# Asset Management Plan
# 1st April 2018 – 31st March 2028

Approved by Electra Board: 29th March 2018
Direct enquiries to: General Manager - Lines Business

# 0. Summary

## 0.1 Chief executive's introductory remarks

I am pleased to present Electra's AMP for March 2018, which sets out our asset investment plans for the next 10 years. The over-arching themes and initiatives of this AMP include…

**Connecting more closely with our customers**

We are giving increasing attention to improving customer experience, extending beyond our traditional asset investment focus on the core price-reliability aspect of customer experience through to wider process-based aspects such as real-time communication of network status and reliability, more flexible pricing options, consultation on price and reliability possibilities, technical advice and assistance with lines owned by customers. The ADMS successfully commissioned in 2017 has formed an important foundation for our plans.

**Maintaining our current mix of high reliability and low costs**

Electra's weighted average reliability and cost performance over the last 5 years has been within the best quartile of EDB performance as follows:

| Parameter | Value | National positioning |
|---|---|---|
| Unplanned reliability (SAIDI minutes) | 76.6 | Within top (best) quartile |
| Capex per customer | $238 | Within lowest (best) quartile |
| Opex per customer | $243 | Within lowest (best) quartile |

Source – Commerce Commission public tableau analysis of disclosure information, "all years (2013-17)" option selected.

Our network continues to be one of the most reliable networks in New Zealand. However, our network remains susceptible to severe weather events. While the focus is on renewal and replacement, we also expect the programme to result in a concurrent improvement in underlying reliability for our customers by installing devices that can provide and act on the increasing amount of data that will be available. The increased availability and application of data and technology will also enhance our ability to respond to changing customer expectations.

**Confirmation that network capacity is adequate for virtually all foreseeable demand growth**

Forecasted demand is not expected to exceed firm (n-1) capacity at any of our zone substations. Shannon is the only substation close to being loaded to near its firm (n-1) capacity. Load growth at Shannon is static, and in any case load can transferred to other substation by switching on the 11kV.Hence most of our growth Capex will be focused on LV and 11kV, mostly in conjunction with renewals.

**Recognition that emerging technologies present both challenges and opportunities to our business**

Our current business model is based on a mix of fixed and variable revenue streams that recover costs that are almost totally fixed. The location, magnitude and timing of the electricity demand and injections from emerging technologies such as LED streetlighting, electric vehicles, solar panels and batteries could upset the resulting mix of revenues and costs. We are examining these developments closely and working on strategies to embrace the change.

This AMP is an important and evolving document and your feedback is welcome. Our General Manager – Lines Business and I would be happy to hear from you.

Kind regards
Neil Simmonds
Chief Executive

# 0.2 Key themes of this AMP

The key themes of this AMP for the period 1st April 2018 to 31st March 2028 are…

- Continuation of the simplification introduced in the 2017 AMP layout bringing outcomes and reasoning to the fore, while including supporting information on strategy and process in appendices.

- Improve network controllability, monitoring and network reliability through:
    - Introduction and installation of more automated switches and sensors at strategic network points. This will improve customer experiences and provide key network data to improve future asset investment decisions. (This data will improve the accuracy of the engineering model in the ADMS).
    - Continuing deployment of feeder interconnectivity and self-healing schemes.
    - Improve network sectionalisation by unbundling looped transformers in southern network.
- Targeted improvements in network resilience:
    - At sub transmission level by focussing beyond SAIFI & SAIDI to network availability and formation of plans to reduce network element outages (distance to fault, hazardous tree program, standardise the protection schemes applied to sub transmission).
    - Seismic assessment and strengthening of zone substation buildings and structures.

- Safety and network performance improvements through:
    - Continuation of a risk based replacement program for pitch filled metallic cable terminations, metal link pillar boxes, deck mounted transformers and oil switches.
    - A strategic project to enhance vegetation management; defining performance improvement and cost reduction targets to be achieved over the next five years. This will build on the operational and tactical achievements since vegetation cut and trim works were brought in house delivery.

- A medium to long-term focus on meeting isolated pockets of demand growth.

- The continued implementation of the Advanced Distribution Management System during 2018/19 that will provide state estimation at an LV level and will provide insights on LV power flows, quality and interruptions.

- Further development of cost reflective price options.

- Issues on Electra's watch list include uptake of solar and batteries, and the impact of energy efficient street lighting on kWh revenue for that sector.

# 0.3 Material projects

Material projects for the planning period include:

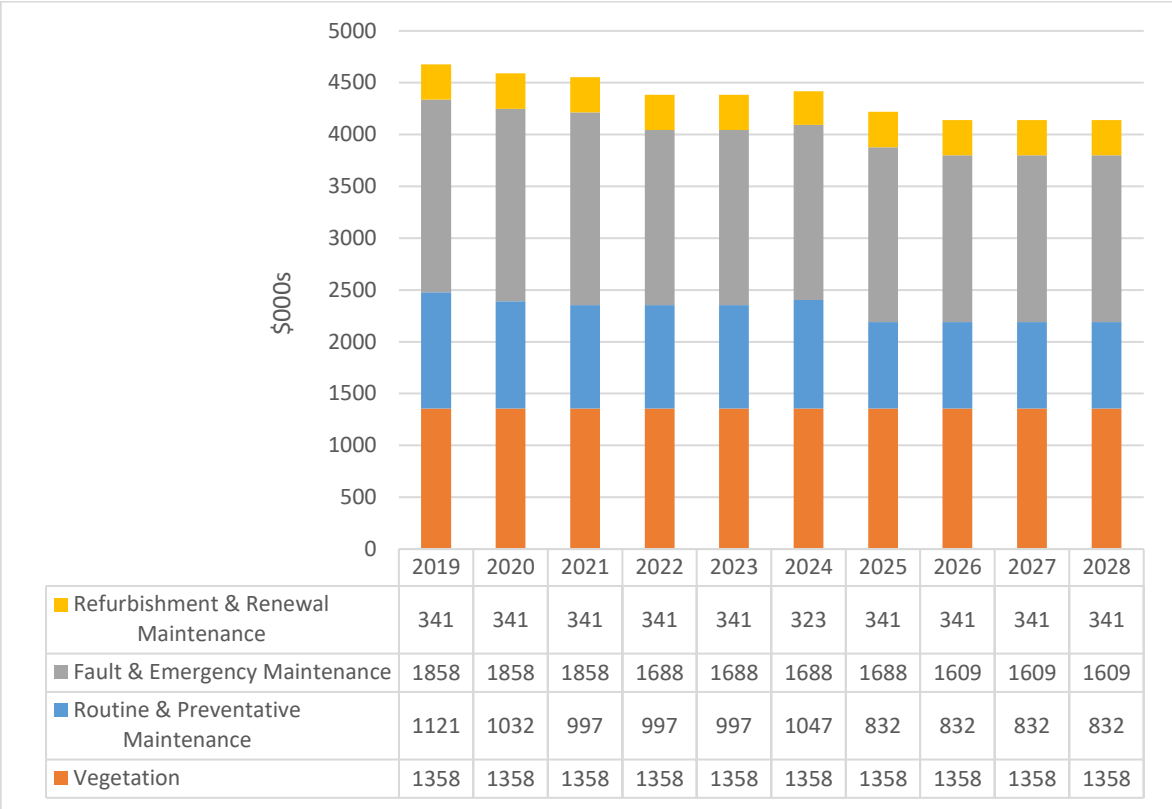
| Description | Main Driver | Proposed timing | Expected cost |
|---|---|---|---|
| Raumati 11kV north half switchgear replacement | Asset Renewal | 2019 | $450,000 |
| Relocate PRM-RAUMATI 33kV cable away from landslip | Quality of Supply | 2019 | $900,000 |
| Protection Upgrades | Quality of Supply | 2019-2022 | $2,600,000 |
| Seismic upgrade of Zone Substation buildings. | Quality of Supply | 2019-2022 | $700,000 |
| Replace 11kV switchgear Paekakariki substation | Asset Renewal | 2020 | $327,000 |
| Upgrade Mangahao to Levin East 33kV circuit. | Asset Renewal | 2021-2024 | $2,620,000 |
| Foxton to Levin West line section upgrade | Growth | 2021-2024 | $1,839,000 |
| Rebuild Raumati Zone Substation | Asset Renewal | 2023-2026 | $2,657,500 |
| Levin West to Levin East 33kV line section upgrade | Growth | 2025 | $613,000 |
| Build Waikawa rural substation | Growth | 2026-2027 | $1,272,000 |

# 0.4 Forecast expenditure

Projected capital expenditure drivers over the next 10 years are expected to be 8.9% of total for growth, 18.9% of total for reliability, safety and environment and 72.2% of total for renewal and replacement work.

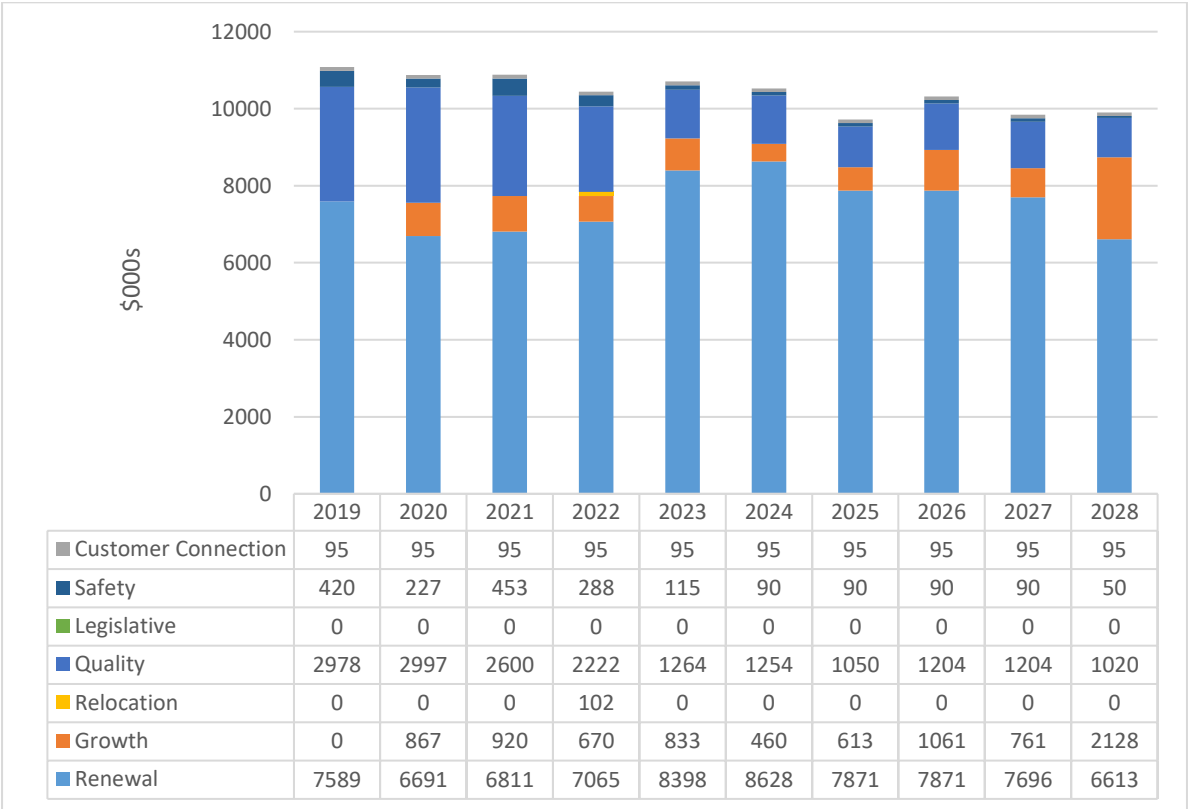
Capital costs are expected to average $10.4m per year over the next 10 years while operational costs are expected to average $4.36m per year over the same period. Major change in projected Opex from previous year is predominantly due to new rules around related party transactions. Electra has the flexibility to adjust this investment if growth accelerates beyond our expectations. The expenditure forecast is based on 2018 constant dollars.

## Summary Opex forecast (year ending 31st March)




| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| Refurbishment & Renewal Maintenance | 341 | 341 | 341 | 341 | 341 | 323 | 341 | 341 | 341 | 341 |
| Fault & Emergency Maintenance | 1858 | 1858 | 1858 | 1688 | 1688 | 1688 | 1688 | 1609 | 1609 | 1609 |
| Routine & Preventative Maintenance | 1121 | 1032 | 997 | 997 | 997 | 1047 | 832 | 832 | 832 | 832 |
| Vegetation | 1358 | 1358 | 1358 | 1358 | 1358 | 1358 | 1358 | 1358 | 1358 | 1358 |

## Summary Capex forecast (year ending 31st March)




| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| Customer Connection | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| Safety | 420 | 227 | 453 | 288 | 115 | 90 | 90 | 90 | 90 | 50 |
| Legislative | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Quality | 2978 | 2997 | 2600 | 2222 | 1264 | 1254 | 1050 | 1204 | 1204 | 1020 |
| Relocation | 0 | 0 | 0 | 102 | 0 | 0 | 0 | 0 | 0 | 0 |
| Growth | 0 | 867 | 920 | 670 | 833 | 460 | 613 | 1061 | 761 | 2128 |
| Renewal | 7589 | 6691 | 6811 | 7065 | 8398 | 8628 | 7871 | 7871 | 7696 | 6613 |

# Contents

# 1. Background, context & objectives

## 1.1 Purpose statement

This AMP documents Electra's governance and management framework, applying Electra's asset management thinking, systems and processes to develop and deliver work programs aimed at achieving intended customer and community experience of supply reliability, pricing and safety.

The format and data content of this plan is presented to facilitate comparative and longitudinal benchmarking and is consistent with the requirements of the Electricity Distribution Information Disclosure Determination 2012.

## 1.2 Mission & vision

Electra's mission is to…

**Enhance the region's development through the provision of 21st Century infrastructure.**

More specifically, this AMP sets out how Electra will build, operate and maintain infrastructure to maximise long-term value for consumers and owners through competitive prices and quality services with safe and efficient operations.

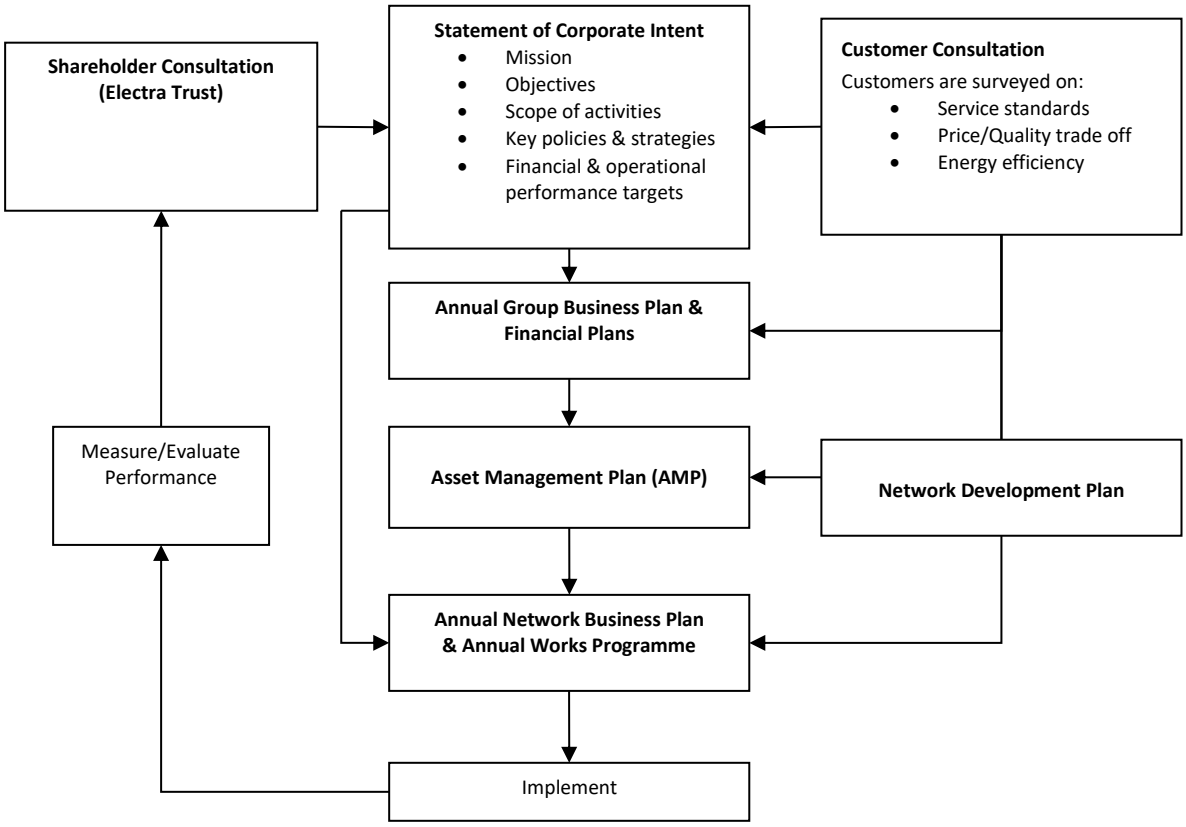
## 1.3 Key plans and documents

Electra's key plans and documents include…

| Document title | Purpose |
|---|---|
| Statement of Corporate Intent | Articulates key strategies, governance philosophy, scope of activities and high-level goals of business performance and customer experience.SCI is approved by Trust as the owner of the company. |
| Group strategic plan | Consolidates the strategic plans of Electra's subsidiaries into a coordinated Group plan. |
| Asset management plan | Connects management of long-life assets to Electra's strategic direction. |
| Annual group business plan and financial plans | Presents the tactical plans for the year ahead, and allocates resources. |
| Annual network business plan and annual works program | Define detail of specific works on a 12-month basis. |

# 1.4 Relationships between plans and documents

The relationship between Electra's key plans and documents is as follows…




# 1.5 Linkages between planning goals

The above sub-chapters emphasise the line-of-sight and progressive refinement Electra's approach from strategic goals to tactical to operational plans. This is complemented by a small and close working environment.

# 1.6 Planning period

The planning period for this AMP is 1st April 2018 to 31st March 2028. The AMP embodies 3 levels of increasing certainty for nearer term plans.

| Period | Scope | Cost | Timing |
|---|---|---|---|
| 1st April 2018 – 31st March 2019 | Firm, approved in principle | ±5% | Quarter / month |
| 1st April 2019 – 31st March 2023 | Major components | ±10% | Quarter |
| 1st April 2023 – 31st March 2028 | Indicative | ±25% | Year |

# 1.7 Board approval

This AMP was submitted in draft to the February Board meeting to allow for inclusion of the Board's comments before final approval on 29th March 2018.

# 1.8 Stakeholder interests

Electra defines its stakeholders as any person or organisation who effects or is affected by Electra's business.

## 1.8.1 Stakeholder interests and how they are identified

Electra defines its stakeholders as any person, class of persons or organization that does or may do one or more of the following:

- Have a financial interest in Electra (be it equity or debt);
- Be physically connected to Electra's network (a customer);
- Uses Electra's network for conveying electricity;
- Supplies Electra with goods or services;
- Is affected by the existence, nature or condition of Electra's network (especially if it is in an unsafe condition); or
- Has a statutory obligation to perform an activity in relation to the network's existence (such as request disclosure data or regulate the location of assets).

Electra has identified the following specific stakeholder interests.

| Stakeholder | Key Stakeholder Interests | | | | How those interests are identified |
|---|---|---|---|---|---|
| | Viability | Supply Quality | Safety | Compliance | |
| Electra Trust | ✓ | ✓ | ✓ | | • Statement of Corporate Intent<br>• Quarterly briefings<br>• Informal discussions with the Board and Chief Executive. |
| Bankers | ✓ | | | | • Terms and conditions of financing arrangements<br>• Quarterly meetings<br>• General negotiations. |
| Connected customers | ✓ | ✓ | ✓ | | • Enquiries via 0800 phone number and website enquiry section<br>• Questions and comments at AGM<br>• Customer survey responses<br>• Community gossip<br>• Media comment. |
| Energy retailers | ✓ | ✓ | | | • Negotiation of terms and conditions<br>• Pricing amendments<br>• Regular meetings<br>• Informal communication<br>• Resolution of billing disputes. |
| Mass-market representative groups | ✓ | ✓ | | | • AGM<br>• Feedback from interest groups. |

| | | | | | |
|---|---|---|---|---|---|
| Industry representative groups | ✓ | ✓ | | | • Annually via meetings and conferences. |
| Staff & contractors | ✓ | ✓ | ✓ | ✓ | • Weekly staff meeting<br>• Monthly contractor meetings<br>• As required for specific projects<br>• General workplace interactions<br>• Performance appraisals. |
| Suppliers of goods & services | ✓ | | | | • General interactions during service deliveries<br>• Price and volume negotiations. |
| Public (as distinct from customers) | | | ✓ | | • As required via 0800 phone number and website enquiry section<br>• General interactions. |
| Land owners | | | ✓ | ✓ | • As required for specific projects. |
| Councils (excluding as a consumer) | | | ✓ | ✓ | • Monthly Emergency Management meeting<br>• Annual planning disclosure<br>• As required for specific projects<br>• During and after drills and actual events. |
| Land Transport | | | ✓ | ✓ | • Reading of bulletins<br>• Meetings to discuss specific projects. |
| Ministry of Business Innovation & Employment | | | ✓ | ✓ | • Reading of bulletins<br>• Attending seminars<br>• Responding to consultations. |
| Energy Safety Service | | | ✓ | ✓ | • Reading of bulletins<br>• general interaction around safety requirements<br>• Incident investigations. |
| Commerce Commission | ✓ | ✓ | | ✓ | • Reading bulletins and determinations<br>• Attending seminars and workshops<br>• Complying with determinations and disclosure requirements. |
| Electricity Authority | | | | ✓ | • Reading bulletins and determinations<br>• Attending seminars and workshops<br>• Complying with Code requirements. |
| Utilities Disputes | | ✓ | | ✓ | • Reading bulletins, responding to complaint investigations. |
| Ministry of Consumer Affairs | | ✓ | | ✓ | • Reading bulletins<br>• Responding to complaint investigations. |
| Transpower | ✓ | ✓ | ✓ | ✓ | • Quarterly updates<br>• Annual planning meetings<br>• General interactions about grid connections<br>• Discussions about specific grid connection issues such as price and capacity. |

## 1.8.2 Linking stakeholder interests to asset management practices

Electra's stakeholder interests are linked to its asset management practices as follows…

| | | |
|---|---|---|
| Safety | ➔ | • Electra keeps the public at large safe by keeping all above-ground assets structurally sound, live conductors are well out of reach, all enclosures are secure, and all exposed metal is earthed.<br>• Electra's Safety Management System (SMS) provides a structured approach to maintaining public safety.<br>• Electra maintains safety of its staff and contractors by providing all necessary equipment, improving safe work practices, and stopping work in unsafe conditions.<br>• Motoring safety is assisted by placing above-ground structures as far as practically possible from the carriage way within the constraints of private land and road reserve. |
| Supply quality | ➔ | • Electra will accommodate its stakeholders' needs for supply quality by focussing resources on continuity and restoration. Many of the renewal jobs discussed in this AMP are aimed at maintaining Electra's security of supply. Electra's most recent mass-market survey (February 2017) indicated a general satisfaction with the present supply quality. |
| | | • Electra will accommodate its stakeholders' needs for long-term viability by delivering earnings that are sustainable and reflect an appropriate risk-adjusted return on capital employed. In general terms this will need to be at least as good as Electra's owners could obtain from a term |

| | | |
|---|---|---|
| Viability | ➔ | deposit at the bank plus a margin to reflect the risks to capital in an increasingly regulated lines sector.<br>• Price is the key to viability, but must be managed to be in line with similar network companies and to provide a satisfactory discount to Electra's consumer/owners. |
| Compliance | ➔ | • Electra ensure that all safety issues are adequately documented and available for inspection by authorised agencies as well as for learning by its own staff and contractors.<br>• Electra discloses performance information in a timely and compliant fashion. |

### 1.8.3 Managing conflicting stakeholder interests

Stakeholder interests will be managed in the following order of priority…

1. Safety of the public, Electra's staff and contractors. This will be achieved for new works by developing design and construction options through the application of Safety in Design principles, and by routine inspection and hazard assessments during the assets operating life.

2. Customer's requirements for a reliable and efficient energy supply will be given second priority.

3. Non-safety compliance.

4. Viability.

## 1.9 Accountabilities for asset management

### 1.9.1 Accountability at governance level

Accountability at the governance level is by two mechanisms…

- Electra's Board are accountable to the Electra Trust via the Statement of Corporate Intent.

- The Electra Trust are accountable to the connected consumers through the Trustee elections.

### 1.9.2 Accountability at management level

Accountability at management level is primarily through the performance criteria set out in employment contracts and achievement of planning goals.

- The Chief Executive is accountable to the Board.

- The General Manager – Lines Business is accountable to the Chief Executive.

- There are four managers accountable to the General Manager – Lines Business.

### 1.9.3 Accountability at field operations level

Accountability at field operations level is primarily with the Program Manager and the Service Delivery Manager for overall delivery of work packages.

## 1.9.4 Summary of roles, delegated authorities & reporting

The roles, delegated authorities and reporting are summarised as follows…

| Activity | Board | Chief Executive | GM – Lines Business |
|---|---|---|---|
| Preparing Statement of Corporate Intent | Key role in preparing and amending under instruction from the Trust. | Key role under direct delegation from the Board. | Consulted for contribution. |
| Role with Strategic Plan | Some input, key role is approving. | Preparation, submit to Board for approval. | Contributes together with the Executive Team. |
| Role with Asset Management Plan | Approval. | Provide strategic direction, submit to Board for approval. | Preparation. |
| Role with Annual Business Plan | Approval. | Preparation. | Preparation. |
| Approval of works from approved budget | In excess of Chief Executive's authority. | In excess of GM – Lines Business authority ($1,000,000). | In excess of Lines Business Managers' authorities ($200,000). |
| Approval of works not from approved budget | In excess of Chief Executive's authority. | In excess of GM – Lines Business authority ($100,000) | In excess of Lines Business Managers' authorities ($50,000). |
| Reviewing performance of works and projects | Noting progress of projects over $500,000 or that are strategically significant. | Notes progress of all works programs and significant projects | Responsible for detailed oversight of all works programs. |
| Reporting of outages | Summary included in monthly Board reports. | Summary included in monthly Board reports. | Receives a report of incidents, causes and follow up actions. |

## 1.9.5 Use of external contractors and advisers

Electra uses a range of external contractors and advisers in the following circumstances:

- Where specific expertise is required.
- Where additional resourcing is required due to temporary overflow of requirement.
- Where an independent viewpoint is required (typically by a statutory agency).

Electra's preference is to retain frequently required core expertise in-house, and to use external advisers or contractors for work that is encountered infrequently or backfilling extended vacancies or efficiently providing commoditised services. Parties contracted for work directly by Electra include:

- ICONA Ltd of Ashurst who are contracted to maintain SCADA and Control Centre radio communications. ICONA provide similar specialised support for a few other EDB's
- Eagle Technology of Wellington for GIS support for the ESRI system used by several other EDB's and Local Authorities.
- Sandfield SQL database provisioning.
- Utility Consultants of Hamilton for asset management strategy and planning advice.
- Energia of New Plymouth for regulatory and valuation advice.
- Tesla Consultants for engineering design and drafting.
- Connetics for procurement, project stock management and overflow field work.

- Tatanas and PEL for civil works and traffic management.

# 1.10 Overview of asset strategy & delivery

Key features of Electra's asset strategy & delivery include…

- A demonstrable alignment with the Statement of Corporate Intent and the Group Strategic Plan.
- Visible inclusion of each phase of an assets lifecycle.
- Consideration of reliability, safety and lifecycle costs as an integral part of managing assets lifecycle (Safety in Design).
- Contionuously seek lower cost methods of carrying out required Opex and Capex identified by the AMP.

Refer to the individual asset lifecycle strategies in Chapter 6

# 1.11 Overview of systems & information

Electra uses a number of asset management systems to facilitate best practice asset management.

| System | Data Held | What data is used for | Extent of integration |
|---|---|---|---|
| NIMS (GIS) | Contains geospatial information for all assets including asset description, location, age, electrical attributes, condition and associated easements | Used by field, real-time operators, planning and project management staff within the Network team to obtain information on asset location, attributes and connectivity | Requires at least some manual intervention to import or export data into recognised formats. |
| iAuditor (part of NIMS) | GPS co-ordinates for all scheduled maintenance assets. This information includes, but is not limited to asset ID, date of inspection and condition of asset | Used to determine the maintenance work for the following year | Fully integrated. |
| SCADA | Asset operational information including loadings, voltages, temperatures and switch positions | Measuring load on various parts of the network. This is used for assessing security, load forecasts and feeder configurations | Low level of integration with outage web page. |
| Advanced Distribution Management System (Milsoft) | An integrated system containing geospatial information of assets, customers and has an engineering model which takes input from SCADA which can carry out load flows. | Used by field, real-time operators, planning and project management staff within the Network team to update the customer outage viewer, obtain information about assets and carrying out engineering studies. | Integrated with GIS,SCADA and outage web viewer. |
| NIMS (incident tracking) | System outages, location, duration, cause, number of consumers affected | Used to identify assets that are causing outages and to report on SAIFI/SAIDI and CAIDI | Integral part of NIMS |
| Valuation Spreadsheets | Asset types, quantities, ages, expected total lives, remaining lives and values | Used for system fixed asset valuations | High (export from NIMS) |
| Paper & Electronic Documents | Miscellaneous records, design and operational files | Used to support GIS (NIMs) data | Highly manual |

Reconciliation between the various data sets means that Electra now has improved data quality levels for its assets. These are summarised in the table below.

| Asset Type | Information Held | Information Quality | Methods for ensuring data accuracy |
|---|---|---|---|
| 33kV Lines | Size and Material | Accurate | Documents recording installation<br>Site inspection |
| | Age | Accurate to within 6 months | Documents recording installation |
| 33kV Cables | Size and Material | Accurate | Documents recording installation |
| | Age | Accurate to within 3 months | Documents recording installation |
| 11kV Lines | Size and Material | Accurate | Documents recording installation<br>Site inspection |
| | Age | Accurate to within 6 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |
| 11kV Cables | Size and Material | Accurate | Documents recording installation |
| | Age | Accurate to within 3 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |
| 400V Lines | Size and Material | Accurate post 1995<br>70% accurate pre 1995 | Documents recording installation<br>Site inspection |
| | Age | Accurate to within 3 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |
| 400V Cables | Size and Material | Accurate | Documents recording installation |
| | Age | Accurate to within 3 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |
| Poles | Material | Accurate | Site inspection |
| | Age | Accurate to within 3 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |
| Pillars | Type and Material | Accurate | Site inspection |
| | Age | Accurate to within 3 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |
| Transformers | Rating, Manufacturer, Age | Accurate | Site inspection<br>Documents recording installation |
| RMU's | Rating, Manufacturer, Age | Accurate | Site inspection<br>Documents recording installation |
| Circuit Breakers | Rating, Manufacturer, Age | Accurate | Site inspection<br>Documents recording installation |
| Other Switches | Rating, Manufacturer | Accurate | Documents recording installation |
| | Age | Accurate to within 3 months post 1995<br>Accurate to within 5 years pre 1995 | Documents recording installation |

Asset condition information is recorded as part of the regular inspection cycle for each asset class as described in Chapter 6.

# 1.12 Limitations of this AMP

Compilation of this AMP has revealed the following possible limitations:

- Some classes of asset condition data are either known or thought to be inaccurate. An on-going identification and cleansing process is in place.

- Demand forecasting methods have historically used linear extrapolations. Electra recognises that demand forecasting particularly for the southern network includes an increasing number of variables. Electra intends to develop a more comprehensive methodology that will include consideration of emerging technologies, declining consumption and increasing demand.

- Rapid changes in technology and uncertain rates of technology uptake make a 10 year forecast less certain than in previous years.

Despite the less certain long-term view, Electra remains confident that it can continue to operate and maintain a safe, reliable network and recover the true economic cost of that network.

# 1.13 Overview of key lifecycle processes

## 1.13.1 Routine inspections

Electra routinely inspects all classes of assets on a time basis. The timing and scope of inspections varies by asset class, asset criticality and public safety risk and are described in detail in chapter 6.

## 1.13.2 Maintenance

Electra uses the following range of maintenance strategies:

- The timing and scope of most maintenance is driven by the results of condition inspections, subject to manufacturer's minimum requirements or industry safety recommendations.
- Individual low value, low risk components maybe managed on a run-to-breakdown basis.

These are described in detail in chapter 6.

## 1.13.3 Development projects

The key drivers of all development projects are:

- Demand growth within existing network capacity (requiring a customer connection and minor network change).
- Demand growth in excess of existing network capacity
- Demand growth that requires network extension.

Electra considers the following approaches to meeting new demand…

| Approach | Effect on asset utilisation | Effect on failure risk |
|---|---|---|
| Supplying the demand without any alterations to either asset capacity or operational processes (the "do-nothing" approach). This approach will only be adopted after a risk analysis has confirmed that the overall risk exposures (particularly of in-service asset failure) remains acceptable. | Increases (capacity headroom declines). | Increases. |
| Supplying the demand through an operational process e.g. insisting that new load is controllable, or designing a tariff that encourages off-peak use. | Increases in some locations (capacity headroom declines), but declines in other locations. Nett effect is minimal change in asset utilisation. | Ideally nil, probably minimal in practice. |
| Only after both of the above approaches have been determined to be unacceptable will Electra invest in new assets. | Ideally nil (capacity headroom maintain by matching investment level to demand increase). In practice, a decrease if the next highest rated component is installed. | Nil, possibly decrease depending on how much capacity is added. |

These are described more fully in Chapter 5.

### 1.13.4 Measuring performance

Electra measures its performance in the following areas…

- Performance of the overall network (reliability).
- Performance of individual asset classes and assets (reliability, efficiency)
- Works delivery performance (timeliness, budget and unit costs).
- Asset management performance (alignment to long-term company objectives).

Electra has adopted the approach that it is not only important for both physical and financial budgets to be met, it is also critical that those budgets accurately reflect the network condition and capacity utilisation to avoid a long-term accumulation of asset deterioration.

## 1.14 Overview of documentation and controls

Electra manages its documentation and information records through controls of various levels. These include…

- Allocation of a unique numerical identifier to all key documents that is traceable.
- Assigning an authorisation level for altering or approving documents.
- Specifications for the nature and accuracy of asset data that is to be returned from field services staff and contractors.

These documentation and data controls are described in Chapter 9.

## 1.15 Overview of communication processes

Electra communicates the key features of its asset management planning and activities to staff and contractors in the following ways…

- Asset Planning & Development staff prepare the AMP and its associated work programs and budgets.
- The Finance team compile budgets for personnel, IT, AMP and non-network assets.
- Electra's Program Management, Service Delivery and Operations teams are advised of the key AMP themes and trends and consulted on the scope, method, timing and budgets of the works program.
- Electra has a panel of pre-qualified field service contractors that are available to meet overflow work. They are informed when Electra identifies a likely overflow of work volumes.

- Consultants can obtain the public copy of the AMP to understand Electra's priorities and work programs.

These communication processes are described in the AMMAT section in Chapter 9.

# 1.16 Significant assumptions

Significant assumptions for this AMP are…

| Assumption class | Assumption | What if assumption occurs | What if assumption doesn't occur ? |
|---|---|---|---|
| Resident population growth | Horowhenua District's resident population is forecast to increase by 8,600 people over the next 20 years, including an expected 4,900 houses and 3,000 jobs created. | Implement Growth Capex projects as planned | Implication would be a mis-match of asset capacity and demand, which can be minimised by regularly monitoring demand growth and either advancing or delaying capital projects. |
| | The Kapiti Coast District's resident population is forecast to increase by 6,300 people over the next 15 years. | | |
| Technology uptake | Unless the Government increases the incentives and subsidies for EV's, uptake is expected to be about 640 in Kapiti and maybe 160 in Horowhenua by 2021, with maybe a further 270 EV's travelling the SH1 corridor daily[1]. | Implement Growth Capex projects as demand requires. | Implication would be a mis-match of asset capacity (primarily network, but possibly also chargers) and demand. Any mis-match can be minimised by regularly monitoring EV numbers and also by encouraging off-peak charging[2]. |
| | That EV fast charging rates may increase from the current 50kW to as high as 300kW as the recharging period emerges as the barrier to EV uptake[3]. | Implement Growth Capex projects as demand requires (minimal overall impact, as there would only be a few within the network area). | Fast charging rates remain at about 50kW, reducing the need for network reinforcement |
| | The number of roof-top solar and battery installations will increase, possibly to the point of creating localised voltage disturbances. | Active control of LV system voltage may be required. | Voltage disturbances will be less likely |
| | Evolving application of device interconnectivity (the internet of things) will expand into energy transmission and network operations. | Opportunities will emerge to increase the number and nature of asset condition monitoring. | The existing level of monitoring will continue. |
| | Councils adopt LED streetlighting, leading to reduced kWh sales | kWh revenue will decline. | Existing level of kWh sales will prevail. |
| Financial parameters | The rate of inflation for the Planning Period will be 2.1%, which is based on the ANZ Bank forecasts. | Actual costs and margins should align with budgets. | Actual revenues, costs and margins may vary from budget, budgets may need to be revised, with the possibility that work volumes may need to be reduced. |

[1] Source – "Compiling an EV charging strategy" prepared for Electra by Utility Consultants.

[2] Mercury recently noted that even a 10% price discount has been sufficient to encourage EV owners to shift charging to off-peak periods.

[3] Another EDB has been approached by a vendor offering a 300kW charger.

| | | | |
|---|---|---|---|
| Public policy | That the Government's climate change initiatives will see increased emphasis on renewable generation. | Generation mix likely to include more renewables, possibly leading to price increases and declining kWh sales. | Generation mix and hence prices and kWh consumption likely to stay the same. |
| | No significant changes in Council land use policy that will increase the cost of Electra doing work. | Continue locating assets on Council land with no increase in costs. | Electra may have to purchase land for new network assets, cost of additional land access requirements will need to be recovered either from specific customers or at large. |
| | No significant changes in land access policy by NZTA or by KiwiRail that will increase the cost of Electra doing work. | Continue locating assets on NZTA or KiwiRaill land with no increase in costs. | |
| | The Wellington Northern Corridor roading development will continue as stated in the Roads of National Significance (the NZTA's website). | Declining diversity between Kapiti zone substations as more commuters arrive home earlier may increase coincident GXP demand. Also possibility of people moving northwards from Wellington to Kapiti, and from Kapiti to Horowhenua. | Kapiti population growth may not be as high as forecast, such that Growth Capex projects can be deferred. |
| Sector regulation | The current Electricity Authority emphasis on cost reflective pricing will continue. | Could require extensive rebalancing of fixed and variable charges. | Tariffs and revenue model should be able to remain similar to present |
| | That trust-owned EDB's will continue to be exempted from revenue and quality regulation. | Continue to set own revenue and quality targets. | Compliance costs would increase, possibility that revenue may be reduced. |

# 1.17 Causes of possible material differences

Key factors that may result in material differences between this AMP and future disclosures include…

| Class of cause | Cause | Result | Possible response(s) | Ability to recover costs of response |
|---|---|---|---|---|
| Transport policy | Variations to the established motorway development plans, most likely a deferral | Slowdown in Kapiti population growth | Delay Capex to meet demand. | Currently strong. |
| | A shift in Government policy towards a more aggressive uptake of EV's (possibly like the California Zero Emission Vehicles program) that could provide subsidies for EV's and restrictions for gasoline vehicles. | Possible increase in peak demand unless charging is incentivised to off-peak periods | Growth Capex to meet demand | Currently strong, possibility that ability to recover costs may be weakened[4]. |
| | An inability to manage electric car recharging to off-peak periods (whether through policy or otherwise). | Likely increase in peak demand | | |
| Costs | Variations from forecast labour and material costs. | Actual costs may exceed budget | Either increase total budget or reduce work volumes to fit within | Currently strong |

[4] It is noted that investor-owned electric companies in California were restricted in their ability to recover the full costs of peak-time charging.

