kept offsite.

The Asset Performance Standards are also used to set the levels of availability of spares and resources required to recover from a disaster situation while still meeting the Standard.

Restoration contingencies and procedures are based on single event emergencies.

Document Security

In the event the Haven Road Zone Substation was destroyed, and all plans and computer information lost, NEL has processes in place to minimise the disruption.

Mitigation: NEL has backup copies of the following:

- Computer network file server data;
- Underground cable records;
- Field book records;
- GIS data;
- Network schematics.

Copies are stored off site and can be accessed and used in an emergency. Nelson Electricity has now completed construction of a fire-rated document storage area within the building to minimise risk of damage to network information stored in this room.

Zone Substation records, schematics and plans are drawn or have been redrawn using AutoCad. These are held on the file server and backed up daily. Older records have been captured on microfilm.

SECTION 9 - Evaluation of Performance

9.1 Evaluation of Performance

NEL network development is in line with load growth and the replacement of aged assets as detailed in this Plan and previous Plans. There are situations where some projects are brought forward and others deferred based on new information, increased growth, new developments, and finding more cost-effective solutions.

Previous sections of this Plan refer to the Asset Risk Model and associated Performance Standards as the tool for measuring the reliability of asset performance. Where maintenance is required to an asset the Risk Model will assist with evaluating the most efficient and economical solution.

With continual auditing of the assets and use of the Office Management System reporting and Improvement Form, asset management and the NEL business is under continual analysis and improvement.

NEL takes into consideration comments and evaluations made in the Commerce Commission reviews into the previous Asset Management Plan. It also compares with other Electricity Distribution Business performances to assess best practise. The Asset Management Plan, when complete, is then peer reviewed by Network Tasman (as part of the engineering support agreement) and additional changes made to further improve the quality and compliance level of the document. This review is undertaken prior to director endorsement and disclosure.

9.2 Review of Progress and Gap Analysis

Financial Performance

Nelson Electricity has introduced the financial targets below and will report actual versus target.

Operational Expenditure per ICP	Industry Average 2020	2016	2017	2018	2019	2020	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast
Network	$118	$44	$70	$49	$83	$74	$77	$83	$85	$86	$88
Non Network	$169	$148	$149	$159	$150	$151	$153	$154	$154	$153	$153

Capital Expenditure per ICP	Industry Average 2020	2016	2017	2018	2019	2020	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast
Network	$460	$51	$84	$102	$192	$189	$130	$193	$168	$180	$179
Non Network	$108	$5	$11	$1	$36	$12	$0	$3	$13	$3	$3

Operational Non Network costs per ICP overall are in line with target for 2021. NEL will be aiming to keep operational costs per ICP at only increasing by 1% per year (allowing for CPI adjustments) over the planning period. This will reflect the improved efficiency of the management of the network and offsetting the increasing compliance costs associated with being a regulated business.

Operational Network costs have increased compared to previous year and below target of $83 per ICP by $5. The main reasons for this are:

- Unplanned expenses are lower than forecast due to lower than expected number of network faults.
- Works resulting from asset condition audits are lower in numbers for the year.

It is expected that operational network costs will remain level (allowing for the typical unavoidable variances) for the planning period.

Reliability and Performance

NEL has been actively recording 33kV and 11kV outage statistics since 1994-1995 and the annual figures reflect significant improvement from those of the early years. The main improvement has come in the area of the 33kV feeders where problems with cable/joint failures and contractor strikes in the 1990s have been reduced with the implementation of policy and regular contact with excavation contractors.

Network reliability has improved significantly in recent years because of major investment in a new Zone Substation and fourth 33kV feeder.

- The 2014 year was above target due to the planned change over from the old to new Zone Substation affecting all NEL customers at some point during the project.

SAIDI

	Year End	Transpower Planned	Transpower Unplanned	Transpower Total	NEL Planned	NEL Unplanned	NEL Total	Overall SAIDI
Actual	2003	0.00	0.00	0.00	27.00	72.00	99.00	99.00
Actual	2004	0.00	0.00	0.00	7.00	46.00	53.00	53.00
Actual	2005	0.00	0.00	0.00	12.00	39.00	51.00	51.00
Actual	2006	0.00	101.00	101.00	12.00	10.00	22.00	123.00
Actual	2007	0.00	215.00	215.00	9.00	16.00	25.00	240.00
Actual	2008	0.00	0.00	0.00	5.00	12.00	17.00	17.00
Actual	2009	0.00	70.00	70.00	29.00	87.00	116.00	186.00
Actual	2010	0.00	90.00	90.00	54.00	25.00	79.00	169.00
Actual	2011	0.00	0.00	0.00	9.00	106.00	115.00	115.00
Actual	2012	0.00	0.00	0.00	9.00	54.00	63.00	63.00
Actual	2013	0.00	0.00	0.00	10.24	34.00	44.24	44.24
Actual	2014	0.00	39.59	39.59	1.77	20.61	22.38	61.97
Actual	2015	0.00	0.00	0.00	2.55	17.39	19.94	19.94
Actual	2016	0.00	0.00	0.00	0.57	10.39	10.96	10.96
Actual	2017	0.00	0.00	0.00	8.83	27.44	36.27	36.27
Actual	2018	0.00	116.79	116.79	6.86	9.55	16.41	133.2
Actual	2019	0.00	0.00	0.00	16.79	7.55	24.34	24.34
Actual	2020	0.00	0.00	0.00	11.46	0.56	12.02	12.02
Forecast	2021	0.00	0.00	0.00	15.0	0.00	15.0	15.0
Industry 2019 Average								**229**

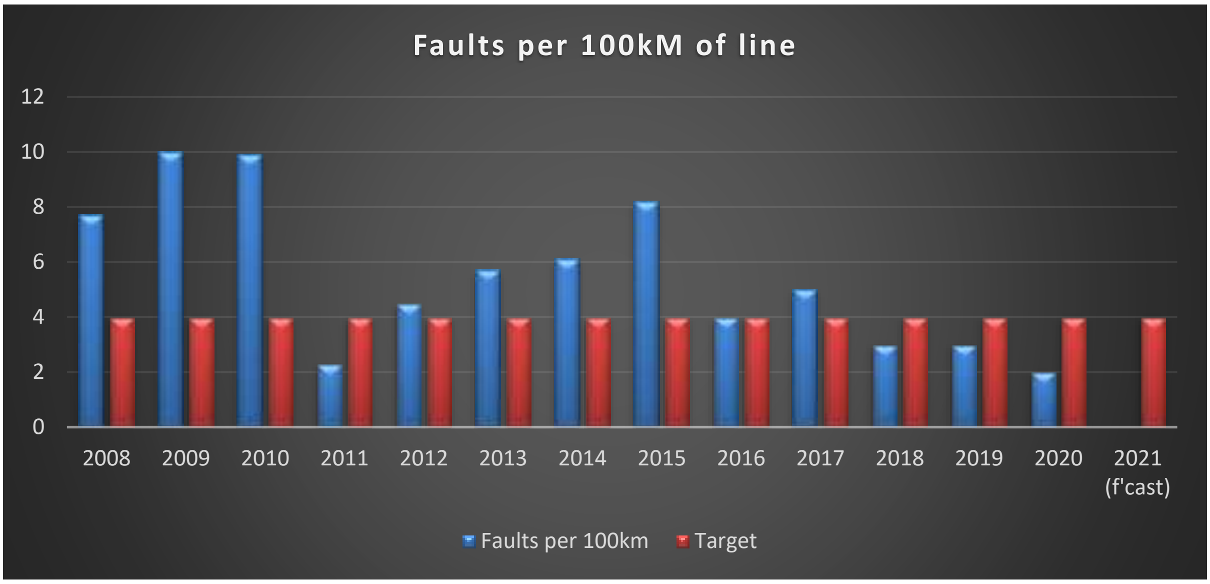
NEL will continue to work with contractors to ensure that appropriate care is taken around network assets.