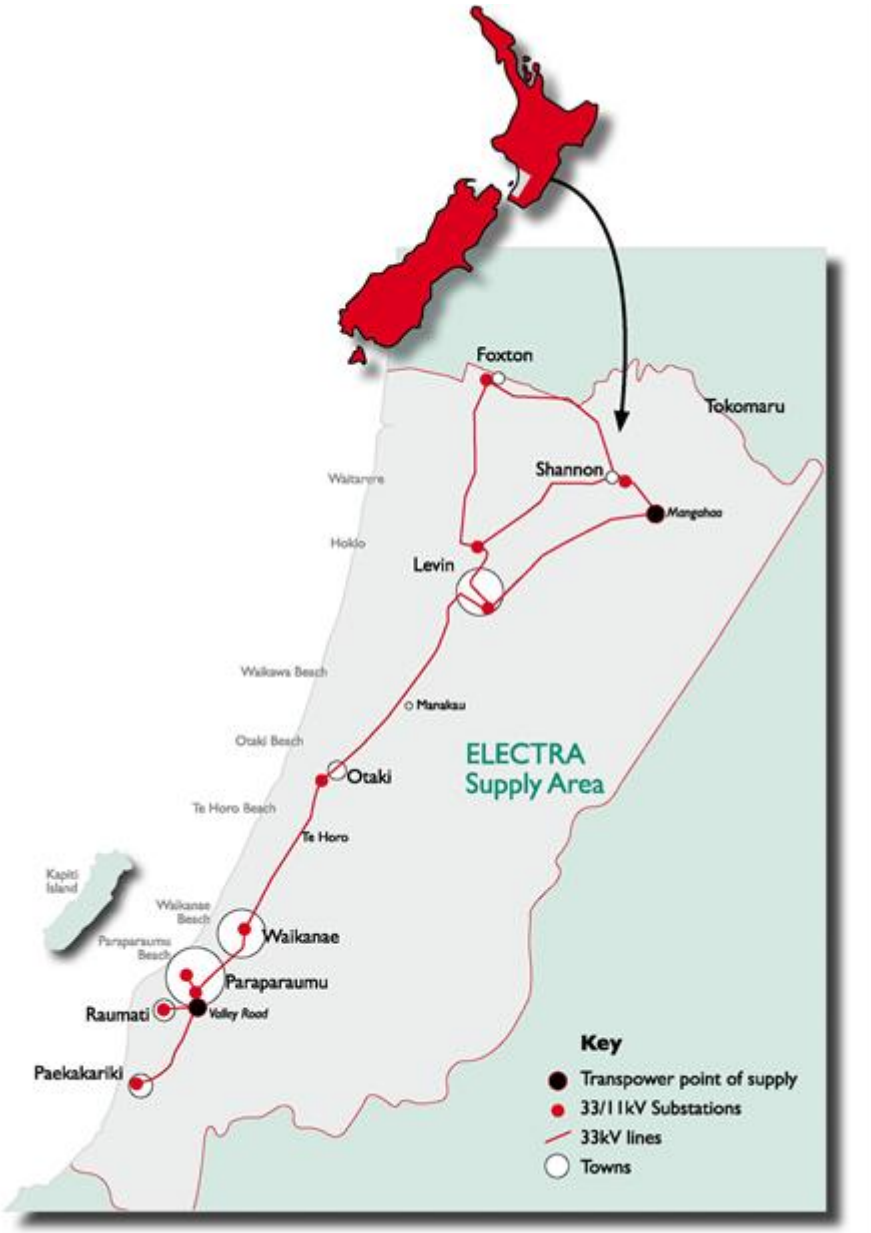
| | | | | |
|---|---|---|---|---|
| | | | existing budget subject to risk assessment | |
| | Increased health, safety and traffic management requirements that increase the cost of work. | Increased time per job, resulting in increased costs per job. | Decrease work volumes to fit within budget subject to risk assessment | Currently strong |
| | Increased requirements for access to land by NZTA or KiwiRail that increase the cost of work. | Increased time per job and costs per job | Reduce number of jobs to fit within budget, subject to risk assessment. | Currently strong |
| Performance | Migration of tree trimming from a compliance-based approach to a risk-based approach may reduce SAIDI to below forecasts. | Possible that actual SAIDI will be below long-term targets | Reduce tree trimming budget in the long-term | Currently strong |
| Asset condition | A previously unknown widespread asset defect emerges that effects a large number of assets. | Requires an accelerated replacement program | Increased Replacement Capex after performing specific risk assessment | Currently strong |
| Customer behaviour | Changes to the rate of customer adoption of new technologies. | Variations between actual and forecast demand | Advance or delay Growth Capex | Currently strong |
| Sector regulation | Shifts in government preference for electricity sector regulation | Possible increase in compliance costs | Recover costs through increased prices, or reduce consumer discount | Possibility of reduced cost recovery. |

# 2. Assets covered by this AMP

## 2.1 Network area

### 2.1.1 Regions covered

Electra's assets are spread over the Horowhenua and Kapiti districts on the narrow strip of land between the Tasman Sea and the Tararua Ranges, stretching from Foxton and Tokomaru in the north to Paekakariki in the south, as illustrated below. The network covers approximately 1,628 km$^2$.




### 2.1.2 Large consumers

Electra's largest network customers are…

- Alliance Group, Levin (meat processing).
- Carter Holt Harvey, Levin (packaging manufacturer).
- Kapiti Coast District Council (sewage and water treatment).
- Pak n Save, Paraparaumu (supermarket).
- Unisys, Paraparaumu (data processing).
- KiwiRail, Kapiti Coast (rail transportation).

These consumers represent less than 5% of the energy conveyed through Electra's network. Accordingly, Electra faces a low revenue risk from its large industrial consumers' consumption trends.

Each of these consumers forecast demand and security requirements are discussed during Electra's consumer consultation process, and specific requirements are included in the AMP as required.

## 2.1.3 Network load characteristics

While Electra's network is electrically contiguous, it is best considered as two market segments….

- A northern network supplied predominantly from the Mangahao GXP, and supplying Levin, Foxton and Shannon. The economy of this market segment is strongly tied to root and leaf vegetable prices and to dairy prices, and has demonstrated low growth in both MW demand and ICP numbers along with declining kWh due to low economic growth and minimal growth in housing.

- A southern network supplied predominantly from Valley Road GXP, and supplying Paekakariki, Paraparaumu, Raumati, Waikanae and Otaki. This market segment has a broader demographic comprising a range of features including strongly urbanised through to lifestyle rural to agricultural production. A key feature of the southern network is that because many people in this area commute to Wellington, the day-time demand is considerably less than the evening demand, leading to a low load factor.

About 43% of the energy conveyed by Electra is though the northern network, and about 57% through the southern network.

## 2.1.4 Demand and energy

Key parameters of Electra's network as of 31st March 2017 are….

| Parameters | Quantity |
|---|---|
| Number of connected customers | 44,158 |
| Electra maximum demand | 103 MW |
| Annual electricity conveyance | 433 GWh |
| Line and cable length | 2,248 km |
| Number of zone substations | 10 |
| Number of distribution substations | 2,572 |
| Network asset valuation | $169m |

# 2.2 Network configuration

Key "at a glance" features of Electra's network are as follows. Details of individual asset categories are set out in Chapter 3.

| System level | Key features at a glance |
|---|---|
| Bulk supply & embedded generation | • 2 GXP's supplying a coincident maximum demand of 104 MW.<br>• Embedded hydro station of 38 MW (Mangahao).<br>• About 300 rooftop solar installations. |
| Sub-transmission | • 2 circuits of 14km of overhead 110kV line that will be repurposed and operated at 33kV.<br>• 152km of overhead 33kV line<br>• 29.3km of underground 33kV cable |
| | • 4 zone substations supplied from Mangaho GXP.<br>• 5 zone substations supplied from Valley Road GXP.<br>• 1 zone substation that can be supplied from either Valley Road or Mangahao. |
| Distribution network | • 849 km of overhead line<br>• 232 km of underground cable. |
| Distribution substations | • 2,534 substations ranging in capacity from 5 kVA to 1,000 kVA. |

# 3. Assets by category

## 3.1 Bulk supply assets

Electra takes bulk supply from two GXP's:

- Mangahao GXP, which supplies the northern area.
- Paraparaumu GXP, which supplies the southern area. Electra's Otaki zone substation may be supplied from either GXP, but is usually supplied from Valley Road.

Key features of these bulk supply points are….

| GXP | Winter firm capacity (MVA) | Current peak demand (2017) |
|---|---|---|
| Mangahao | 30 | 37.4 |
| Paraparaumu | 120 | 65.2 |

The 38 MW Mangahao hydro generation station is embedded in Electra's network with a direct connection to Transpower's 33 kV bus at Mangahao.

## 3.2 Sub-transmission lines

Electra has 10 sub-transmission feeders as follows…

| GXP | Feeder | Rating (A) | Typical loading (%) | Performance & risk concerns |
|---|---|---|---|---|
| Mangahao | Mangahao – Shannon 1 | 600 | 6% | Nil |
| | Mangahao – Shannon 2 | 600 | 6% | Nil |
| | Mangahao – Levin East 1 | 390 | 28.6% | Mangahao CB 332 will be replaced before its rating of 390 A is likely to be constrained by N-1 rating when feeding Otaki |
| | Mangahao – Levin East 2 | 390 | 28.6% | Mangahao CB 312 will be replaced before its rating of 390 A is likely to be constrained by N-1 rating when feeding Otaki. |
| Valley Road | Valley Road – Waikanae 1 | 530 | 24.16% | Nil |
| | Valley Road – Waikanae 2 | 600 | 21.34% | Nil. |
| | Valley Road – Para West | 530 | 40.66% | Nil |
| | Valley Road – Paraparaumu 1 | 600 | 36.56% | Nil |
| | Valley Road – Paraparaumu 2 | 600 | 36.56% | Nil |
| | Valley Road - Paekakariki | 600 | 6.58% | Nil |

# 3.3 Zone substations

Electra has 10 zone substations which transform energy from the 33kV sub-transmission network to the 11kV distribution network. All but 1 are dual transformer substations.

| Zone Substation | Description | Security | ICP's | Nature of Load | Performance & risk concerns |
|---|---|---|---|---|---|
| Shannon | • Dual-transformer<br>• Indoor switchgear<br>• Built in 2010. | (n-1) | 1,975 | Mix of urban load in Shannon and rural load toward Tokomaru and Opiki. | • No known issues<br>• Performing within specification |
| Foxton | • Dual-transformer<br>• High-level steel structure outdoor<br>• Significantly rebuilt in 2004. | (n-1) | 3,569 | Predominantly urban load in Foxton with some rural load in all directions. | • No known issues<br>• Performing within specification |
| Levin East | • Dual transformer<br>• High-level steel structure<br>• Built in 1990. | (n-1) | 5,849 | Predominantly urban, although with some rural load to the south and east of Levin. | • No known issues<br>• Performing within specification |
| Levin West | • Dual transformer<br>• High-level steel structure<br>• Built in 1974. | (n-1) | 5,867 | Predominantly the rural areas to the north and west of Levin, Waitarere Beach, some urban load in the western parts of Levin. | • No known issues<br>• Performing within specification |
| Otaki | • Dual transformer<br>• Indoor substation<br>• Built in 1994 | (n-1) | 6,136 | Predominantly urban load in Otaki with some rural load in Otaki Gorge, Manakau, Te Horo and Waikawa Beach. | • No known issues<br>• Performing within specification |
| Waikanae | • Dual-transformer<br>• Indoor substation<br>• Built in 1996 | (n-1) | 7,120 | Dense urban load in and around Waikanae, some rural load to the north in Peka Peka and to the east in Reikorangi. | • No known issues<br>• Performing within specification |
| Paraparaumu | • Dual-transformer<br>• High-level concrete pole outdoor<br>• Built in 1970, rebuilt in 2015 | (n-1) | 4,436 | Dense urban load in the eastern and central parts of Paraparaumu, some rural load on the immediate outskirts of Paraparaumu. | • Performing within specification<br>• Increased inspection frequency for 1 transformer. |
| Paraparaumu West | • Dual-transformer<br>• Indoor substation<br>• Built in 2002. | (n-1) | 5,352 | Dense urban load in central and western parts of Paraparaumu. | • No known issues<br>• Performing within specification |
| Raumati | • Dual-transformer<br>• High-level steel structure outdoor substation<br>• Built in 1988 | (n-1) | 4,041 | Dense urban load in and around Raumati. | • No known issues<br>• Performing within specification |
| Paekakariki | • Single transformer<br>• High-level outdoor substation<br>• Built 1982<br>• *Single transformer and 33 kV feeder is backed up by 11 kV feeder except for NZR traction substation on n security and backed up by other NZR supplies to the north and south | (n-1)* | 918 | Mix of light urban and semi-rural load around Paekakariki. | • No known issues<br>• Performing within specification |

## 3.3.1 Incoming switchgear

Incoming (33kV) switch gear is as follows…

| Zone Substation | Description & number | Age (years) | Typical loading |
|---|---|---|---|
| Shannon | 10 indoor SF6 circuit breakers | Ten at 8 years | 3% |
| Foxton | 4 outdoor SF6 circuit breakers | One at 29 years<br>Three at 15 years | 9% |
| Levin East | 6 outdoor SF6 circuit breakers | Three at 28 years<br>Two at 9 years<br>One at 5 years | 18% |
| Levin West | 5 outdoor SF6 circuit breakers | One at 42 years<br>One at 11 years<br>One at 9 years<br>Two at 6 years | 19% |
| Otaki | 5 indoor SF6 circuit breakers | Four at 24 years<br>One at 15 years | 8% |
| Waikanae | 6 indoor SF6 circuit breakers | Six at 22 years | 10% |
| Paraparaumu | 8 indoor SF6 circuit breakers | Eight at 3 years | 9% |
| Paraparaumu West | 5 indoor SF6 circuit breakers | Five at 16 years | 8% |
| Raumati | 5 outdoor SF6 circuit breakers | Four at 30 years<br>One at 13 years | 7% |
| Paekakariki | 1 outdoor oil circuit breaker | One at 36 | 3% |

## 3.3.2 Power transformers

Power transformers (33/11kV) are as follows…

| Zone Substation | Number and rating | Cooling | T1 age | T2 age | Utilisation of Installed Firm Capacity |
|---|---|---|---|---|---|
| Shannon | Two 5 MVA | ONAN | 41 | 44 | 69% |
| Foxton | Two 11.5/23 MVA | ONAN, ONAF | 14 | 14 | 23% |
| Levin East | Two 11.5/23 MVA | ONAN, ONAF | 39 | 45 | 45% |
| Levin West | Two 11.5/23 MVA | ONAN, ONAF | 7 | 18 | 46% |
| Otaki | Two 11.5/23 MVA | ONAN, ONAF | 42 | 42 | 40% |
| Waikanae | Two 11.5/23 MVA | ONAN, ONAF | 22 | 22 | 53% |
| Paraparaumu | Two 11.5/18/23 MVA | ONAN, ONAF, OFAF | 48 | 48 | 45% |
| Paraparaumu West | Two 11.5/23 MVA | ONAN, ONAF | 16 | 15 | 45% |
| Raumati | Two 11.5/23 MVA | ONAN, ONAF | 7 | 31 | 36% |
| Paekakariki | One 5 MVA | ONAN | 58 | | - |

Shannon is the only substation close to being loaded to near its firm (n-1) capacity. Load growth at Shannon is static, and in any case load can transferred to other substation by switching on the 11kV.

## 3.3.3 Outgoing switchgear

Outgoing switchgear (11kV) is as follows…

| Zone Substation | Description & number | Age | Typical loading |
|---|---|---|---|
| Shannon | 7 Reyrolle LMVP | Seven at 8 years | 14% |
| Foxton | 7 Reyrolle LMVP | Seven at 15 years | 17% |
| Levin East | 8 South Wales SF6<br>1 Reyrolle LMVP | Nine at 28 years | 22% |
| Levin West | 9 Reyrolle LMVP | Three at 44 years<br>Six at 19 years | 22% |
| Otaki | 8 Reyrolle LMVP | Eight at 24 years | 21% |
| Waikanae | 9 Reyrolle LMVP | Nine at 22 years | 25% |
| Paraparaumu | 10 Reyrolle LMVP | Ten at 3 years | 23% |
| Paraparaumu West | 8 Reyrolle LMVP | One at 10 years<br>Seven at 16 years | 23% |
| Raumati | 4 Yorkshire SF6<br>3 Reyrolle LMVP | Four at 30 years<br>Three at 21 years | 24% |
| Paekakariki | 4 Reyrolle LMT oil | Four at 36 years | 8% |

## 3.3.4 Buildings

Buildings are as follows…

| Zone Substation | General description | Age | Condition grade |
|---|---|---|---|
| Shannon | Timber Framed | 13 | Normal deterioration monitored in normal inspection cycle. |
| Foxton | Masonry Shear Walls | 29 | Normal deterioration monitored in normal inspection cycle. |
| Levin East | Masonry Shear Walls | 30 | Normal deterioration monitored in normal inspection cycle. |
| Levin West | Masonry Shear Walls | 45 | Normal deterioration monitored in normal inspection cycle. |
| Otaki | Timber Framed | 26 | Normal deterioration monitored in normal inspection cycle. |
| Waikanae | Timber Framed | 23 | Normal deterioration monitored in normal inspection cycle. |
| Paraparaumu | Masonry Shear Walls | 4 | Good or as new condition. |
| Paraparaumu West | Timber Framed | 17 | Normal deterioration monitored in normal inspection cycle. |
| Raumati | Masonry Shear Walls | 31 | Normal deterioration monitored in normal inspection cycle. |
| Paekakariki | Masonry Shear Walls | 37 | Normal deterioration monitored in normal inspection cycle. |

# 3.4 Distribution lines & cables

Electra has 849km of 11kV overhead lines and 232km of 11kV cables connecting its zone substations to its distribution substations. It is constructed mainly as follows:

- CBD areas are almost exclusively cable. In older urban areas with low load growth such as Levin and Foxton these cables are PILC 185mm$^2$ Aluminium. New installations are constructed of XLPE cable.

- Suburban areas tend to be a mix of line and cable depending on whether the area was developed before or after undergrounding was adopted more widely around 1970. Cable tends to be PILC Aluminium conductor, whilst overhead conductor is a variety of Bee, 19/0.064 Copper and 7/0.083 Copper, almost totally on concrete poles.

- Rural areas are mostly line (but with increasing lengths of cable). These lines are Gopher or 7/0.064 Copper.

Line and cable length by zone substation area is as follows.

| Zone Substation | Distribution network length (km) | | |
|---|---|---|---|
| | Overhead | Underground | Total |
| Levin East | 127 | 29 | 155 |
| Levin West | 107 | 22 | 129 |
| Shannon | 163 | 8 | 171 |
| Foxton | 140 | 15 | 155 |
| Paraparaumu | 29 | 32 | 61 |
| Paraparaumu West | 6 | 29 | 36 |
| Raumati | 11 | 13 | 24 |
| Waikanae | 64 | 41 | 104 |
| Paekakariki | 16 | 6 | 22 |
| Otaki | 186 | 35 | 221 |
| **Total** | **849** | **232** | **1,081** |

# 3.5 Distribution switchgear

Electra has 1,273 individual distribution switches including ring main units, auto reclosers, air break switches and drop-out fuses. Precise numbers of each class of switches are in Chapter 6.

# 3.6 Distribution substations

Electra's distribution transformers range from rural 1-phase 5kVA pole-mounted transformers with minimal fuse protection, to 3-phase 1,000kVA ground-mounted transformers with ring main unit and circuit breaker protection, and are detailed in Chapter 6. Transformers may provide electricity to single large consumers, several large consumers or many small consumers.

Systemic issues:

- Corrosion of ground mounted transformer enclosures closer to coastal areas, which typically requires replacement after 30-40 years of service.
- Deck mounted transformers (on poles) requiring replacement due to declining structural integrity of the deck.

# 3.7 LV lines & cables

Electra has 507km of overhead LV (400V) and 484km of underground LV connecting its distribution substations to its customers, with an associated 10,863 pillars and cabinets.

LV line and cable length by zone substation area is as follows.

| Zone Substation | LV network length (km) | | |
|---|---|---|---|
| | Overhead | Underground | Total |
| Levin East | 91 | 58 | 149 |
| Levin West | 74 | 46 | 120 |
| Shannon | 71 | 9 | 80 |
| Foxton | 64 | 16 | 80 |
| Paraparaumu | 21 | 68 | 89 |
| Paraparaumu West | 8 | 77 | 85 |
| Raumati | 24 | 36 | 60 |
| Waikanae | 45 | 110 | 155 |
| Paekakariki | 10 | 5 | 15 |
| Otaki | 99 | 59 | 158 |
| **Total** | **507** | **484** | **991** |

# 3.8 Customer connections

The consumer connection assets connect Electra's 44,525 consumers to the 11kV and 400V distribution networks. These connection assets include simple pole fuses, suburban distribution pillars and dedicated lines and transformer installations supplying single large consumers.

In most cases the fuse holder forms the demarcation point between Electra's network and the consumers' assets (the "service main"). This is usually located at or near the physical boundary of the consumers' property. These assets form the point of delivery for Electra's distribution services.

The key systemic issue with consumer connections has been the corrosion of some earlier thin steel pillars and the degradation of non UV stabilised polymer pillars. The affected pillars are replaced progressively based on risk they pose to network and public safety.

# 3.9 Other assets

## 3.9.1 Load control

Electra owns and operates the following load control plant…

- One Zellweger SFU-K/203 injection plant at Shannon rated at 80kVA, and signalling to the northern area. This was installed in 2011 as part of the substation rebuild.

- One Landis + Gyr SFU-K/403 injection plant rated at 200kVA in at Electra-owned building at Paraparaumu zone substation, and signalling to the southern area. This was installed in 2016.

- Two Zellweger SFU-K/203 injection plant controllers rated at 80kVA in storage at Paraparaumu West and Shannon, which are spares.

Both the Shannon and the Valley Road plants inject into the 33kV at 283Hz.

Most customer load control relays are owned by the energy retailer. Electra, does however, still owns 1,924 relays for controlling street lights, under veranda lighting and pilot-wire load control.

## 3.9.2 Protection & control

Electra's network includes the following broad classes of protection and control…

- Legacy protection relays (over current, earth fault, auto reclose functions).

- More recent digital protection (voltage, frequency, directional, distance, bus zone, and failure functionality).

- Transformer and tap changer temperature sensors including surge arrestors, explosion vents and oil level sensors.

Electra's main class of control assets are tap changer controls, for which Electra has standardised on the Eberle range.

## 3.9.3 SCADA & communications

Electra uses iSCADA for general control and monitoring. This was installed during 2010. The master station is located at Levin West. This relays information via a point-to-point link to the network control centre at Electra's offices in Levin. A replica emergency control centre is also located at Levin West.

Microwave radio and voice connect all sites with a self-healing topology that includes the following repeater sites…

- Forest Heights, Waikanae.

- Mataihuka south of Paraparaumu.

- Moutere Hill west of Levin.

- Levin West substation.

- Tunapo at Paekakariki.

## 3.9.4 Mobile generator

Electra has owned a 500kVA mobile diesel generator since 2008. It is primarily used to maintain supply during planned and unplanned outages.

## 3.9.5 ADMS

Historically Electra has operated a range of network ICT systems that have functioned well but have lacked interconnectivity and had few specific analysis capabilities. In 2015 Electra identified a range of barriers to improving its reliability / cost mix, and implemented a number of isolated technology solutions. Those solutions provided some quick gains in fault restoration times, cost reductions and overall staff appreciation of technology, but still did not provide a unified ICT platform with advanced functionality.

Following an RFP process, Electra purchased the Milsoft ADMS which was considered to provide the best functionality, scalability and cost for an EDB of up to100,000 connections. Milsoft provides modules to integrate the previously separate functions of distribution management, SCADA, outage management, fault dispatching and various network engineering analysis functions. There are streams of work identified to improve the data quality to further enhance the Milsoft functions and improve customer experience overall through a combination of improved network reliability and lower costs.

Expected benefits include…

- Quicker restoration of faults, including through quicker dispatch of fault crews.
- Improved demand and load flow analysis that is likely to allow deferral of asset upgrades.
- Improved customer perceptions.
- Automated telephone and website updates during major events.
- Enhanced data capture.

## 3.9.6 Customer-owned lines

Whilst customer-owned lines (broadly defined as any line on the customers side of the property boundary) are not owned by Electra, those lines form an integral part of the electricity supply chain.

Electra plan to commence a program to inform customers about risks associated with powerlines and offer a service to assist them in reducing any identified issues.

# 3.10 Asset valuation (RAB) allocation

Electra's Regulated Asset Base (RAB) comprises…

| Asset class | Valuation (31st March 2017) | Percent of valuation * |
|---|---|---|
| Distribution and LV cables | $36,901,000 | 21.8% |
| Distribution and LV lines | $33,028,000 | 19.5% |
| Zone substations | $30,194,000 | 17.8% |
| Distribution substations and transformers | $26,231,000 | 15.5% |
| Other network assets | $12,408,000 | 7.3% |

| | | |
|---|---|---|
| Sub transmission cables | $10,325,000 | 6.1% |
| Distribution switchgear | $11,048,000 | 6.5% |
| Sub transmission lines | $6,970,000 | 4.1% |
| Non-network assets | $2,525,000 | 1.5% |
| **Total** | **$169,630,000** | **100.0%** |

* Percentages may not add due to rounding.

# 4. Proposed service levels

## 4.1 Customer service levels

### 4.1.1 Primary customer service levels

Electra's primary customer service level is supply continuity and restoration, as measured by SAIDI, SAIFI and CAIDI. Electra doesn't deliberately distinguish between customers in different geographical areas, but the radial configuration of its rural network will inevitably mean that while all customers will experience a similar frequency of interruptions, those in rural areas are likely to experience longer supply interruptions.

Electra's historical and forecast SAIDI, SAIFI and CAIDI are…

| Measure | ← Actual (historical) | | | | | Forecast → | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 |
| SAIDI | 58 | 67.4 | 139.3 | 100.1 | 89.3 | 83.0 | 83.0 | 83.0 | 83.0 | 83.0 |
| SAIFI | 0.93 | 1.3 | 2.25 | 1.16 | 1.49 | 1.66 | 1.66 | 1.66 | 1.66 | 1.66 |
| CAIDI | 62 | 52 | 62 | 86 | 60 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 |

* Actual for 2017/18 not available at time of writing.

Comments on the historical performance include…

- Storms in April 2014 and August 2014 meant the 2014/15 SAIDI exceeded target.
- An unplanned interruption on the back up supply to Levin whilst the main 33kV supply was out of service for maintenance meant the 2015/16 SAIDI exceeded target.
- Kaikoura earthquake related faults led to 2016/17 SAIDI target excursion.
- A further 33kV interruption during the 2017/18 year has focused Electra's attention on the less-than-acceptable resilience of its 33kV network, and resulted in specific program of work to systematically improve the reliability of sub transmission network through protection improvements and component replacements.

Customer consultation and community engagement reveals that Electra's customers prefer not to pay more for further improvements in reliability. However, Electra has identified several tactical programmes that have the potential to improve reliability and safety, and deliver improved returns within the current cost base (discussed in the next chapter).

### 4.1.2 Secondary customer service levels

Electra's secondary customer service levels include the following aspects…

- Processing an application for a new connection.

- Providing technical advice.

- Giving sufficient notice for planned shutdowns.

Electra's target for these secondary customer service levels are as follows…

| Attribute | Measure | Forecast → | | | | |
|---|---|---|---|---|---|---|
| | | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 |
| Processing new connection application | Number of working days to process | 3 | 3 | 3 | 3 | 3 |
| Providing technical advice | Number of working days to acknowledge by mail | 4 | 4 | 4 | 4 | 4 |
| | Number of working days to acknowledge by phone | 2 | 2 | 2 | 2 | 2 |
| | Number of working days to investigate inquiry or validate complaint | 5 | 5 | 5 | 5 | 5 |
| | Number of working days to provide advice for non-complaint matter | 3 | 3 | 3 | 3 | 3 |
| | Number of working days to resolve proven complaint unless non-minor asset modification required) | 10 | 10 | 10 | 10 | 10 |
| Notice for planned shutdowns | Number of customers to who 3 working days of a shutdown is not provided. | 5 | 5 | 5 | 5 | 5 |
| | Number of large customers to whom 60 minutes advanced notice of a planned shutdown is not provided. | 1 | 1 | 1 | 1 | 1 |
| | Number of large customers whose preferred shutdown times cannot be accommodated. | 2 | 2 | 2 | 2 | 2 |

Customer surveys by both Electra and other EDB's have identified these service attributes as less important than supply reliability (continuity and restoration). A key feature of these secondary service attributes is that they are based on processes rather than fixed asset investment.

# 4.2 Asset performance levels

Electra's asset performance levels include…

- Load factor.

- Capacity utilisation.

- Network losses.

Electra's historical performance values are…

| Measure | ← Actual (historical) | | | | | Forecast → | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 |
| Load factor | 49% | 54% | 53% | 56% | 48% | 50% | 50% | 49% | 49% | 49% |
| Capacity utilisation | 33% | 26% | 26% | 25% | 31% | 32% | 33% | 33% | 33% | 33% |
| Network losses | 7.3% | 7.5% | 7.4% | 6.7% | 6.7% | 6.7% | 6.7% | 6.7% | 6.7% | 6.6% |

* Actual for 2017/18 not available at time of writing.

# 4.3 Public safety performance levels

Electra's public safety performance includes the following measures…

- Maintaining an independently certified Safety Management System

- Compliance with Health and Safety at Work Act 2015
- Compliance with the Electricity (Safety) Regulations 2011.
- Compliance with the Electricity (Hazards from Trees) Regulations 2003.

Electra's targets are nil non-compliances with Regulation and Act every year.

## 4.4 Regulatory performance levels

Regulatory performance levels are generally set by statutory agencies, and include…

- Compliance with the Electricity Distribution Information Disclosure Determination 2012.
- Compliance with the Electricity Industry Participation Code.
- Compliance with the operative Horowhenua and Kapiti Coast district plans.
- Compliance with the operative Wellington and Horizons regional plans.
- Participation in regional disaster recovery initiatives such as Life Lines.
- Compliance with NZTA requirements for locating assets within road reserve, and for working within road corridors.
- Compliance with KiwiRail requirements for locating assets near railway lines, and for working within rail corridors.
- Compliance with electrical worker certification and training requirements.

Electra aims to fully comply with all of the above requirements.

## 4.5 Public good service levels

Electra also provides a range of (non-safety) services that are considered to be for the public good. These include…

- Switching of controlled loads, including street lights and under veranda lighting.
- Laying ducts during other parties excavations to avoid future excavations.
- Allowing other parties to suspend cables from Electra's poles.
- Allowing other parties to mount signs on Electra's poles.
- Relocating assets to better suit other parties, especially near roadways.

# 4.6 Justification for service levels

Electra has adopted it's current and planned future service levels as a result of the following…

- Customer surveys have repeatedly revealed a preference for paying about the same line charges to receive about the same reliability.
- Specific requests from customers to receive a different mix of reliability and pricing from what would otherwise be available.
- Decisions over many decades as to whether the 11kV network configuration should be radial or meshed, which strongly influences supply restoration times.Refer section 5.2.3 for Electra's current security of supply targts which determines the 11Kv connectivity.
- Decisions over many decades that have influenced asset condition and lifespan, which in turn influences supply reliability.
- External agencies may impose either a service level (e.g. public safety, AMP disclosure etc) or impose criteria that manifest as service levels (e.g. a requirement to underground all new lines).

# 4.7 Translating stakeholder needs into service levels

Electra translates its stakeholder needs into service levels as follows…

| Service level attribute | | Consumer response | | Service levels |
|---|---|---|---|---|
| What do consumers want the most? | ➔ | Continuity and restoration first and foremost | ➔ | Give priority to continuity and restoration of supply first and foremost. |
| How much do they want? | ➔ | About the same as they are currently getting | ➔ | Maintain continuity and restoration performance at about the current level. |
| How much do they want to pay? | ➔ | About the same as they are currently paying | ➔ | Keep line charges at about the same level as they currently are. |
| Are the consumers happy? | ➔ | Yes | ➔ | Keep delivering similar service levels for other attributes. |

# 4.8 Tactical programmes

In order to meet its service level targets, Electra has identified the following tactical programs ….

| Issue / concern | Requirement | Program | Linkage to AMP programs |
|---|---|---|---|
| Declining component condition is leading to an increase in the number of 33kV outages on the Northern ring. | • Avoid an increase in the number of unplanned interruptions due to component deterioration. | Improve northern 33kV resilience | • 5.7.2<br>• 5.7.3<br>• 6.3<br>• 6.4 |
| Increasing number of spurious protection operations on the 33kV. | • Avoid an increase in the number of unplanned interruptions due to spurious protection trippings. | 33kV protection study and strategy development | • 5.7.1<br>• 5.7.2 |
| New connections leading to more customers interrupted by any single fault. | • Reduce the number of customers effected by an unplanned interruption.<br>• Reduce the time to restore supply may result from increased interconnection. | Increase network sectionalisation. | • 5.4<br>• 5.7.1<br>• 5.7.2 |
| Legacy copper conductor becoming increasingly brittle. | • Remove brittle conductor which is a safety hazard. | Replacement of copper conductors. | • 6.3 |
| Legacy copper conductor has limited capacity. | • Reduce the time to restore supply (by allowing more 11kV back-feed options). | | |
| Retrieved wooden cross-arms insufficiently deteriorated to justify replacement. | • Refine criteria for wooden cross-arm replacement based on improved understanding of timber deterioration processes. | Optimise replacement of wooden cross-arms | • 6.4 |
| Specific classes or makes of assets known to be of less than acceptable reliability or safety remain in service. | • Remove specific classes or makes of assets. | Reduce number of risky assets | • 6.6<br>• 6.9 |
| Tree trimming was focused only on compliance. | • Improve value of tree-trimming program by considering improvements to customer reliability. | Migration to risk-based tree trimming | • 6.15 |

## 4.8.1 Improve northern 33kV resilience

This issue has been the subject of a dedicated tactical study during 2017 in which Electra has identified the following circuits within its Northern 33kV ring as being particularly unreliable…

- Mangahao – Levin East (2 parallel circuits as far as Waihou Rd, then single circuit from Waihou Rd to Levin East).

- Foxton to Levin West.

- Shannon – Foxton.

The most effective and efficient approach to improving the reliability of these circuits would be to isolate them one at a time for a prolonged period and work intensely, rather than working on a day-by-day basis and returning to service overnight. Unfortunately the respective back-up circuits are not considered sufficiently reliable to rely on for prolonged periods.

The proposed solution is a planned sequence of work that begins with reconfiguring both 110kV lines as a 33kV line between Mangahao and Levin East to provide (n-1) security to Levin East whilst the Waihou Rd – Levin East line is isolated. The reasoning is…

- The identified circuits each have a less-than-acceptable reliability that is likely to decline as the individual circuits deteriorate. This occurred during a cross arm replacement project between Mangahao and Shannon where the NZI brown porcelain insulators were falling apart as they were removed from circuit. It also provided insight into "unknown"trippings we are having on 33kV in the northern region.

- The most effective and efficient way of improving the reliability of those circuits is to isolate them for a prolonged period and work intensely rather than work on a day-by-day basis and return to service overnight.

- A sequence of work has been identified that will enable prolonged isolation of each circuit whilst still providing (n-1) security to all zone substations.

## 4.8.2 33kV protection study and strategy development

A 33kV interruption during the 2017/18 year has focused Electra's attention on the less-than-acceptable resilience of its 33kV network, and resulted in specific program of work to systematically improve the reliability of sub transmission network through protection improvements.

Technical investigations reveal that spurious protection tripping have been partly to blame for unplanned outages. It is proposed to engage a protection specialist during 2018 to completely review Electra's 33kV protection settings and develop a strategy. The objectives of that strategy will be to…

- Create a roadmap to improve the main and back up protection schemes(standardise) for various asset classes based on cost risk and performance.

- Extract value out of Transpower investments e.g. ODID (outdoor to indoor conversion) to install relays supporting unit protection schemes.

- Validate existing protection settings are fit for purpose.

## 4.8.3 Increase network sectionalisation

As more customers are added to individual feeders (mainly in Kapiti), the customers at risk of interruption from any single fault increases. Electra intends to insert switches (automated where required) into the 11kV network to…

- Reduce the number of customers exposed to any single fault.
- Enable increased meshing of the 11kV to enable restoration by switching rather than by repair.

At this stage, Electra's approach will be to…

- Identify feeders that have exceeded Electra's planning criteria of either 1,500 domestic customers or 5,000kVA of commercial load.
- Identify suitable locations for inserting switches that will both reduce the customers at risk and allow for meshing, thus providing a dual win of reduced customers effected by a fault and reduced restoration time.

## 4.8.4 Replacement of copper conductors

Electra's network still has 7/0.083, 19/0.064 and 19/0.092 copper conductor, which presents the following operational constraints and risks….

- The low current rating of 7/0.083 in particular limits the ability to restore supply by back feeding on the 11kV.
- The relatively high impedance of the conductors also contribute to voltage regulation issues.
- The conductor has work-hardened and become brittle over many years, increasing the risk of in-service failure.
- Field services do not work on live copper because of the increased risk of it snapping during work and recoiling into other conductors. This makes jobs expensive due to generation or inconvenient to customers due to shutdowns.

Hence, Electra plans prioritise and to replace these copper conductors due to these contributing drivers other than just condition based asset renewal.

## 4.8.5 Optimise replacement of wooden cross-arms

During 2017 Electra undertook a study of wooden cross-arm replacement practices. Particular emphasis was given to understanding the actual failure modes and what the easily observable features of imminent failure look like so that replacement could be optimised. Part of this work involved dissection of retrieved cross-arms to identify how much unconsumed life is being discarded, for which a picture is starting to build up.

Electra expects to continue dissecting retrieved cross-arms to further calibrate replacement decisions against actual condition. Part of the study is to also understand what are methods available to improve the inspection and asset condition coding than rating cross arms from ground.

## 4.8.6 Reduce number of risky assets

Electra's network still contains some assets that are now considered to have an unacceptable risk of in-service failure to staff and public. e.g. pitch filled metal pot heads, metallic link pillar boxes, deck mounted transformer structures etc. Electra has included provisions in the AMP to remove these high-risk assets based on their location and the risk they present.

# 5. Network development

## 5.1 Development context

Electra's development plans are driven primarily by capacity constraints (which almost always occur due to increasing demand), declining reliability, voltage excursions, or security of supply.

At its most fundamental level, demand is created by consumers drawing energy from or by injecting energy into their individual connections. Electra recognises that the issues that have historically led to demand growth are now more complex with the uptake of smart home and business technologies and Distributed Energy Resources (DER).

## 5.2 Development criteria

Electra considers the following driving factors as the criteria for developing its network.

- Capacity and voltage.
- Reliability.
- Security of supply.

### 5.2.1 Capacity & voltage triggers

If any of the triggers below are exceeded Electra will intervene which may include adding additional capacity to the network:

| Asset category | System Growth (consider adding capacity) | |
|---|---|---|
| | **Capacity trigger** | **Voltage trigger** |
| 400V lines & cables | • Not applicable – tends to manifest as voltage constraint. | • Voltage at consumers' premises consistently drops below 94% of the nominal value. |
| Distribution substations | • Where fitted, MDI reading exceeds 100% of nameplate rating. | • Voltage at LV terminals consistently drops below 100% of the nominal value. |
| Distribution lines & cables | • Conductor current consistently exceeds 70% of thermal rating for more than 3,000 half-hours per year. | • Voltage at HV terminals of transformer consistently drops below 10.5kV and cannot be compensated by local tap setting. |
| | • Conductor current exceeds 100% of thermal rating for more than 10 consecutive half-hours per year. | |
| Zone substations | • Max demand consistently exceeds 100% of nameplate rating. | • 11kV voltage Alarms from SCADA as recorded in SCADA Alarm and Event history |
| Sub-transmission lines & cables | • Conductor current consistently exceeds 66% of thermal rating for more than 3,000 half-hours per year. | • 33kV voltage below 31.5kV at Zone substation supplied |
| | • Conductor current exceeds 100% of thermal rating for more than 10 consecutive half-hours per year. | • Low volts alarms from Scada and reported in Scada Alarm & event history |

## 5.2.2 Reliability triggers

In order to limit the load interrupted by any 1 fault, Electra will consider intervening when the following levels are reached.

- An aggregation of up to 1,500 urban domestic consumer connections on any 1 feeder.
- An aggregation of about 5,000 kVA of urban commercial load on any 1 feeder.

Interventions may include…

- Inserting a recloser to reduce the number of customers effected by a fault.
- Meshing the 11kV (typically by inserting a ring main unit) to reduce the restoration time.
- Constructing a new feeder and moving a larger percentage of customers to that new feeder to reduce the number of customers effected by a fault.

Integration of previously discrete network ICT systems through the Milsoft E&O is expected to reduce restoration times including through more precise dispatch of fault crews.

## 5.2.3 Security of supply triggers

Electra's security of supply standards are set out below. In setting target security levels Electra's preferred means of providing security to urban zone substations will be by alternative sub-transmission assets with any available back-feeding on the 11kV providing a second tier of security.

| System level | Load type | First fault | Second fault |
|---|---|---|---|
| GXP | Greater than 12MW or 6,000 consumers. | No loss of supply. | 50% of load restored in 15 minutes, 100% of load restored in 2 hours |
| Zone substation | Between 4 and 12MW or 2,000 to 6,000 consumers. | No loss of supply | All load restored within 60 minutes. |
| Zone substation | Less than 4 MW | Loss of supply, 100 % load restored within 30 minutes from adjacent substations. | Fault repair time |
| 11kV feeder | Between 2.0 and 4.0 MW | Loss of supply, supply restored within 30 minutes from adjacent feeders. | Loss of supply, supply restored within 4 hours from adjacent feeders. |
| 11kV feeder | Between 0.5 and 2.0 MW | Loss of supply, supply restored within 30 minutes from adjacent feeders where available. | Fault repair time |
| 11kV feeder | Less than 0.5 MW | Fault repair time | Fault repair time |
| 400V feeder | About 30 to 40 residential customers. | Fault repair time | Fault repair time |

# 5.3 Development policies, standards, methods etc

## 5.3.1 Methods and approaches used to standardise activities

Electra uses standards, codes and guidelines to achieve the following purposes (essentially all risk management tools)…

| Method | Purpose | | | |
|---|---|---|---|---|
| | Achieve construction and operational safety and asset performance | Minimise inventory costs | Minimise operating costs | Minimise design and construction costs |
| Use of standard design concepts | | | ● | ● |
| Use of technical design standards | ● | | ● | |
| Use of standard asset sizes and configuration | | ● | ● | ● |
| Use of preferred purchasing | ● | ● | | ● |
| Use of in-house field staff | ● | | | ● |

## 5.3.2 Consideration of energy efficiency

Electra recognises that network losses are significant (about 6.7% of energy entering the network), hence the following approaches are used…

- Upgrading of overloaded conductors to reduce the $i^2R$ losses.
- Consideration of Iron and Copper losses when purchasing equipment.
- Identify and improve poor power factor installations to a minimum of 0.95.
- Optimisation of open points.

## 5.3.3 Policies on embedded generation

Electra's policies for embedded generation are on its website. Key features of those policies are…

- Noting the Electricity Industry Participation Code requirements.
- Stating the requirement for exported electricity to be sold to a retailer.
- Setting out the application process.
- Setting out the safety, technical, operational, commercial and regulatory requirements.
- A list of approved inverters.

## 5.3.4 Impact of embedded generation

Apart from Mangahao (which is embedded at the GXP) there are about 300 known embedded generation sites on the Electra network with a combined capacity of about 1,100 kW. There are likely to be few occasions when that 1,100kW will exceed the 20% of prevailing load that is recognised as the level that complicates operation. Electra is engaging with prospective customers and partners to integrate dynamic Distributed Energy Resources (DERs) into the network. Simultaneously Electra keeps a watching brief on developments in overseas markets and other NZ EDB areas.

## 5.3.5 Options for meeting or managing demand

Electra considers the following 3 classes of options for meeting or managing demand…

| Class of option | Specific approach | Description |
|---|---|---|
| Do nothing | | Where one or more parameters have exceeded a trigger point, the do nothing option may be a "do nothing yet but watch more frequently" option. Essentially, do nothing is acceptable only when Electra is confident that service levels can be maintained and risks remain acceptable. |
| Non-network (low investment) | Operational activities | Actions such as switching the distribution network to shift load from heavily-loaded to lightly-loaded feeders or winding up a tap changer to mitigate a voltage problem will be considered. The downside to this approach is that it may increase line losses, reduce security of supply, or compromise protection settings. |
| | Influence consumers to alter their consumption patterns | This allows assets to perform at levels below the trigger points. Examples include shifting demand to different time periods, negotiating interruptible tariffs with certain consumers so that overloaded assets can be relieved, or assisting a consumer to adopt a substitute energy source to avoid new capacity; |
| | Install distributed generation or batteries | This allows adjacent assets to perform at levels below the trigger point. Distributed generation may be particularly useful where additional network capacity could eventually be stranded or where primary energy is going to waste, e.g. waste steam from a process; |
| | Modify an asset | Allowing the trigger point to move to a level that is not exceeded, e.g. by adding forced cooling. This approach is more suited to larger classes of assets such as 33/11kV transformers. |
| | Install voltage regulator | Installing an 11kV voltage regulator may relieve voltage constraints, which defers or avoids the need for upgrading to 33kV. |
| | Retrofitting high-technology devices | These can exploit the features of existing assets (including historically generous design margins), e.g. using remotely switched air-breaks to improve reliability, or using advanced software to thermally re-rate heavily-loaded lines.<br><br>Electra expects that installation of smart meters will provide more accurate demand data including the duration of peak loads. |
| Network solution | Install new assets with a greater capacity | This will increase the assets trigger point to a level at which it is not exceeded, e.g. replacing a 200kVA distribution transformer with a 300kVA transformer so that the capacity trigger is not exceeded. |

## 5.3.6 New Technology Initiatves (Low Investment Options)

Electra views the implementation and Smart Grid as comprising five interrelated areas:

1. Smart technology on the network
2. Smart technology in the homes and businesses of our customers
3. Back office systems for the processing of information exchange with the above smart technologies
4. Web based systems serving information for rule based customer and Electra decisions

5. Customer engagement and product offerings

Electra has identified a range prospective partners and products that together can make up a functioning ecosystem for customers to not only lower their energy costs but to participate in a transactive grid where energy is traded across the distribution network.

The roadmap for development in 2018/2019 comprises the initial activities of:

**Network**

Further implementation of remotely operable sectionalisation

Further implementation of fault passage indicators

Provision of faulted phase and distance to fault information back to the Control Room

Select simple IoT sensing devices for installation across the network to provide richer status information e.g. voltage levels along 11 kV feeders and selected 400 V reticulation.

**Homes & Businesses**

Select devices to connect via customer Wi-Fi and independent IoT channels to enable remote monitoring and provide local customer information on consumption and demand

Identify inverters suited for remote monitoring and control for dispatch of load, energy and vars. The proposition is to manage power quality, monitor network state, manage demand / generation for the service quality and commercial benefit of the customer (and Electra).

Engage with selected retailers for the development of energy trading products, offering customers better than wholesale prices, with the view enabling Electra to establish a non-zero export price option.

**Foundation Linking Technologies**

Together with ICT and ICONA (the Lines Business SCADA & Comms contractor) establish channels and servers for the retrieval and secure provision of information to Electra's customers and business partners.

In practice, Electra applies these options as follows…

- The annual planning process identifies where triggers have been or are likely to be exceeded for the planning period.
- For small assets, the do-nothing option will be considered, often informally based on individual engineers knowledge of the assets, and their judgement.
- It generally won't be formally documented unless the network solution is expensive.
- It is generally accepted that eventually a network solution will be required as opportunities for doing nothing and for non-network solutions are exhausted.
- Non-network solutions such as demand management and embedded generation often require the continued participation of a third party over time, and hence are not always easy to implement.

### 5.3.7 Role of the ADMS in choosing options

Adoption of non-network (low investment) solutions requires network status and load information that is disaggregated (possibly to the level of individual ICP's), in real time (for fault indication and restoration) and very accurate (for matching capacity to demand), information that has traditionally not been available.

Electra sees that completion of its ADMS project will provide such information, which will eliminate the reliance on the guess-work and assumptions that traditional network planning has relied upon. This will increase the confidence and correspondingly reduce the risk associated with adopting non-network or low-investment options e.g. deferring transformer upgrades on the basis of half-hourly demand profiles rather than 1 max demand reading.

## 5.4 Known constraints

Electra faces the following significant constraints (all security rather than capacity *per se*)…

| Constraint | Description | Intended Remedy |
|---|---|---|
| Mangahao GXP | Limited rating of Transpower transformers can mean full (n-1) security is not available when Electra is taking full load and Mangahao is not generating. | Transpower to install larger transformers as part of replacing existing old transformers (provisionally timed for 2021/22). |
| Shannon - Foxton - Levin West 33kV circuit | When load is above 35MVA and the Managahao – Levin East 33kV circuit(s) trip, the Shannon – Foxton – Levin East 33kV circuit will overload. | Operate the recently purchased Transpower 110kV circuits at 33kV to duplicate the Mangahao – Levin East 33kV circuit(s). |
| Shannon - Foxton - Levin West 33kV circuit | If the Mangaho – Levin East 33kV circuit trips when Otaki is supplied from Mangahao GXP, the 3km of Bee in the Shannon – Foxton – Levin West 33kV circuit will overloaded. | Operate the recently purchased Transpower 110kV circuits at 33kV to duplicate the Mangahao – Levin East 33kV circuit(s). |

The annual planning process has revealed a low rate of demand growth in the Northern area, which combined with sufficient capacity for the current planning period means that it is unlikely that the capacity of any significant assets will be exceeded without sufficient time to react. Electra does however recognise that demand growth in the Southern area is higher due to both residential sub-division development in Paraparaumu and Waikanae and retail development around Paraparaumu. Most of the development is 11kV feeder duplication and meshing to increase available capacity and to reduce the number of customers effected by individual faults.

Specific issues which arise from the load projections are:

• Increasing air conditioning load is likely to over-lap into peak periods when demand is already high. The potential impact on the network is not yet known and feeder loading information is being captured, along with temperature and rainfall to identify any relevant trends. This issue has not been factored into the load forecast;

• The increasing popularity of beach-front settlements will require up-sizing or duplication of existing 11kV lines. This is required to minimise the effects of outages which have an impact on the security levels.

# 5.5 Development prioritisation

The finite funds that are available each year (both from revenue, and from borrowing) require development work to be prioritised or ranked by their contribution to Electra's goals. These goals closely reflect the priority of stakeholder interests and how competing or conflicting interests will be managed (described in Chapter 1.8).

Prioritisation is also strongly linked to risk management (Chapter 8). Projects that reduce risks with high likelihood and high consequence are assigned a higher priority.

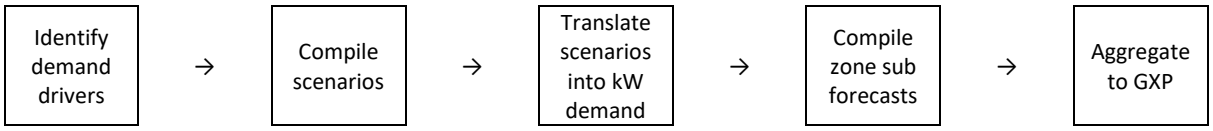
Each of the possible approaches to meeting demand that are outlined in Chapter 5.8 provide potential solutions that are considered.

# 5.6 Demand forecasts

Historically Electra has used a simple linear projection of recent zone substation demand growth rates to forecast demand, and supplemented by inclusion of localised factors e.g. known industrial developments, observations of farm land being sold for residential development etc. The uncertain implications of emerging technologies mean that such an approach is less likely to accurately forecast demand. Electra has started work on the following proposed scenario-based forecasting methodology and expects to progress this work through to individual substation and possibly 11kV levels .

## 5.6.1 Forecasting approach

Electra has adopted the following forecasting approach…




## 5.6.2 Demand drivers

Electra considers the following demand drivers (which reflect the assumptions set out in 1.16) that will impact on….

- Demand per customer connection.
- Number of customer connections.

| Class of driver | Detailed driver | Impact on demand per customer | Impact on number of customers |
|---|---|---|---|
| Resident population growth | Organic population growth at large | Minimal of itself | Increase |
| | Property price differentials between the Wellington metro area, Kapiti and Horowhenua encouraging northward migration, and in particular any housing policies that cause property prices to retreat. | Minimal of itself | Increase |

| | | | |
|---|---|---|---|
| | Residential sub-division growth around Waikanae and Paraparaumu | Minimal of itself | Increase |
| | Commercial growth around Paraparaumu. | Minimal of itself | Increase |
| Transport policy | Slowdown in established motorway build program | Minimal of itself, but likely to preserve existing diversity between zone substations if commute times remain the same. | Possible decline in new house growth in Kapiti |
| | Uptake of EV's, compounded by any policies that require any-time charging. | Potentially large especially if policies don't restrict any-time charging | Minimal |
| Customer preferences | Increasing use of domestic air conditioning | Potentially significant if installed cost of air conditioners declines | Minimal |
| | Increased expectation of air conditioning in retail and commercial premises | Possibly significant | Minimal |
| | Increasing popularity of beach front settlements. | Possibly significant if existing beach houses have air conditioning installed | Increase if new beach houses are built |
| Air quality policies | Policies that restrict solid fuel home heating, and essentially require a shift to electric heating | Potentially significant | Minimal |
| Emerging technologies | Uptake of rooftop solar and batteries | Potential to reduce demand if policy incentives are correct, but also possibility of disrupting existing kWh-based revenue model | Minimal |
| | Affordability of devices, especially battery-power devices, power tools, garden tools etc | Possibly significant depending on user preferences for recharging. | Minimal |

The following specific technologies and their likely implications for demand growth or contraction have been considered…

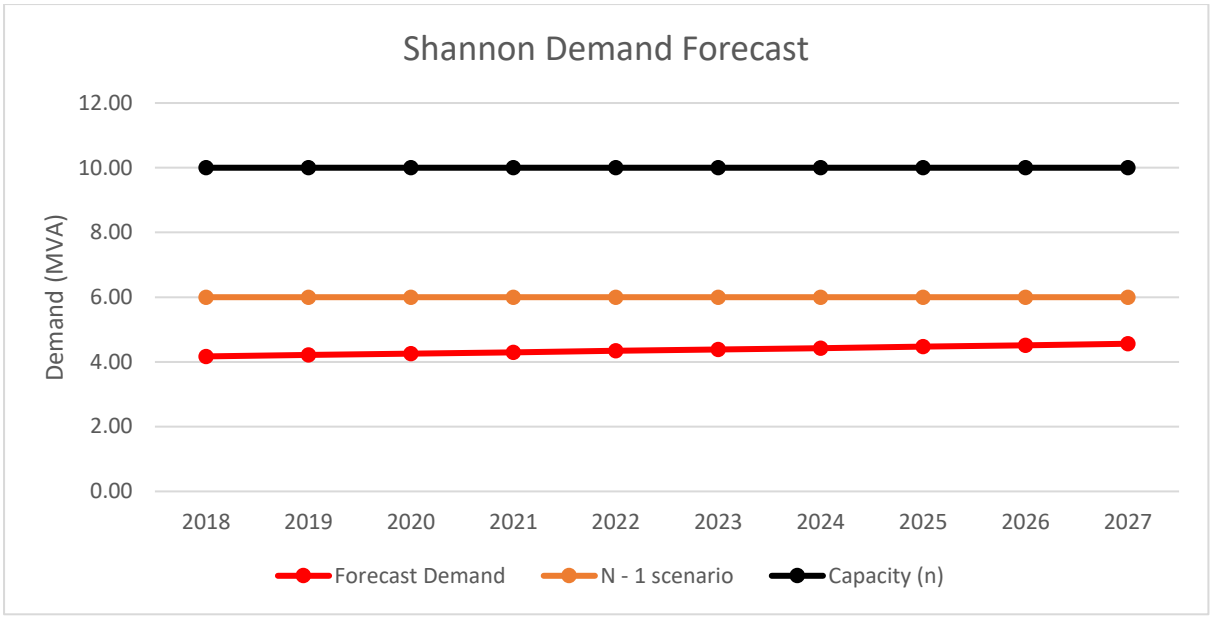
| Specific technology | Mode of operation | Implications for Electra |
|---|---|---|
| Conventional, well understood loads | Consumption | • Increasing demand per customer. |
| Inverter heat pumps | Consumption | • Increasing peak demand, but with no commensurate increase in kWh.<br>• Declining load factor<br>• Declining power factor.<br>• Increasing harmonics. |
| Roof top solar | Injection | • Possible off-set of GXP demand (but probably not during peak periods).<br>• Possible increase in peak loading of some feeders, possibly leading to export congestion.<br>• Over voltages during periods of high generation and low demand.<br>• Increased bi-directional power flows that require changes to protection and control settings.<br>• Reduced kWh sales if located behind the meter.<br>• Peak seen by the GXP's may shift later into summer evenings. |
| Batteries | Consumption | • Possible improving load factor if charging restricted to off-peak. |
| | Injection | • Possible off-set of GXP demand.<br>• Ability to maintain supply during faults may reduce criticality of fault restoration processes. |

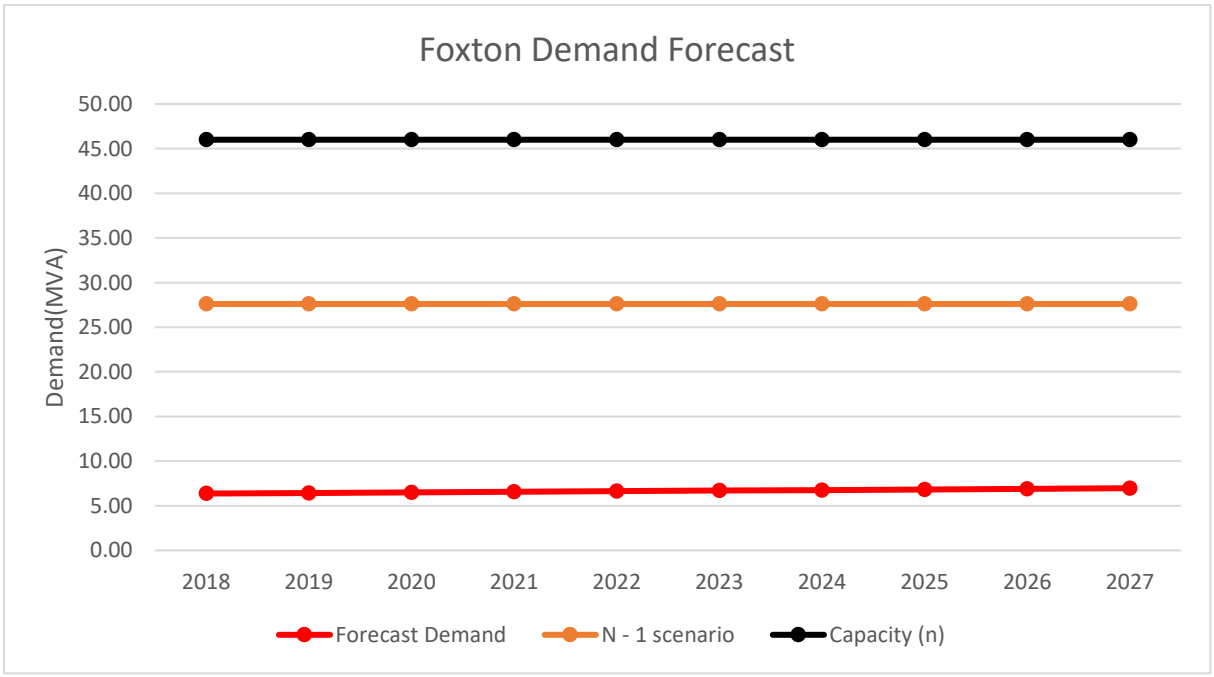
| | | |
|---|---|---|
| Electric vehicles | Consumption | • Possible improving load factor if charging restricted to off-peak.<br>• Increased demand if charging unmanaged. |
| | Injection | • This is speculative and application of this capability will be monitored. |
| Low energy interior lighting | Consumption | • Reduced demand and consumption |
| Low energy streetlighting | Consumption | • Reduced demand and consumption. Lower consumption based revenue will impact the value of this supply business |

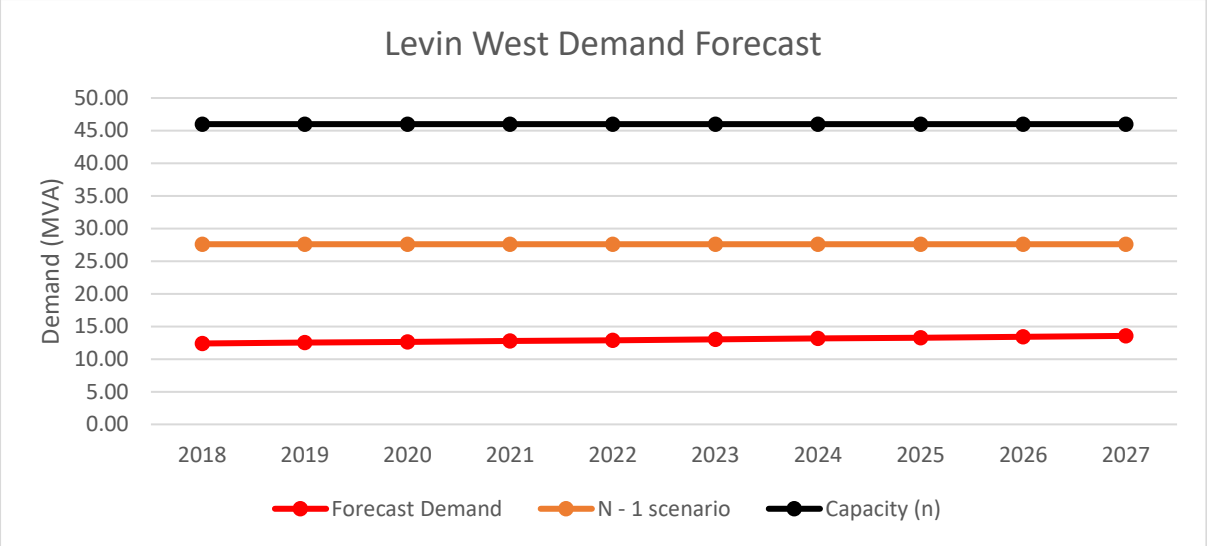
## 5.6.3 Zone substation demand forecasts

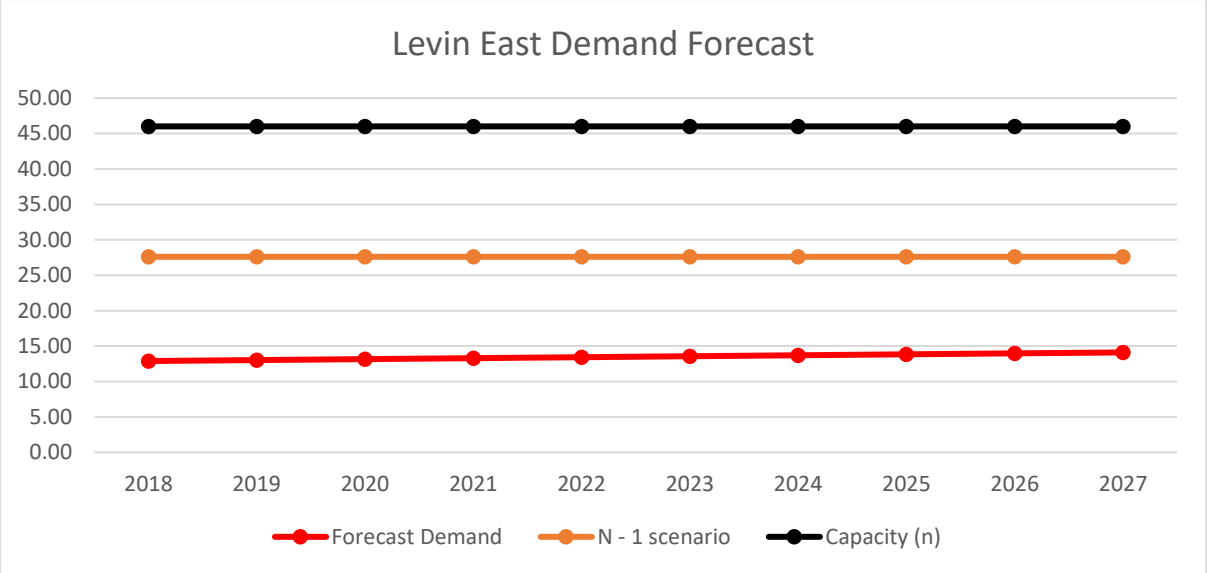
Electra's zone substation demand forecasts are set out below based on the following growth assumptions…

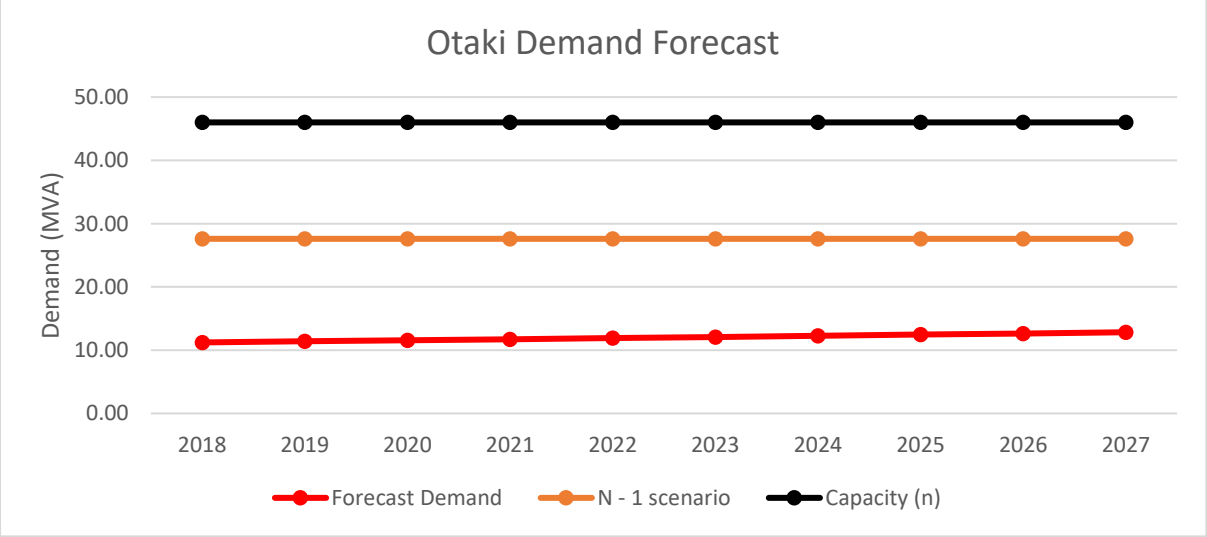
| Zone Substation | Rate and Nature of Growth | Provision for Growth |
|---|---|---|
| Shannon | About 0.5% per year, mainly lifestyle blocks around Tokomaru. | None required. |
| Foxton | About 1.0% per year, mainly residential development at Foxton Beach. | None required |
| Levin East | About 1.7% per year, mainly commercial and lifestyle blocks to the south and east of Levin. Possible large off-peak industrial load growth. | None required |
| Levin West | About 1.3% per year, mainly residential properties at Waitarere Beach and lifestyle properties to the north and west of Levin. | None required |
| Otaki | About 1.8% per year, mainly lifestyle blocks in Manakau and Te Horo. | Load is being managed by redistribution amongst existing feeders. An additional feeder is proposed within the planning period. |
| Waikanae | About 2.6% per year, mainly residential. | Capacity on existing feeders continues to be increased before end of life replacement. An additional feeder allowing full duplication if the main supply to Waikanae Beach fails is proposed within the planning period. |
| Paraparaumu | About 2.0% per year, mainly commercial and residential infill. | Increased utilisation of existing capacity. The construction of Paraparaumu West has allowed much of the former load to be transferred. |
| Paraparaumu West | About 3.0% per year, mainly commercial and residential infill. | An additional feeder will ultimately be needed with the ongoing development of Paraparaumu Airport. This will be factored into the development plan once a better understanding of development timing is known. |
| Raumati | About 1.0% per year, mainly residential infill. | An additional feeder could be required if there is land spare from the Kapiti Expressway development. This has not yet been factored into the development plan. |
| Paekakariki | About 0.3% per year, mainly residential infill. | No loading parameters are expected to be exceeded during the planning period, therefore no growth related projects are proposed either. |

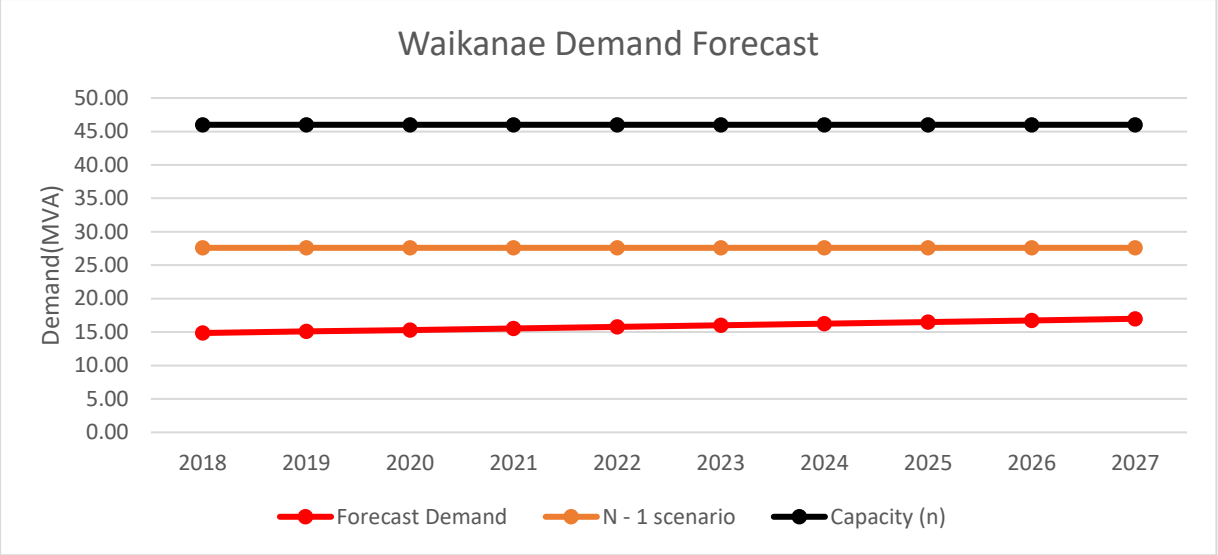

Shannon Demand Forecast
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Demand (MVA)
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

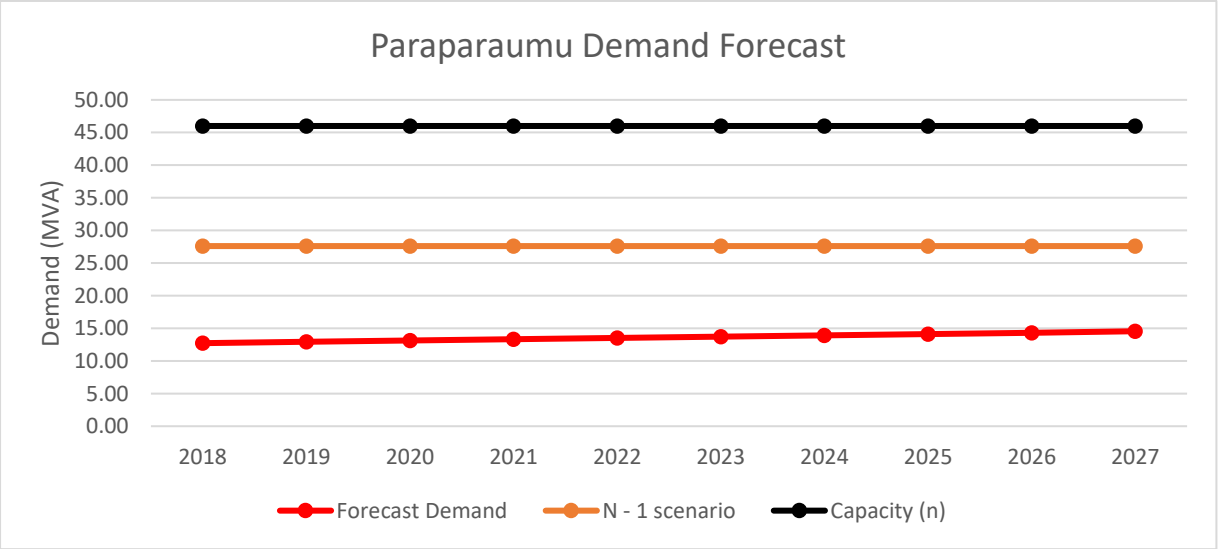

Foxton Demand Forecast
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Demand(MVA)
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

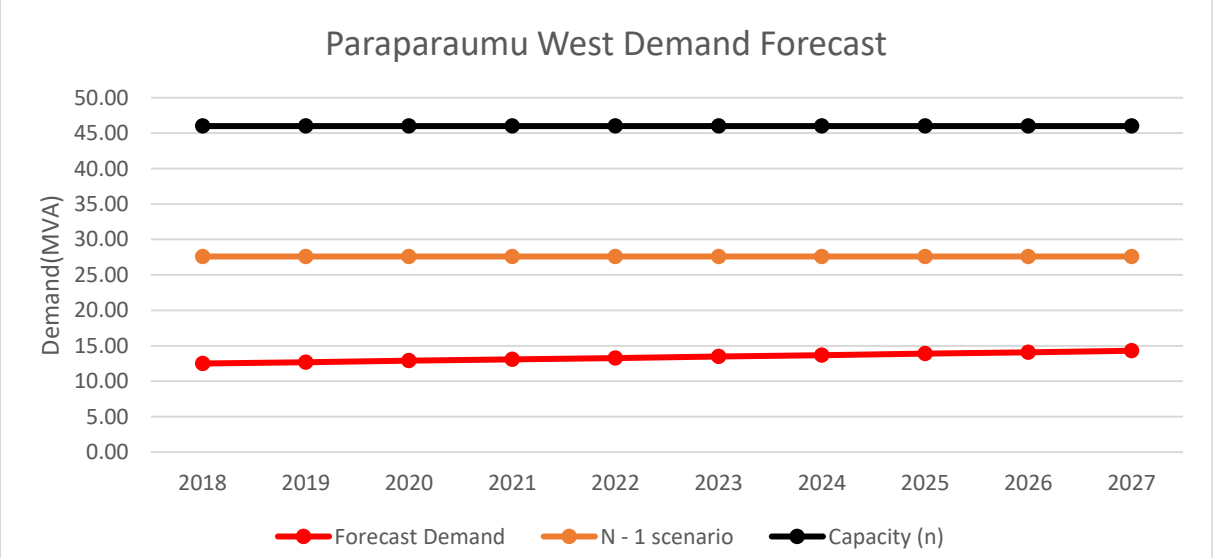

Levin West Demand Forecast
Demand (MVA)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

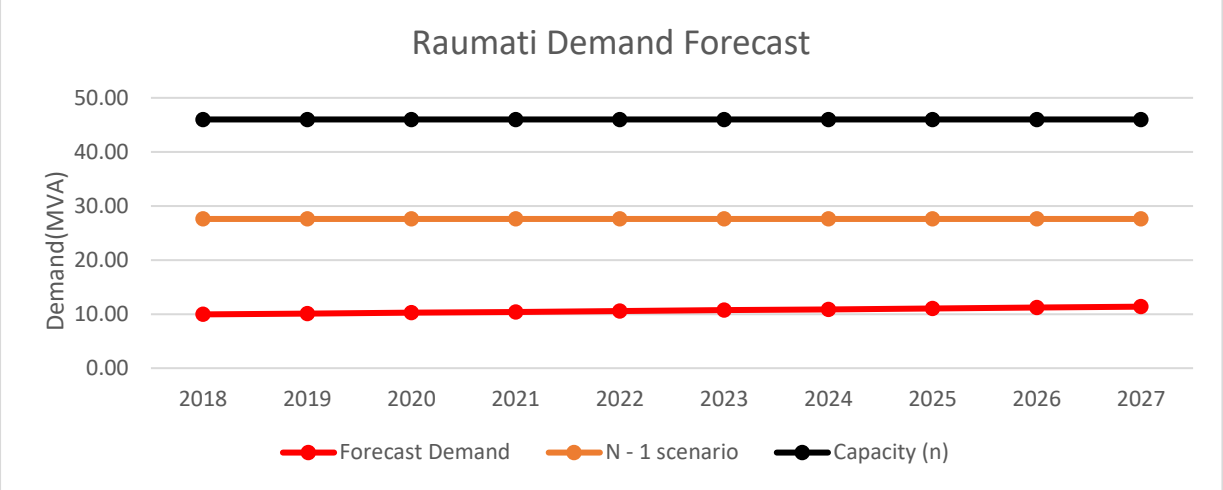

Levin East Demand Forecast
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

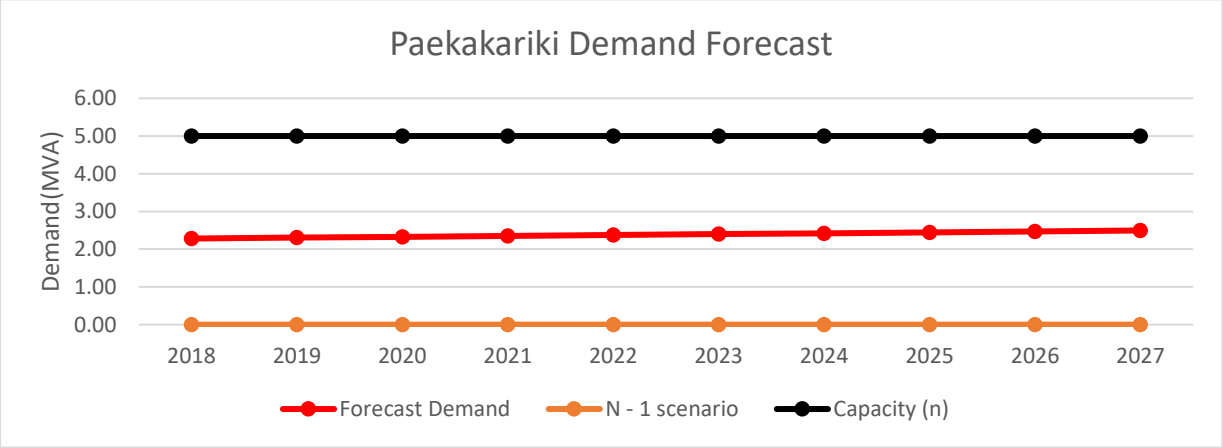

Otaki Demand Forecast
Demand (MVA)
50.00
40.00
30.00
20.00
10.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


Waikanae Demand Forecast
Demand(MVA)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


Paraparaumu Demand Forecast
Demand (MVA)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


Paraparaumu West Demand Forecast
Demand(MVA)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

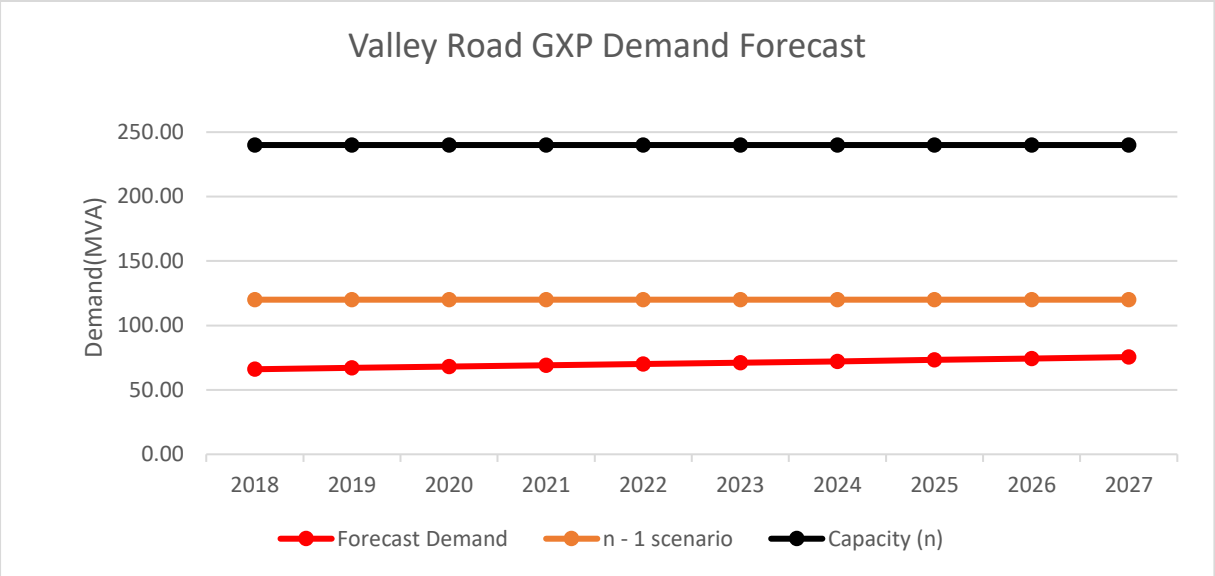

Raumati Demand Forecast
50.00
40.00
30.00
20.00
10.00
0.00
Demand(MVA)
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

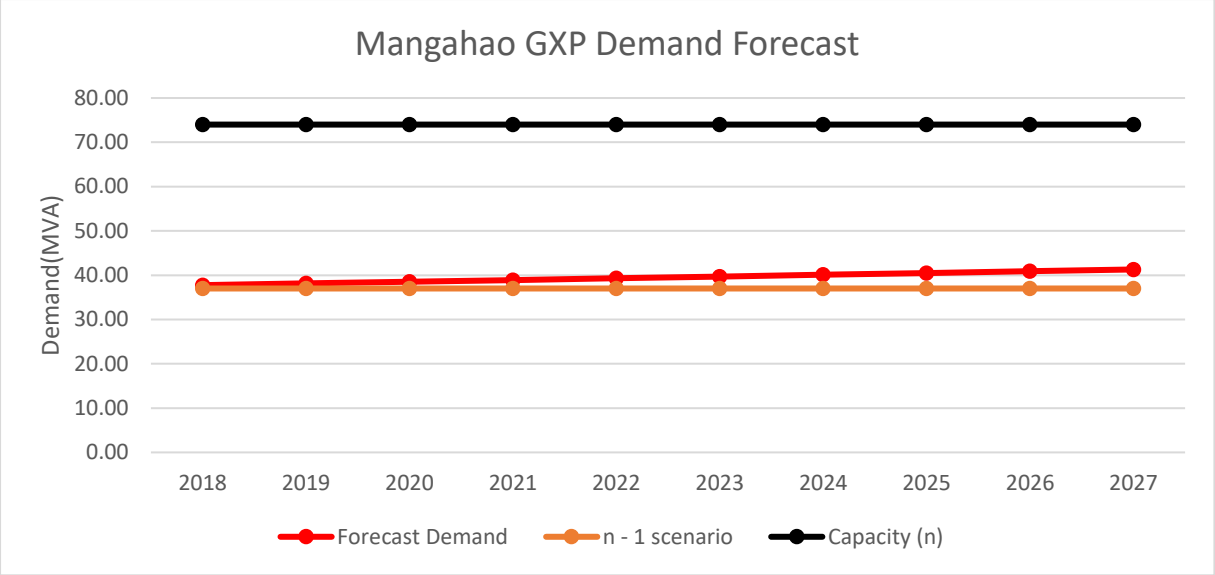

Paekakariki Demand Forecast
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Demand(MVA)
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

## 5.6.4 GXP demand forecasts

The zone substation demand forecasts have been aggregated to the following GXP demand forecasts…

| GXP | Rate and Nature of Growth | Provision for Growth |
|---|---|---|
| Mangahao | Average of 0.2MW per year | No provision for capacity or security growth will be possible until about 2020 when it is expected that the existing transformers will be upgraded to approximately 60MVA. |
| Paraparaumu | Average of 0.6MW per year | None required. This GXP has recently been reconfigured to obtain supply from Transpower's 220kV network to accommodate the proposed Transmission Gully highway. The result is that firm capacity has increased from 68 MVA to 120MVA. This means that any future growth can be met from the existing supply and the provisional measures outlined in previous AMP's to delay upgrade work are no longer needed. |






## 5.6.5 Improving demand forecasting

During the 2018 year Electra plans to develop a suite of Low, Medium (Base) and High demand scenarios based on the following 5 factors which are expected to dominate demand growth or contraction…

- National and regional economic growth.
- Aspects of transport policy that incentivise EV uptake.
- Further decline in the cost of rooftop solar and residential batteries.
- Housing policies that cause property prices to retreat from recent high levels, reducing the incentive to migrate from Wellington to Kapiti to Horowhenua.
- Further penetration of domestic and retail premise air conditioning.