It must be noted that NEL is a small network, and that any outage has a huge impact on outage statistics. There will always be annual differences and extremes. This was demonstrated in the 2012 results showing a total SAIDI of 63 minutes. One outage accounted for 55 minutes and one outage in 2013 which contributed 23 minutes of the total 34 minutes of unplanned SAIDI.

All unplanned outages will continue to be investigated and corrective procedures and actions put in place to reduce or eliminate the risk of a similar outage and reduce the impact if a similar outage does occur. Tables of all outage statistics are included in the Service Level section.

Number of Faults per 100 Kilometres of Network

The number of faults per 100 kilometres of line is on target for 2020 and significantly below the industry average of 9.2 faults per 100 kilometre of line.



NEL is a small network, and any fault has a severe impact on this. In previous years, the performance levels have been affected by contractors digging up cables. An added awareness campaign on usage of cable locations and safety observers looks to have reduced the number of these types of cable faults.

The target of four faults per 100 kilometres of line is a target based on the theoretical best performance of an underground type of network. It must be noted that many faults that occur are not network related but more third party or contractor related. NEL has attempted to minimise this and will continue to educate contractors and public on electricity network risks.

Fluctuating Voltage

There were 10 recorded voltage fluctuations for the year, seven related to a network issue while three were related to consumer issues. All were generally related to loose or damaged connections at the NCP, NCP fuse or service main termination point. All issues were resolved in a timely manner. The network standard was for no more than seven proven network voltage complaints received per year. NEL will continue to monitor the results of voltage recordings closely to ensure this was not more than a statistical abnormality.

Capacity Utilisation and Load Factor

The Capacity Utilisation and Load Factors have been reducing in recent years predominantly due to the flattening of peak demand and declining kilowatt hour consumption. The changes in peak demand and consumption may see some transformer downgrades but this will most likely be through consumers with dedicated transformers requesting downsizing. It is expected that these rates will begin to recover to target levels over a length of time.

Harmonics and Interference

There have been no reported issues with harmonics in recent years.

Environmental Performance

The environmental performance for the year was satisfactory. There were no environmental incidents on the network during the year. The oil spill kits are maintained at appropriate locations and available when lifting oil filled equipment on and off trucks.

Safety Performance

There were no loss time injuries by staff or contractors working on the network. A small number of public safety issues were identified by auditing or reported to NEL.

Type	Damaged service boxes	Lines down	Other
No.	28	0	0

Records

NEL maintains a GIS system linked to the Asset and ICP databases, photos, field books and scanned copies of the underground records. Whilst a standalone system, development remains ongoing and NEL retains a set of hard copy historical underground record plans of which staff and contractors still rely for day-to-day operation of the network. As-built drawings of new works and alterations are recorded in the GIS, field books and drawing system.

Gap Analysis Process

Gap Analysis comprises:

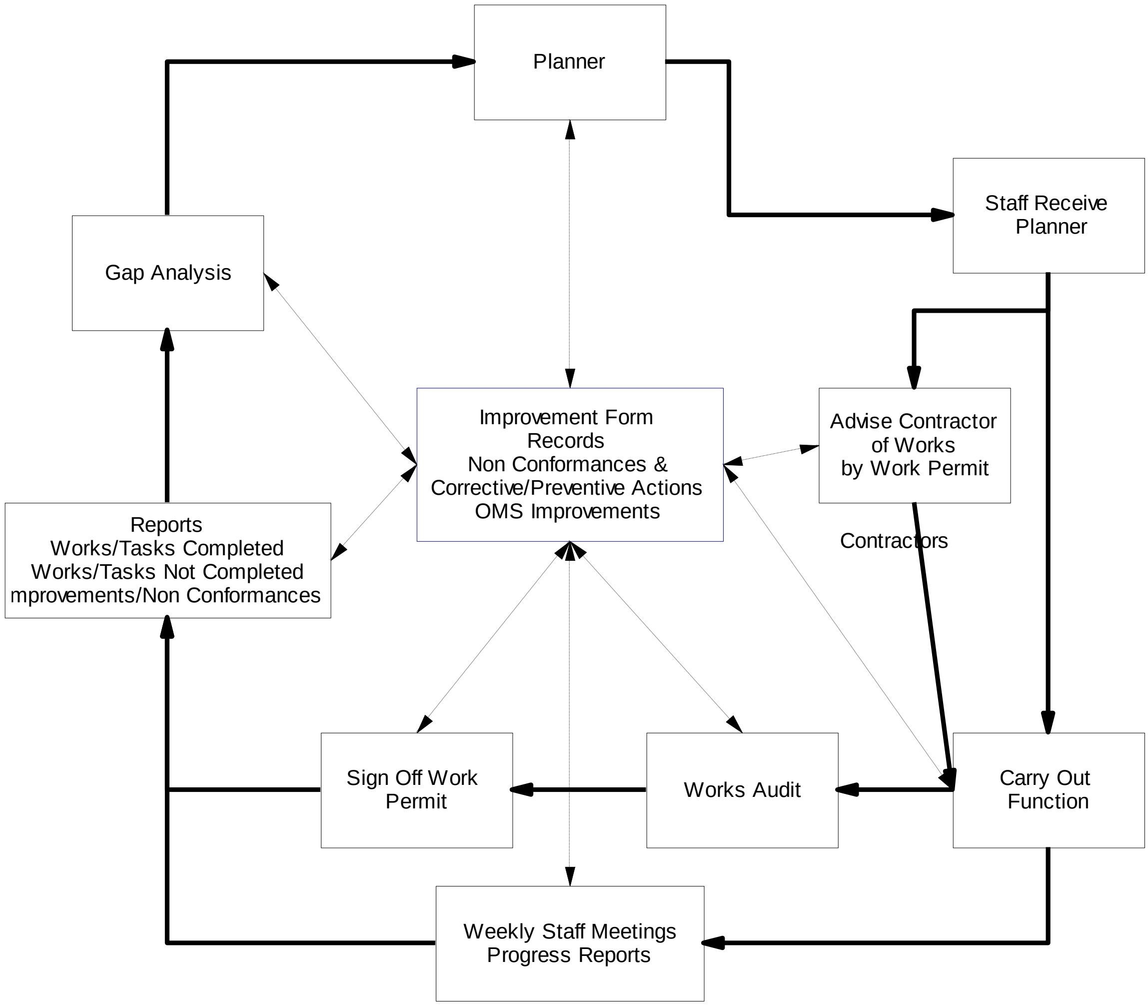
- Identification of the gap;
- Analysis of problems and solutions;
- Corrective/preventive actions.

The Office Management System provides the ideal tools for identifying, analysing and correcting problems within the business. All works and business tasks are programmed on a Planner, which is issued to each staff member in the last days of the month, for the following month, with copies of each to the General Manager. During the weekly staff meetings, the General Manager requests updates on all tasks. Any non-conformances are recorded on the Improvement Form and discussed between the staff member and General Manager.