Electra expects these scenarios to look something like the following…

| Driver | Low scenario | Mid (base) scenario | High scenario |
|---|---|---|---|
| National and regional economic growth | National GDP remains at about 2% per year until 2023 without the peak predicted for the base scenario. | National GDP is expected to increase from the current 2% to a peak of 3.5% around late 2019, but decline back to about 2% by 2023[5, 6]. | National GDP peaks at about 3.5% around late 2019 and remains at similarly high levels. |
| Aspects of transport policy that incentivise EV uptake | Expect maybe 400 EV's in Kapiti and maybe 50 in Horowhenua by about 2021, again with an even mix of peak and off-peak charging. | Expect 640 EV's in Kapiti and maybe 160 in Horowhenua by about 2021, with an even mix of peak and off-peak recharging. | Expect 1,000 EV's in Kapiti and maybe 200 in Horowhenua by about 2021, with an even mix of peak and off-peak charging. |
| Further decline in the costs of rooftop solar and batteries | The installed cost of a 2kW solar plus batteries supply will remain at about $14,000. | The installed cost of a 2kW solar plus batteries supply that currently costs about $14,000 will decline to about $11,000 by 2022[7, 8] and then remain constant. | The installed cost of a 2kW solar plus batteries supply will decline from the current $14,000 to about $9,000 by 2022 and then remain constant. |
| Housing policies that cause property prices to retreat from recent high levels | House price growth in the lower North Island will drop sharply into a retreat. | House price growth in the lower North Island will slow and eventually retreat into a decline in prices. | House prices in the lower North Island will continue to grow, albeit at a slightly lower rate. |
| Further penetration of domestic and retail premise air conditioning | Air conditioning penetration remains at about 45% for planning period. | Air conditioning penetration will increase from about 45% in 2016 to about 50% by 2021 and then remain constant[9]. | Air conditioning penetration increased to about 60% by 2021 and then remains constant. |

Electra also expects to have to consider component loading at an 11kV and possibly even LV feeder level as increasing penetration of batteries and solar panels may lead to localised demand growth that is not seen at a zone substation level.

5 https://www.anz.co.nz/resources/4/2/42aa96a5-a567-4017-a3b3-45467aae9fcc/ANZ-EO-20170928.pdf?MOD=AJPERES

6 https://www.westpac.co.nz/assets/Business/Economic-Updates/2017/Bulletins-2017/Westpac-QEO-November-2017_EMAIL.pdf

7 https://www.mysolarquotes.co.nz/about-solar-power/residential/how-much-does-a-solar-power-system-cost/

8 https://www.greentechmedia.com/articles/read/solar-costs-are-hitting-jaw-dropping-lows-in-every-region-of-the-world#gs.XYIx1yw

9 https://www.transpower.co.nz/sites/default/files/publications/resources/E528-use-forecasting-for-heat-pumps-jul-09.pdf

# 5.7 Development projects

## 5.7.1 Development projects for 2018/19 year

Material projects (>$200,000) for the 2018/19 are…

| Ref. | Description | Category | Cost |
|---|---|---|---|
| 1 | Relocate PRM-RAUMATI 33kV cable away from landslip. | Quality | $ 900,000 |
| 2 | Substation Protection Work | Quality | $ 550,000 |
| 3 | Automation of Switchgear | Quality | $ 270,000 |
| 4 | Network sectionalisation | Quality | $ 250,000 |

| Ref. | Description and purpose of project | Category | Cost | Options considered | | | Option chosen and reason |
|---|---|---|---|---|---|---|---|
| | | | | Do-Nothing | Non-Network | Network | |
| 1 | Relocate PRM-RAUMATI 33kV cable away from landslip. | Quality | $900,000 | • Unacceptable risk as Raumati and Paekakariki ZS security of supply will be compromised. | • Install grid size battery bank and diesel generators | • Relocate the existing 33 circuit outside of the landslip area. | • Relocate the existing 33kV circuit outside of the landslip area.<br>• Battery and diesel generators solution is not cost effective.<br>• Network solution provides the best solution considering cost risk and performance measures. |
| 2 | Tesla Protection Work. | Quality | $550,000 | • Slow operating protection | | • Upgrade to digital SEL relays. | • Upgrade to digital SEL relays.<br>• Inadequate protection operating speed is both an operational and a safety risk. |
| 3 | Automate switchgear on specified feeders to reduce restoration times. | Quality | $270,000 | • Continue with existing manual switching arrangements. | • Improve existing manual switching arrangements. | • Automate specific switches. | • Automate specific switches.<br>• As more customers are added to feeders, the number of customers effected by a fault will also increase, which is undesirable. Automating specific switches will reduce supply restoration time.<br>• These devices will provide network data, which will help to improve network investment decisions of future. |
| 4 | Install sectionalisers on specified feeders to reduce number of customers affected by faults. | Quality | $250,000 | • Continue with existing feeder sections. | | • Install line sectionlisers on specific feeder locations. | • Install line sectionlisers on specific feeder locations.<br>• As more customers are added to feeders, the number of customers effected by a fault |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | will also increase, which is undesirable. Sectionalising will reduce the number of customers affected.<br>• These devices will provide network data, which will help to improve network investment decisions of future. |

* includes "low investment" options.

Non-material projects (<$200,000) for the 2018/19 are…

| Ref. | Description | Category | Cost |
|---|---|---|---|
| 5 | Link between feeder L357 and L349 (BTW L213&L394) | Quality | $195,000 |
| 6 | Seismic Strengthening -ZS Buildings | Quality | $175,000 |
| 7 | Change 33kV/11kV arms to avoid bird related outages | Quality | $160,000 |
| 8 | Link between feeder 652 and 632 (BTW S186 & P285) | Quality | $85,000 |
| 9 | Install additional fault locators - Permanent | Quality | $51,327 |
| 10 | Install LV -power quality monitors | Quality | $50,000 |
| 11 | Link LV network where gaps exist | Quality | $40,772 |
| 12 | Fault locator communication. | Quality | $28,392 |

Alternative options considered include…

| Ref. | Description and purpose of project | Category | Cost | Options considered | | | Option chosen and reason |
|---|---|---|---|---|---|---|---|
| | | | | Do-Nothing | Non-Network | Network | |
| 5 | Link between feeder L357 and L349 (between L213 & L394) to provide alternative circuit. | Quality | $195,000 | • Continue with existing unmeshed feeders. | • Encourage customers to uptake solar and / or battery storage | • Install link between L357 and L349. | • Install link between L357 and L349.<br>• Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted.<br>• Any connected solar or batteries may not be of reliable source due to intermittency of supply.<br>• Being able to back-feed un-faulted sections of both feeders provides an opportunity to reduce restoration times which wouldn't necessarily occur with solar and / or batteries. |
| 6 | Seismic Strengthening -ZS Buildings | Quality | $175,000 | • Continue with high risk buildings, which are prone to earthquake damage. | | • Get buildings seismically assessed and carry out | • To carry out studies and carry out recommendations to get buildings compliant to the code to reduce the risk levels. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | modifications to rate the building to L4 of the code. | |
| 7 | Change 33kV/11kV arms to avoid bird related outages | Quality | $160,000 | • Continue with existing configuration. | • Use Hendrix cable. | • Change the configuration of 33kV to delta and install bird diverters. | • Change configuration of circuits to avoid bird related outages.<br>• Hendrix cables are expensive compared to reconfiguration and would require easements. |
| 8 | Link between Feeders 652 and 632 (between S186 & P285) to provide alternative circuit. | Quality | $85,000 | • Continue with existing unmeshed feeders. | | • Install link between Feeders 652 and 632. | • Install link between Feeders 652 and 632.<br>• Being able to back-feed un-faulted sections of both feeders provides an opportunity to reduce restoration times. |
| 9 | Install additional permanent fault locators to allow quicker location of faults. | Quality | $51,327 | • Rely on existing telemetered devices to locate faults. | | • Install fault locators | • Install fault locators.<br>Quicker location of faulted section of feeder is consistent with strategy of improving reliability. |
| 10 | Install LV -power quality monitors | Quality | $50,000 | • Continue with no visibility of LV power quality information. | • Install smart sensors on selected distribution transformers. | • | • Install LV PQ monitors on selected transformers.<br>• This will provide valuable information to create a baseline of existing power quality, validate ADMD assumptions and additionally can feed information To ADMS to inform LV outages. |
| 11 | Link LV network where gaps exist to reduce fault restoration times. | Quality | $40,772 | • Continue with existing LV network configuration. | | • Install links between LV circuits. | • Install links between LV circuits.<br>• Allow supply restoration in switching time rather than repair time. |
| 12 | Install comm's on specified fault locators to allow remote indication. | Quality | $28,392 | • Continue with existing fault locaters that require manual observation. | • | • Install comms to allow remote indication of faults. | • Install comms to allow remote indication of faults.<br>• Remote indication of faults allows quicker directing of fault men to faults, reducing restoration times. |

* includes "low investment" options.

## 5.7.2 Development projects for 2019/20 to 2022/23

Development projects proposed for 2019/20 to 2022/23 include…

| Ref. | Description | Category | Cost |
|---|---|---|---|
| 1 | Protection Work | Quality | $2,050,000 |
| 2 | Automation of Switchgear | Quality | $1,080,000 |

| | | | |
|---|---|---|---|
| 3 | Network sectionalisation | Quality | $950,000 |
| 4 | Link between W42 and W293 -Pram Airport and install CFC | Quality | $220,000 |
| 5 | Seismic Strengthening -ZS Buildings | Quality | $525,000 |
| 6 | Install additional fault locators – Permanent | Quality | $204,424 |
| 7 | Install LV -power quality monitors | Quality | $200,000 |
| 8 | Link LV network where gaps exist | Quality | $163,088 |
| 9 | Fault locator communication. | Quality | $113,568 |
| 10 | 6th Feeder- Park Avenue | Growth | $475,000 |
| 11 | Mangahao ODID conversion. | Quality | $250,000 |
| 12 | Additional Ripple Plant | Quality | $500,000 |
| 13 | Upgrade to Butterfly- Foxton to Levin West 33kV | Growth | $1,379,850 |
| 14 | Install cable Switch gear close Ring (underground LV also) | Quality | $59,400 |
| 15 | Install cable Switch gear close Ring (underground LV also) | Quality | $459,950 |
| 16 | Q91 to P271 Close ring | Quality | $306,634 |
| 17 | Additional Feeder- Riverbank Road-Otaki | Growth | $310,000 |
| 18 | Install ring feed cable to back up L21 to L332 | Quality | $250,000 |
| 19 | Install cable Switch gear close Ring | Quality | $153,317 |
| 20 | Install Switchgear and reconfigure | Quality | $102,600 |
| 21 | 2nd transformer (cold standby) Paekakariki | Quality | $120,000 |
| 22 | Cable installation between W494 and W502 | Growth | $122,653 |
| 23 | Cable installation between W97 and W98 | Growth | $210,000 |
| 24 | Replace W300 SW Gear and close ring W532 | Quality | $65,000 |
| 25 | Alternative supply between W468 & Z50 | Quality | $511,056 |
| 26 | 2nd Feeder- Beach | Growth | $460,000 |
| 27 | Install new cable Switchgear close ring upgrade conductor to T180 | Quality | $59,400 |
| 28 | Alternate Supply-Waitarere Beach | Quality | $613,268 |
| 29 | Install 5th Feeder- Matai Rd | Growth | $81,769 |
| 30 | New feeder from Shannon Substation | Growth | $250,000 |

## Alternative options considered include…

| Ref. | Description and purpose of project | Category | Cost | Options considered | | | Option chosen and reason |
|---|---|---|---|---|---|---|---|
| | | | | Do-Nothing | Non-Network | Network | |
| 1 | Tesla Protection Work. | Quality | $2,050,000 | • Slow operating protection | | • Upgrade to digital SEL relays. | • Upgrade to digital SEL relays.<br>• Inadequate protection operating speed is both an operational and a safety risk. |
| 2 | Automate switchgear on specified feeders to reduce restoration times. | Quality | $1,080,000 | • Continue with existing manual switching arrangements. | | • Automate specific switches. | • Automate specific switches.<br>• As more customers are added to feeders, the number of customers effected by a fault will also increase, which is undesirable. Automating specific switches will reduce supply restoration time. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | • These devices will provide network data, which will help to improve network investment decisions of future. |
| 3 | Install sectionalisers on specified feeders to reduce number of customers affected by faults. | Quality | $950,000 | • Continue with existing feeder sections. | | • Install line sectionlisers on specific feeder locations. | • Sectionalise feeders.<br>• As more customers are added to feeders, the number of customers effected by a fault will also increase, which is undesirable. Sectionalising will reduce the number of customers affected. |
| 4 | Link between W42 and W293 - Pram Airport and install CFC | Quality | $220,000 | • Continue with existing spur network arrangement. | • Install backup generators/battery for redundancy. | • Install a cable section to close the ring. | • Install ring feed cable.<br>• Diesel generators and battery solutions are not cost effective.<br>• Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability |
| 5 | Seismic Strengthening -ZS Buildings<br>. | Quality | $525,000 | • Continue with high risk buildings, which are prone to earthquake damage. | | • Get buildings seismically assessed and carry out modifications to rate the building to L4 of the code. | • To carry out studies and carry out recommendations to get buildings compliant to the code to reduce the risk levels. |
| 6 | Install additional permanent fault locators to allow quicker location of faults. | Quality | $204,424 | • Rely on existing telemetered devices to locate faults. | | • Install fault locators | • Install fault locators.<br>Quicker location of faulted section of feeder is consistent with strategy of improving reliability. |
| 7 | Install LV -power quality monitors | Quality | $200,000 | • Continue with no visibility of LV power quality information. | • Install smart sensors on selected distribution transformers. | • | • Install LV PQ monitors on selected transformers.<br>• This will provide valuable information to create a baseline of existing power quality, validate ADMD assumptions and additionally can feed information To ADMS to inform LV outages. |
| 8 | Link LV network where gaps exist to reduce fault restoration times. | Quality | $163,088 | • Continue with existing LV network configuration. | • | • Install links between LV circuits. | • Install links between LV circuits.<br>• Allow supply restoration in switching time rather than repair time. |
| 9 | Install comms on specified fault locators to allow remote indication. | Quality | $113,568 | • Continue with existing fault locaters that require manual observation. | • | • Install comms to allow remote indication of faults. | • Install comms to allow remote indication of faults.<br>Remote indication of faults allows quicker directing of fault men to faults, reducing restoration times. |
| 10 | Install an additional feeder to Park Avenue to supply increasing load. | Growth | $475,000 | • Allow load and customer numbers on existing feeder to increase. | • Encourage customers to uptake solar and / or battery storage. | • Add new feeder. | • Add new feeder.<br>• Simply adding more customers will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | policy on asset loading and increasing asset capacity.<br>• As more customers are added to the feeder, the number of customers effected by a fault will also increase which is undesirable. Offloading customers will reduce the number of customers affected.<br>• Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted.<br>• Any connected solar or batteries may not be of reliable source due to intermittency of supply. |
| 11 | Mangahao ODID | Quality | $250,000 | • No switches outside GXP to isolate circuits by Electra. | | • Install load brake switches outside GXP to isolate individual circuits by Electra staff. | • Install ABSs on poles where new cables /circuits terminate outside after ODID.This will enable Electra to isolate the circuits quicker once Transpower remotely isolates breakers. |
| 12 | Ripple Plant installation at Otaki to cover whole network if either of the existing plants are out of service. | Quality | $500,000 | • Continue with existing plants. | • | • Purchase and install additional ripple plant | • Purchase and install additional ripple plant.<br>• New plant will ensure that whole network will have ripple coverage.<br>• Loss of ripple plant in either network could result in higher costs e.g. failure to control load to within Transpower peaks. |
| 13 | Replace 3km section of Bee in the Foxton - Levin West 33kV with Butterfly to remove constraint if Levin East circuit trips. | Growth | $1,379,850 | • Leave section of Bee in place. | • Install station class battery banks in substations to supply load during contingency. | • Replace 3km section of Bee with Butterfly. | • Replace section of Bee with Butterfly.<br>• Leaving the 3km of Bee in place limits the capacity of this circuit should the Levin East 33kV circuit trip, which is unacceptable.<br>• Whole life cost of battery banks doesn't justify the investment. |
| 14 | Install cable and switchgear to close ring at specified locations and underground the LV to allow quicker restoration of faults. | Quality | $59,400 | • Retain existing spur configuration. | • | • Install ring feed cable. | • Install ring feed cable.<br>• Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability |
| 15 | Install cable and switchgear to close ring at specified locations and underground the LV to allow quicker restoration of faults. | Quality | $459,750 | • Retain existing spur configuration. | | • Install ring feed cable. | • Install ring feed cable.<br>• Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability |
| 16 | Install cable and switchgear to close ring at specified locations | Quality | $306,634 | • Retain existing spur configuration. | | • Install ring feed cable. | • Install ring feed cable. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | and underground the LV to allow quicker restoration of faults. | | | | | | • Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability |
| 17 | Additional Feeder -Otaki | Growth | $310,000 | • Allow load and customer numbers on existing feeder to increase | • Encourage customers to uptake solar and / or battery storage. | • Add new feeder. | • Add new feeder.<br>• Simply adding more customers will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's policy on asset loading and increasing asset capacity.<br>• As more customers are added to the feeder, the number of customers effected by a fault will also increase which is undesirable. Offloading customers will reduce the number of customers affected.<br>• Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted.<br>• Any connected solar or batteries may not be of reliable source due to intermittency of supply. |
| 18 | Install ring feed cable between L21 and L332 to allow meshing and reduce fault restoration time. | Quality | $250,000 | • Retain existing spur configuration. | | • Install ring feed cable. | • Install ring feed cable.<br>• Meshing of circuits allows reduced restoration times. |
| 19 | Install cable and switchgear to close ring at specified locations. | Quality | $153,317 | • Retain existing spur configuration. | • | • Install ring feed cable. | • Install ring feed cable.<br>Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability |
| 20 | Install Switchgear and reconfigure | Quality | $102,600 | • Retain existing spur configuration. | | • Install a ring main unit and improve the back feed capability. | • Install a RMU.<br>• Meshing of circuits allows reduced restoration times |
| 21 | Relocate a 33/11kV transformer to act as a cold standby at Paekakariki. | Quality | $120,000 | • Continue with existing single transformer configuration, and relocate a transformer from another substation in the event of failure. | • Relocate a transformer from another substation and keep as a cold standby at Paekakariki that could be livened in 6 to 8 hours | • Purchase second transformer and keep as a cold standby at Paekakriki that could be livened in 6 to 8 hours. | • Relocate a transformer from another substation to keep as a cold standby at Paekakariki.<br>• Only some Paekakariki customers can be back fed on the 11kV from other substations, so a transformer failure would interrupt supply until the transformer was repaired (possibly months) or replaced. |
| 22 | Replace cable between W494 & W502 to allow load growth. | Growth | $122,653 | • Retain existing cable. | | • Replace existing cable with larger cable. | • Replace existing cable with larger cable.<br>• Simply adding more load will increase its asset utilisation and risk of in-service failure. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | This is inconsistent with Electra's policy on asset loading and increasing asset capacity. |
| 23 | Replace cable between W97 & W98 to allow load growth. | Growth | $210,000 | • Retain existing cable. | | • Replace existing cable with larger cable. | • Replace existing cable with larger cable.<br>• Simply adding more load will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's policy on asset loading and increasing asset capacity. |
| 24 | Replace W300 switchgear and close ring W532 to allow quicker restoration of faults. | Quality | $65,000 | • Retain existing spur configuration. | | • Install ring feed cable. | • Install ring feed cable.<br>• Meshing of circuits allows reduced restoration times. |
| 25 | Install alternative supply between W468 & Z50 to allow quicker restoration of faults. | Quality | $511,056 | • Continue with existing unmeshed feeders. | | • Install link between W468 and Z50. | • Install link between W468 and Z50.<br>• Being able to back-feed un-faulted sections of both feeders provides an opportunity to reduce restoration times.<br>• |
| 26 | Install a second feeder to the Beach to supply existing load. | Growth | $460,000 | • Allow load and customer numbers on existing feeder to increase. | Encourage customers to uptake solar and / or battery storage | • Add second feeder. | • Add second feeder.<br>• Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted.<br>• Any connected solar or batteries may not be of reliable source due to intermittency of supply.<br>• Simply adding more customers will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's policy on asset loading.<br>• As more customers are added to the feeder, the number of customers effected by a fault will also increase which is undesirable. Offloading customers will reduce the number of customers affected. |
| 27 | Install new cable and switchgear to close ring, and upgrade conductor to T180. | Quality | $59,400 | • Retain existing spur configuration. | | • Install ring feed cable. | • Install ring feed cable.<br>• Meshing of circuits allows reduced restoration times. |
| 28 | Install alternative supply to allow quicker restoration of faults. | Quality | $613,268 | • Continue with existing unmeshed feeders. | | • Install link between W468 and Z50. | • Install link between W468 and Z50.<br>• Being able to back-feed un-faulted sections of both feeders provides an opportunity to reduce restoration times. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 29 | Install a fifth feeder to Matai Rd to supply increasing load. | Growth | $81,769 | • Allow load and customer numbers on existing feeders to increase. | | • Add new feeder. | • Add new feeder.<br>• Simply adding more customers will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's policy on asset loading and increasing asset capacity.<br>• As more customers are added to the feeder, the number of customers effected by a fault will also increase which is undesirable. Offloading customers will reduce the number of customers affected. |
| 30 | New 11kV feeder from Shannon Substation to supply increasing load. | Growth | $250,000 | • Allow load and customer numbers on existing feeder to increase. | Encourage customers to uptake solar and / or battery storage. | • Add new feeder. | • Add new feeder.<br>• Simply adding more customers will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's policy on asset loading and increasing asset capacity.<br>• As more customers are added to the feeder, the number of customers effected by a fault will also increase which is undesirable. Offloading customers will reduce the number of customers affected.<br>• Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted.<br>• Any connected solar or batteries may not be of reliable source due to intermittency of supply. |

* includes "low investment" options.

## 5.7.3 Development projects for 2023/24 to 2027/28

Development projects proposed for 2023/24 to 2027/28 include…

| Ref. | Description | Category | Cost |
|---|---|---|---|
| 1 | Protection Project | Quality | $300,000 |
| 2 | Automation of Switchgear | Quality | $1,480,000 |
| 3 | Network Sectionalisation | Quality | $1,050,000 |
| 4 | Install additional fault locators - Permanent | Quality | $255,530 |

| | | | |
|---|---|---|---|
| 5 | Link LV network where gaps exist | Quality | $203,860 |
| 6 | Fault locator communication. | Quality | $141,960 |
| 7 | Relocate Access issues | Quality | $102,211 |
| 8 | Upgrade to butterfly- Levin West to Levin East 33kV | Growth | $459,950 |
| 9 | Rural Substation | Growth | $1,272,112 |
| 10 | Install SW Gear and reconfigure | Quality | $102,600 |
| 11 | Alternative supply between W38 & W39 | Quality | $306,633 |
| 12 | Install conductor and close ring | Quality | $1,022,112 |
| 13 | New zone sub to back up Foxton and Shannon and load growth | Growth | $1,728,000 |
| 14 | T106 to T57 install cable close Ring | Quality | $408,845 |
| 15 | Install new cable Switchgear close ring upgrade conductor to T180 | Quality | $357,739 |
| 16 | Close 11kV Rings | Growth | $950,000 |
| 17 | Upgrade to butterfly-Levin West to Levin East 33kV | Growth | $613,267 |

# 6. Network lifecycle management plans

Electra manages its assets by asset type. The lifecycle plans for each asset type are set out below sections. The alignment of Electra's grades with the grades set out in the Determination is as follows…

| Determination | | Electra | |
|---|---|---|---|
| **Grade** | **Definition** | **Condition** | **Definition** |
| 0 | Not used in the Determination | 0 | • Imminent risk of failure. Schedule replacement for next working day unless repair or replacement required immediately. |
| 1 | End of serviceable life, immediate intervention required. | 1 | • Close to failure, schedule for replacement within next 3 months. |
| 2 | Material deterioration but asset condition still within serviceable life parameters. Intervention likely to be required within 3 years. | 2 | • Will require replacement before next scheduled inspection. Schedule for replacement, scope to be confirmed during first half of next inspection cycle. |
| 3 | Normal deterioration requiring regular monitoring | 3 | • Does not require replacement during this inspection cycle. Continue with scheduled inspection cycle. |
| 4 | Good or as new condition | 4 | • No sign of deterioration. Continue with scheduled inspection cycle. |
| Unknown | Unknown or not yet assessed | | • Unknown or not yet assessed. Criticality is determined as part of the asset identification, and it will be assigned an inspection cycle.<br>• Condition assessment methods are periodically evaluated for low-value, low-risk asset categories that are otherwise run to failure. |

# 6.1 Concrete & steel poles

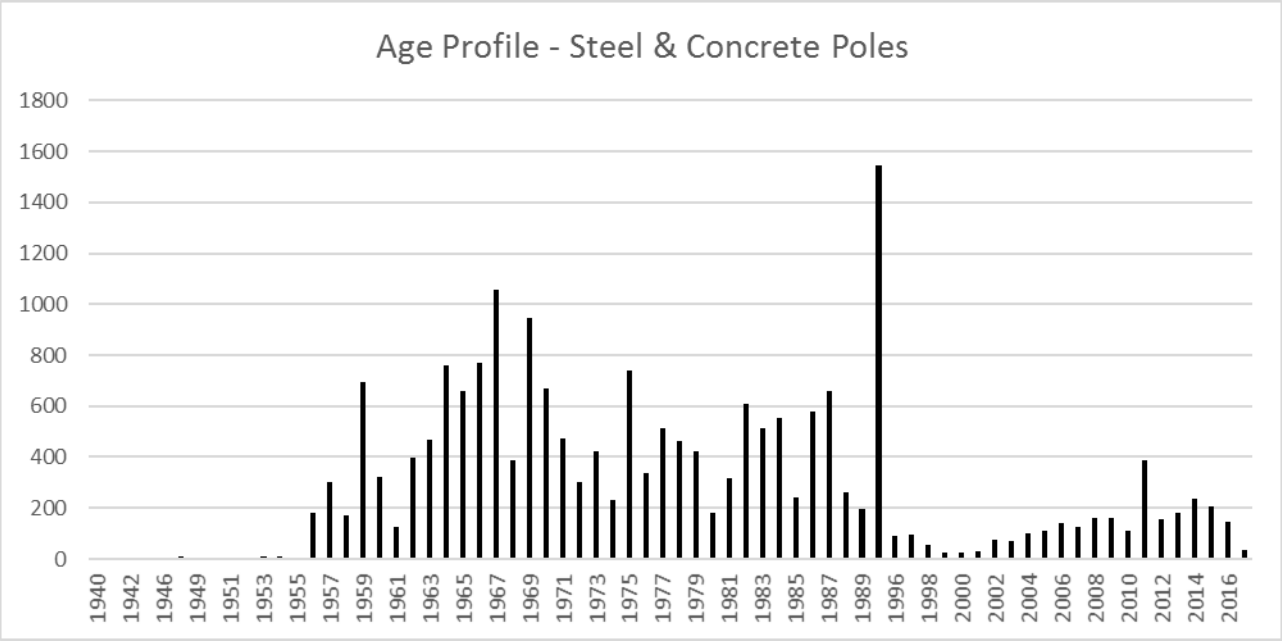
Key features of Electra's concrete & steel pole management are as follows.

## Summary of asset class

Electra has 20,338 concrete poles and 52 steel poles on its network. These range in age from new to 78 years old, and have been sourced from a range of suppliers including the HEPB's own pole factory.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| Pre-stressed concrete | 1,746 | Each | 8.53% | No known concerns, but observed that heavily loaded poles are deteriorating faster. |
| Solid concrete | 18,560 | Each | 91.2% | No known concerns, but observed that heavily loaded poles are deteriorating faster. |
| Spun concrete | 2 | Each | 0.01% | |
| Steel | 38 | Each | 0.19% | |
| Oclyte | 14 | Each | 0.07% | |
| **Total** | **20,360** | Each | **100%** | |




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | 1.5% | 93.40% | 5.10% | - | 3 | 2.50% |

## Systemic issues & mitigation

There are no known systemic issues with Electra's concrete or steel poles.

# Key design parameters

| Parameter | Value |
|---|---|
| Durability | General design life of 60 years. |
| Structural strength | Minimum strength embodied in Electra's Overhead Line Design Standard. |

# Management tactics

## Maintenance drivers

- Overall integrity of concrete.
- Verticality of pole in all directions, including slumping or subsidence of surrounding ground.
- Clearance of live conductors from both ground and surrounding structures.
- Corrosion of steel poles, especially at ground level.

## Maintenance criteria

- Cracking or spalling of concrete becomes greater than hair-line or more than 250mm long.
- Reinforcing steel becomes exposed.
- Supporting ground shows evidence of erosion or subsidence e.g. pole slumping.
- Pole leans to the point where conductors are overly strained, or sag below minimum allowable height.
- Steel pole corroded to more than surface deep, especially near ground level.

## Assumptions

- Spalling of concrete will lead to unsafe pole condition within 5 years in inland areas, and 3 years in coastal areas.
- Erosion of ground will lead to unsafe condition within 2 years.
- Surface corrosion of steel poles will continue to corrode deeper.
- Deterioration at ground level is most critical due to greater bending moment.

## Condition assessment techniques and methods

- Primarily visual

- May include any one or more of accepted industry techniques for either structural (loading) testing or estimating remaining cross-section.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as revealed by inspections.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – will not be refurbished, may have minor repairs to lift from Grade 1.
- Grade 3 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew within 3 months.
- Grade 2 – renew within inspection cycle.

## Lifecycle decision criteria

- Electra will repair hairline cracks in concrete poles using commercially proven grout and treatments.
- The criteria for replacement of the pole is whether the crack is bigger than hairline, more than 250mm long, or has exposed the reinforcing steel.
- For poles with a planned replacement date, an optimised reduced maintenance program maybe developed if analysis concludes that the risks can be prudently managed. This may include different approaches for specific assets in sensitive areas such as parks or near schools.

## Life extension & investment deferral techniques

- Electra views poles as safety-critical and therefore weights the risk of failure more heavily in its "refurbish-replace" decisions, which creates a bias for replacement (rather than squeezing a few remaining years out of pole).

# Major projects & programs

## Projects & programs 2018/19

| Ref. | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 400V Pole Replacements - Inspection Driven | Renewal | $204,000 |
| 2 | All | 11kV Pole Replacements - Inspection Driven | Renewal | $248,000 |
| 3 | All | 33kV Pole Replacements - Inspection Driven | Renewal | $150,000 |
| 4 | All | Fault/Urgent defect replacement | Renewal | $50,000 |

## Projects & programs 2019/20 to 2022/23

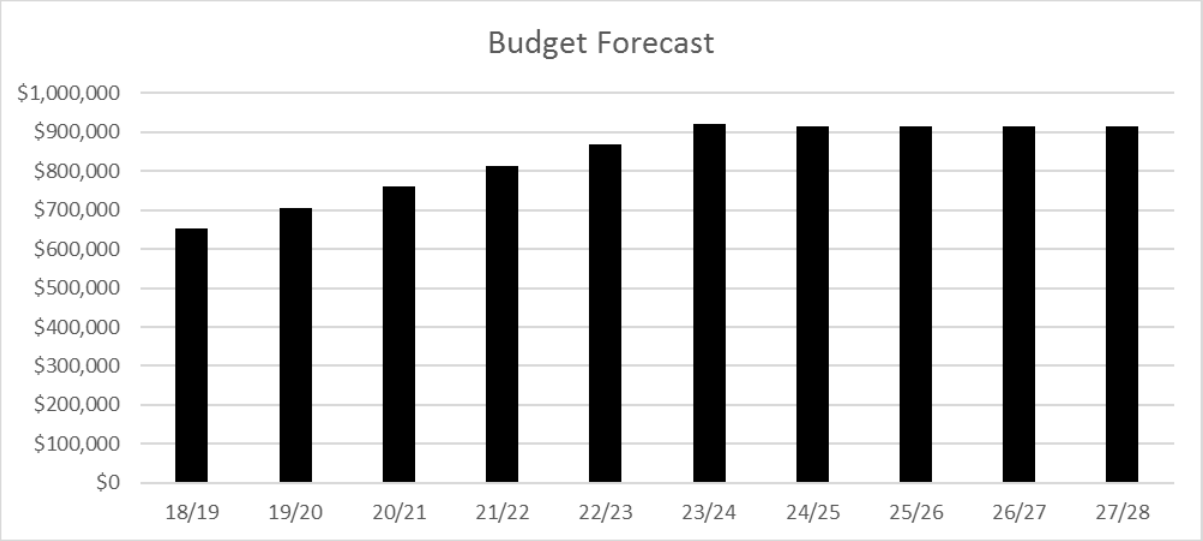
| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 400V Pole Replacements - Inspection Driven | Renewal | $815,000 |
| 2 | All | 11kV Pole Replacements - Inspection Driven | Renewal | $1,534,000 |
| 3 | All | 33kV Pole Replacements - Inspection Driven | Renewal | $600,000 |
| 4 | All | Fault/Urgent defect replacement | Renewal | $200,000 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 400V Pole Replacements - Inspection Driven | Renewal | $1,019,000 |
| 2 | All | 11kV Pole Replacements - Inspection Driven | Renewal | $2,767,000 |
| 3 | All | 33kV Pole Replacements - Inspection Driven | Renewal | $550,000 |
| 4 | All | Fault/Urgent defect replacement | Renewal | $250,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $652k | $706k | $760k | $814k | $868k | $922k | $916k | $916k | $916k | $916k |




# 6.2 Wooden poles

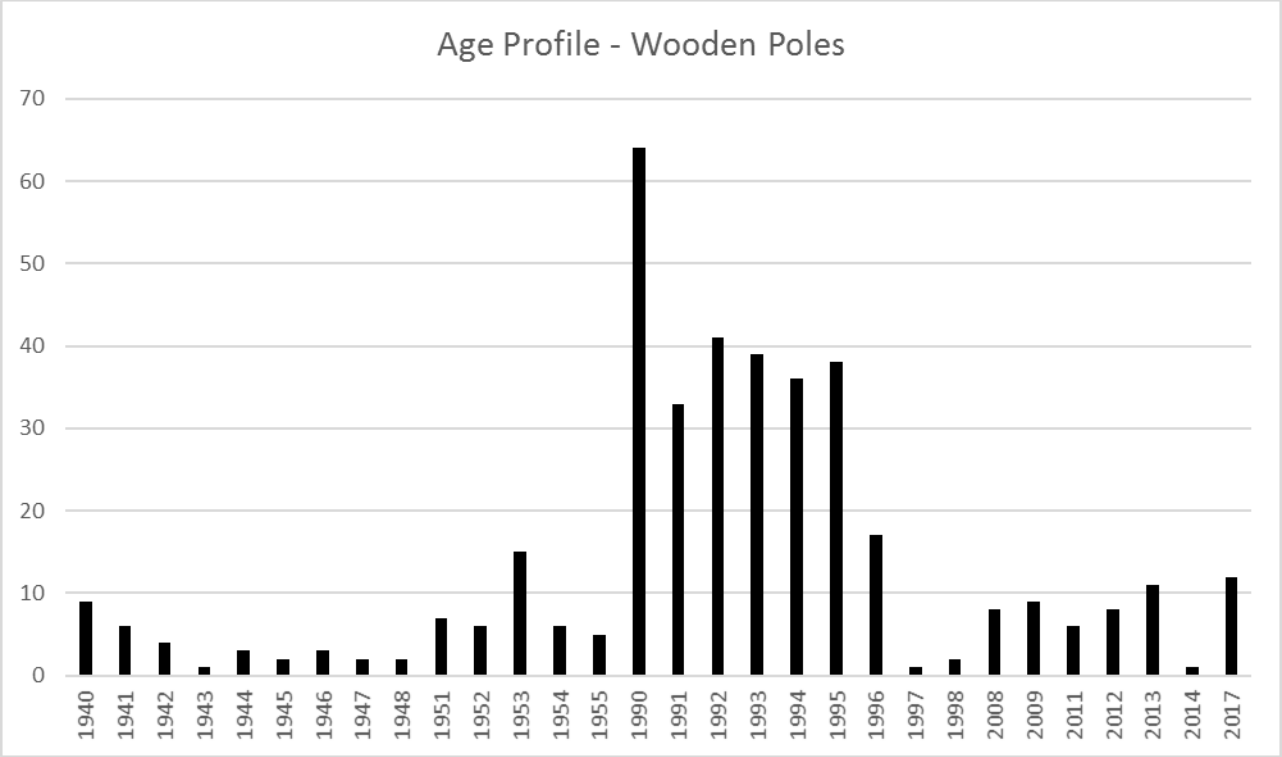
Key features of Electra's wood pole management are as follows.

## Summary of asset class

Electra has 22 hardwood poles on its 11kV network, of which 4 are being replaced in early 2018. There are records of a further 1,177 service line poles for which ownership may include Chorus or customers, and is very unlikely to include Electra. These range in age from new to 78 years old, and have been sourced from a range of suppliers.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| Soft wood | 836 | Each | 71% | |
| Hard wood | 341 | Each | 29% | |
| **Total** | **1,177** | **Each** | **100%** | |




# Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| 11kV hardwood distribution | - | 37.78% | 62.22% | - | - | 3 | 44.00% |

# Systemic issues & mitigation

There are no known systemic issues with Electra-owned wood poles.

Electra is developing a customer-owned (wood) pole strategy during 2018 which will present a range of options for Electra to assist customers in maintaining their service lines and service mains in a safe condition.

# Key design parameters

| Parameter | Value |
|---|---|
| Durability | No longer applicable as Electra is no longer installing wooden poles. |
| Structural strength | No longer applicable as Electra is no longer installing wooden poles. |

# Management tactics

## Maintenance drivers

- Overall integrity of timber, including absence of splits, warping or enlarging of knots.

- Verticality of pole in all directions.
- Evidence of rot or fungus, especially at ground level.
- Clearance of live conductors from both ground and surrounding structures.

## Maintenance criteria

- Splitting of timber becomes greater than finger-width.
- Warping or twisting of timber strains or slackens conductors.
- Heart timber becomes exposed.
- Supporting ground shows evidence of erosion or subsidence.
- Pole leans to the point where conductors are overly strained, or sag below minimum allowable height.
- Deterioration of timber becomes more than surface deep, especially at ground level.

## Assumptions

- Splitting of timber will lead to unsafe pole condition within 5 years in inland areas, and 3 years in coastal areas.
- Erosion of ground will lead to unsafe condition within 2 years.
- Surface deterioration of timber will continue to deteriorate deeper.
- Deterioration at ground level is most critical due to greater bending moment.

## Condition assessment techniques and methods

- Primarily visual, noting that very few remain on Electra's network.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as revealed by inspections.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Electra will increase the frequency of inspection when a pole exceeds any of the maintenance criteria.
- Electra will schedule replacement of wood poles when inspections reveal it to be structural unsound, or placing undue load on other components including straining or slackening conductors.

## Life extension & investment deferral techniques

- Not applicable as Electra no longer installs wood poles.

# Major projects & programs

Wood poles are included with concrete poles at a program level, refer to Chapter 6.1.

# Budget forecast

Wood poles are included with concrete poles at a program level, refer to Chapter 6.1.

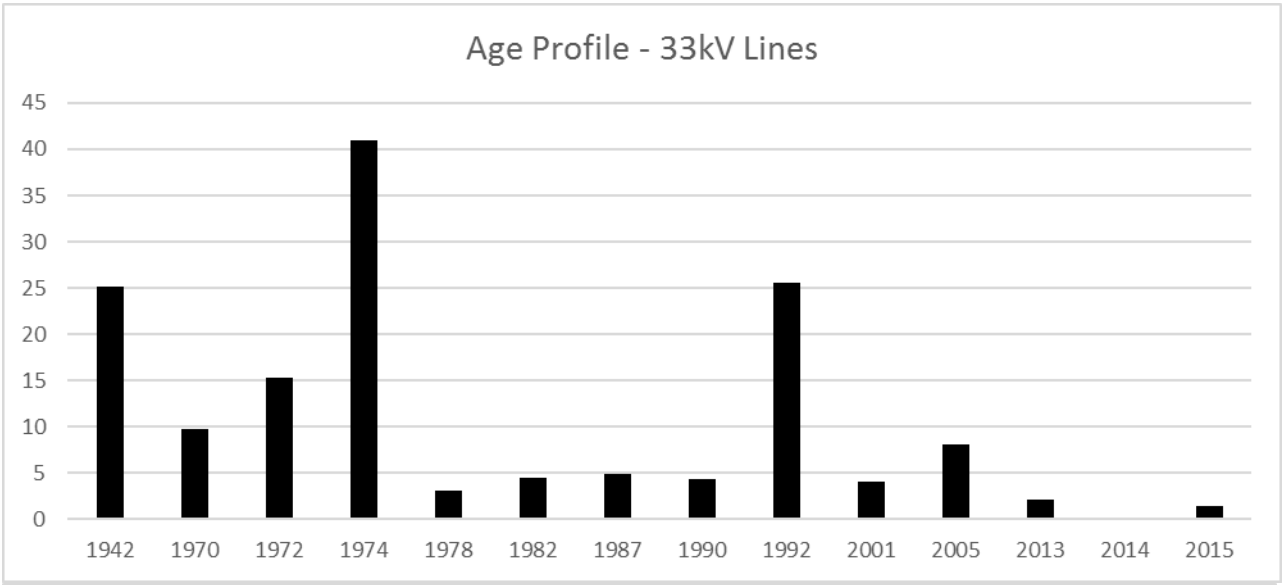
# 6.3 Overhead conductor

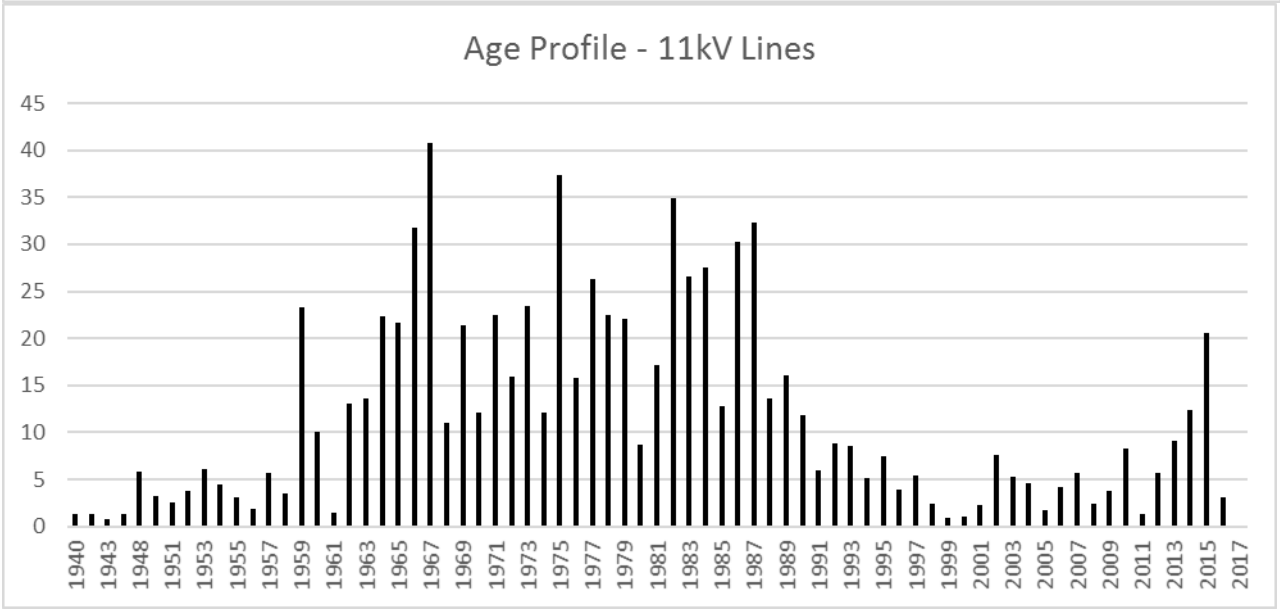
Key features of Electra's overhead conductor management are as follows.

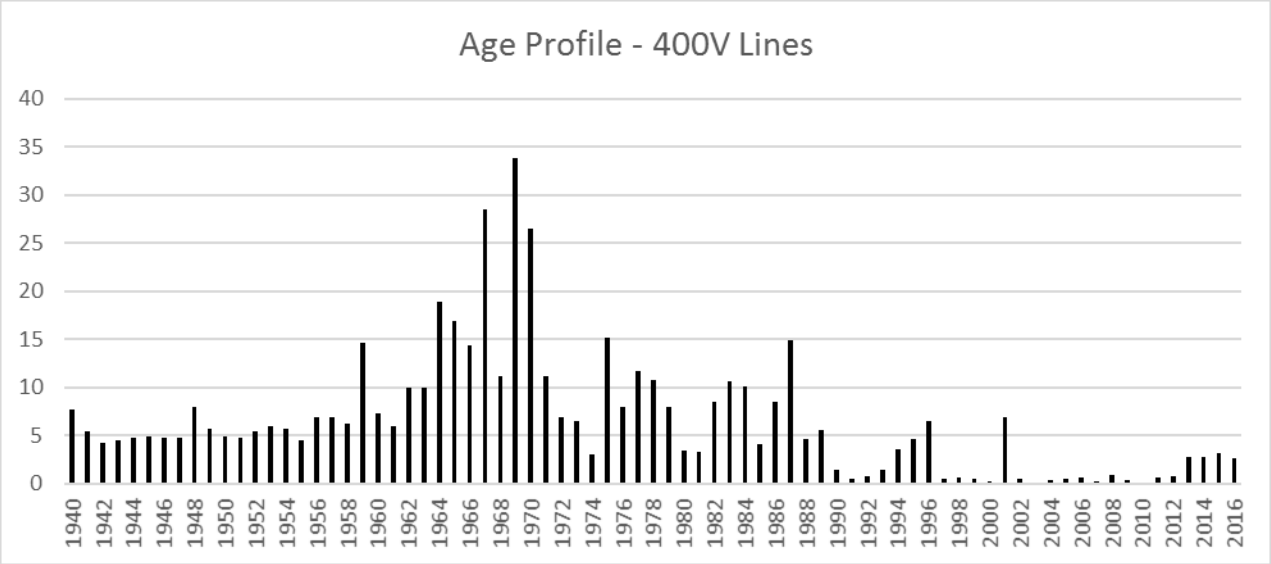
## Summary of asset class

Electra has 152 km of 33kV overhead conductor, 849 km of 11kV overhead conductor, and 505 km of LV overhead. These conductors are a mix of Gopher, Bee, Butterfly, 7/0.083 Copper, 19/0.064 Copper and 19/0.092 Copper.

## Population and age profile






# Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| 33kV conductor | | 9.50% | 89.15% | 1.35% | | 4 | 10.0% |
| 11kV conductor | | 9.40% | 85.10% | 5.50% | | 3 | 10.02% |
| LV conductor | | 2.60% | | 1.20% | 96.20% | 3 | 4.00% |

## Key design parameters

| Parameter | Value |
|---|---|
| Capacity | Nominal load of 70% of manufacturer's rating. |
| Mechanical strength | Embodied in Electra's overhead line design standard, which in turn are referenced to span lengths and tension. |

## Capacity, security & reliability constraints

Refer to Chapter 5.4

# Systemic issues & mitigation

| Systemic issue | Mitigation | Magnitude of issue and impact on Electra |
|---|---|---|
| ACSR conductors in coastal area have had problems with corrosion | Electra's standards have been changed so that ACSR conductors have Aluminium coated rather than grease coated steel reinforcing | This issue is of minimal magnitude, and doesn't significantly impact on Electra. |

# Management tactics

## Maintenance drivers

- Overall integrity of complete conductor.
- Breakage , fraying or splaying of individual strands.
- Stretching, elongation or necking consistent with annealing.
- Bird-caging of complete conductor.
- Clearance of live conductors from ground, trees, other parties wires and surrounding structures.
- Excessive surface corrosion.

## Maintenance / replacement criteria

- Cross-section area reduced to less than 85% of as-new conductor.
- One or more strands of a 7 strand conductor visibly broken or close to breaking.
- Three or more strands of a 19 strand conductor visibly broken or close to breaking.
- Corrosion (especially black or green) appears more than surface for significant fractions of individual spans.
- Individual strands visibly bird-caging.
- Evidence of overheating.
- Excess tension (usually a pole leaning issue).
- Sag below minimum allowable distance (usually a pole leaning issue).

## Assumptions

- Fraying of individual strands will place more strain on remaining strands and lead to accelerated failure.
- Corrosion that is deeper than surface will place more strain on remaining strands and lead to accelerated failure.
- Heavy loading for prolonged periods may anneal the conductor, reducing its tensile strength.

## Condition assessment techniques and methods

- Visual, specifically looking for cracked or corroded strands, or splaying of strands.

# Lifecycle policies, criteria and activities

## Inspections

- Condition 0 – scheduled for immediate replacement.
- Condition 1 – no further inspection, schedule for replacement within next 3 months.
- . Condition 2 – no further inspection, replacement scope to be confirmed during first half of next inspection cycle.
- Condition 3 – will not meet replacement criteria during this inspection cycle, continue inspecting.
- Condition 4 – no sign of deterioration, continue scheduled inspections.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Condition 0 or 1 – will not be refurbished.
- Condition 2 – minor repairs only.
- Condition 3 or 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal / replacement

- Condition 0 – replace either immediately or next working day.
- Condition 1 – replace with 3 months.
- Condition 2 – replace within first half of next inspection cycle.
- Condition 3 or 4 – no replacement required.

- Progressive replacement of all Copper conductor with thicker conductor to allow 11kV back feeding and eliminate safety hazard (breakage and whipping), starting with 7/0.064 where possible.

## Lifecycle decision criteria

- Up-size if conductor is loaded beyond 70% of nominal rating for more than about 3,000 hours per year.

- Replace if more than 1 strand of a 7 strand conductor or 3 strands of a 19 strand conductor are visibly broken or splayed.

## Life extension & investment deferral techniques

- Use of Aluminium coated steel reinforced ACSR rather than grease coated steel reinforcing.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Carry Over Bucket | Renewal | $200,000 |
| 2 | Waitohu Valley Rd, Otaki | Replace 16mm Cu with Bee (2.5km) | Renewal | $204,000 |
| 3 | Old Hautere Road | Reconductor 7/16 Cu with Bee(1.9km) | Renewal | $160,000 |
| 4 | SH1 -North of Koputaroa Road(1.7km), Foxton | Replace rango/mink conductor with Bee (1.7km) | Renewal | $160,000 |
| 5 | Bergin Rd, Foxton | Replace 16mm Cu with bee (1.5km) | Renewal | $132,000 |
| 6 | Convent Rd/Old Couch Rd, Otaki | Replace 7/14 Cu with Bee(1.4km) | Renewal | $130,000 |
| 7 | Kuku Beach Rd, Levin | Replace 7/14 Cu up to J74 and install an ABS | Renewal | $120,000 |
| 8 | Huia St, Waikanae | Replace 16mm Cu with Bee (1km) | Renewal | $85,000 |
| 9 | Queen St West, Levin | Replace 16mm Cu with Bee (1km) | Renewal | $82,000 |
| 10 | All | Inspection Driven Conductor Replacements | Renewal | $51,000 |
| 11 | Hadfield Rd, Waikanae | Reconductor 7/16 Cu with Bee(0.5km) | Renewal | $60,000 |
| 12 | Donovan Rd, Paraparaumu | Replace 25mm Cu with Gopher (0.3km) | Renewal | $41,000 |
| 13 | Avenue Rd, Foxton | Replace 400V line | Renewal | $30,000 |
| 14 | Arapaepae Rd, Levin | Replace 620m of 7/14 Cu Bare LV with Beetle. | Renewal | $65,000 |
| 15 | Mako Mako Rd, Levin | Replace 1 km of 7/14 & 19 /16 Cu Bare with Beetle | Renewal | $90,000 |
| 16 | Te Horo Beach Rd/Sims | Replace 580m of 7/14 Cu Bare LV with Beetle. | Renewal | $53,000 |
| 17 | Marine Parade/Rangiuru, Otaki | Replace 390m of 7/14 Cu Bare LV with Beetle. | Renewal | $35,000 |
| 18 | Kuku Beach Rd, Levin | Replace 600m of 7/14 Cu Bare LV with Beetle. | Renewal | $54,000 |
| 19 | Shannon | Replace 350m of 7/14 Cu Bare LV with Beetle. | Renewal | $32,000 |
| 20 | Peka Peka Rd, Waikanae | Replace 530m of 7/14 Cu Bare LV with Beetle. | Renewal | $48,000 |
| 21 | Boulton Road | Replace 600m of 7/14 Cu Bare LV with Beetle | Renewal | $56,000 |

## Projects & programs 2019/20 to 2022/23

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|

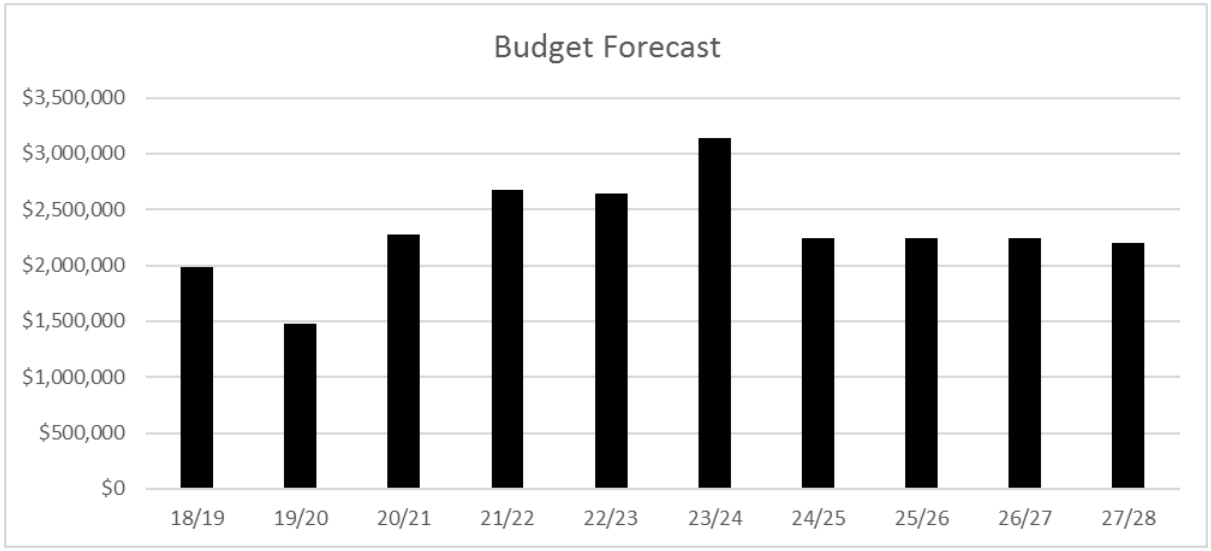
| | | | | |
|---|---|---|---|---|
| 1 | All | 400V Reconductors | Renewal | $1,635,000 |
| 2 | Kuku Beach Rd, Levin | Replace 7/14 Cu up to J74 and install an ABS | Renewal | $225,000 |
| 3 | All | Inspection Driven Conductor Replacements | Renewal | $204,000 |
| 4 | Donovan Rd, Paraparaumu | Replace 25mm Cu with Gopher (0.3km) | Renewal | $92,000 |
| 5 | School Rd, Otaki | Replace 16mm Cu with Bee (3km) | Renewal | $307,000 |
| 6 | SH1 Waitarere Beach Rd to Koputaroa Rd | Replace Mink with Bee (2.5km) | Renewal | $153,000 |
| 7 | Foxton Shannon Rd | Replace 35mm Cu with Bee | Renewal | $920,000 |
| 8 | SH1 South, Foxton | Replace 25mm Cu with Bee | Renewal | $511,000 |
| 9 | Vista Rd, McLeavy Rd, Levin | Replace extension arms, reconductor and connect | Renewal | $153,000 |
| 10 | H219 to L224 | Check conductor size upgrade to Bee | Renewal | $409,000 |
| 11 | Lindsay Rd, Levin | Replace 16mm Cu with Gopher (2km) | Renewal | $123,000 |
| 12 | Kuku Beach Rd, Levin | Replace 16mm Cu with Gopher (4km) | Renewal | $245,000 |
| 13 | Whakahoro Rd, Otaki | Replace 16mm Cu with Gopher (1km) | Renewal | $61,000 |
| 14 | Domain Rd, Otaki | Replace 16mm Cu with Gopher (0.5km) | Renewal | $41,000 |
| 15 | Convent Rd, Otaki | Replace 16mm Cu with Gopher (2km) | Renewal | $163,538 |
| 16 | Te Manuao Rd, Otaki | Replace 16mm Cu with Bee (1km) | Renewal | $102,000 |
| 17 | Manakau South Rd, Otaki | Replace 16mm Cu with Bee | Renewal | $204,000 |
| 18 | Old Hautere Rd, Otaki | Replace 16mm Cu with Gopher (2km) | Renewal | $123,000 |
| 19 | Hautere Cross Rd, Otaki | Replace 16mm Cu with Bee (4km) | Renewal | $307,000 |
| 20 | Valley Rd, Paraparaumu | Replace 16mm Cu with Gopher (1.5km) | Renewal | $123,000 |
| 21 | Otaihanga Rd, Paraparaumu | Replace 16mm Cu with Gopher (1.5km) | Renewal | $92,000 |
| 22 | Rata Rd, Raumati | Replace 16mm Cu with Gopher (1km) | Renewal | $82,000 |
| 23 | Mangahao Rd, Shannon | Replace 16mm Cu with Gopher (4km) | Renewal | $327,000 |
| 24 | Engles Rd, Shannon | Replace 16mm Cu with Gopher (2km) | Renewal | $123,000 |
| 25 | Bryce Rd, Shannon | Replace 16mm Cu with Gopher (2km) | Renewal | $123,000 |
| 26 | Puriri St, Waikanae | Replace 16mm Cu with Gopher (1.5km) | Renewal | $123,000 |
| 27 | Seddon St, Waikanae | Replace 16mm Cu with Bee (1km) | Renewal | $82,000 |
| 28 | Tui Cres, Waikanae | Replace 16mm Cu with Gopher (1km) | Renewal | $82,000 |
| 29 | Hadfield Rd, Waikanae | Replace 16mm Cu with Bee (0.5km) | Renewal | $41,000 |
| 30 | Mangahao to Levin East 33kV | Upgrade to Butterfly double circuit | Renewal | $1,896,000 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 400V Reconductors | Renewal | $2,044,000 |
| 2 | All | Inspection Driven Conductor Replacements | Renewal | $8,343,000 |
| 3 | Foxton Shannon Rd | Replace 35mm Cu with Bee | Renewal | $307,000 |
| 4 | Newth Rd, Foxton | Reconductor with Bee | Renewal | $511,000 |
| 5 | Ngaio Rd, Raumati | Replace 16mm Cu with Bee | Renewal | $123,000 |
| 6 | Mangahao To Levin East 33kV | Upgrade to butterfly double circuit | Renewal | $724,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $1.888m | $1.482m | $2.273m | $2.678m | $2.637m | $3.139m | $2.238m | $2.238m | $2.238m | $2.198m |


Budget Forecast
$3,500,000
$3,000,000
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
18/19
19/20
20/21
21/22
22/23
23/24
24/25
25/26
26/27
27/28

# 6.4 Pole-top hardware

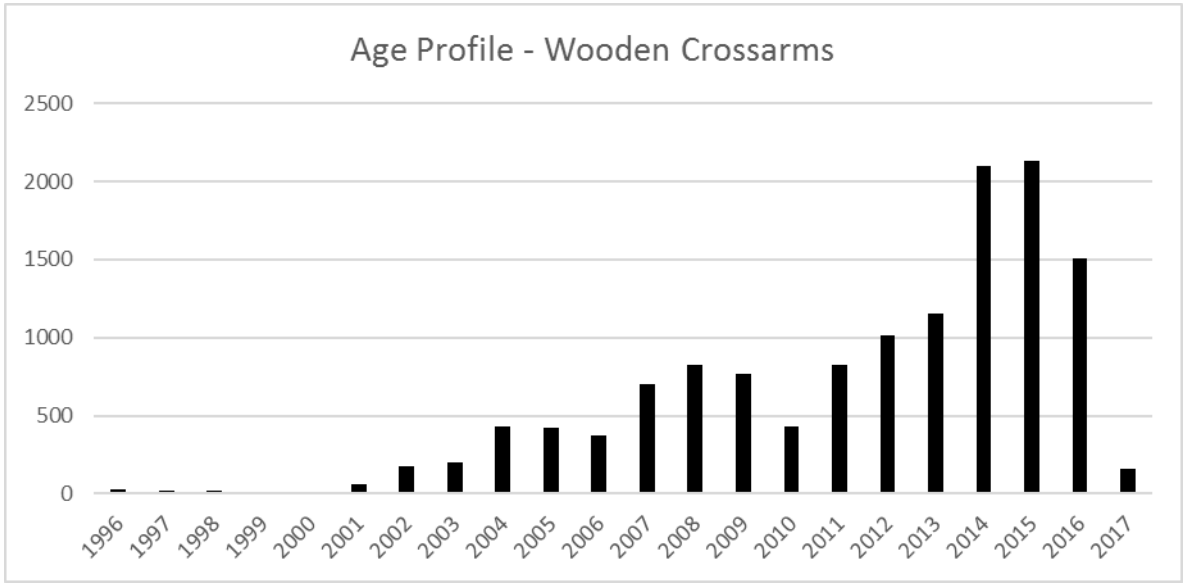
Key features of Electra's pole-top hardware management are as follows.

## Summary of asset class

Electra has 40,942 wooden cross arms 4,014 galvanised steel cross arms.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| Hard wood | 6,600 | Each | 14.66% | |
| Soft wood | 71 | Each | 0.16% | |
| Tallow wood | 34,271 | Each | 76.16% | |
| Steel | 165 | Each | 0.37% | |
| Steel box section | 3,849 | Each | 8.55% | |
| Polymer | 42 | Each | 0.09% | |
| Unknown | 13 | Each | 0.03% | |
| **Total** | **45,011** | **Each** | **100%** | |




# Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | 8.9% | 77.6% | 13.5% | | - | 10% |

# Systemic issues & mitigation

| Systemic issue | Mitigation | Magnitude of issue and impact on Electra |
|---|---|---|
| Wind-borne pollutants tracking on porcelain insulators | Electra has standardised on polymeric insulators from 2013 | This issue is of minimal magnitude and doesn't significantly impact on Electra. |

# Key design parameters

| Parameter | Value |
|---|---|
| Weight | Minimise, to ease carrying to site and ease (safety) of installation. |
| Durability | Expect to last 35 to 40 years |
| Insulation | May be designed to higher voltage for salty coastal areas (e.g. 22kV instead of 11 kV). |
| Structural strength | Embodied in Electra's overhead line design standards, and includes consideration of static and wind loads. |

# Management tactics

## Maintenance drivers

- Splitting, warping or bending of wooden arms.
- Brown, white or soft rot of wooden cross arms, including sap staining as an early indicator of rot.
- Mildew or lichen (as an indicator of moisture and as an early indicator of possible rot)

- Fungus, especially fruiting (indicative of significant decay).
- Burning or scorching possibly from tracking.
- Rust on galvanised steel arms more than surface deep as observed from ground level.
- Corrosion of stays significant enough to reduce physical strength.
- Loose or fallen stays.
- Corrosion of bolts.
- Missing nuts, plate washers or spring washers.
- Deterioration of air break switches, and associated actuators and linkages.

## Maintenance criteria

- Splitting of wooden arms more than 300mm long, risk of pin or bolt disengaging due to split width, or fungus beginning to form in split.
- Brown rot (spotting or streaking) covering most of arm surface, shrinkage leading to cracking or risk of pin or bolt disengaging.
- White rot (stripes) more than about 300mm long and 50mm wide, or emerging fungus (later stage).
- Soft rot (dark spots or streaks) more than about 100mm long and 15 mm thick.
- Thickening mildew or lichen (possible early indicator of rot).
- Round fungus about the size of a golf ball or fla fungus more than about 100mm long.
- Intermittent burn marks between pin and pole.
- Visibly chipped or broken insulators
- Loose or missing nuts or washers.
- Visibly loose binder.
- Stay has become unfastened or is missing.
- Air break switch becomes difficult to operate.

## Assumptions

- Splitting of timber arms may lead to sudden failure.
- Warping or bending or timber arms may unevenly strain conductors, leading to excessive binding tension.

- Burning or scorching indicates electrical tracking.
- Lichen or mildew indicates retained moisture which may lead to rot.
- Visible fungus indicates likely internal decay.
- Loose nuts or washers may be caused by timber arms shrinking or warping.
- Tightening of air break switch operation indicates corrosion.
- Visible cracking of insulators could result in water ingress and further cracking.

## Condition assessment techniques and methods

- Primarily visual for cross-arms, looking specifically for splits, enlarged holes or fungal growth.
- Visual for stay straps, bolts etc.
- Visual for air-break switches, with follow up on any switches reported to be stiff or not fully operating.

# Lifecycle policies, criteria and activities

## Inspections

- . Condition 0 – scheduled for immediate replacement.
- Condition 1 – no further inspection, schedule for replacement within next 3 months.
- Condition 2 – no further inspection, replacement scope to be confirmed during first half of next inspection cycle.
- Condition 3 – will not meet replacement criteria during this inspection cycle, continue inspecting.
- Condition 4 – no sign of deterioration, continue scheduled inspections.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant defects that could lead to asset failure (e.g. arm breaking) – correction within 1 week of identification.
- Minor defects – repair by approved method within 3 months of identification.

## Refurbishment

- Pole top components are generally renewed rather than refurbished.
- General servicing of air break switches on a 5-year cycle, starting with Ohau and Manakau in 2017.

## Renewal

- Condition 0 – replace either immediately or next working day.
- Condition 1 – replace with 3 months.
- Condition 2 – replace within first half of next inspection cycle.
- Condition 3 or 4 – no replacement required.

## Lifecycle decision criteria

- Worn, damaged or broken components are generally renewed at the first convenient opportunity.
- Loose cross arm bolts would generally be re-tightened unless there was evidence of excessive arm shrinkage, warping, mould, lichen, rot or fungus in which case the arm would be renewed.

## Life extension & investment deferral techniques

- Electra does apply any life extension techniques to pole top hardware.

# Major projects & programs

## Projects & programs 2018/19

| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Inspection Driven Cross arm Replacements – 11kV | Renewal | $840,000 |
| 2 | All | Inspection Driven Cross arm Replacements – 400V | Renewal | $660,000 |
| 3 | All | Inspection Driven Cross arm Replacements – 33kV | Renewal | $200,000 |
| 4 | All | Fault/Urgent defect replacement of cross arms | Renewal | $82,000 |

## Projects & programs 2019/20 to 2022/23

| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Inspection Driven Cross arm Replacements – 11kV | Renewal | $2,820,000 |
| 2 | All | Inspection Driven Cross arm Replacements – 400V | Renewal | $2,086,000 |
| 3 | All | Inspection Driven Cross arm Replacements – 33kV | Renewal | $800,000 |

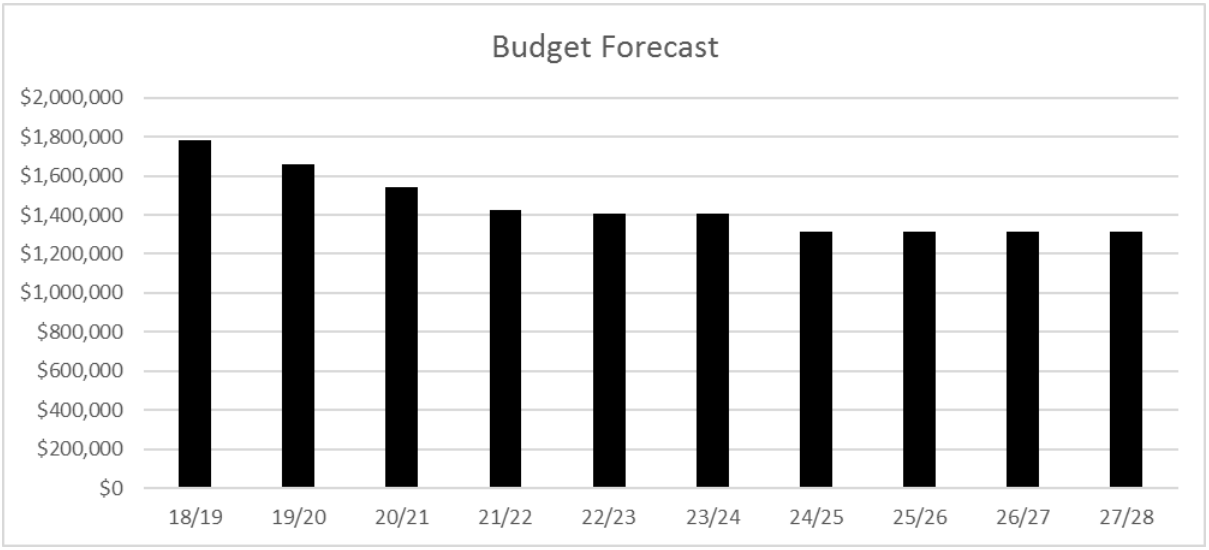
| | | | | |
|---|---|---|---|---|
| 4 | All | Fault/Urgent defect replacement of cross arms | Renewal | $326,000 |

## Projects & programs 2023/24 to 2027/28

| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Inspection Driven Cross arm Replacements – 11kV | Renewal | $3,300,000 |
| 2 | All | Inspection Driven Cross arm Replacements – 400V | Renewal | $2,328,000 |
| 3 | All | Inspection Driven Cross arm Replacements – 33kV | Renewal | $630,300 |
| 4 | All | Fault/Urgent defect replacement of cross arms | Renewal | $408,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $1.78m | $1.66m | $1.54m | $1.42m | $1.41m | $1.41m | $1.32m | $1.32m | $1.32m | $1.32m |



# 6.5 33kV cable

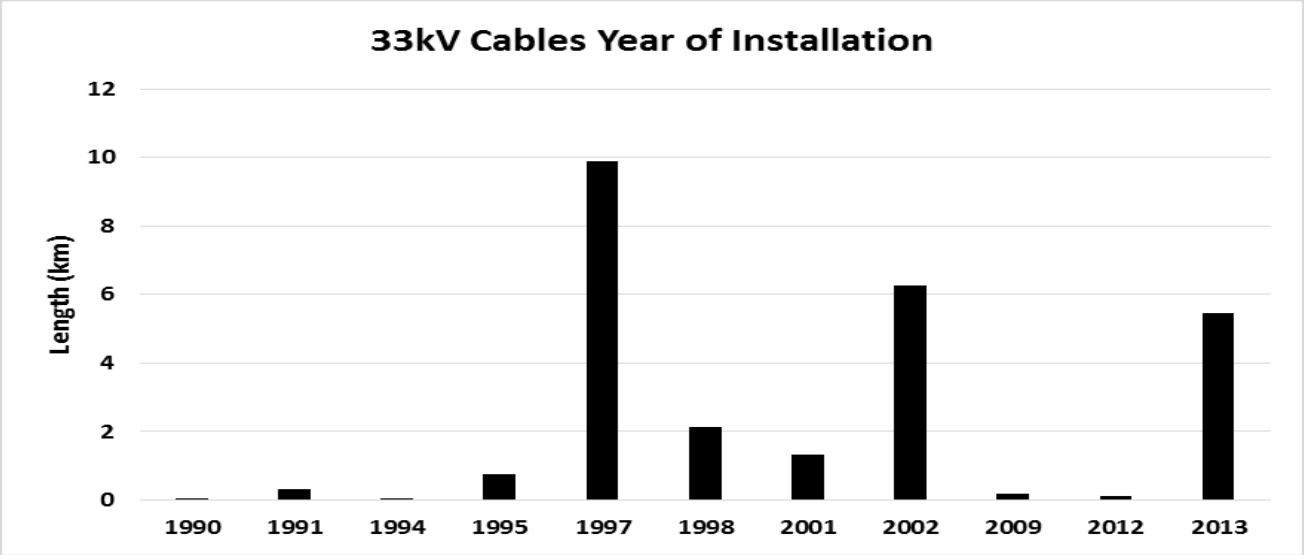
Key features of Electra's 33kV cable fleet are as follows.

## Summary of asset class

Electra has 29.3 km of 33kV cable and associated terminations.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| 500 mm$^2$ aluminium XLPE | 6.1 | km | 20.8% | |
| 630 mm$^2$ aluminium XLPE | 17.7 | km | 60.3% | |
| 800 mm$^2$ aluminium XLPE | 5.5 | km | 18.9% | |
| **Total** | **29.3** | **km** | **100%** | |




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | | 79.70% | 20.30% | | 4 | 4.0% |

## Systemic issues & mitigation

There are no known systemic issues with Electra's 33kV cables.

## Capacity, security & reliability constraints

There are no 33kV cable constraints

# Key design parameters

| Parameter | Value |
|---|---|
| Load rating | Load to about 70% of manufacturer's rating before application of any other de-rating factors e.g. proximity, soil thermal conductivity, ambient temperature etc. |
| Durability | Expect XLPE cable to last 50 to 60 years. |

# Management tactics

## Maintenance drivers

- Visible deterioration of pot heads or terminations.
- Visible deterioration of cable sheathing.
- Deterioration of cable insulation.
- Visible shifting of the cable within the mountings or ground that may be straining internal components.

## Maintenance criteria

- Tan Delta exceeds limits .
- Partial discharge test results exceed limits.
- Thermography of cable terminations reveals excessive temperatures.
- Splitting or cracking of PVC cable sheath such that armour wire or insulation is visible.
- Excessive UV deterioration of PVC sheaths.
- Movement of anchor points relative to supports or ground that may be straining internal components.

## Assumptions

- Unacceptable Tan Delta readings will continue to deteriorate rather than plateau.
- Deterioration of PVC sheaths will lead to cracking, exposure of armour wires and eventual failures.
- Straining of internal components due to movement is likely to damage insulation.

## Condition assessment techniques and methods

- Visual inspection of exposed components.

- Walk down of routes to check for excavation or penetrations.
- Regular Tan Delta and similar insulation checks.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Consider up-sizing if loading beyond 70% of manufacturer's rating occurs for more than 3,000 hours per year.
- Consider up-sizing if fault level exceeds cable fault rating.

## Life extension & investment deferral techniques

Design cable life is achieved by correct rating at the design stage, understanding the cable loading and thermal characteristics of the soil, and by careful handling at the installation stage including adherence to minimum bending radii.

## Major projects & programs

No major 33kV  cable projects or programs are planned.

# 6.6 11kV cable

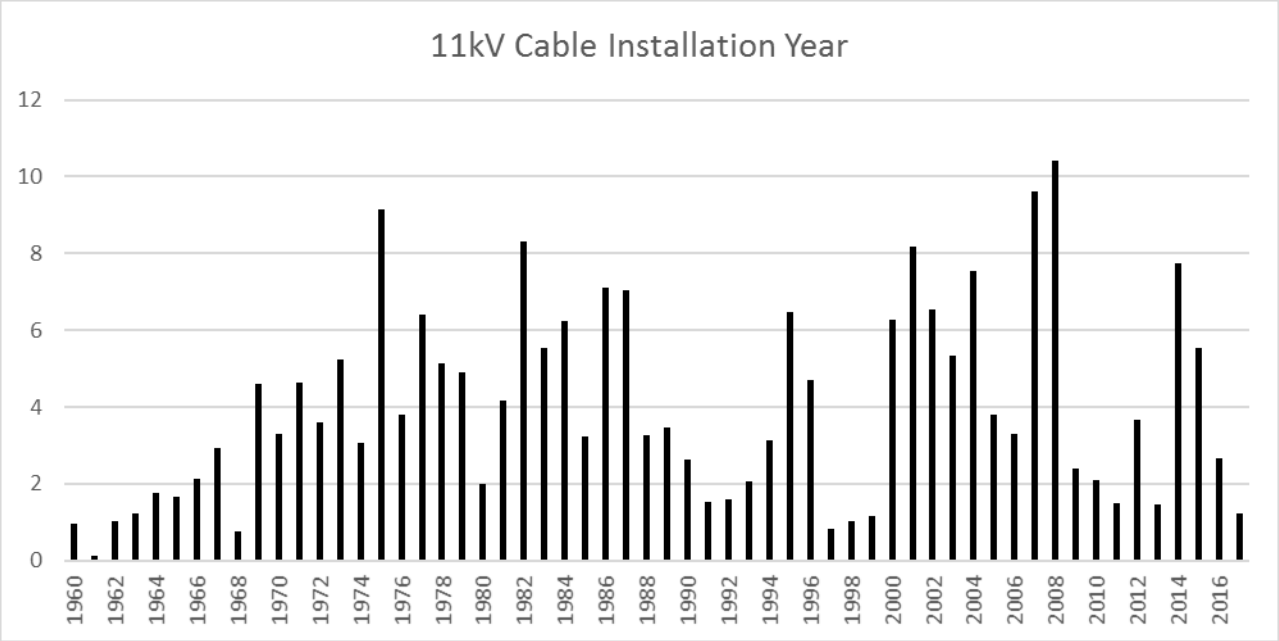
Key features of Electra's 11kV cable management are as follows.