Contractors' works are delivered by way of the Work Permit. When the work/task is completed it may be audited, then the Work Permit is signed off. Reports are produced for management to analyse all works/tasks completed and those not completed. Likewise, Improvement Form reporting is also analysed. Possible solutions are discussed and may be risk modelled then corrective/preventive measures put in place. Refer flow chart below.

System reliability targets and statistics will also be analysed regularly as programmed on the Planner. The Planner will also programme reviews of the Office Management System, Asset Management Plan and Business Plan progress. The reviews and continuous improvement strategies will be discussed at the weekly staff meetings.

NEL Staff and Contractor Work/Task Flow



Asset Management and Planning

On an annual basis, NEL reviews its asset management processes by various means to ensure it is appropriate for the network. There are three fundamental processes undertaken to ensure that the processes used are appropriate and in line with good industry practise.

- NEL has the Asset Management Plan peer-reviewed by Network Tasman engineering staff. This process identifies, on occasion, new initiatives that may have been missed. It also ensures that the asset management processes are confirmed as appropriate.
- NEL critically reviews any Asset Management Plan reviews commissioned by the Commerce Commission. This review always highlights new areas for improvement and also helps target resources when reviewing the asset management processes.
- Monitor other network company asset management plans.

The Asset Management Plan has now been reformatted to align with the Electricity Information Disclosure Handbook. This has the benefit of the plan being easier to review by the Commission as well as simplifying the document which has become quite large with some fragmented information.

Asset Management Maturity Assessment

NEL has undertaken an asset management maturity assessment as required under the Electricity Distribution Information Disclosure Determination 2012. The accompanying Schedule 13 from the Determination is included at the back of this Asset Management Plan. The Schedule has been compiled and assessed by utilising an Independent Qualified Electrical Engineer. This provides a level of independence in the assessment.

While the original independent 2013 assessment and subsequent in-house review in 2017 shows NEL maintains a reasonable level of maturity, there are some areas identified for improvement which are addressed as the opportunity arises.

SECTION 10 - Expenditure Forecasts and Reconciliations

As a review of progress against the Asset Management Plan 2019–2029, the following is the Asset Management Plan Requirement for expenditure forecasts and reconciliations.

10.1 Capital Expenditure

2019-2020 Asset Management Plan- Original Budget versus Actual

Capital Expenditure	Actual 31 Mar 2020	Budget 31 Mar 2020	Difference % 31 Mar 2020
Network Capex			
Consumer connection	$109	$145	(25%)
System growth	$122	$115	6%
Asset replacement and renewal	$996	$665	50%
Asset relocations	$307	$175	75%
Reliability, safety and environment:	$217	$430	(49%)
Non-Network Capex	$22	$36	65%
Total Capital Expenditure	**$1,788**	**$1,552**	**15%**

2020-2021 Asset Management Plan – Original Estimate versus Forecast End of Year

Capital Expenditure	Forecast 31 Mar 2021	Budget 31 Mar 2021	Variance % 31 Mar 2021
Network Capex			
Consumer connection	$3	$85	-95%
System growth	$36	$195	-81%
Asset replacement and renewal	$838	$950	-12%
Asset relocations	$36	$65	-44%
Reliability, safety and environment:	$340	$195	74%
Non-Network Capex	$4	$27	-84%
Total Capital Expenditure	**$1,257**	**$1,517**	**-17%**

The forecast Capital Expenditure for 2020-2021 is $1,257,000 which will be under the disclosed estimate in the 2020-2030 Asset Management Plan Update of $1,500,000. The year-end estimate is 17% below budget primarily due to the disruptive business year resulting in the deferment of an 11kV switchboard replacement project and Nelson City Council infrastructure projects where NEL is co-ordinating works to minimise civil costs.

10.2 Operational Expenditure

2019-2020 Asset Management Plan - Forecast versus Actual

	Actual 31 Mar 2020	Budget 31 Mar 2020	Variance % 31 Mar 2020
Network Opex			
Service interruptions and emergencies	$158	$127	24%
Vegetation management	$38	$33	15%
Routine and corrective maintenance and inspection	$408	$347	18%
Asset replacement and renewal	$80	$82	(2%)
	$684	**$589**	**16%**
Non-Network Opex			
System operations and network support	$411	$255	61%
Business support	$983	$1,280	(23%)
	$1,394	**$1,535**	**(9%)**
Total Operational Expenditure	**$2,078**	**$2,124**	**(2%)**

Network Operational Expenditure for the year ending 31 March 2020 was $684,000 which was $95,000 over the budget of $589,000.

There was higher expenditure in overhead asset replacements as well as maintaining access to poles partly due to rising traffic management and road corridor access costs.

There was the continued number of 400V service and link boxes replaced during the year with 40% of the total replacement cost has been assessed as operating expenditure as there was a significant proportion of the total cost to excavate and remove the old equipment. The expenditure is predicted to reduce in coming years given the expected improvements in asset condition results from auditing.

There is always a variation in the expenditure of Service interruptions and emergencies as it is reactionary to events that occur throughout the year. The expenditure was $31k higher than forecast.

All planned asset auditing has been completed for the year.

Non-Network Expenditure was 2% lower for the year.

2020-2021 Asset Management Plan - Forecast versus Forecast End of Year

Operational Expenditure	**Estimate 31 Mar 2021**	**Budget 31 Mar 2021**	**Variance % 31 Mar 2021**
Network Opex			
Service interruptions and emergencies	$60	$133	
Vegetation management	$33	$37	
Routine and corrective maintenance and inspection	$250	$248	
Asset replacement and renewal	$340	$350	
	$683	**$768**	
Non-Network Opex			
System operations and network support	$250	$282	
Business support	$1,205	$1205	
	$1,400	$1487	
Total Operational Expenditure	**$2,855**	**$2,255**	

Asset Management Plan network operational expenditure forecast for the year ending 2021 is $683,000 which is $85,000 below the budget of $768,000. This 11% reduction is due to a low number unplanned or emergency events affecting the network.

Maintenance Initiatives

The auditing and maintenance programme, which has been continually fine-tuned, is working effectively. The main reason for its effectiveness is due to having a robust auditing programme undertaken by extremely competent people. The work that comes from the audits are prioritised and undertaken in a timely manner. The frequency of the auditing is reviewed on an annual basis to ensure NEL is in line with at least good industry practise.

There will always be modifications to the programmes and the current changes or initiatives revolve around auditing service lines on road reserve and NEL assets on private property.