## Summary of asset class

Electra has 232 km of 11kV cable.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| PILC | 119 | km | 50.18% | |
| XLPE, PVC or HDPE | 116 | km | 49.76% | |
| Unknown | 0.14 | km | 0.06% | |
| **Total** | **232** | **km** | **100%** | |




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| XLPE, PVC or HDPE | - | - | 61.30% | 38.70% | - | 3 | - |
| PILC | - | 1.63% | 98.37% | - | - | 3 | 2.00% |

## Systemic issues & mitigation

There are no known systemic issues with Electra's 11kV cable.

## Capacity, security & reliability constraints

There are no known constraints with Electra's 11kV cable.

# Key design parameters

| Parameter | Value |
|---|---|
| Load rating | Nominally loaded to about 70% of manufacturer's rating |
| Durability | Expect XLPE cable to last 50 to 60 years |

# Management tactics

## Maintenance drivers

- Visible deterioration of pot heads or terminations.
- Visible deterioration of cable sheathing.
- Deterioration of cable insulation.
- Visible shifting of the cable within the mountings or ground that may be straining internal components.

## Maintenance criteria

- Splitting or cracking of PVC cable sheath such that armour wire or insulation is visible.
- Excessive UV deterioration of PVC sheaths.
- Movement of anchor points relative to ground that may be straining internal components.

## Assumptions

- Deterioration of PVC sheaths will lead to cracking, exposure of armour wires and eventual failures.
- Straining of internal components due to movement is likely to damage insulation.

## Condition assessment techniques and methods

- Visual inspection of exposed components only, mainly for chipped or broken bushings or perishing insulation.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Consider up-sizing if loading beyond 70% of manufacturer's rating occurs for more than 3,000 hours per year.
- Consider up-sizing if fault level exceeds cable fault rating.

## Life extension & investment deferral techniques

- Design cable life is achieved by correct rating at the design stage, understanding the cable loading and thermal characteristics of the soil, and by careful handling at the installation stage including adherence to minimum bending radii.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Design Line/Cable Jobs | Renewal | $250,000 |
| 2 | All | Replace 11kV cable feeding Alliance meat works | Renewal | $80,000 |
| 3 | All | Replace pitch filled potheads with Raychem terminations | Safety | $60,000 |
| 4 | All | Fault/Urgent defect replacement of 11kV cables | Renewal | $60,000 |

## Projects & programs 2019/20 to 2022/23

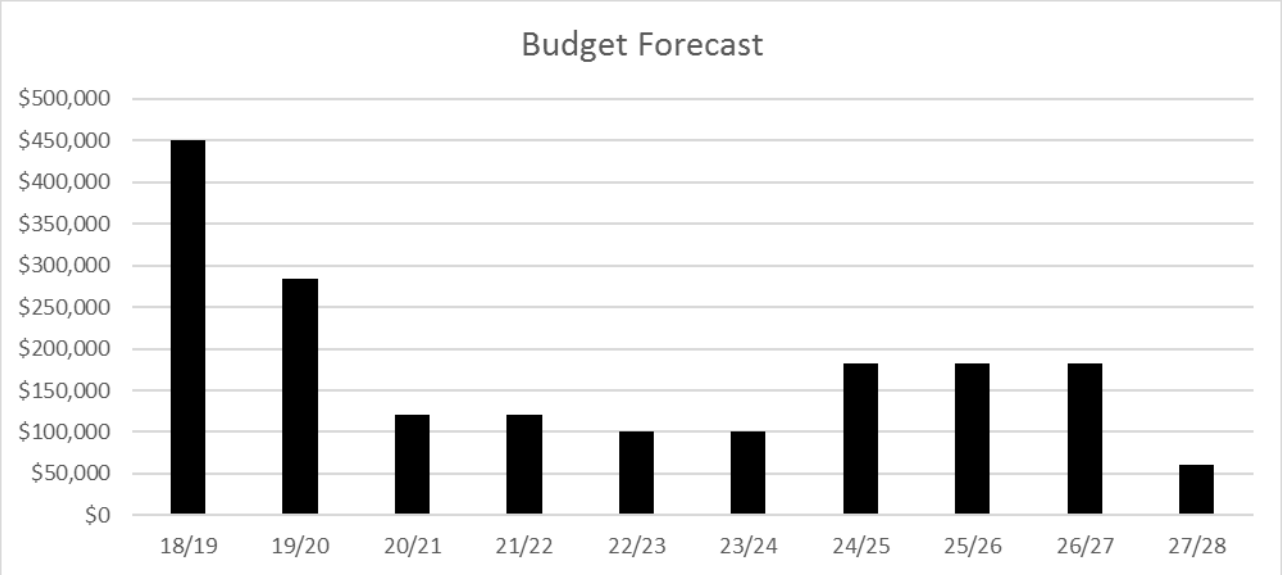
| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | L21 to L332, Manakau | Replace HT cable and LV across road and rail to village – 11kV | Renewal | $82,000 |
| 2 | Bath St, Levin | Replace 11kV cable E313-E83 | Renewal | $82,000 |
| 3 | All | Replace pitch filled potheads with Raychem terminations | Safety | $220,000 |
| 4 | All | Fault/Urgent defect replacement of 11kV cables | Renewal | $240,000 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | Tui Rd, Raumati | Replace cable between Z92 & Z103 – 11kV | Renewal | $245,000 |
| 2 | All | Replace pitch filled potheads with Raychem terminations | Safety | $160,000 |
| 3 | All | Fault/Urgent defect replacement of 11kV cables | Renewal | $300,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $450k | $284k | $120k | $120k | $100k | $100k | $182k | $182k | $182k | $60k |



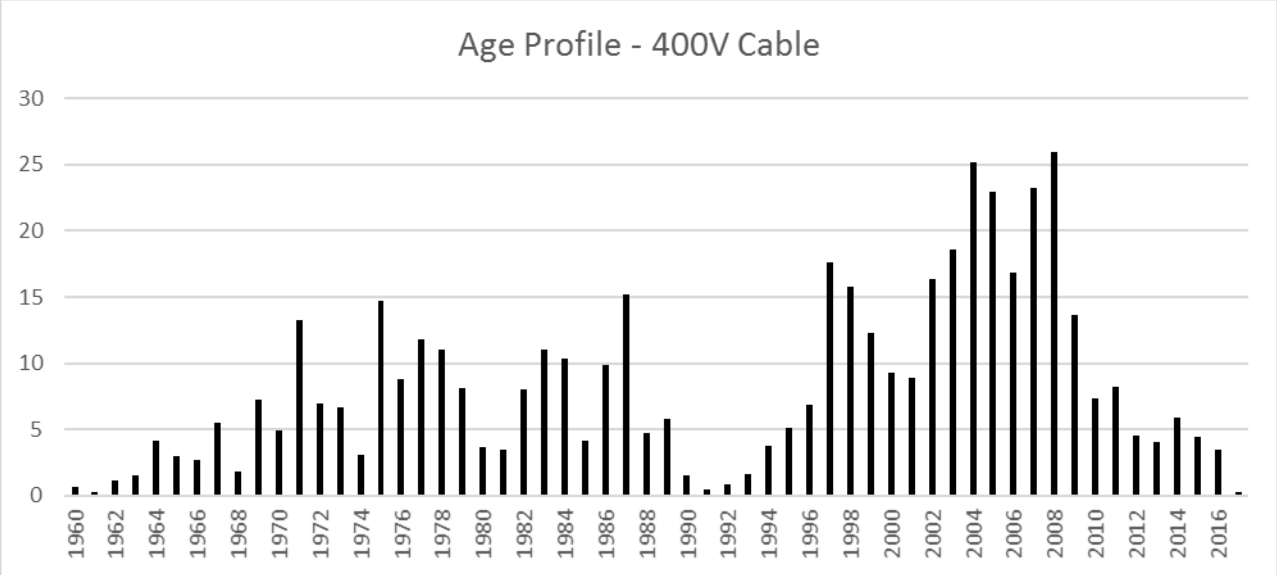
# 6.7 LV cable

Key features of Electra's LV cable management are as follows.

## Summary of asset class

Electra has 484 km of LV cable and associated distribution pillars and fittings.

## Population and age profile




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | | | 44.00% | 56.00% | 3 | 2.00% |

## Systemic issues & mitigation

There are no known systemic LV cable issues. The following problems have been encountered in the past, but have been corrected…

- Failures of tee joints on pre-1970 cables.

- Ground level corrosion of pre-1980 steel pillars.

## Capacity, security & reliability constraints

There are no known LV cable constraints. As constraints are discovered, they are managed by paralleling transformers at link pillars. These parallels are being confirmed in preparation for the ADMS implementation .

# Key design parameters

| Parameter | Value |
|---|---|
| Load rating | Load to about 70% of manufacturer's rating before application of any other de-rating factors e.g. proximity, soil thermal conductivity, ambient temperature etc. |
| Durability | Expect XLPE cable to last 50 to 60 years. |

# Management tactics

## Maintenance drivers

- Visible deterioration of pot heads or terminations.
- Visible deterioration of cable sheathing.
- Deterioration of cable insulation.
- Visible shifting of the cable within the mountings or ground that may be straining internal components.

## Maintenance criteria

- Splitting or cracking of PVC cable sheath such that armour wire or insulation is visible.
- Excessive UV deterioration of PVC sheaths.
- Movement of anchor points relative to ground that may be straining internal components.

## Assumptions

- Deterioration of PVC sheaths will lead to cracking, exposure of armour wires and eventual failures.
- Straining of internal components due to movement is likely to damage insulation.

## Condition assessment techniques and methods

- Visual inspection of exposed components only, mainly for chipped or broken bushings or perishing insulation.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.

- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew within 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Consider up-sizing if loading beyond 70% of manufacturer's rating occurs for more than 3,000 hours per year.
- Consider up-sizing if fault level exceeds cable fault rating.

## Life extension & investment deferral techniques

- Design cable life is achieved by correct rating at the design stage, understanding the cable loading and thermal characteristics of the soil, and by careful handling at the installation stage including adherence to minimum bending radii.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Fail/Urgent defect replacement of 400V/Streetlight cables | Renewal | $40,000 |

## Projects & programs 2019/20 to 2022/23

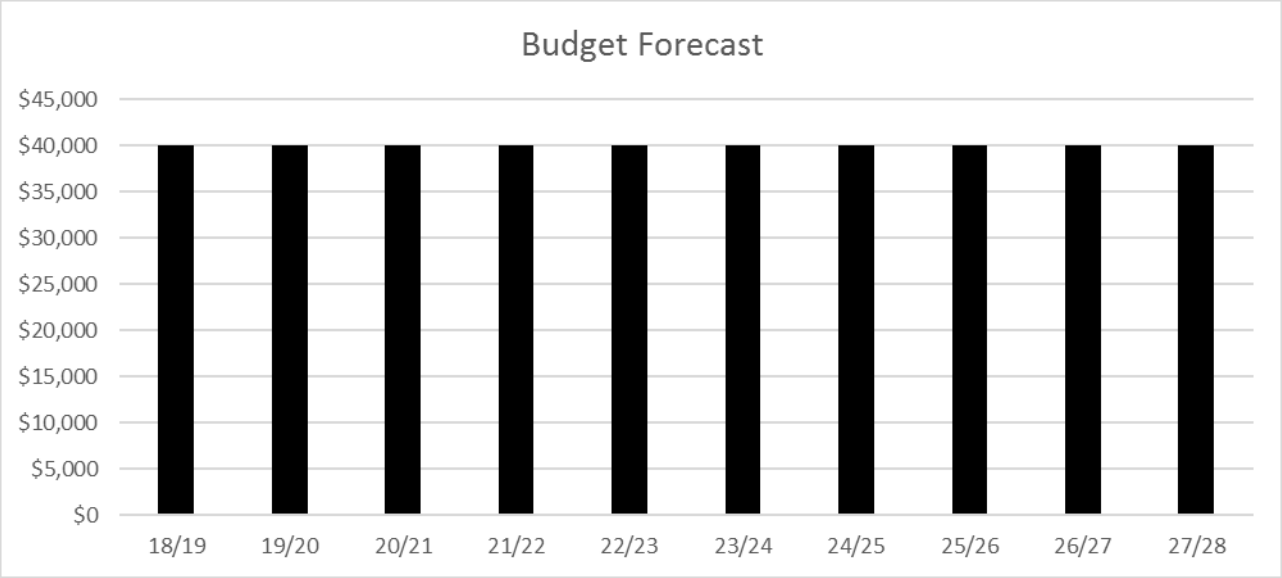
| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Fail/Urgent defect replacement of 400V/Streetlight cables | Renewal | $160,000 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Fail/Urgent defect replacement of 400V/Streetlight cables | Renewal | $200,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $40k | $40k | $40k | $40k | $40k | $40k | $40k | $40k | $40k | $40k |



# 6.8 Distribution transformers

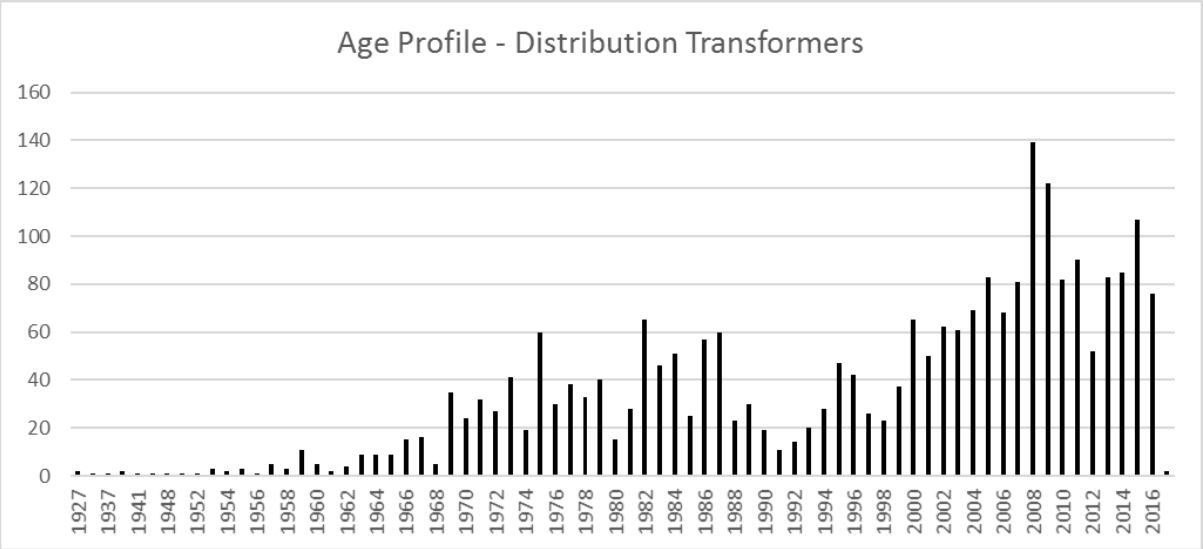
Key features of Electra's distribution substation management are as follows.

## Summary of asset class

Electra has 1,598 overhead distribution transformers and 936 ground-mounted distribution transformers of various kVA ratings as follows…

| Substation Rating | Pole Mounted (Quantity) | Ground Mounted (Quantity) | Total (Quantity) |
|---|---|---|---|
| 1-phase 5kVA | 1 | 0 | 1 |
| 1-phase 10kVA | 8 | 0 | 8 |
| 1-phase 15kVA | 23 | 0 | 23 |
| 1-phase 30kVA | 10 | 1 | 11 |
| 1-phase 50kVA | 0 | 2 | 2 |
| 1-phase 100kVA | 1 | 0 | 1 |
| 3-phase 5kVA | 0 | 0 | 0 |
| 3-phase 7kVA | 2 | 0 | 2 |
| 3-phase 10kVA | 3 | 0 | 3 |
| 3-phase 15kVA | 79 | 0 | 79 |
| 3-phase 25kVA | 7 | 0 | 7 |
| 3-phase 30kVA | 864 | 24 | 888 |
| 3-phase 50kVA | 359 | 56 | 415 |
| 3-phase 75kVA | 2 | 0 | 2 |
| 3-phase 100kVA | 215 | 106 | 321 |
| 3-phase 150kVA | 2 | 1 | 3 |
| 3-phase 200kVA | 25 | 208 | 233 |
| 3-phase 250kVA | 0 | 19 | 19 |
| 3-phase 300kVA | 4 | 414 | 418 |
| 3-phase 500kVA | 0 | 83 | 83 |
| 3-phase 750kVA | 0 | 14 | 14 |
| 3-phase 1000kVA | 0 | 8 | 8 |
| **Total** | **1,598** | **936** | **2,534** |

## Population and age profile




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| Pole mounted | - | 5.0% | 61.0% | 34.00% | - | 4 | 7.0% |
| Ground mounted | - | 5.6% | 52.90% | 41.50% | - | 4 | 8.0% |

## Systemic issues & mitigation

| Systemic issue | Mitigation | Magnitude of issue and impact on Electra |
|---|---|---|
| Corrosion of ground mount steel transformer enclosures. | Replace corroded enclosure with more suitable type. | Minimal, no significant impact. |
| Safety concerns around structural integrity of deck mounted transformers | Replace with light weight overhead or ground mounted transformers | Minimal |

### Capacity, security & reliability constraints

There are no known distribution substation constraints.

## Key design parameters

| Parameter | Value |
|---|---|
| Rating | Design loading to 80% of manufacturer's rating subject to design ambient temperature and airflow. |
| Durability | Expect to last 45 years. |

# Management tactics

## Maintenance drivers

- Rusting of tank.
- Oil staining of tank.
- Colour of silica gel breather where fitted
- Excessive graffiti or evidence of interference or tampering.

## Maintenance criteria

- Rusting of tank becomes more than surface deep.
- Oil staining on tank suggests repeated internal overheating.
- Silica gel breather remains blue.
- Level of graffiti shows repeated attempts.
- Evidence of attempts to force entry into cabinets.

## Assumptions

- Oil staining of tank suggests boiling of oil to the point of expulsion from around lid seal.
- Once tank rust appears more than service deep from ground level, tank perforations are likely.

## Condition assessment techniques and methods

- Primarily visual, especially for oil leaks, breather colour, tank rust, chipped or broken bushings and perished seals or gaskets.
- Oil sample tests only on 750kVA and above.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grades 1 and 2 – will not be refurbished (generally scrapped as too expensive to refurbish)
- Grades 3 and 4 – minor repair to maintain life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Replace when necessary repairs become more than minor.
- Replace when MDI readings reveal regulator loading to more than 100% of design rating.

## Life extension & investment deferral techniques

- Additional galvanising or paint for coastal areas.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Constraint Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Ground Transformer Replacements | Renewal | $600,000 |
| 2 | All | Pole Transformer Replacements | Renewal | $182,000 |
| 3 | All | Ground Transformer Faults | Renewal | $150,000 |
| 4 | Bartholomew Rd | Upgrade transformer room G126 | Safety | $100,000 |
| 5 | H68 | Remove H68 and run new service from H215 to feed Allied Concrete | Renewal | $85,000 |
| 6 | All | Pole Transformer Faults | Renewal | $105,000 |
| 7 | Weraroa Rd | Replace deck transformer E64 | Safety | $85,000 |
| 8 | Swamp Rd | Replace deck transformer P65 | Safety | $85,000 |

## Projects & programs 2019/20 to 2022/23

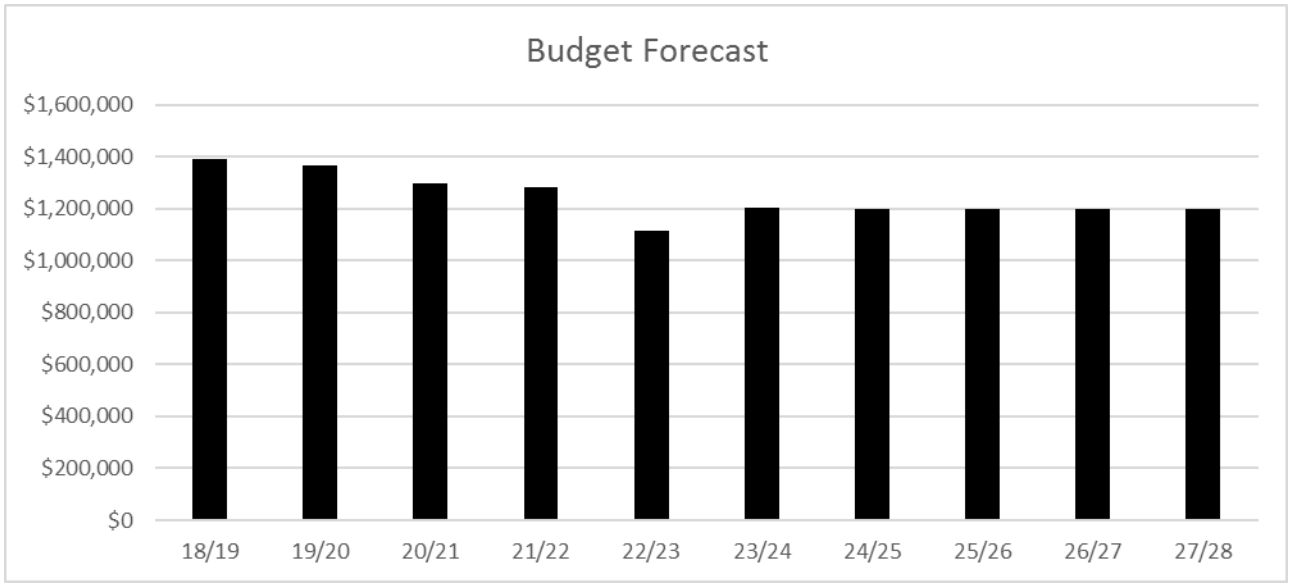
| Ref | Location | Constraint Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Ground Transformer Replacements | Renewal | $2,400,000 |
| 2 | All | Pole Transformer Replacements | Renewal | $728,000 |
| 3 | All | Ground Transformer Faults | Renewal | $600,000 |
| 4 | SH1, Levin | Upgrade transformer room H25 | Renewal | $91,000 |
| 5 | All | Pole Transformer Faults | Renewal | $420,000 |
| 6 | Weraroa Rd | Replace deck transformer H1 with 200kVA | Safety | $77,000 |
| 7 | Kimberley Rd, Levin | Upgrade transformer room G120 | Renewal | $91,000 |
| 8 | Gladstone Rd | Rebuild Deck Transformer G334 | Safety | $77,000 |
| 9 | Totara St, Levin | Upgrade transformer room G177 | Renewal | $91,000 |
| 10 | Kimberley Rd, Levin | Upgrade transformer room G93 | Renewal | $91,000 |
| 11 | Hokio Beach Rd, Levin | Upgrade transformer room H174 | Renewal | $91,000 |
| 12 | Kirk St, Otaki | Replace deck transformer M12 | Renewal | $77,000 |
| 13 | Gladstone Rd | Rebuild Deck Transformer G76 | Safety | $77,000 |
| 14 | S133, Waikanae | replace with ground mount Transformer Check | Renewal | $71,000 |
| 15 | Whirokino Rd | Rebuild Deck Transformer C23 | Renewal | $77,000 |

## Projects & programs 2023/24 to 2027/28

| # | Location | Constraint Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Ground Transformer Replacements | Renewal | $3,000,000 |
| 2 | All | Pole Transformer Replacements | Renewal | $910,000 |
| 3 | All | Ground Transformer Faults | Renewal | $750,000 |
| 4 | All | Pole Transformer Faults | Renewal | $525,000 |
| 5 | All | Indoor Subs | Renewal | $654,000 |
| 6 | Kimberly Rd | Upgrade Transformer Room G97 | Renewal | $91,000 |
| 7 | Tararua Rd, Levin | Replace deck transformer G326 with single pole 200kVA | Renewal | $77,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $1.39m | $1.37m | $1.3m | $1.28m | $1.11m | $1.2m | $1.2m | $1.2m | $1.2m | $1.2m |


Budget Forecast
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
18/19
19/20
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27/28

# 6.9 Distribution switchgear

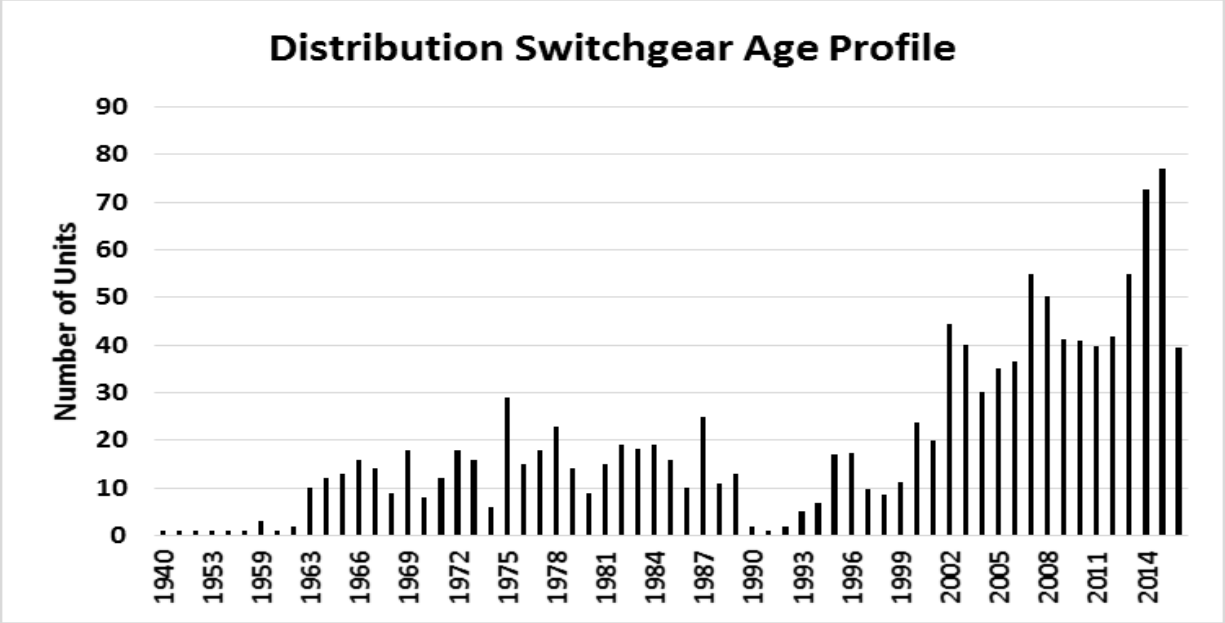
Key features of Electra's distribution switchgear management are as follows.

## Summary of asset class

Electra has 1,273 individual items that are broadly classified as distribution switches.

## Population and age profile

| Sub-class | Number | Percent |
|---|---|---|
| Ground mount switches | 142 | 11.2% |
| Auto reclosers | 38 | 2.9% |
| Air break switches | 339 | 26.6% |
| In-line drop-out fuses | 754 | 59.2% |
| **Total** | **1,273** | **100%** |




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| Pole mounted circuit breakers (reclosers and sectionalisers) | | 3.00% | 85.00% | 12.00% | | 4 | 3.00% |
| Indoor circuit breakers | | 12.00% | 78.00% | 10.00% | | 4 | 12.00% |
| Pole mounted switches & fuses | | 3.00% | 66.00% | 31.00% | | 3 | 5.00% |
| Ring main units | | 8.0% | 52.0% | 40.00% | | 3 | 10.00% |

## Systemic issues & mitigation

There are no known system issues with any class of distribution switchgear

## Capacity, security & reliability constraints

There are no known constraints with any class of distribution switchgear

# Key design parameters

| Parameter | Value |
|---|---|
| Durability | Expected life of 45 years |
| Load rating | Generally use minimum commercially available rating of 630A. |

# Management tactics

## Maintenance drivers

- Interrupting medium levels or pressures.
- Continued correct operation of mechanisms without excessive force.
- Continue correct operation of remote capability.
- Rusting of enclosures.
- Stability of mounting, including slumping or subsidence of surrounding ground.
- Manufacturers recommended overhaul intervals.

## Maintenance criteria

- Number of operations exceeds manufacturers recommendations.
- Oil levels drop below indicated minimum
- Gas or vacuum pressure varies outside of prescribed levels.
- Failure to operate correctly, or with accepted level of force.
- Timing test reveals contact separation times are outside of specification.
- Testing reveals that trip coil is not operating within specified voltages
- Rust more than surface deep.
- Slumping or movement of ground, particularly tilting that may expose live components above oil level.

## Assumptions

- Stiff operating mechanism will eventually fail, rather than plateau.
- Decline in insulating medium level or pressure will continue, rather than plateau.

## Condition assessment techniques and methods

- Visual, including public safety checks.
- Regular checking of fluid levels, gas pressures etc as per OEM specifications.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Ground-mounted switches that are considered to have an unacceptably high public safety risk will be specifically marked for accelerated replacement. The precise order of replacement will include consideration of actual condition, known defects from industry experience, and proximity to sensitive locations like parks and schools.

- Decision to renew rather than refurbish made on a case-by-case basis for ground-mounted distribution switches.

- Decision to up-size or to replace single phase with three phase based on load and fault level studies.

## Life extension & investment deferral techniques

- Electra may apply extra paint, galvanising or grease to individual switches near coastal areas.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Replace Ring Main Switches | Renewal | $310,000 |
| 2 | All | Urgent DDO/ABS Replacement | Renewal | $30,000 |
| 3 | All | ABS new & renewals | Renewal | $82,000 |

## Projects & programs 2019/20 to 2022/23

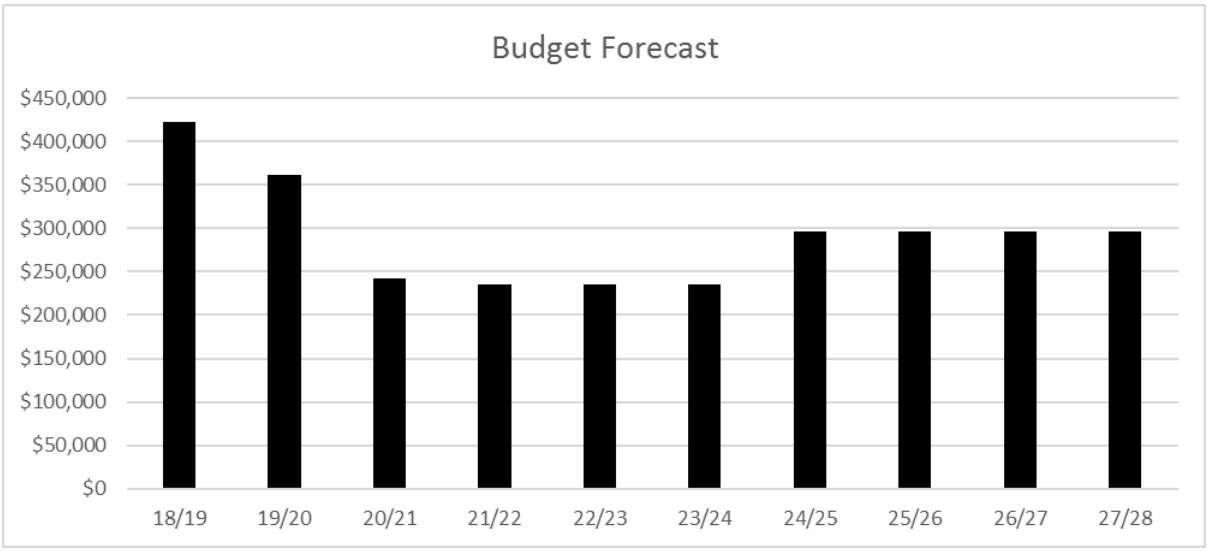
| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Replace Ring Main Switches | Renewal | $625,000 |
| 2 | All | ABS new & renewals | Renewal | $328,000 |
| 3 | All | Urgent DDO/ABS Replacement | Renewal | $120,000 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Replace Ring Main Switches | Renewal | $859,000 |
| 2 | All | ABS new & renewals | Renewal | $410,000 |
| 3 | All | Urgent DDO/ABS Replacement | Renewal | $150,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $422k | $362k | $242k | $235k | $235k | $235k | $296k | $296k | $296k | $296k |


Budget Forecast
$450,000
$400,000
$350,000
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$0
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26/27
27/28

# 6.10 Zone substation transformers

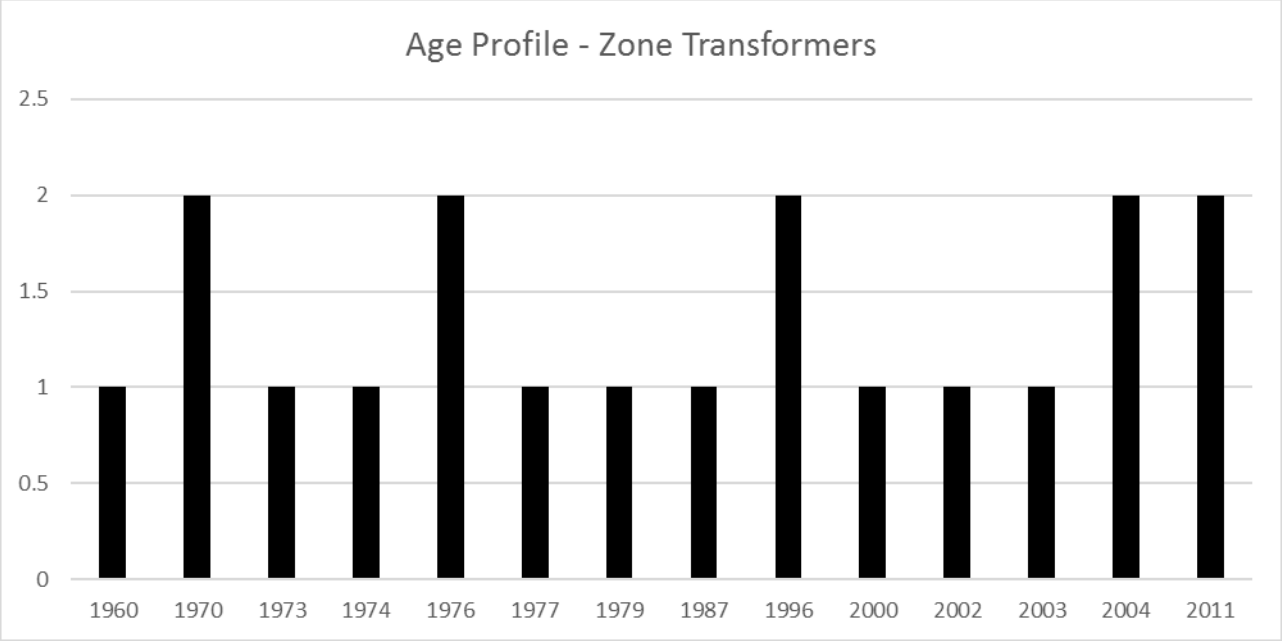
Key features of Electra's zone substation transformers management are as follows.

## Summary of asset class

Electra has 19 zone substation transformers, all 33/11kV. These range in capacity from 5 MVA to 11.5/18/23 MVA and have various levels of ONAN, ONAF and OFAF cooling.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| 5 MVA | 3 | Each | 18.75% | |
| 11.5/23 MVA | 16 | Each | 84.21% | |
| **Total** | **19** | **Each** | **100%** | |




## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | | 90.00% | 10.00% | | 4 | 5.2% |

## Systemic issues & mitigation

There are no known system issues with Electra's zone substation transformers.

## Capacity, security & reliability constraints

There are no known constraints with Electra's zone substation transformers.

# Key design parameters

| Parameter | Value |
|---|---|
| Durability | Expect a minimum life of 60 years. |
| Rating | Design load to no more than 67% to enable load of faulted substation to supplied by 2 neighbouring substations. |

# Management tactics

## Maintenance drivers

- Oil purity.
- Integrity of gaskets and flexible seals on tank and fittings.
- Chipping or cracking of bushings.
- Oil leaks or staining on tank.

## Maintenance criteria

- Key oil parameters such as acidity, gas content and moisture content exceed manufacturers' recommendations for main tank and tap changer compartment.
- Tests such as partial discharge, Furans, paper sampling etc reveal out of specification.
- Cabinets show evidence that gaskets and seals are failing.
- Bushings are chipped, cracked or deteriorating to the point of imminent failure.
- Oil leaks or staining suggests on-going leakage.

## Assumptions

- Declining oil condition will continue to decline rather than plateau.
- Chipped or cracked bushings could result in sudden failure.
- Corona discharge signals deteriorating component condition.
- Oil rising into conservator tank suggests excessive heating, suggesting a localised hot spot in the absence of overloading.

## Condition assessment techniques and methods

- Visual inspection of tank, bushings, gaskets, seals, instruments etc.

- Regular testing of oil for dissolved gases and metals.
- Regular impedance and insulation testing.
- Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – bi-monthly inspections but no further detailed monitoring, as it will be replaced within 12 to 18 months.
- Grade 2 – bi-monthly inspections and close monitoring, and is likely to be replaced within 3 years if repair or refurbish options are not cost effective.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years if repair and refurb options are not cost effective.

## Lifecycle decision criteria

- Oil filtration will be triggered by unacceptable acidity, gas or moisture levels.
- Re-packing and re-bolting of core will be triggered by excessive vibration.
- Major refurbishment of windings will typically occur after 35 years operation.

- Consideration of lifetime loading.

- Consideration of number and intensity of faults.

## Life extension & investment deferral techniques

- Extra paint or galvanising may be applied if the transformer will be located in a coastal area.

- Capacity margin may be deliberately planned to ensure light loading.

- Major interventions such as oil filtration, and re-packing the core may occur.

# Major projects & programs

## Projects & programs 2018/19

None

## Projects & programs 2019/20 to 2022/23

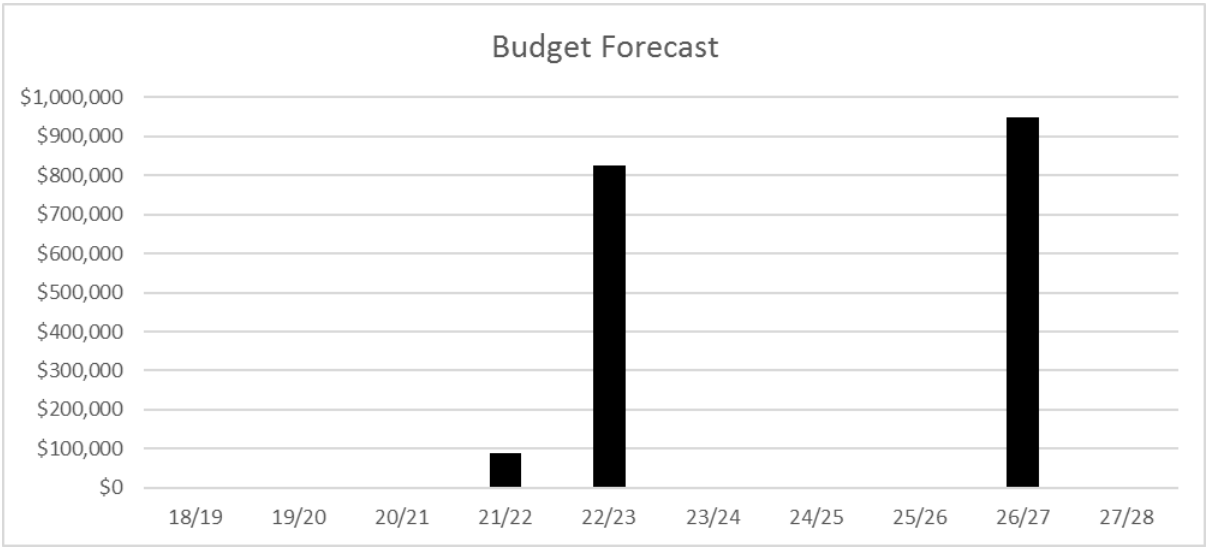
| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | Paekakariki Substation | Power Transformer Replacement | Renewal | $915,000 |

## Projects & programs 2023/24 to 2027/28

| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | Levin East Substation | Power Transformer Replacement | Renewal | $950,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $0 | $0 | $0 | $90k | $825k | $0 | $0 | $0 | $950k | $0 |



# 6.11 Zone substation switchgear

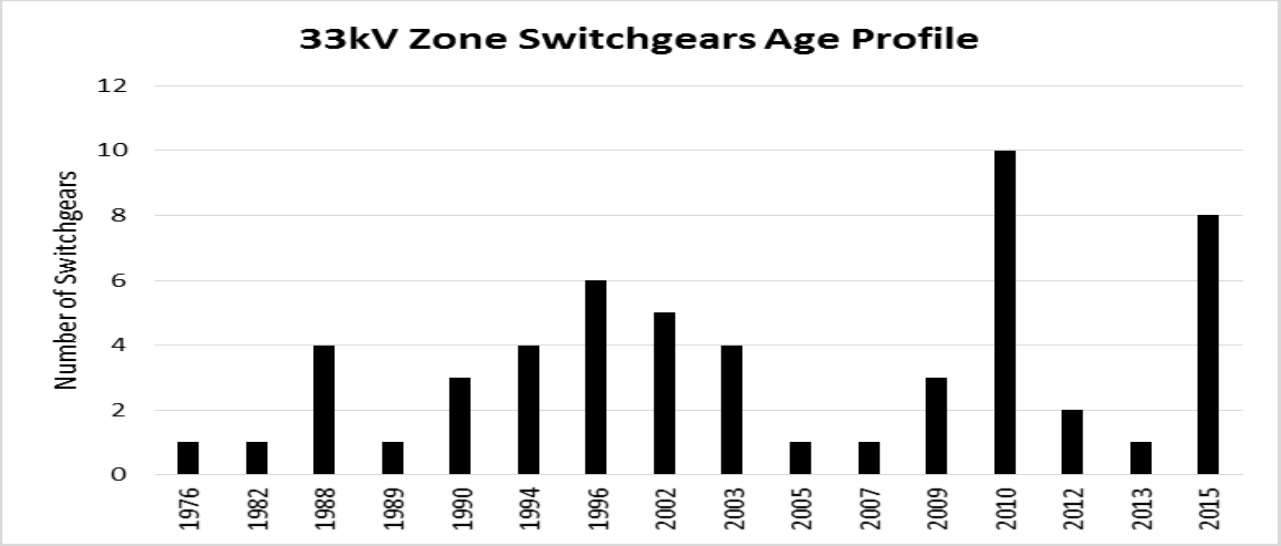
Key features of Electra's zone substation switchgear management are as follows.