APPENDICES

Appendices A-E

Audit Programme 1 April 2021 - 31 March 2031																
Category	Asset Type	Audit Type	Description	Audit Frequency ID	Total No of Assets	Comments	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
33 kV Networks	CB Switch	Partial Discharge	Zone Substation	2 Yearly	4		4		4		4		4		4	
33 kV Networks	OH/UG Structure	Thermal Imaging	Boundary Rd	2 Yearly	1	DELTA	1		1		1		1		1	
33 kV Networks	Pole	Visual	Concrete	2 Yearly	3	DELTA	3		3		3		3		3	
33 kV Networks	Zone Substation	Planned Maintenance	Checks/Cleaning	Monthly		DELTA										
33 kV Networks	UG Cable	Partial Discharge	St Vinc / Vang / Ruth / Waimea	2 Yearly	4		4		4		4		4		4	
33 kV Networks	Earths	Test	Zone Substation	5 Yearly	1		1					1				
33/11 kV Transformers	Transformer	Oil Sample	T1-T2-T3	2 Yearly	3			3		3		3		3		3
33/11 kV Transformers	Transformer	Tap Change Recordings	Plan Mtce	Monthly	3											
33/11 kV Transformers	Transformer	Temperature	Plan Mtce	Monthly	3											
11kV Networks	Earths	Test	Distribution Subs	5 Yearly	199		39	40	40	40	40	39	40	40	40	40
11kV Networks	Earths	Visual	Distribution Subs (Plan Mtce)	6 Monthly	199											
11kV Networks	Cables (all)	Partial Discharge	Zone Substation	2 Yearly			1		1		1		1		1	
11kV Networks	HV Link Box	Visual	Plan Mtce	6 Monthly	42											
11kV Networks	Main Feeders	Partial Discharge	Zone Substation	2 Yearly	14		14		14		14		14		14	
11kV Networks	Zone Sub OCB	Partial Discharge	11kV OCB (Zone Sub)	2 Yearly	14		14		14		14		14		14	
11kV Networks	VCB Switch	Oil Sample / Earth Test / Protection Settings	HV Switches (Sealords only)	2 Yearly	1		1		1		1		1		1	
11kV Networks	VCB Switch	Partial Discharge	HV Switches (Sealords only)	2 Yearly	1		1		1		1		1		1	
11kV Networks	Pole (concrete)	Visual	includes stay poles	5 Yearly	191		38	38	38	39	38	38	38	39	38	38
11kV Networks	Pole (wood)	Visual/UG Test		3 Yearly	4			4			4			4		
11kV Networks	HV Switches	Visual	Plan Mtce	6 Monthly	313											
1kV Networks	HV Switches	Oil Sample	Maintenance	5 Yearly	313		62	62	62	62	63	62	62	62	62	63
11kV/400V Transformers	Transformer	Oil Sample		5 Yearly	208		45	45	44	44	44	45	45	44	44	44
11kV/400V Transformers	Transformer	MDI Readings	Plan Mtce (excludes stock)	6 Monthly	208											
11kV/400V Transformers	Transformer	Temperature	Plan Mtce (excludes stock)	6 Monthly	208											
11kV/400V Transformers	Transformer	Visual	Plan Mtce (excludes stock)	6 Monthly	208											
400V Networks	LV Link Box	Visual/Internal Audit		5 Yearly	327		65	65	65	65	64	65	65	65	65	64
400V Networks	Pole (wood)	Visual/UG Test		3 Yearly	103		34	34	34	34	33	34	34	34	34	33
400V Networks	Pole (concrete)	Visual	includes metal poles	5 Yearly	552		110	110	110	110	109	110	110	110	110	109
400V Networks	Service Box	Visual/Internal Audit	includes veranda boxes	5 Yearly	2469		493	493	493	493	494	493	493	493	493	494
400V Networks	Link/Service Box	External Safety Audit	excludes veranda boxes	2 Yearly	2496		1398	1398	1398	1398	1398	1398	1398	1398	1398	1398
400V Networks	Sub Station	Visual	Plan Mtce	6 Monthly	200											
400V Networks	Sub Station	Hot Spots	Plan Mtce	6 Monthly	200											
400V Networks	OH Lines	Line Heights		5 Yearly	N/A	All OH Lines		All				All				All