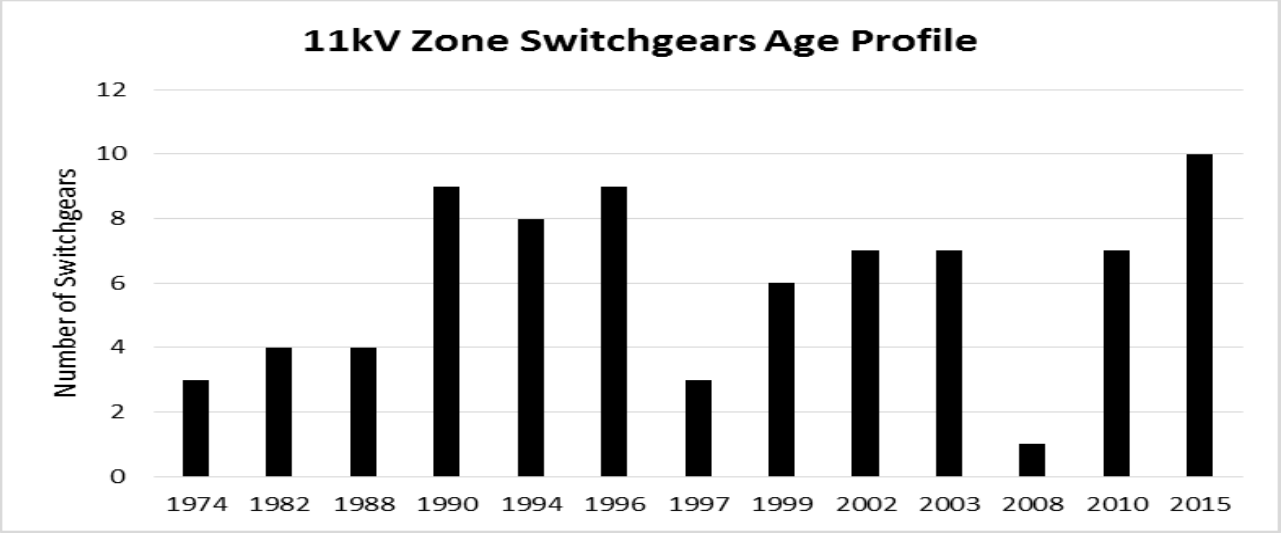
## Summary of asset class

Electra has 55 separate 33kVcircuit breakers and 78 separate 11kV circuit breakers in its zone substations, including associated protection.

## Population and age profile

| Sub-class | Number | Unit | Percent | Key features of sub-class |
|---|---|---|---|---|
| 33kV SF6 (indoor) | 35 | Each | 26.32% | |
| 33kV SF6 (outdoor) | 20 | Each | 15.04% | |
| 11kV oil | 4 | Each | 3.01% | |
| 11kV vacuum | 62 | Each | 46.62% | |
| 11kV SF6 | 12 | Each | 9.02% | |
| **Total** | **133** | | **100%** | |



# Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| Indoor 22kV or 33kV | | | 50.00% | 50.00% | | 4 | |
| Outdoor 22kv or 33kV | | | 90.48% | 9.52% | | 4 | |
| 3.3kV, 6.6kV, 11kV or 22kV | | 5.19% | 82.31% | 12.50% | | 3 | 10.38% |

# Systemic issues & mitigation

There are no known systemic issues with Electra's zone substation switchgear.

## Capacity, security & reliability constraints

There are no known constraints with Electra's zone substation switchgear.

# Key design parameters

| Parameter | Value |
|---|---|
| Durability | Expected life of 40 to 45 years |
| Load rating | Generally standard 630 A, which is often far in excess of likely load. |

# Management tactics

## Maintenance drivers

- Correct operation of mechanism, including remote functionality.
- Correct pressure or level of arc-quenching medium.
- Correct alignment of contacts, and timing of contact separation.
- Integrity of interrupting chambers.
- Surface rust on cabinets.

## Maintenance criteria

- Number of operations exceeds manufacturers maintenance recommendations.
- Operating mechanism requires excessive force.
- Remote functionality fails to operate correctly.
- Pressure or level of arc-quenching medium below manufacturers recommendations.
- Rust becomes more than surface deep.
- Evidence that arc is not being correctly quenched.

## Assumptions

- Decline in arc-quenching medium pressure or level will continue to decline rather than plateau.
- Increasingly stiff operating mechanism will require repairs.
- Surface rust will continue to deepen.

## Condition assessment techniques and methods

- Visual.
- Regular checking of fluid levels, gas pressures etc as per OEM specifications.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – bi-monthly inspections and close monitoring, and is likely to be replaced within 3 years if repair or refurbish options are not cost effective.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Significant structural integrity defects – correction within 1 week of identification.
- Minor structural integrity defects – repair by approved method within 3 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – repair to extend life as considered appropriate by Planning & Development Manager.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Electra may refurbish when a majority of components require maintenance, but is more likely to renew (replace) due to other criteria such as safety, fault level or obsolescence of key components.

## Life extension & investment deferral techniques

- If the sole issue is fault rating, an attempt will be made to replace the interrupter heads with higher rated heads to avoid replacing the whole switchboard.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | Raumati Substation | Replace north half of 11kV board | Renewal | $450,000 |
| 2 | All | Unplanned Capital | Renewal | $31,000 |

## Projects & programs 2019/20 to 2022/23

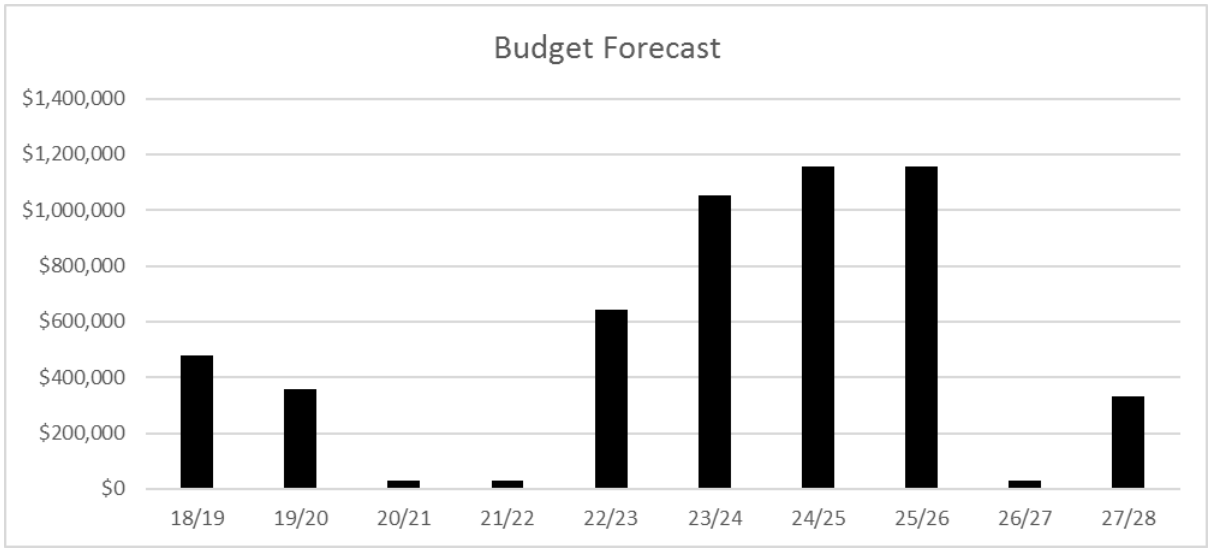
| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Unplanned Capital | Renewal | $122,000 |
| 2 | Paekakariki Substation | CB replacement | Renewal | $327,000 |
| 3 | Matai Rd, Raumati | Rebuild Substation | Renewal | $613,000 |

## Projects & programs 2023/24 to 2027/28

| # | Location | Constraint Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | Unplanned Capital | Renewal | $153,000 |
| 2 | Union St, Foxton | Rebuild Substation | Renewal | $1,227,000 |
| 3 | Matai Rd, Raumati | Rebuild Substation | Renewal | $2,044,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $481k | $358k | $31k | $31k | $644k | $1,053k | $1,155k | $1,155k | $31k | $31k |


Budget Forecast
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
18/19
19/20
20/21
21/22
22/23
23/24
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25/26
26/27
27/28

# 6.12 Load control plant

Key features of Electra's load control plant management are as follows.

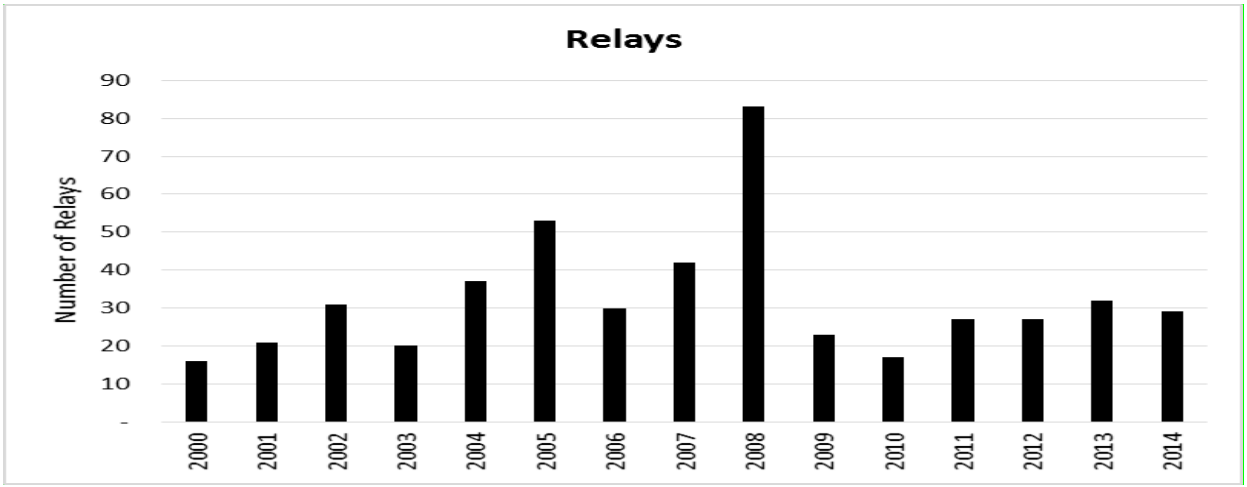
## Summary of asset class

Electra owns and operates the following load control plant…

- One Zellweger SFU-K/203 injection plant at Shannon rated at 80kVA, and signalling to the northern area. This was installed in 2011 as part of the substation rebuild.
- One Landis + Gyr SFU-K/403 injection plant rated at 200kVA in an Electra-owned building at Paraparamu zone substation, and signalling to the southern area. This was installed in 2016.
- Two Zellweger SFU-K/203 injection plant controllers rated at 80kVA in storage at Paraparaumu West and Shannon, which are spares.

Both plants inject into the 33kV at 283Hz. Most customer load control relays are owned by the energy retailers however Electra does still own 1,924 relays for controlling street lights, under veranda lighting and pilot-wire load control.

## Population and age profile




There are 1,436 relays of unknown age.

## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| Centralised plant | | | 50.0% | 50.0% | | 4 | |
| Relays | | | | | 100.0% | 3 | 10.0% |

# Systemic issues & mitigation

There are no known systemic issues with Electra's load control plant.

## Capacity, security & reliability constraints

There are no known constraints with Electra's load control plant.

# Key design parameters

| Parameter | Value |
|---|---|
| Durability | Expected life of 20 years |
| Load rating | About 50kVA to 100kVA. |
| Frequency | 283 Hz |

# Management tactics

## Maintenance drivers

- Correct injection of required signals when instructed.
- Correct operation of relays.
- Integrity and isolation of coupling cells.

## Maintenance criteria

- Injection fails.
- Relay fails to operates.
- Coupling cell shows evidence of failure or insulation breakdown.

## Assumptions

- Signal generator will be need eventual replacement as more connected load absorbs signal.

## Condition assessment techniques and methods

- Visual inspections.
- Regular testing to confirm signal frequency and strength.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Injection failure – correct immediately (requirement to manage demand).
- Minor control defects – repair within 1 months of identification.

## Refurbishment

- Grade 1 – will not be refurbished.
- Grade 2 – minor repairs only.
- Grades 3 and 4 – refurbish major components. Functionality and signal penetration considered, as this may make replacement more feasible.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Load control may be replaced rather than renewed if analysis reveals that improved functionality can be obtained by replacement.
- Insufficient signal penetration may require replacement with a more powerful signal generator.

# Major projects & programs

There are no major load control or relay programs forecast for the planning period.

# 6.13 Protection and control

Key features of Electra's protection and control are as follows.

## Summary of asset class

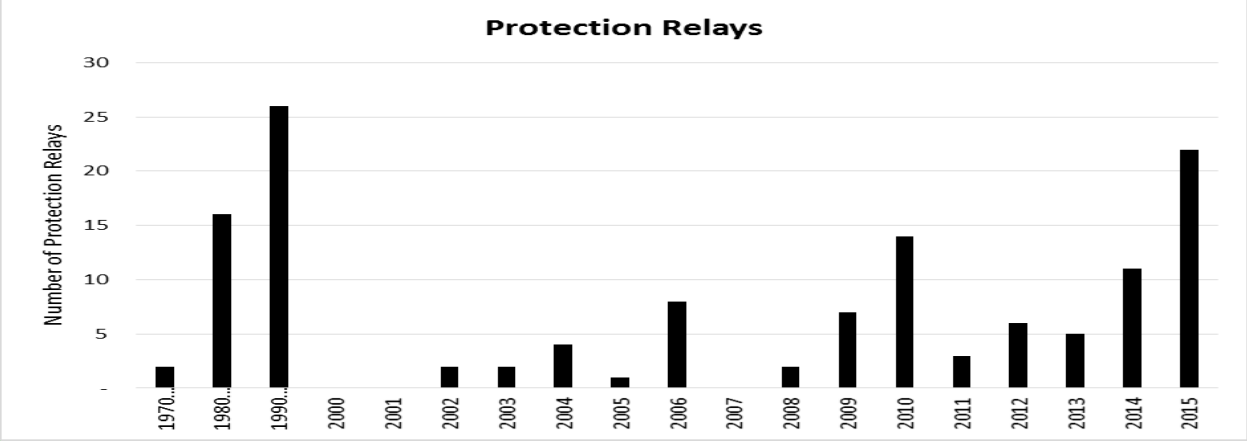
Electra's key protection systems include…

| Asset | Directional | Over current | Earth fault | Auto reclose | Differential | Inter-trip | Fuse |
|---|---|---|---|---|---|---|---|
| Each 33kV circuit breaker | ● | ● | ● | | | | |
| Each 11kV zone substation circuit breaker | | ● | | ● | | | |
| Each 33/11Kv transformer (bank) | | ● | ● | | ● | ● | |
| Each 11kV bank bus at zone substation | | ● | ● | | | | |
| Distribution feeder | | ● | | | | | ● |

Electra also owns a number of battery chargers, batteries and power supplies rated for a minimum of 6 hours continuous supply. All of these assets are in good serviceable condition.

## Population and age profile

There are 131 protection relays, with ages as follows.




## Condition

| **Condition:** | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | 10.0% | 55.0% | 35.0% | | 4 | 15.0% |

## Systemic issues & mitigation

There are no known systemic issues with Electra's protection and control plant.

## Capacity, security & reliability constraints

There are no known constraints with Electra's protection and control assets, however a number of spurious 33kV trippings has prompted a review of protection and the development of a strategy which will occur during the 2018 year.

# Key design parameters

| Parameter | Value |
|---|---|
| Functionality | Minimum as specified by Electra |
| Durability (relays) | Expected life of 15 to 20 years |
| Durability (batteries) | Expected life of 8 to 15 years |
| Capacity (batteries, UPS) | Minimum 6 hours full load |

# Management tactics

## Maintenance drivers

- Correct operation of relays.
- Battery chargers continue to charge at rated capacity.
- Batteries hold charge.

## Maintenance criteria

- Relay fails to operate correctly.
- Battery charger fails to maintain battery charge or voltage.
- Battery fails to hold charge.
- Battery age reaches design life.
- Blown fuse.

## Assumptions

- Failure to hold a charge indicates imminent failure.
- A relay that has failed to correctly operate once will continue to fail.

## Condition assessment techniques and methods

- Primarily visual for batteries, with fluid level checks for non-sealed batteries.
- Regular testing of relay functionality and sensitivity where necessary.

# Lifecycle policies, criteria and activities

## Inspections

- Grade 1 – no further inspections, as it will be replaced within 1 year.
- Grade 2 – no further inspection, as it will be replaced within 3 years.
- Grades 3 and 4 – continue to inspect, amend grade as required.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Relay fails to operate correctly – investigate within 1 week, remedy within 1 month.
- Failure of battery charger – replace within 1 month to reduce dependence on duplicate charger.
- Failure of battery to hold charge – replace within 1 week.

## Refurbishment

- Protection and control plant is normally replaced rather than refurbished.

## Renewal

- Grade 1 – renew with 1 year.
- Grade 2 – renew within 3 years.

## Lifecycle decision criteria

- Due to the criticality and low value of individual protection and control plant, components are usually replaced rather than refurbished.

# Major projects & programs

## Projects & programs 2018/19

| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 33kV protection | Renewal | $50,000 |

## Projects & programs 2019/20 to 2022/23

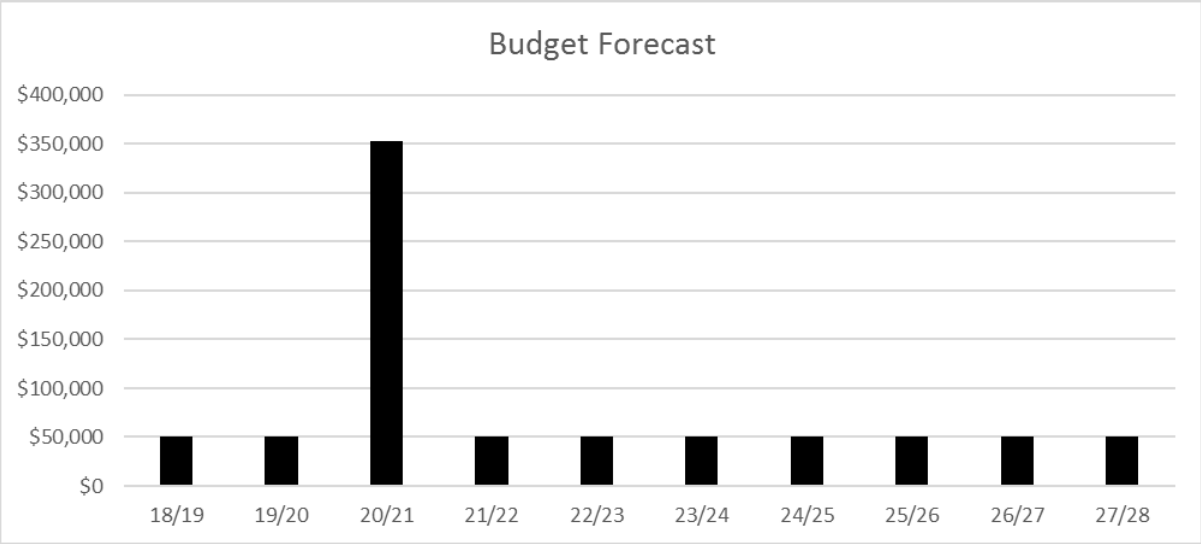
| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 33kV protection | Renewal | $200,000 |
| 2 | Zone Substations | Arc Flash Protection | Safety | $303,000 |

## Projects & programs 2023/24 to 2027/28

| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | All | 33kV protection | Renewal | $250,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $50k | $50k | $353k | $50k | $50k | $50k | $50k | $50k | $50k | $50k |



# 6.14 SCADA and communications

Key features of Electra's SCADA and communications management are as follows.

## Summary of asset class

Electra has 1 central SCADA.

## Population and age profile

- The SCADA master station was installed in 2012 and has had progressive upgrades of software and hardware sufficient to keep within the requirements of vendor (Catapault) support.
- The age of RTU's ranges from 1 to 10 years.

## Condition

| Condition: | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy | Percent forecast for replacement over next 5 years |
|---|---|---|---|---|---|---|---|
| | | 10.0% | 70.0% | 20.0% | | 3 | 15.0% |

## Systemic issues & mitigation

There are no known systemic issues with Electra's SCADA.

### Capacity, security & reliability constraints

There are no known constraints with Electra's SCADA.

## Key design parameters

| Parameter | Value |
|---|---|
| Functionality | Minimum as specified by Electra |

## Management tactics

### Maintenance drivers

- Increasing failure of core functionality.
- Failure of RTU's.

## Assumptions

- Faulty operation indicates imminent failure.
- Generally better to replace than refurbish to capture new functionality.

## Condition assessment techniques and methods

- Tends to be based on failure events.

# Lifecycle policies, criteria and activities

## Inspections

- Review of system errors and alarm logs to identify faults.

## Defect correction

- Major loss of functionality or processing capacity – immediately.
- Major input or RTU - immediately.
- Minor input or RTU – within 3 days.

## Refurbishment

- More likely to be replaced than refurbished.

## Renewal

- Tends to be driven by obsolescence or declining functionality rather than condition.

## Lifecycle decision criteria

- Tends to be driven by obsolescence or declining functionality rather than condition.

# Major projects & programs

## Projects & programs 2018/19

| # | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | Control Centre | SCADA upgrade | Renewal | $175,000 |
| 2 | All | Comms general- FMS | Renewal | $159,000 |

## Projects & programs 2019/20 to 2022/23

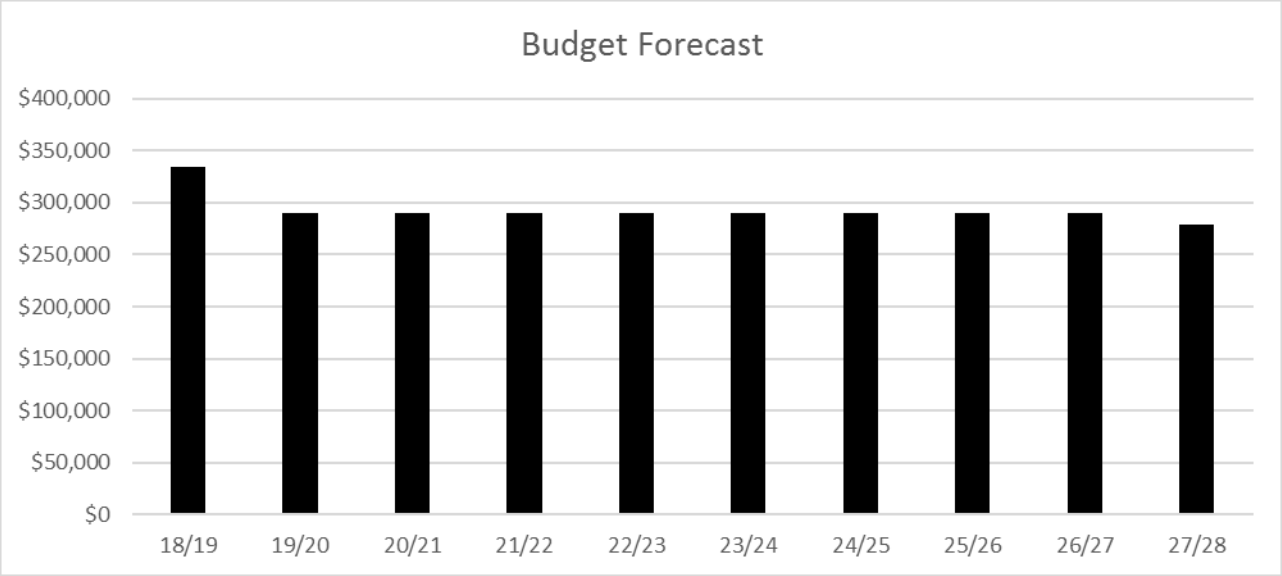
| Ref | Location | Description | Category | Cost |
|---|---|---|---|---|
| 1 | Control Centre | Scada upgrade | Renewal | $700,000 |
| 2 | All | Comms general- FMS | Renewal | $460,000 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Constraint Description | Category | Cost |
|---|---|---|---|---|
| 1 | Control Centre | Scada upgrade | Renewal | $875,000 |
| 2 | All | Comms general- FMS | Renewal | $564,000 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $334k | $290k | $290k | $290k | $290k | $290k | $290k | $290k | $290k | $279k |



# 6.15 Trees

Electra doesn't own any trees, but it does have significant obligations under the Electricity (Hazards from trees) Regulations 2003 to provide security of supply and safety to the public by keeping trees clear of conductors.

## Summary of asset class

Electra's overhead lines are surrounded by trees of varying heights, foliage types, growth rates and ownership classes.

## Population and age profile

Not applicable.

## Condition

Not applicable.

## Systemic issues & mitigation

Not applicable.

### Capacity, security & reliability constraints

Not applicable.

## Key design parameters

Not applicable.

## Management tactics

### Maintenance drivers

- Risk of supply interruption
- Minimum clearances specified in the Regulations.
- Fall zone.
- Roots interfering with cables or ground level assets.

## Maintenance criteria

- Number of customers at risk of interruption from specific tree contacts.
- Branches or leaves encroach into minimum clearances specified in the Regulations.
- Roots observed to interfere with ground level assets.
- Roots believed to interfere with cables.
- Obviously unsafe tree within fall zone.

## Assumptions

- Most tree owners will accept the first cut at Electra's expense, but will prefer the tree to be removed rather than pay for second and subsequent cuts themselves.
- People give little thought to power lines when choosing the location or species of tree.

## Condition assessment techniques and methods

- Primarily visual, with a focus on major trunk splits or defects that could cause the tree to fall across a line.

# Lifecycle policies, criteria and activities

## Inspections

- Grades not applicable.
- Six monthly inspection of entire network, based on zone substation areas.

## Defect correction

- Public safety defects – correction within 1 week of identification.
- Tree condition determined to be unsafe – remove within 1 month subject to land owner approval.

## Refurbishment

- Not applicable.

## Renewal

- Efforts will be made to replace fast growing species with slow growing natives.

- Low growing species such as toi toi and flax that encroach on ground mounted assets will be removed.

## Lifecycle decision criteria

- Not applicable.

## Life extension & investment deferral techniques

- Not applicable.

# Major projects & programs

During 2018 Electra will investigate methods and specific technologies for migrating its tree trimming from a strict compliance-based approach to a risk-based approach to systematically reduce tree related SAIFI and SAIDI in future years. Initial goals are to focus on vegetation on feeder sections electrically closest to zone substations that are likely to interrupt the most customers and then progressively out to automated switching points further along the feeders. GIS will be used to aggregate risk from vegetation and tactically determine which areas to address in order to achieve the greatest risk improvement.

## Projects & programs 2018/19

| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Vegetation control (not faults) | Vegetation | $1,357,578 |

## Projects & programs 2019/20 to 2022/23

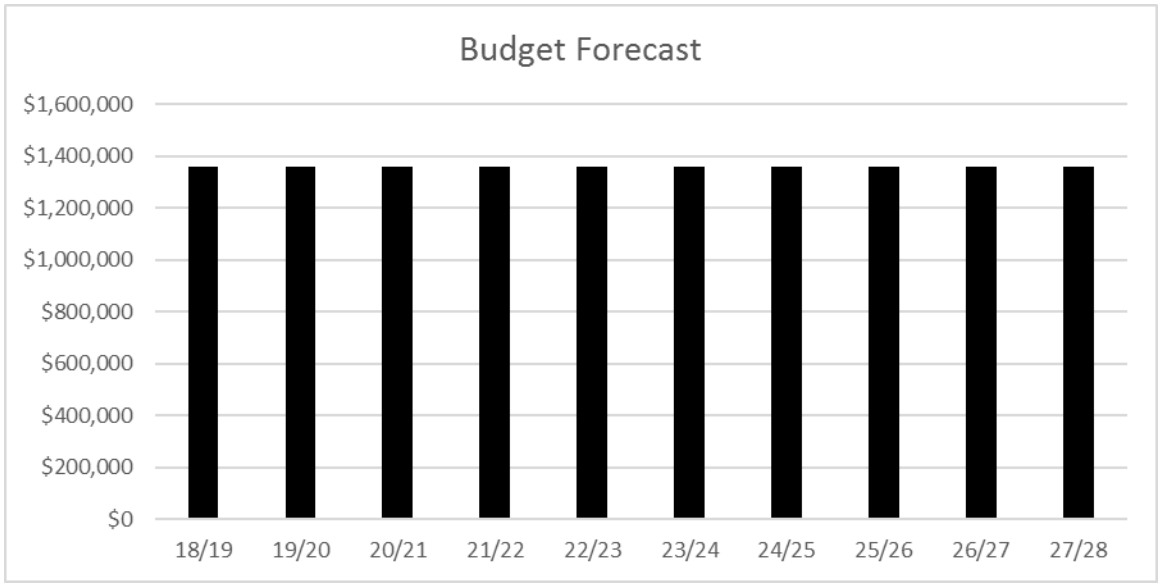
| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Vegetation control (not faults) | Vegetation | $5,430,312 |

## Projects & programs 2023/24 to 2027/28

| Ref | Location | Type of Work | Category | Cost |
|---|---|---|---|---|
| 1 | All | Vegetation control (not faults) | Vegetation | $6,787,890 |

# Budget forecast

| Budget | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | $1,358 | $1,358 | $1,358 | $1,358 | $1,358 | $1,358 | $1,358 | $1,358 | $1,358 | $1,358 |


Budget Forecast
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
18/19
19/20
20/21
21/22
22/23
23/24
24/25
25/26
26/27
27/28

# 6.16 Summary of inspections and maintenance

Inspections and maintenance for all asset classes are summarised below.

| Operations & Maintenance (Current $000) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Subtransmission** | | | | | | | | | | |
| Routine faults restoration | 226 | 226 | 226 | 226 | 226 | 226 | 226 | 226 | 226 | 226 |
| Planned Pole and cross arm renewals | - | - | - | - | - | - | - | - | - | - |
| Re-active Pole and cross arm renewals | - | - | - | - | - | - | - | - | - | - |
| Planned Maintenance | 165 | 165 | 165 | 165 | 165 | 165 | - | - | - | - |
| Annual line inspection | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| **Zone Substations** | | | | | | | | | | |
| Inspections | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Planned Maintenance | 498 | 402 | 367 | 367 | 367 | 399 | 367 | 367 | 367 | 367 |
| Re-active Maintenance | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 |
| **Distribution Network** | | | | | | | | | | |
| Inspections - 11kV & 400 O/H | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Inspections - Pillars | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| Transformer inspections | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| Planned Pole and cross arm renewals | - | - | - | - | - | - | - | - | - | - |
| Re-active Pole and cross arm renewals | - | - | - | - | - | - | - | - | - | - |
| Planned Maintenance | - 14.26 | - 14.26 | - 14.26 | - 14.26 | - 14.26 | - 14.26 | - 14.26 | - 14.26 | - 14.26 | - 14.26 |
| Fault restoration | 926 | 926 | 926 | 755 | 755 | 755 | 755 | 676 | 676 | 676 |
| Vegetation control | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 |
| Planned Transformer maintenance | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 |
| Re-Active Transformer maintenance | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| Planned Low Voltage maintenance | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| Re-Active Low Voltage maintenance | 507 | 507 | 507 | 507 | 507 | 507 | 507 | 507 | 507 | 507 |
| Planned Switchgear maintenance | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| Re-Active Switchgear maintenance | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| **Other Assets** | | | | | | | | | | |
| Communications maintenance | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 |
| SCADA maintenance | 268 | 276 | 276 | 276 | 276 | 276 | 276 | 276 | 276 | 276 |
| Ripple Maintenance | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| **Total Operations & Maintenance** | **4,678** | **4,589** | **4,554** | **4,384** | **4,384** | **4,416** | **4,219** | **4,139** | **4,139** | **4,139** |

# 7. Non-network asset policies & plans

## 7.1 Summary of non-network assets

Electra's non-network assets include…

| Asset class | Description | Approx. value | Criticality to asset management |
|---|---|---|---|
| Non-network ICT & AMIS | Financial system - Microsoft Nav-Dynamics. | About $1m total replacement cost. | Financial reporting and purchasing would be disrupted. Criticality would be about 1 month unless a specific data extraction job was necessary. |
| | A general work environment of 60 desk tops, 30 lap tops and 60 tablets and phones, plus CAD stations and minor applications such as payroll. | $469,900 (NBV) | Fault dispatch work would be disrupted Criticality would be about 12 hours. |
| | In-house outage management and job dispatch system. | $133,500 (NBV) | Fault dispatch work would be disrupted. Criticality is about 12 hours. |
| | SCADA – iFix (Catapult, marketed by GE). | $2,060,300 (NBV) | Real-time operations would require manual HV switching. Criticality is minutes. |
| AM systems | NIMS – based on ESRI GIS, but largely in-house. | $1,370,400 (NBV) | Existing work could continue, but new jobs couldn't be created. Criticality is about 30 days. |
| | Planned installation of Milsoft ADMS suite | About $3m over 3 years. | |
| Buildings | • Head office (Levin).<br>• Depot (Levin)<br>• Depot (Paraparaumu) | $1,465,700 (NBV) | • Head office critical over the long-term, but short-term alternatives for control room and other critical work have been established.<br>• Each depot is critical for efficient works delivery over the long-term, but in the short-term work can be done from either depot (e.g. after an earthquake). |
| Office furniture | • Desks & work stations<br>• Chairs | $22,900 (NBV) | • Not critical as easily replaced. |
| Vehicles | • Cars<br>• Vans<br>• 2WD Utes<br>• 4WD Utes | $188,400 (NBV) | • Not critical as alternatives can be arranged. |
| Tools, plant & machinery | • Hand tools<br>• Power tools | $166,200 (NBV) | • Not critical as easily replaced through local retailers or specialised suppliers. |

## 7.2 Non-network ICT

Electra maintains an Information System's Strategic Plan (ISSP) that provides clarity to Electra on the principles, approach and overall investment priorities for the business.

The ISSP is reviewed and update annually to reflect the changing needs of the business. It aligns with the other strategic and operational plans of the company including this Asset Management Plan, the departmental business plans and associated budgets.

This section of the AMP refers to all technology centric operations and the development of systems to support the electricity distribution business.

**Strategic Context**

Electra's Statement of Corporate Intent (SCI) identifies three Focus areas for the company. These are to provide a superior experience for customers and stakeholders, deliver best in class in the operation and management of the business, and to grow the business. These focus areas feature in Electra Group Business Plan and budgets. A summary of the relative position of the ICT systems and capabilities provides direction to the ISSP.

| Force | Business Needs from ICT |
|---|---|
| Opportunities | Serve customers with accurate and timely information<br>Support internal efficiency of the business<br>Support growth through targeted investment in the Lines business |
| Threats | Damage and disruption from cyber and security threats<br>Disruption from significant regional natural disasters<br>Failure to meet expectations of customers and stakeholders |
| Strengths | ICT operation and management expertise<br>Modern business information systems<br>Capable Advanced Distribution Management System (ADMS) |
| Weaknesses | Lack of Business Intelligence and Big Data Analytics<br>Silos of information and systems<br>Required business process change to realise ADMS benefits |

*Figure 1.: Needs Analysis Survey. Source: Electra ISSP 2017*

Electra desire to serve our customers with better quality information by leveraging the new ADMS. The business expects the highest levels of service availability while being cognisant of the threats to our operation.

**Electra's ICT Assets**

The operations and functions of each capability are integrated, and any business service often relies on one or more of these to operate at effective service levels.

The following model outlines Electra's approach to categorising our ICT assets and capabilities:

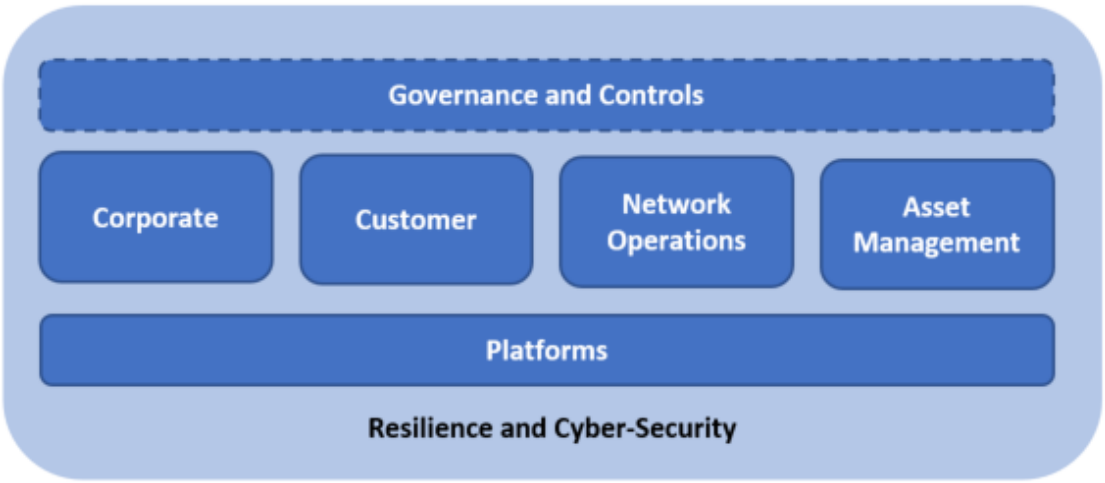



*Figure 2.: Electra ICT Asset and Capability framework. Source: Electra ISSP 2017*

Each asset class provides business services, being:

| ICT Asset Class | Business Services |
|---|---|
| Governance and Controls | Provides the overarching strategic direction, alignment and application of controls around investment and operation |
| Corporate | Support the effective operation of business functions, including Finance, Human Resources and Payroll, Health & Safety and knowledge management. |
| Customer | Allow our customers to interact with Electra – to understand outages, advise of concerns/incidents and to request new connections |
| Network Operations | Ensure the safe and effective operation of our electricity network. |
| Asset Management | Allow Electra to manage, maintain our lines and related assets, including capturing field work and related activity. |
| Platforms | Underpin the delivery and management of Electra's ICT solutions – both our Cloud and on-premise operating environments. |
| Cyber-Security and Resilience | Response to the threats and risks through establishing and maintaining a suite of internal controls. |

**ISSP – Planned ICT Investments**

The Electra ISSP addresses the financial years ending 31 March 2019 through 2021. These plans fall into three horizons, each of which is approximately 12 months, with:

| | |
|---|---|
| **Horizon 1** | Next 12 months, reasonably foreseeable, enables the known |
| **Horizon 2** | Following 12 months (months 13-24). Expected, foreseeable not proximate |
| **Horizon 3** | Last 12 months (months 25-36). Potential, possible, medium term options |

The use of the 3 planning horizons, enables specific plans are in place for the first 12 months, with other less certain for the following 24 months. This ensures the ISSP can accommodate changes in both business needs and from rapidly evolving technology through annual business planning.