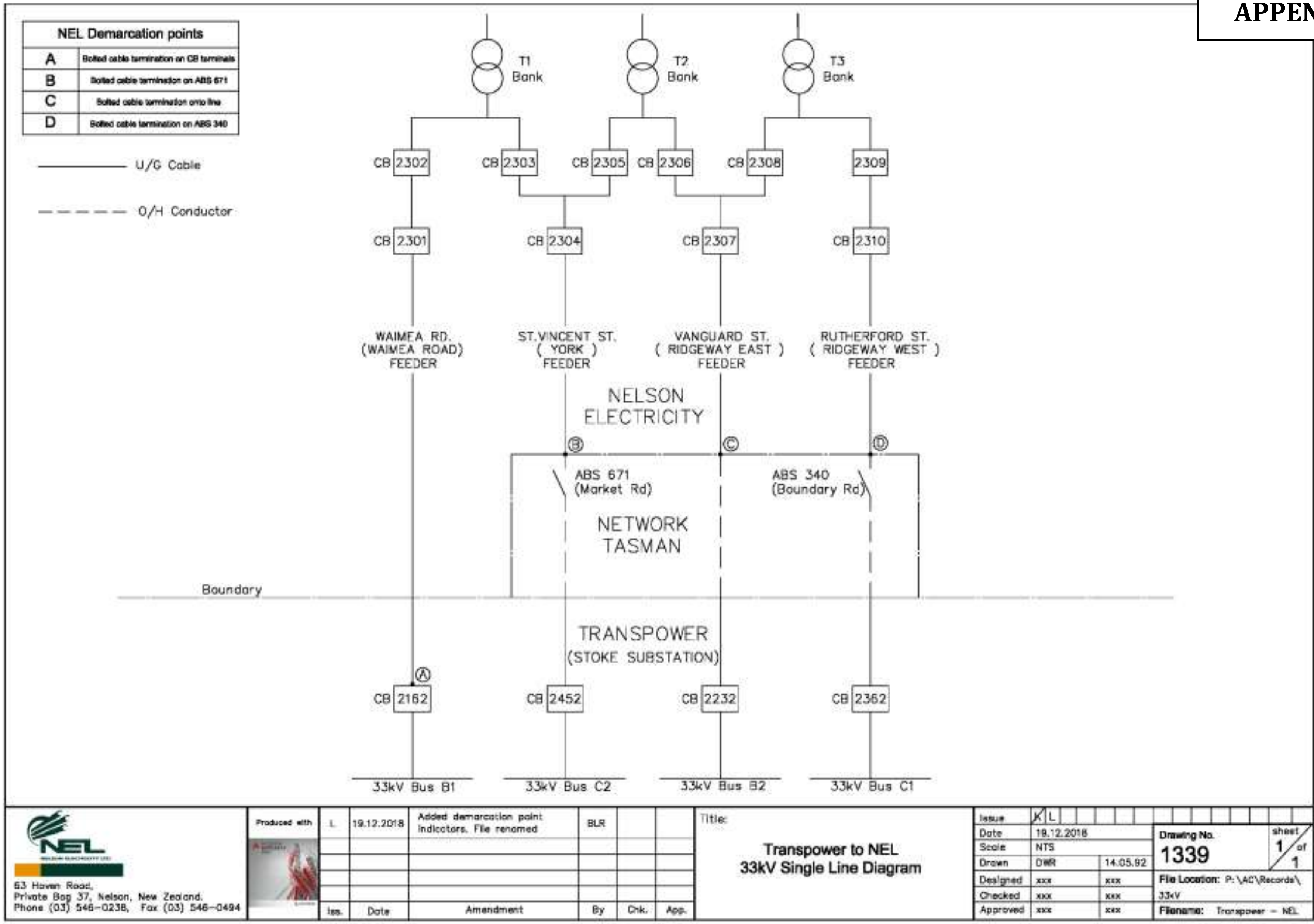
APPENDIX B

NELSON ELECTRICITY NETWORK AREA & 33kV CABLE ROUTES REV B. 2014

NEL - ELECTRICAL LV BOUNDARIES since April 2003

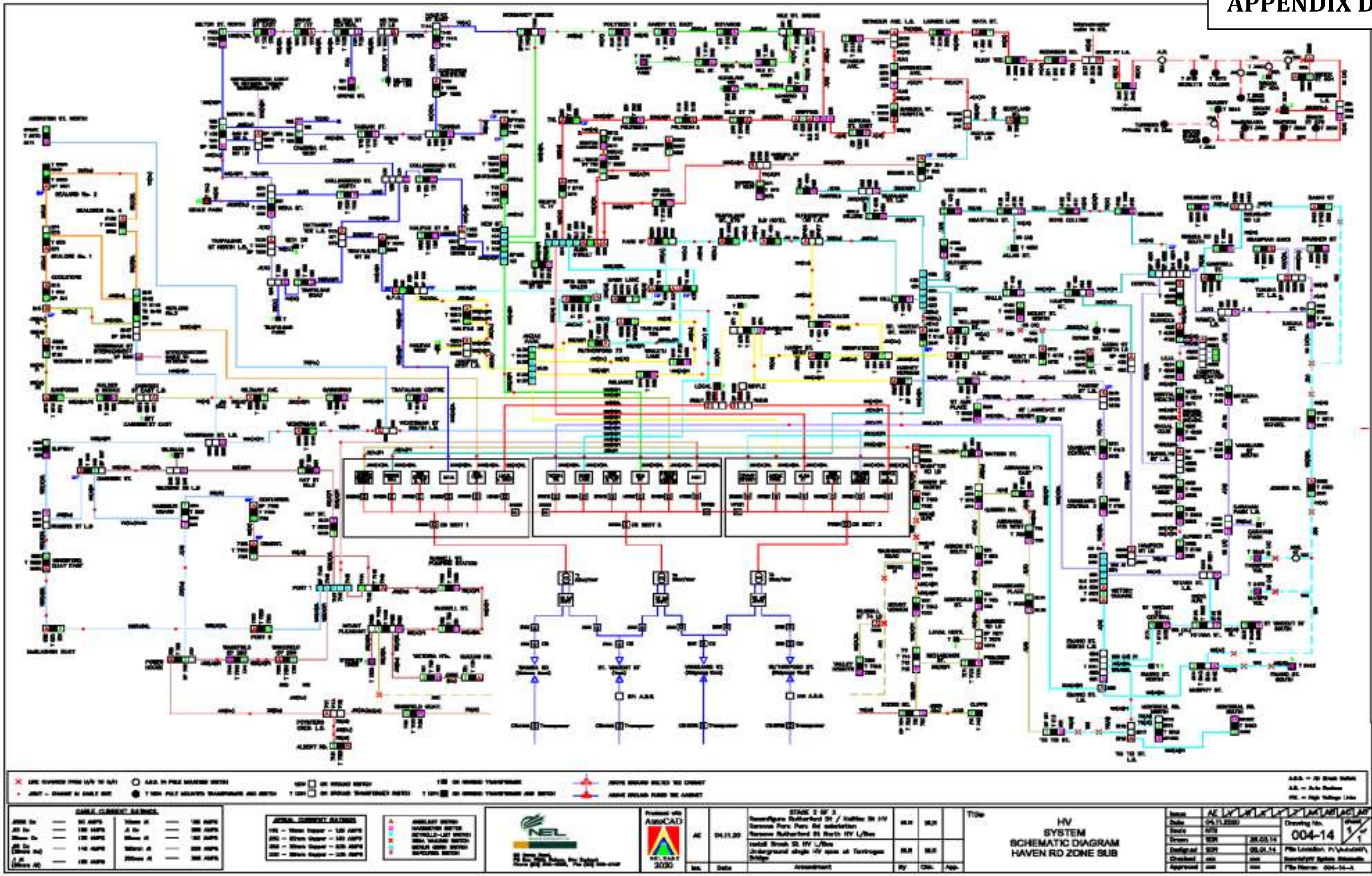
Location	Last Consumer
North Road (East Side)	No 38
North Road (West Side)	No 25
Atawhai Drive (East Side)	No 22
Atawhai Drive (West Side)	No 23A
Maitai Drive (North Side)	Branford Park Ablutions Block
Hanby Park (South Side)	No 26
Upper Brook Street	Brook Camp and Gibbons Quarry
Market Road (North Side)	To Pinewood Way
Waimea Road (East Side)	No 201 - Bowling Club
Waimea Road (West Side)	No 204
Boundary Road	All North Side
Kawai Street (West Side)	No 248
Princes Drive (East Side)	No 187C
Princes Drive (West Side)	No 128
The Cliffs (East Side)	No 35 and then from No 56
The Cliffs (West Side)	No 22 and then from No 53
Rocks Road (East Side)	No 455
Rocks Road (West Side)	No 350
Haulashore Island and Boulder Bank to Lighthouse	Port Area
Akersten Street	To Dixon Basin

APPENDIX C



NEL Demarcation points
A Bolted cable termination on CB terminals
B Bolted cable termination on ABS 671
C Bolted cable termination onto line
D Bolted cable termination on ABS 340
U/G Cable
O/H Conductor
T1 Bank
T2 Bank
T3 Bank
CB 2302
CB 2303
CB 2305
CB 2306
CB 2308
2309
CB 2301
CB 2304
CB 2307
CB 2310
WAIMEA RD. (WAIMEA ROAD) FEEDER
ST.VINCENT ST. (YORK) FEEDER
VANGUARD ST. (RIDGEWAY EAST) FEEDER
RUTHERFORD ST. (RIDGEWAY WEST) FEEDER
NELSON ELECTRICITY
B
C
D
ABS 671 (Market Rd)
ABS 340 (Boundary Rd)
NETWORK TASMAN
Boundary
TRANSPOWER (STOKE SUBSTATION)
A
CB 2162
CB 2452
CB 2232
CB 2362
33kV Bus B1
33kV Bus C2
33kV Bus B2
33kV Bus C1
NEL
63 Haven Road, Private Bag 37, Nelson, New Zealand. Phone (03) 546-0238, Fax (03) 546-0494
Produced with
L 19.12.2018 Added demarcation point indicators. File renamed BLR
Iss. Date Amendment By Chk. App.
Title: Transpower to NEL 33kV Single Line Diagram
Issue K L
Date 19.12.2018
Scale NTS
Drawn DWR 14.05.92
Designed xxx xxx
Checked xxx xxx
Approved xxx xxx
Drawing No. 1339
sheet 1 of 1
File Location: P:\AC\Records\33kV
Filename: Transpower - NEL

APPENDIX D



Company Name	Nelson Electricity Limited
For Year Ended	31 March 2020
Network / Sub-network Name	

SCHEDULE 9a: ASSET REGISTER

This schedule requires a summary of the quantity of assets that make up the network, by asset category and asset class. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref

8	Voltage	Asset category	Asset class	Units	Items at start of year (quantity)	Items at end of year (quantity)	Net change	Data accuracy (1–4)
9	All	Overhead Line	Concrete poles / steel structure	No.	716	716	–	2
10	All	Overhead Line	Wood poles	No.	180	179	(1)	2
11	All	Overhead Line	Other pole types	No.			–	N/A
12	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km			–	N/A
13	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km			–	N/A
14	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km	12	12	0	3
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km			–	N/A
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km			–	N/A
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km	6	6	0	2
18	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km			–	N/A
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km			–	N/A
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km			–	N/A
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km			–	N/A
22	HV	Subtransmission Cable	Subtransmission submarine cable	km			–	N/A
23	HV	Zone substation Buildings	Zone substations up to 66kV	No.	1	1	–	4
24	HV	Zone substation Buildings	Zone substations 110kV+	No.			–	N/A
25	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.			–	N/A
26	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.			–	N/A
27	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.			–	N/A
28	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.			–	N/A
29	HV	Zone substation switchgear	33kV RMU	No.			–	N/A
30	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	10	10	–	4
31	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.			–	N/A
32	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	28	28	–	4
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.			–	N/A
34	HV	Zone Substation Transformer	Zone Substation Transformers	No.	3	3	–	4
35	HV	Distribution Line	Distribution OH Open Wire Conductor	km	7	7	(0)	2
36	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km			–	N/A
37	HV	Distribution Line	SWER conductor	km	–		–	2
38	HV	Distribution Cable	Distribution UG XLPE or PVC	km	26	24	(1)	2
39	HV	Distribution Cable	Distribution UG PILC	km	52	53	2	2
40	HV	Distribution Cable	Distribution Submarine Cable	km			–	N/A
41	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	1	1	–	4
42	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.	42	42	–	4
43	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	30	20	(10)	3
44	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.	47	47	–	2
45	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	260	252	(8)	2
46	HV	Distribution Transformer	Pole Mounted Transformer	No.	12	10	(2)	3
47	HV	Distribution Transformer	Ground Mounted Transformer	No.	191	191	–	3
48	HV	Distribution Transformer	Voltage regulators	No.			–	N/A
49	HV	Distribution Substations	Ground Mounted Substation Housing	No.	188	192	4	3
50	LV	LV Line	LV OH Conductor	km	21	21	(0)	2
51	LV	LV Cable	LV UG Cable	km	174	174	(0)	2
52	LV	LV Street lighting	LV OH/UG Streetlight circuit	km	69	68	(0)	2
53	LV	Connections	OH/UG consumer service connections	No.	9,231	9,272	41	3
54	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	78	79	1	4
55	All	SCADA and communications	SCADA and communications equipment operating as a single syste	Lot	1	1	–	4
56	All	Capacitor Banks	Capacitors including controls	No			–	N/A
57	All	Load Control	Centralised plant	Lot	1	1	–	4
58	All	Load Control	Relays	No			–	N/A
59	All	Civils	Cable Tunnels	km			–	N/A

		4(vii): Disclosure by Asset Category	Subtransmission lines	Subtransmission cables	Zone substations	Distribution and LV lines	Distribution and LV cables	Distribution substations and transformers	Distribution switchgear	Other network assets	Non-network assets	Total
96												
97												
98												
99		**Total opening RAB value**	–	5,310	9,782	634	15,216	4,554	2,487	3,619	333	41,934
100	*less*	Total depreciation		167	258	30	653	161	126	102	33	1,530
101	*plus*	Total revaluations	–	135	248	16	386	115	63	92	8	1,063
102	*plus*	Assets commissioned	–	–	54	73	350	771	525	60	51	1,883
103	*less*	Asset disposals	–	–	–	–	–	–	–	–	–	–
104	*plus*	Lost and found assets adjustments	–	–	–	–	–	–	–	–	–	–
105	*plus*	Adjustment resulting from asset relocations	–	–	–	–	–	–	–	–	–	–
106	*plus*	Asset category transfers	–	–	–	–	–	–	–	–	–	–
107		**Total closing RAB value**	–	5,277	9,825	693	15,298	5,279	2,949	3,667	359	43,349
108												
109		Asset Life										
110		Weighted average remaining asset life	–	32.9	26.9	25.8	21.1	28.0	15.1	20.4	1.9	(years)
111		Weighted average expected total asset life	–	50.4	44.5	57.9	54.3	54.7	39.9	44.6	8.1	(years)

INFORMATION DISCLOSURE COMPLIANCE SCHEDULES (11-14)

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

SCHEDULE 12a: REPORT ON ASSET CONDITION

SCHEDULE 12b: REPORT ON FORECAST CAPCITY

SCHEDULE 12c: REPORT ON FORECAST NETWORK DEMAND

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

SCHEDULE 14a: MANDATORY EXPLANATORY NOTES ON FORECAST INFORMATION

Company Name	**Nelson Electricity Ltd**
AMP Planning Period	**1 April 2021 – 31 March 2031**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

h ref

			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8		for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
9	**11a(i): Expenditure on Assets Forecast**		**$000 (in nominal dollars)**										
10	Consumer connection		3	240	157	102	52	52	53	54	54	55	56
11	System growth		36	110	152	153	155	156	158	161	163	166	168
12	Asset replacement and renewal		807	765	596	933	1,319	978	919	1,115	1,164	1,182	1,199
13	Asset relocations		36	180	51	51	-	-	-	-	-	-	-
14	Reliability, safety and environment:												
15	Quality of supply		317	300	460	291	52	343	338	161	163	221	168
16	Legislative and regulatory			-	-	-	-	-	-	-	-	-	-
17	Other reliability, safety and environment		22	220	162	163	113	31	63	166	169	171	174
18	**Total reliability, safety and environment**		339	520	621	454	165	375	401	327	332	392	342
19	**Expenditure on network assets**		1,221	1,815	1,576	1,693	1,690	1,561	1,532	1,656	1,714	1,795	1,766
20	Expenditure on non-network assets		4	72	78	28	28	80	29	29	84	30	30
21	**Expenditure on assets**		1,225	1,887	1,653	1,721	1,718	1,641	1,560	1,685	1,798	1,825	1,796
22													
23	*plus* Cost of financing												
24	*less* Value of capital contributions		13										
25	*plus* Value of vested assets												
26													
27	**Capital expenditure forecast**		1,212	1,887	1,653	1,721	1,718	1,641	1,560	1,685	1,798	1,825	1,796
28													
29	Assets commissioned		1,212	1,887	1,653	1,721	1,718	1,641	1,560	1,685	1,798	1,825	1,796

30			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
31		for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
32			**$000 (in constant prices)**										
33	Consumer connection		3	240	155	100	50	50	50	50	50	50	50
34	System growth		36	110	150	150	150	150	150	150	150	150	150
35	Asset replacement and renewal		807	765	590	915	1,280	940	870	1,040	1,070	1,070	1,070
36	Asset relocations		36	180	50	50	-	-	-	-	-	-	-
37	Reliability, safety and environment:												
38	Quality of supply		317	300	455	285	50	330	320	150	150	200	150
39	Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
40	Other reliability, safety and environment		22	220	160	160	110	30	60	155	155	155	155
41	**Total reliability, safety and environment**		339	520	615	445	160	360	380	305	305	355	305
42	**Expenditure on network assets**		1,221	1,815	1,560	1,660	1,640	1,500	1,450	1,545	1,575	1,625	1,575
43	Expenditure on non-network assets		4	72	77	27	27	77	27	27	77	27	27
44	**Expenditure on assets**		1,225	1,887	1,637	1,687	1,667	1,577	1,477	1,572	1,652	1,652	1,602
45													
46	**Subcomponents of expenditure on assets (where known)**												
47	Energy efficiency and demand side management, reduction of energy losses												
48	Overhead to underground conversion			120	60	60	60	-	-	-	-	-	-
49	Research and development												

Company Name	**Nelson Electricity Ltd**
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SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref

	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 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
Difference between nominal and constant price forecasts	$000										
Consumer connection	-	-	2	2	2	2	3	4	4	5	6
System growth	-	-	2	3	5	6	8	11	13	16	18
Asset replacement and renewal	-	-	6	18	39	38	49	75	94	112	129
Asset relocations	-	-	1	1	-	-	-	-	-	-	-
Reliability, safety and environment:											
Quality of supply	-	-	5	6	2	13	18	11	13	21	18
Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
Other reliability, safety and environment	-	-	2	3	3	1	3	11	14	16	19
Total reliability, safety and environment	-	-	6	9	5	15	21	22	27	37	37
Expenditure on network assets	-	-	16	33	50	61	82	111	139	170	191
Expenditure on non-network assets	-	-	1	1	1	3	2	2	7	3	3
Expenditure on assets	-	-	16	34	51	64	83	113	146	173	194

11a(ii): Consumer Connection

	Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
*Consumer types defined by EDB**	$000 (in constant prices)					
Group 2	3	240	155	100	50	50
**include additional rows if needed*						
Consumer connection expenditure	3	240	155	100	50	50
less Capital contributions funding consumer connection						
Consumer connection less capital contributions	3	240	155	100	50	50

11a(iii): System Growth

	Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
Subtransmission		-	-	-	-	-
Zone substations		-	-	-	-	-
Distribution and LV lines		-	-	-	-	-
Distribution and LV cables		-	-	-	-	-
Distribution substations and transformers	36	95	45	50	50	50
Distribution switchgear		-	-	-	-	-
Other network assets		15	105	100	100	100
System growth expenditure	36	110	150	150	150	150
less Capital contributions funding system growth						
System growth less capital contributions	36	110	150	150	150	150

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SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

11a(iv): Asset Replacement and Renewal

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
91–92	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
93		**$000 (in constant prices)**					
94	Subtransmission		-	-	-	-	-
95	Zone substations		-	-	-	-	-
96	Distribution and LV lines	122	-	-	85	60	-
97	Distribution and LV cables	154	670	495	770	850	670
98	Distribution substations and transformers	12	-	-	-	-	-
99	Distribution switchgear	364	-	-	-	275	-
100	Other network assets	155	95	95	60	95	270
101	**Asset replacement and renewal expenditure**	807	765	590	915	1,280	940
102	*less* Capital contributions funding asset replacement and renewal						
103	**Asset replacement and renewal less capital contributions**	807	765	590	915	1,280	940
104							

11a(v): Asset Relocations

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
105–106	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
108	*Project or programme**	**$000 (in constant prices)**					
109	Relocate AMP substation (programme)	36	20	-	-	-	-
110	Relocate New South Wales substation (programme)		20	50	50	-	-
111	Relocate Wakefield Quay mini substation		70	-	-	-	-
112	Konini St - Replace O/H sub with GM		70				
113							
114	**include additional rows if needed*						
115	All other project or programmes - asset relocations						
116	**Asset relocations expenditure**	36	180	50	50	-	-
117	*less* Capital contributions funding asset relocations						
118	**Asset relocations less capital contributions**	36	180	50	50	-	-
119							

11a(vi): Quality of Supply

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
120–121	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
123	*Project or programme**	**$000 (in constant prices)**					
124	Emano St North Tripping VCB		250				
125	LV Network Monitoring		50	50	50		
126	Other Quality of supply projects	317		405	235	50	330
127							
128							
129							
130							
131	Q **include additional rows if needed*						
132	*less* All other projects or programmes - quality of supply						
133	**Quality of supply less capital contributions**	317	300	455	285	50	330
134	Capital contributions funding quality of supply						
135		317	300	455	285	50	330

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SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref

11a(vii): Legislative and Regulatory

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26
*Project or programme**	$000 (in constant prices)					
Le **include additional rows if needed*						
less All other projects or programmes - legislative and regulatory						
Legislative and regulatory less capital contributions	-	-	-	-	-	-
Capital contributions funding legislative and regulatory						
	-	-	-	-	-	-

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 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26
*Project or programme**	$000 (in constant prices)					
Other	22	100	100	100	50	30
O/H to U/G		120	60	60	60	-
O **include additional rows if needed*						
less All other projects or programmes - other reliability, safety and environment						
Other reliability, safety and environment less capital contributions	22	220	160	160	110	30
Capital contributions funding other reliability, safety and environment						
	22	220	160	160	110	30

11a(ix): Non-Network Assets

Routine expenditure	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26
*Project or programme**	$000 (in constant prices)					
Safety equipment		5				
Misc	4	25	25	25	25	25
Office Equipment		2	2	2	2	2
Computers			50			20
Vehicles		40	-			30
Ro **include additional rows if needed*						
Atyp All other projects or programmes - routine expenditure						
	4	72	77	27	27	77
*Project or programme**						
At **include additional rows if needed*						
All other projects or programmes - atypical expenditure						
Expenditure on non-network assets	-	-	-	-	-	-
	4	72	77	27	27	77

Company Name	**Nelson Electricity Ltd**
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SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions and emergencies	60	135	138	140	143	146	149	152	155	158	161
11	Vegetation management	33	38	39	40	40	41	42	43	44	45	45
12	Routine and corrective maintenance and inspection	250	253	258	263	268	274	279	285	291	296	302
13	Asset replacement and renewal	340	357	364	371	379	386	394	402	410	418	427
14	**Network Opex**	683	783	799	815	831	848	864	882	899	917	936
15	System operations and network support	250	258	263	268	274	279	285	291	296	302	308
16	Business support	1,205	1,185	1,209	1,233	1,258	1,283	1,308	1,335	1,361	1,388	1,416
17	**Non-network opex**	1,455	1,443	1,472	1,501	1,531	1,562	1,593	1,625	1,658	1,691	1,725
18	**Operational expenditure**	2,138	2,226	2,271	2,316	2,362	2,409	2,458	2,507	2,557	2,608	2,660
19		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
20	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
21		**$000 (in constant prices)**										
22	Service interruptions and emergencies	60	135	135	135	135	135	135	135	135	135	135
23	Vegetation management	33	38	38	38	38	38	38	38	38	38	38
24	Routine and corrective maintenance and inspection	250	253	253	253	253	253	253	253	253	253	253
25	Asset replacement and renewal	340	357	357	357	357	357	357	357	357	357	357
26	**Network Opex**	683	783	783	783	783	783	783	783	783	783	783
27	System operations and network support	250	258	258	258	258	258	258	258	258	258	258
28	Business support	1,205	1,185	1,185	1,185	1,185	1,185	1,185	1,185	1,185	1,185	1,185
29	**Non-network opex**	1,455	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443
30	**Operational expenditure**	2,138	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226
31	**Subcomponents of operational expenditure (where known)**											
32–33	Energy efficiency and demand side management, reduction of energy losses											
34	Direct billing*											
35	Research and Development											
36	Insurance											
37	** Direct billing expenditure by suppliers that direct bill the majority of their consumers*											
38												
39		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
40	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**	**31 Mar 31**
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	-	3	5	8	11	14	17	20	23	26
43	Vegetation management	-	-	1	2	2	3	4	5	6	7	7
44	Routine and corrective maintenance and inspection	-	-	5	10	15	21	26	32	38	43	49
45	Asset replacement and renewal	-	-	7	14	22	29	37	45	53	61	70
46	**Network Opex**	-	-	16	32	48	65	81	99	116	134	153
47	System operations and network support	-	-	5	10	16	21	27	33	38	44	50
48	Business support	-	-	24	48	73	98	123	150	176	203	231
49	**Non-network opex**	-	-	29	58	88	119	150	182	215	248	282
50	**Operational expenditure**	-	-	45	90	136	183	232	281	331	382	434

			Company Name	Nelson Electricity Ltd
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SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref												
7					Asset condition at start of planning period (percentage of units by grade)							
8												% of asset forecast to be replaced in next 5 years
9	Voltage	Asset category	Asset class	Units	H1	H2	H3	H4	H5	Grade unknown	Data accuracy (1–4)	
10	All	Overhead Line	Concrete poles / steel structure	No.			5%	75%	20%		4	1.00%
11	All	Overhead Line	Wood poles	No.			15%	85%			4	1.00%
12	All	Overhead Line	Other pole types	No.							N/A	
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km							N/A	
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km							N/A	
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km				100%			3	
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km							N/A	
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km							N/A	
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km			50%	50%			3	
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km							N/A	
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km							N/A	
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km							N/A	
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km							N/A	
23	HV	Subtransmission Cable	Subtransmission submarine cable	km							N/A	
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.					100%		4	
25	HV	Zone substation Buildings	Zone substations 110kV+	No.							N/A	
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.					100%		4	
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.							N/A	
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.							N/A	
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.							N/A	
30	HV	Zone substation switchgear	33kV RMU	No.							N/A	
31	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.							N/A	
32	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.							N/A	
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.					100%		4	
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.							N/A	
35												

36					Asset condition at start of planning period (percentage of units by grade)							
37												
38	Voltage	Asset category	Asset class	Units	H1	H2	H3	H4	H5	Grade unknown	Data accuracy (1–4)	% of asset forecast to be replaced in next 5 years
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.					100%		4	
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km				78%	22%		3	
41	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km							N/A	
42	HV	Distribution Line	SWER conductor	km							N/A	
43	HV	Distribution Cable	Distribution UG XLPE or PVC	km		10%	10%	65%	15%		2	10.00%
44	HV	Distribution Cable	Distribution UG PILC	km		2%	58%	40%			2	1.00%
45	HV	Distribution Cable	Distribution Submarine Cable	km							N/A	
46	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.				100%			4	
47	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.			16%	-	84%		4	16.00%
48	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.				100%			3	40.00%
49	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.				100%			3	
50	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.		5%	5%	40%	50%		3	5.00%
51	HV	Distribution Transformer	Pole Mounted Transformer	No.			4%	96%			3	1.00%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.			9%	74%	17%		3	1.00%
53	HV	Distribution Transformer	Voltage regulators	No.							N/A	
54	HV	Distribution Substations	Ground Mounted Substation Housing	No.				80%	20%		3	
55	LV	LV Line	LV OH Conductor	km				100%			3	
56	LV	LV Cable	LV UG Cable	km			20%	60%	20%		2	
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km			30%	60%	10%		2	
58	LV	Connections	OH/UG consumer service connections	No.			10%	50%	40%		3	
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.					100%		3	
60	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot				10%	90%		3	
61	All	Capacitor Banks	Capacitors including controls	No.							N/A	
62	All	Load Control	Centralised plant	Lot					100%		4	
63	All	Load Control	Relays	No.							N/A	
64	All	Civils	Cable Tunnels	km							N/A	

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SCHEDULE 12b: REPORT ON FORECAST CAPACITY

This schedule requires a breakdown of current and forecast capacity and utilisation for each zone substation and current distribution transformer capacity. The data provided should be consistent with the information provided in the AMP. Information provided in this table should relate to the operation of the network in its normal steady state configuration.

sch ref

7 **12b(i): System Growth - Zone Substations**

sch ref	*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
8										
9	Haven Road Zone Substation	35	48	N-1	4	73%	48	71%	[Select one]	
10						-			[Select one]	
11						-			[Select one]	
12						-			[Select one]	
13						-			[Select one]	
14						-			[Select one]	
15						-			[Select one]	
16						-			[Select one]	
17						-			[Select one]	
18						-			[Select one]	
19						-			[Select one]	
20						-			[Select one]	
21						-			[Select one]	
22						-			[Select one]	
23						-			[Select one]	
24						-			[Select one]	
25						-			[Select one]	
26						-			[Select one]	
27						-			[Select one]	
28						-			[Select one]	

29 *[1] Extend forecast capacity table as necessary to disclose all capacity by each zone substation*

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AMP Planning Period	**1 April 2021 – 31 March 2031**

SCHEDULE 12C: REPORT ON FORECAST NETWORK DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

sch ref							
7	**12c(i): Consumer Connections**						
8	*Number of ICPs connected in year by consumer type*				**Number of connections**		
9		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
10	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
11	*Consumer types defined by EDB**						
12	Load Group 0 (Unmetered and Builders Temporary)	3	-	-	-	-	-
13	Load Group 1 (Low User)	27	24	24	24	24	24
14	Load Group 2 (Mass Market - Residential)	23	20	20	20	20	20
15	Load Group 2 (Mass Market - Business)	11	15	15	15	15	15
16	Load Group 3 (Time of Use)	1	1	1	1	1	1
17	**Connections total**	65	60	60	60	60	60
18	**include additional rows if needed*						
19	**Distributed generation**						
20	Number of connections	17	60	90	120	160	180
21	Capacity of distributed generation installed in year (MVA)	0.1	0.2	0.2	0.3	0.4	0.5
22	**12c(ii) System Demand**						
23		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
24	**Maximum coincident system demand (MW)** — for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
25	GXP demand	33	33	33	33	33	33
26	*plus* Distributed generation output at HV and above	-	-	-	-	-	-
27	**Maximum coincident system demand**	33	33	33	33	33	33
28	*less* Net transfers to (from) other EDBs at HV and above						
29	**Demand on system for supply to consumers' connection points**	33	33	33	33	33	33
30	**Electricity volumes carried (GWh)**						
31	Electricity supplied from GXPs	145	145	145	145	145	145
32	*less* Electricity exports to GXPs	-	-	-	-	-	-
33	*plus* Electricity supplied from distributed generation	0	0	0	1	1	1
34	*less* Net electricity supplied to (from) other EDBs	-	-	-	-	-	-
35	**Electricity entering system for supply to ICPs**	145	145	145	145	145	145
36	*less* Total energy delivered to ICPs	140	140	140	140	140	140
37	**Losses**	5	5	5	5	5	5
38							
39	**Load factor**	50%	50%	50%	50%	50%	50%
40	**Loss ratio**	3.6%	3.5%	3.5%	3.5%	3.5%	3.6%

Company Name	**Nelson Electricity Ltd**
AMP Planning Period	**1 April 2021 – 31 March 2031**
Network / Sub-network Name	

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned and unplanned SAIFI and SAIDI on the expenditures forecast provided in Schedule 11a and Schedule 11b.

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
9	for year ended	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	11.5	15.0	15.0	15.0	15.0	15.0
12	Class C (unplanned interruptions on the network)	0.6	30.0	30.0	30.0	30.0	30.0
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.03	0.30	0.30	0.30	0.30	0.30
15	Class C (unplanned interruptions on the network)	0.01	0.60	0.60	0.60	0.60	0.60