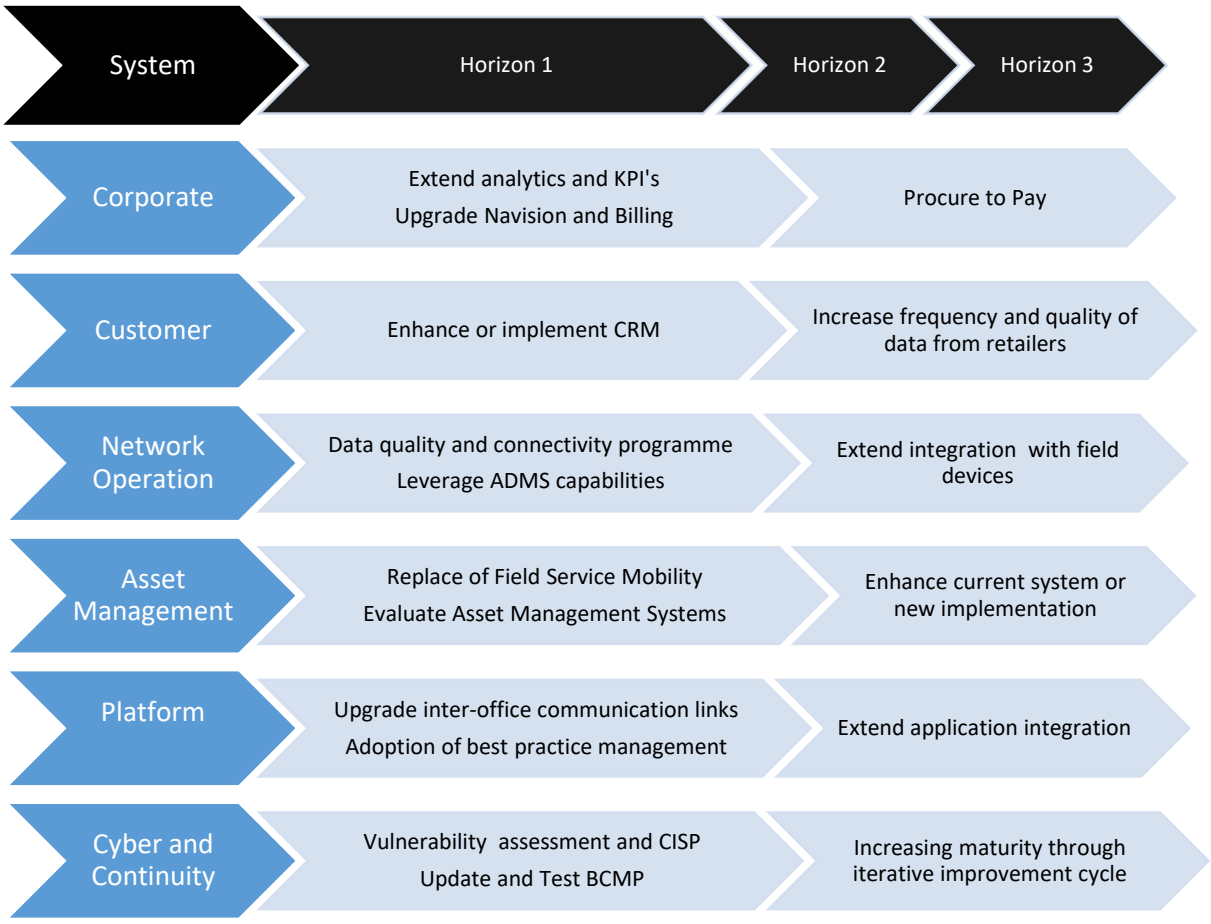



*Figure 3.: ISSP Horizons. Source: Electra ISSP 2017*

**Smart Grid Strategy-ADMS Platform**

In 2017 Electra began the implementation of the implementation of the Advanced Distribution System (ADMS) from Milsoft Utility Solutions. This provides a suite of products for the design, analysis, operation and performance reporting of the distribution business.

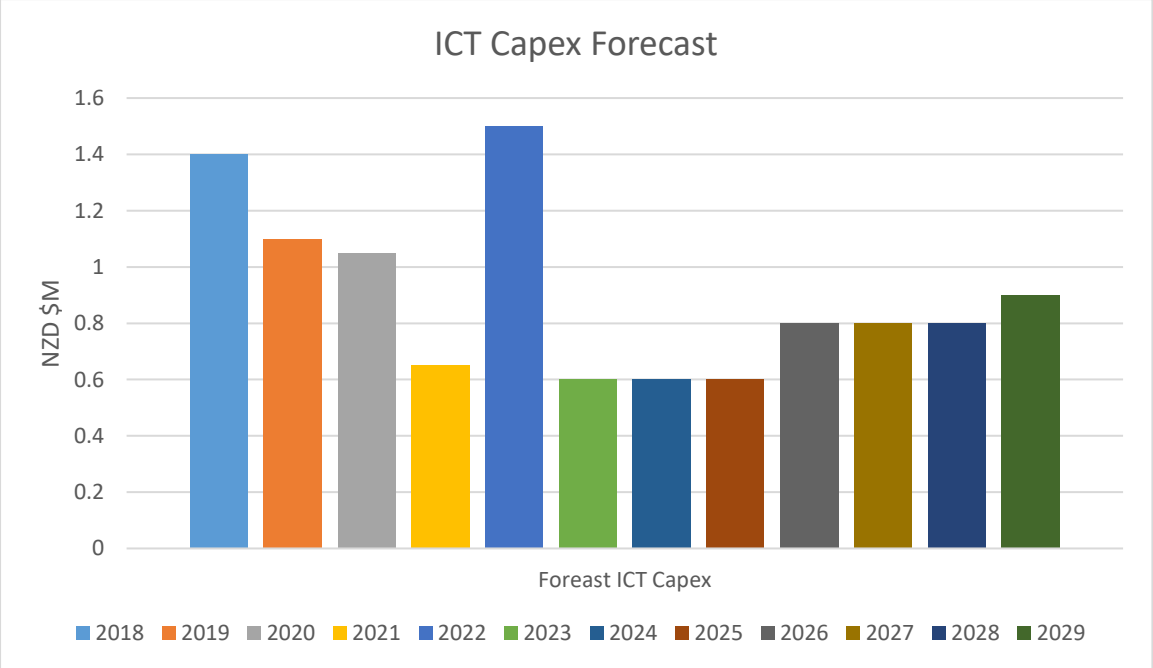
Three key components are

- Outage Management System that despatches jobs to field devices and provides visibility to electricity outages through a webpage and mobile application;
- Design and Engineering analysis maintains the single-source-of-truth for the network design and provides ability to edit and extend the network. This also provides load flow analysis; and
- Management of planned and unplanned outages including regulatory reporting.

Electra is already realising the benefits of improved communication with our customers and greater visibility of processes than span the company. A data quality improvement programme will begin in 2018 to improve the completeness of the underlying information. At the same time a new Field Service Management platform will be implemented to provide the field crews with greater visibility and ability to update and restore customer outages.

**ICT Capex Forecast**

The following table has been produced by analysing our historic costs, then forecasting likely changes to the major systems. The costs have been estimated through consultation with solution providers.




The significant capital spend in the current financial year reflects the implementation of the new Advance Distribution Management System (ADMS) platform and data quality improvement programme. Annual capital expenditure reduces until 2023 when we have made provision to replace, upgrade or integrate this with the ADMS.

## How non-network ICT will support investment and operation

- Efficient works delivery.
- Improved customer experience
- Improved supplier relationships
- Improved real-time operation
- Optimised network investment
- Integration of increasing data into Electra's wider businesses
- One and only one data item that is reliable

## Cyber security plan

Electra has a mature Risk Management Framework that identifies the threat from regional natural disasters and cyber threats, amongst others. These threats are managed and treated as a business risk, rather than a threat to ICT. Several initiatives are planned for 2018 that will further improve our position and preparedness.

# 7.3 Buildings & property

| Asset class | Key policies | Strategies & initiatives |
|---|---|---|
| Buildings | • Head office (Levin).<br>• Depot (Levin)<br>• Depot (Paraparaumu) | • No plans in the horizon for any additions. |

## How buildings and property will support investment and operations

- Safe, comfortable working environment
- Disaster resilience
- Ability to accommodate additional office and field staff
- Flexibility to rearrange staff as org structure evolves

Specific plans for system control, especially back-up (cuts across ICT)

# 7.4 Office furniture & fittings

| Asset class | Key policies | Strategies & initiatives |
|---|---|---|
| Office furniture | • Desks & work stations<br>• Chairs<br>• Cabinets & storage | • No specific strategy, typically low value items that simply follow the need for staff work patterns and duties. |

## How office furniture & fittings will support investment and operations

- Safe, comfortable working environment
- Disaster resilience
- Ability to accommodate additional office and field staff
- Flexibility to rearrange staff as org structure evolves

# 7.5 Vehicles

| Asset class | Key policies | Strategies & initiatives |
|---|---|---|
| Vehicles | • Cars (petrol) – replace after 130,000km or 4 years.<br>• Cars (diesel) – replace after 160,000km or 4 years<br>• Vans and Utes – replace after 160,000km or 6 years.<br>• Trucks – determined by GM – Lines Business, but typically 10 years. | • Key strategy is that the load capacity, terrain capability and range need to align with key network features e.g. extent of network footprint, length and weight of poles etc. |

## How vehicles will support investment and operation

- Ability to perform all required investment and operational activities including transport, lifting, digging etc.

# 7.6 Tools, plant & machinery

Electra's key policies for renewal and replacement of non-network assets include…

| Asset class | Key policies | Strategies & initiatives |
|---|---|---|
| Tools, plant & machinery | • Hand tools – replace when unsafe or insufficient functionality<br>• Power tools<br>• Generator - serviced every 250 hours including replacement of oil and filter. Electrical connections tested annually, COF for the trailer is renewed every 6 months. | • No specific policy |

These replacement policies aim to match the depreciation of the assets.

# 8. Risk management

Electra's network business is exposed to a wide range of risks. Aside from the obvious physical risks such as cars hitting poles, vandalism, public safety and storm damage, the network business is exposed to a wider range of risks that include regulatory commercial and technology uptake.

## 8.1 Risk analysis & methods

Electra has a comprehensive risk management framework that is regularly reviewed by the Board and by Management. This uses an established process (ISO 31000) to…

- Identifying risks that affect the business;
- Assessing the impact and likelihood of the risk occurring;
- Identifying existing controls that will mitigate the risk;
- Identifying the top five residual risks once the controls have been applied;
- Producing and implementing risk treatment plans to further minimise risks; and
- All assessments and plans will be fully documented to assist with the following year's review.

The risk review process has highlighted 21 major risks to the group. Those relevant to the operation of the network are tabled below.

| Master Risk | Risk Description | Jan 2017 Score | Aug 2015 Score |
|---|---|---|---|
| **G1** | **Fatality or serious harm to people** | **165** | **200** |
| | Risk associated with staff and contractors working on the Electra Network | 165 | 200 |
| | Risk to the public associated with the Electra Network | 120 | |
| | Risks to staff or the public from the use of vehicles or heavy mobile equipment | 165 | |
| **G2** | **Inadequate business continuity and disaster recovery management** | **115** | |
| | Inefficient response, restoration and communication to stakeholders | 112 | 154 |
| | Inadequate and/or limited insurance cover for extreme events | 115 | 115 |
| | Unauthorised cyber access, threat or misrepresentation into ICT/SCADA | 115 | 115 |
| | Loss of data and company records | 60 | 60 |
| **G3** | **Inability to maintain economic return / discount contribution related to core business** | **100** | **100** |
| | Historic pricing tariffs threaten medium-term economic return | 80 | 80 |
| | Continued reduced electricity consumption | 80 | 80 |
| | Exposure to avoidable peak demand costs | 100 | 100 |
| **G4** | **Failure to anticipate and plan for technological change** | **112** | **112** |
| | Technological advances threaten businesses established markets | 112 | 112 |
| | Poor data management (access, analysis and decision making) | 82.5 | 82.5 |
| | Lack of timely investment in beneficial technological innovation | 80 | 80 |
| **G5** | **Failure to maintain stakeholder relationships** | **80** | **80** |
| | Decline of company's reputation | 70 | 70 |
| | Lack of contract and contractor management | 60 | 60 |
| | Major customer disputes and litigation by our customers | 50 | 50 |
| | Inadequate skills and aptitude for the role (individual) | 80 | 80 |
| **G6** | **Poor long-term positioning and performance** | **80** | **80** |
| | Failure to maintain a portfolio of core and non-core businesses | 70 | 70 |
| | Failure of businesses to achieve profitability expectations | 80 | 80 |
| **G7** | **Inability to manage political and regulatory change** | **80** | **80** |
| | Increased ComCom, EA costs and any potential industry reform | 80 | 80 |
| **G8** | **Inadequate commercial and financial management** | **80** | **80** |
| | Inadequate group funding strategy leading to liquidity risk | 80 | **80** |

Electra staff and management regularly complete a comprehensive risk analysis on the network and the supporting management structures. These risk analyses are reviewed by and agreed by the Directors. From this analysis, Electra identified the critical elements and plans that were required to manage these risks. Key risks are listed below.

# 8.2 Specific risks

## 8.2.1 Operating safety risks

Operating and maintaining an electrical network involves hazardous situations that cannot entirely be eliminated. Having said that, Electra is committed to provide a safe reliable network that does not place our staff, community or environment at risk. This has been underpinned with the implementation of the Safety Management System (SMS) that has been incorporated into the business. The SMS system is independently audited by Telarc and as a result a certificate verifying compliance with the standard has been issued.

Electra's strategies to mitigate risks relating to personal safety are:

- Development and maintenance of safety policies and manuals;
- Giving the highest priorities to safety related network improvements (as discussed in Chapter 1);
- Design, operate and develop a network in compliance with regulations and accepted industry practice.
- Operation of a Safety Management System (SMS). This is a regulatory requirement that focuses on public safety which was certified to NZS7901 in 2012 and renewed in 2017.

Some of the key aspects of the health and safety policy are to:

- Identify and control hazards by eliminating, isolating or minimising them;
- Work with team members in actively identifying, reporting and dealing with any potential hazard to himself or herself or any other person while at work;
- Provide and maintain training and information to enable team members to fulfil their own and the Company's personal obligations for health and safety;
- Any accident, health and safety incident, near miss or significant safety issue must be reported to the Company using the procedure explained in our health and safety manual;
- Following investigation into causes and preventions of any accident, incident, near miss or significant safety issue identified Electra will, where practicable, action the recommendations arising to prevent a recurrence.

## 8.2.2 Natural disaster risks

Electra's distribution network area is exposed to a range of natural disaster risks. These are described more fully along with Electra's disaster response in Chapter 8.4.3 below.

## 8.2.3 Asset failure risk

The greatest probability of failure to any infrastructure utility is at any point where there is a concentration of assets, such as at a zone substation for an electricity distribution network. At zone substations, the highest risk equipment is the indoor 33kV and 11kV switchboards. This is because a failure of these assets tends to be explosive, and may cause subsequent damage to adjacent assets. This will increase the extent of any outage and the restoration time.

Assets are more likely to fail towards the end of their useful life. As discussed in Chapter 6, Electra inspects all its assets on a cyclical basis. Any assets that are of poor condition and are assessed to have a high likelihood of failure either have maintenance tasks performed on the asset to extend its asset life, or are replaced with a new asset. These replacements are shown as renewals in the network development plan discussed in Chapter 5.

## 8.2.4 Network records risks

Electra records asset information electronically. The principal servers are located within Electra's head office. The inherent risk with this is reduced by offsite storage of computer backups, including SCADA, and contracts with suppliers to provide temporary support if required.

## 8.2.5 Regulatory risk

The high cost of complying with annual disclosures (including compiling of this AMP) continues to burden Electra. The following regulatory risks are also noted…

- The possibility of a return to some form of price or revenue regulation similar to the previous Part 4A of the Commerce Act 1986 is noted.
- The possibility of EDB's being required to connect embedded generation on more generous terms.
- Interference in ownership structure by regulators.

# 8.3 Mitigating network vulnerabilities

Electra manages risk through a combination of measures. These can include both physical and operational measures and will be focused on management and minimization of them.

Specific plans include both physical and operational mitigation measures ranging from replacing assets to insurance and access to financial reserves.

Physical risk management is part of Electra's overall legislative compliance programme. Electra, using the relevant electricity industry and building seismic codes, has a robust network.

| Aspect of work | How risks are managed |
|---|---|
| Data integrity | • As-built plans are required for all new extensions.<br>• Asset data is required for all new extensions and all replacement or maintenance programmes. |
| Easements | • All new assets on private property are suitably protected by registered easements. |
| Control of work | • All work on the electricity assets – regardless of voltage – must be co-ordinated through the Control Centre.<br>• Work must comply, as a minimum, with the Electricity Industry Safety Rules. |
| Strength of works | • As a minimum, all new extensions and all replacement or maintenance work must comply with relevant Electrical Codes of Practice and Electra's Network Construction standards. |

The following table summarises asset specific risk mitigation and management features of the network assets.

| Activity | How risks are managed |
|---|---|
| Transformers and Switchgear | • Oil containment where located outside<br>• All zone transformers have individual oil containment with oil spill kits located at each zone substation in case of other spills<br>• Where a distribution transformer or switchgear has leaked, all affected ground is removed and suitably disposed of in accordance with local by-laws.<br>• VESDA sniffer systems for fire containment are installed at each zone substation's switchgear building<br>• All zone transformers and switchboards have annual diagnostic testing to locate potential faults before they occur. |
| Buildings and Zone Substations | • All major projects, such as a new zone substation, are specifically designed for their location – electrically and structurally.<br>• All buildings are built to the relevant building code.<br>• Electra has seismically engineered bracing on all power transformers at zone substations, with seismic bracing for switchgear and other components as required.<br>• Electra has replaced all zone substation access locks with a tiered key system in 2002, distribution transformers completed in 2003 and all other 11kV equipment in 2004. Access keys are only provided to employees and contractors on a "need to have" basis – the need determined by Electra and not the contractor.<br>• Electra completed security fences at the remaining zone substations in 2004.<br>• Electra undertakes bi-monthly visual inspections of all zone substations. Any necessary repairs are scheduled immediately. |
| Network Design | • As a minimum, Electra uses the Electricity Act and associated Regulations as the basis for construction and maintenance of the network.<br>• Electra, through the design process, ensures that, as the network develops, further interconnection is provided at 11kV. |
| Reticulation | • Electra requires pole strength calculations for all new pole transformers and overhead extensions<br>• Underground cables are specified to withstand through short-circuit faults along with capacity requirements.<br>• The annual network inspections identify any deterioration affecting physical strength, and safety clearances to ensure public safety. |
| Network Operation | • Electra generally operates the 33kV network in two meshed networks to provide a high level of support for the zone substations. Foxton, Otaki and Paekakariki are not on the closed 33kV rings; these substations are backed up by the 33kV and 11kV network through automatic changeover schemes.<br>• Although the 11kV network is operated in a radial manner, all backbone feeders are interconnected with other feeders from the same zone substation and adjacent zone substations. |
| Spares | • Electra holds modern equivalent spares for all electrical assets on the network at a contractor's depot in Paraparaumu and Levin<br>• Individual zone substations have site-specific spares stored at each site as appropriate. |

Electra also uses insurance as the basis for financial risk management, covering professional and director's indemnity, public liability, buildings and plant, loss of profit and vehicles. Except for zone substations, it is not possible for Electra to insure the electricity network for catastrophic damage. Electra requires insurance of its contractors to cover contract works, all project assets, public liability and liquidated damages.

# 8.4 Emergency response plans

Electra responds to emergencies regularly. Generally these are outages on the network and are used as the basis for planning and training for large-scale emergencies. All emergency response is based at Electra's Control Centre (supported by a UPS) through the toll-free fault service 0800 LOST POWER, web outage page and phone app.

## 8.4.1 General network faults

Electra Distribution Operation's staff are available 24/7 in case of outages – with various levels of response to different fault types and widespread events such as storms. Electra's Network staff are also available to provide assistance for contract and network operational issues.

Most faults are restored in less than 3 hours. As a guide, equipment failure, and the associated response can be summarised as follows:

| Level of response | Means of Response | Work required |
|---|---|---|
| Immediate -<br>(30 minutes to 3 hours) | • SCADA or field switching<br>• Field repairs | • No major work required – e.g. clearing tree branch off line<br>• Time depends on cause and available personnel and extent of switching |
| Medium -<br>(3 hours to 12 hours) | • SCADA or field switching (most consumers are restored by switching)<br>• Field repairs | • Equipment damaged – e.g. pole hit by car, transformer needs changing, overhead line needs repairs or replacing<br>• Time depends on cause and available personnel and extent of switching |
| Long -<br>(12 hours to 48 hours) | • SCADA or field switching (most consumers restored by switching)<br>• Field repairs | • Major equipment damaged – e.g. loss of a zone substation, replacing part or all of a damaged 33kV bus.<br>• Time depends on cause, available personnel and spares. |

## 8.4.2 Restoration of key component failures

Electra has considered the following network failure scenarios in order to assess its ability to promptly restore (n) security of supply:

- Busbar faults at each zone substation
- Loss of each sub-transmission circuit

- Loss of each zone substation transformer
- Loss of each communication hub
- Inability to access the Electra Head Office and associated systems.

The likely outcomes of each scenario have been considered, along with the tasks required to restore (n) security of supply and the resources required for each task.

## 8.4.3 Reinstating the network after a disaster

Electra has developed a Major Network Event Guideline which outlines the broad tasks that Electra would need to undertake to restore electricity supply to (n) security under the following publicly credible disaster scenarios:

- An earthquake of Richter magnitude 7.5 or greater on a major Wellington fault;
- Volcanic activity at Ruapehu resulting in ash coverage of about 10mm throughout the Northern part of Electra's area;
- A 1 in 100 year flood of the Otaki, Waikanae or Manawatu rivers; or
- A tsunami impacting on the West Coast that could inundate up to 2km inland.

Preparation of this Guideline has revealed that Electra has already put many recovery initiatives in place and has coordinated its likely responses with other agencies in both the Kapiti and Horowhenua districts.

## 8.4.4 Continuity of key business processes

Electra has used an external advisor to identify its key business processes and assess the vulnerability of those processes to a range of natural disasters, man-made events and deliberate interference. Mission critical processes are…

- Invoicing retailers for use of the network;
- Receipting payments from retailers; and
- Maintaining sufficient business records of invoicing and receipting activities to compile compliant accounts and regulatory disclosures.

The key risks identified to these processes are:

- Unauthorised access to data;
- Accidental fire or arson at Electra's offices or adjoining premises; and

- An earthquake of Richter magnitude 7.5.

Mitigating actions taken include:

- Maintaining a backup Control Centre off-site from the head office that contains all the necessary software and templates to perform critical tasks discussed above;

- Review of the physical security of the principal server in regard to unauthorised physical interference, fire damage or earthquake damage; and

- A review of Electra's vulnerability to being "hacked" over the web.

# 9. Performance evaluation

## 9.1 Works delivery performance

This section outlines Electra's progress against budgeted targets for the year ending 31st March 2017.

### 9.1.1 Maintenance Plan

The following table presents a summary of actual spend against budgeted spend for the key maintenance categories:

| Category | 2016/17 Actual ($000) | 2016/17 Budget ($000) | Variance ($000) | Variance (%) | Reasons for variances |
|---|---|---|---|---|---|
| Fault and emergency maintenance | 1,932 | 1,510 | 422 | 28% | Actual expenditure was greater than budget in this category primarily due to Kaikoura Earthquake related outages. |
| Vegetation Management | 1,515 | 1,224 | 291 | 24% | Actual expenditure was greater than budget in this category due to usage of contractors to ensure delivery of increased work plan. |
| Routine and corrective maintenance | 826 | 821 | 5 | 1% | No material variation. |
| Replacement and renewal Maintenance | 393 | 1,234 | -841 | -68% | Under budget due to the change in the accounting treatment of cross-arms (now recognised as capital rather than operational expenditure). |
| System operations | 1,659 | 1,938 | -279 | -14% | Under budget due to over-stated forecast |
| Business support | 4,594 | 288 | 4,306 | 1,495% | Over budget due to overhead management support costs accidently not being forecasted. |
| **Total** | **10,919** | **7,015** | **3,904** | **56%** | |

Overall, Electra was over its maintenance budget by 56% for the 2016-2017 year. Individual variances in different categories are shown above in the table (using a materiality of $100,000). Material variation in business support was due to overhead management support costs not being forecasted.

### 9.1.2 Development Plan

The following table shows a summary of actual spend against budgeted spend for the key development categories:

| Category | 2016/17 Actual ($000) | 2016/17 Budget ($000) | Variance ($000) | Variance (%) | Reasons for variances |
|---|---|---|---|---|---|
| Consumer connection | 0 | 95 | -95 | -100% | Budgeted on a net basis for vested assets. Electra spent $0 on vested assets. |
| System growth | 89 | 204 | -115 | -56% | Expenditure in this category was below forecast due to 11kV cable replacement synergies achieved by doing other jobs in the area at the same time. |
| Reliability, safety and environment | 1,151 | 2,135 | -984 | -46% | Expenditure in this category was under forecast mainly due to protracted land owner negotiations delaying purchasing the 110kV Line from Transpower ($0.6m) which has been rolled over to 2018 and the delay in completing the duplicate line from Waihou Road which has now been rolled over to 2018 ($0.4m). |
| Asset replacement and renewal | 9,129 | 8,466 | 663 | 8% | Expenditure in this category was over forecast mainly due to various conductring jobs costing more than budgeted such as Roslyn Road, Gladstone Road, and Hautere Cross Road. |
| Asset relocation | 24 | 0 | 24 | 24% | No planned relocations at the time of forecasting. Actual costs related to relocating 400V cables |
| **Total**[(ii)] | **10,394** | **10,900** | **-506** | **-5%** | Overall Expenditure on Assets was $506k under forecast. |

# 9.2 Network business performance

## 9.2.1 Customer service performance (reliability)

Electra's actual performance against target performance for the 2016/17 year for the key customer service attributes is as follows.

| Attribute | Measure | 2016/17 Target | 2016/17 Actual | Comment |
|---|---|---|---|---|
| Network Reliability | SAIDI | 83.0 | 89.27 | Main contributor towards SAIDI being higher than target was the Kaikoura earthquake on Nov 14th. |
| | SAIFI | 1.68 | 1.50 | Compliant |
| | CAIDI | 49.7 | 59.5 | |
| Public Safety | Electricity (Safety) Regulations 2011 | Compliant | Compliant | Continued compliance to NZS 7901 |

## 9.2.2 Asset performance

Electra's actual performance against target performance for the 2016/17 year for the key asset and regulatory measures are as follows.

| Attribute | Measure | 2016/17 Target | 2016/17 Actual | Comment |
|---|---|---|---|---|
| Industry performance | Electricity Information Disclosure Requirements 2004 and subsequent amendments | Compliant | Compliant | AMP assessed as generally compliant and above industry average |
| Financial Efficiency | Capital expenditure per:<br>• total circuit length<br>• connection point | <br>$2,834<br>$174 | <br>$4,942<br>$249 | |
| | Operational expenditure per:<br>• total circuit length<br>• connection point | <br>$2,614<br>$160 | <br>$4,857<br>$245 | |
| Energy Delivery Efficiency | Load factor (units entering network / maximum demand * hours in year) | 54% | 48% | |
| | Loss ratio (units lost / units entering network) | 6.6% | 6.7% | |
| | Capacity utilisation (maximum demand / installed transformer capacity) | 34% | 32.9% | |

# 9.3 Asset management practice performance

## 9.3.1 AMMAT starting point

The starting assessment for improving Electra's asset management practices in the 2017/18 plan was the AMMAT performed in early 2017, which revealed:

- An average score of 2.27.
- A cumulative score of 70.5

- That the lowest scoring practices were around having an asset strategy (score 1.5), documentation of the asset management systems (score 1) and assigning responsibility for handling failure investigations (score 1.5).

While it was recognised that improving some asset management practices would be a lengthy process that would be beyond 1 year, these low scoring areas were selected as foundation improvements over the 2017/18 financial year.

## 9.3.2 Work done during 2017/18 year

**Initial high-level work**

A workshop was held in early 2017 in which the desired scores were defined, which would result in lifting the average score from 2.27 to 2.74 and lifting the cumulative score from 70.5 to 85. Further high-level work grouped the AMMAT questions into 6 clusters and compiled a roadmap of actions required and benefits of improving each practice area.

**Work on specific AMMAT elements**

The following improvement work was performed during 2017…

- Strengthening the asset strategy (Q10) – an asset management hierarchy was developed to better depict the purpose and function of the AM Policy, the AM Strategy and the individual Asset Fleet Strategies. This also involved reconsidering a previously approved AM Policy. The result of the work done to better define and align its AM Hierarchy has been assessed as a score of 2.

- Improving the documenting of the AM System (Q59) – the AM System has been drawn to include the major process steps, key decision points and the data required (noting that it is much more than just a simple IT landscape drawing). The need to broadly align this documentation with element 4.4.5 of PAS 55-1 has also been noted. Electra is confident that it would score a 2.

- Improving the investigation of asset-related failures (Q99) – the required outcomes have been defined in detail, and the necessary task and behavioural changes have been identified.

**Wider asset management practice improvements**

Electra undertook a review of the effectiveness and efficiency of its two largest Capex programs during 2017/18 (wooden cross arm replacements and conductor replacements). Work completed during 2017/18 included improving the works aggregation, clearly and consistently articulating the outcomes required and assessment of the actual condition of assets removed from service has resulted in:

- Both programs achieving target replacement volumes.

- Clarified the conductor replacement program being driven by a collection of significant additional benefits including connecting neighbouring feeders, improving redundancy and fault restoration times.

- Enabling less supply disruption when undertaking planned work.

- In the case of cross arms; condition assessment guidelines were adjusted such that a portion of cross arms could be left in service longer before replacement

Other improvements include:

- Improved project formation rigour, better solution objectivity, improved estimation and fewer variances on works delivery.

- Better safety conversations and better works delivery planning conversations supporting improved safety and productivity outcomes.

- Improved visibility of management and business initiatives for Lines Business team members in regular structured training days.

## 9.3.3 Expected further improvements

Improvements are selected by degree of benefit, effort required to achieve the desired outcome and on whether it is a prerequisite for following improvements. The high level ease - benefit scoring suggests the sequence to be followed in the improvement program

| Benefit | Low Effort | High Effort |
|---|---|---|
| High | **Quadrant #4**<br>High Benefit / Low Effort<br>Do first | **Quadrant #2**<br>High Benefit / High Effort<br>Detailed plan needed |
| Low | **Quadrant #3**<br>Lesser Benefit / Low Effort<br>Do next | **Quadrant #1**<br>Low Benefit / High Effort<br>FAQs explain why not |

Effort / Cost

| Q | Description | March 2017 score | Desired score | Ease & Benefit | March 18 (plan) | March 2019 | March 2020 |
|---|---|---|---|---|---|---|---|
| 3 | To what extent has an asset management policy been documented, authorised and communicated? | 2 | 3 | 2 | 2.5 | 3 | |
| 11 | In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship? | 2 | 2.5 | 2 | 2.5 | | |
| 26 | How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems? | 2 | 2 | 3 | | | |
| 27 | How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery? | 2 | 3 | 3 | 3 | | |
| 29 | How are designated responsibilities for delivery of asset plan actions documented? | 2.5 | 3 | 3 | 3- | 3 | |
| 31 | What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? | 2 | 2.5 | 2 | 2.5 | 3 | |
| 42 | To what degree does the organisation's top management communicate the importance of meeting its asset management requirements? | 2.5 | 3 | 2 | | | 3 |
| 45 | Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy? | 2 | 2.5 | 2 | | | 2.5 |
| 48 | How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)? | 3 | 3.5 | 2 | 3.5- | 3.5 | |
| 49 | How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies? | 2.5 | 3 | 2 | 3 | | |
| 50 | How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience? | 2.5 | 3 | 2 | | | 3 |
| 53 | How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers? | 2 | 2.5 | 2 | | 2.5 | |
| 62 | What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system? | 2 | 2.5 | 2 | | 2.5 | |
| 64 | How has the organisation's ensured its asset management information system is relevant to its needs? | 2 | 3 | 2 | | 3 | |
| 69 | How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle? | 2 | 2.5 | 2 | 2.5 | | |
| 79 | How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs? | 2.5 | 3 | 2 | | 3 | |
| 88 | What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system? | 2.5 | 3 | 2 | | | 3 |
| 95 | How does the organisation measure the performance and condition of its assets? | 2 | 2.5 | 2 | 2.5 | | |
| 109 | How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non-conformance? | 2 | 2.5 | 2 | 2.5 | | |
| 113 | How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle? | 2 | 2.5 | 2 | | 2.5 | |
| 115 | How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation? | 2.5 | 3 | 2 | | | 3 |

# 9.4 Proposed improvement initiatives

Key areas for the Electra Network team to concentrate on over the 2018/19 year are:

| Goal area | Focus of work | Specific activities |
|---|---|---|
| Improve understanding of asset condition | Improve understanding of what the actual condition of key components really is based on observable condition. | • Understand key deterioration modes of components (work already started during 2017).<br>• Improve understanding of how actual condition manifests as visible or measurable features.<br>• Investigate technologies that reduce dependence on simple observations<br>• Cleanse and possibly re-interpret existing asset condition data sets. |
| Strengthen asset replacement decisions | Understand the level of deterioration immediately prior to asset failure. | • Understand how deterioration modes reduce component performance and increase failure risk<br>• Agree on the acceptable level of failure<br>• Translate that acceptable level of failure to component condition, dimensions etc.<br>• Embed those component conditions, dimensions etc into asset replacement policies as criteria. |
| Customer Centricity | Focus on the foundation work identified in the Customer Centric Capability diagram | • Leverage collaboration on key customer projects to enhance smart tech offerings to other customers. Case studies on customer channels (web site to start with)<br>• Targeted advisory to shift up to 100 customers to better price options, contributing to minimised cost to serve and improved network margin<br>• While Electra is not directly responsible for the integrity of customer service line assets, it is an area that is not well understood by our customers and strategically in our interest to proactively promote customer safety, responsibility and what Electra can do to help.<br>• It is planned to utilise GIS to assist in the planning of vegetation management to focus on customer experience improvement through improved network reliability. This is planned to be funded within existing vegetation management costs, systematically leveraging current data to more clearly identify the areas where the best reduction of reliability risk can be achieved. |

| | | | | |
|---|---|---|---|---|
| Smart Grid. | ➔ | Improve network controllability, monitoring and network reliability through | ➔ | • Introduction and installation of automated switches and sensors at strategic network points, which will improve customer experiences and provide key network data to improve future asset investment decisions. (This data will improve the accuracy of engineering model in ADMS)<br>• Continuing deployment of feeder interconnectivity and self-healing schemes<br>• Network sectionalisation (automated switches where required) by unbundling looped transformers in southern network.<br>• Leading the programme of correcting and maintaining the network circuit model<br>• Implementation of the ADMS integration into the business requiring up skilling of current operational and planning staff.<br>• Network Operations (Control Room) team successfully operating the network via ADMS, network performance figures are automatically calculated, network constraint information is revealed and acted on by Operations in conjunction with Planning & Development information |
| Network Resilience. | ➔ | Targeted improvements in network resilience through | ➔ | • At sub transmission level by focussing beyond SAIFI & SAIDI to network availability and formation of plans to reduce network element outages (distance to fault, hazardous tree program, standardise the protection schemes applied to sub transmission)<br>• Seismic assessment and strengthening of zone substation buildings and structures. |

# 10. Works delivery

## 10.1 Resourcing policy & strategy

### 10.1.1 Resourcing approach

Key features of Electra's resourcing strategy include:

- Forecast the annual hours required for the four key occupational classes of electrician / jointer, lineman, live line mechanic, and arborist.
- Identify the annual available hours for each of the four occupational classes, including resignations and retirements.
- Any shortfall of annual man-hours within each occupational class is identified, and plans to meet those shortfalls are developed. Those plans can include multi-skilling of existing staff, improving productivity of existing work practices, training of apprentices, recruitment from the open market, or using contractors.

### 10.1.2 Resourcing guidelines

Electra is guided by the following principles:

- The bulk of network construction, operation and maintenance will be performed by internal staff.
- Where external resources are available at competitive rates; contractors will be engaged for well-defined tasks such as trenching, directional drilling or concreting.
- Infrequently required specialist skills will similarly be contracted when required.
- Any transition from the use of contractors to in-house staff will include consideration of likely work volumes, presence of contractors and the expected difference between wages and contract rates.

### 10.1.3 Strategic workforce issues

Electra recognises a range of strategic workforce issues that include….

- An increasing propagation of Information Technology into field resource teams; moving skills from the office to field teams
- Adjusting field team composition leveraging the skills and experience of older works for inspection and scoping while enabling younger workers to step up to work team leadership.

- Forecast AMP spends by other EDB's will provide strong competition for field services workers
- Retention of workers upon completion of training.

### 10.1.4 Specific resourcing plans

Current service delivery utilisation is about 78%. It is proposed to lift this to about 86% by various process and work improvement improvements, which will create additional capacity to deal with the peak workloads.

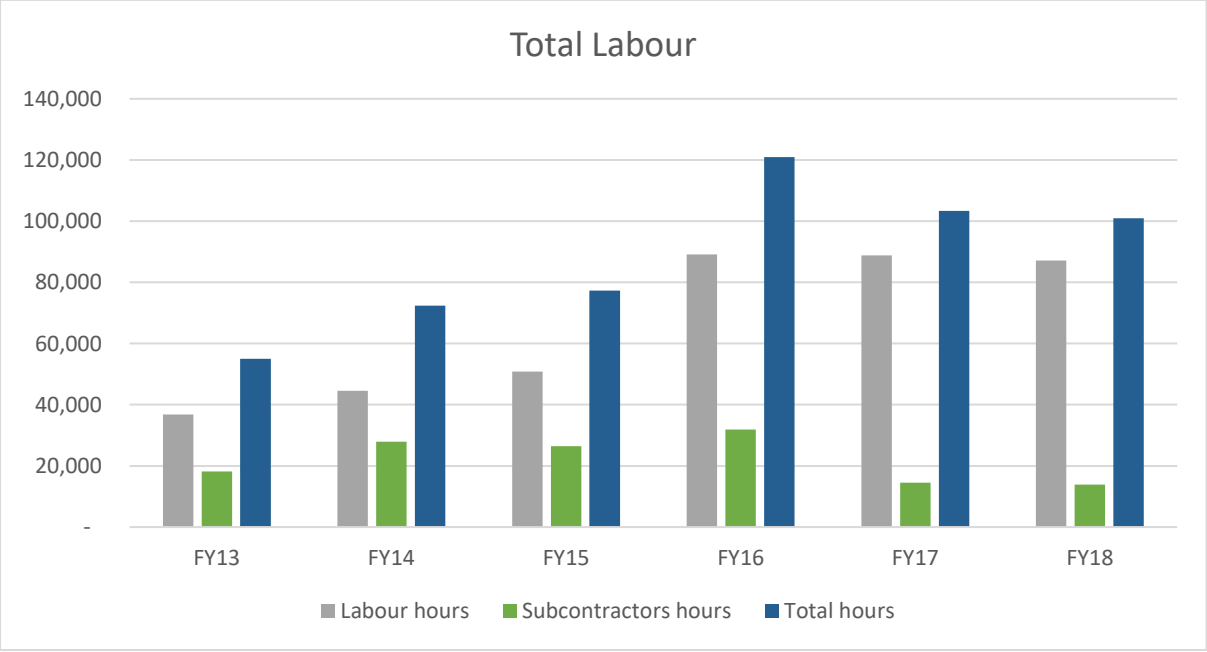
Electra is also in the process of recruiting 4 new apprentices as part of its long-term succession planning, and it expects to continue this practice year on year over the next 10 years.

Part of the capability matrix is to upskill 30 % of the workforce to be multiskilled in different disciplines to accommodate for peak periods.

## 10.2 Required resources to deliver works

### 10.2.1 Forecast resource requirements

Over the past 5 financial years Electra has averaged 44 FTE's across the service delivery team with the last 3 years having an average of 54 FTE's.




Currently Service Delivery has 55 FTE's and a further 6 vacancies in the process of being filled which will bring the FTE total to 61 for the 2018/19 year as there is an increase of third party work delivered

on the network. Two of these new FTE's will be allocated to internal delivery of civil works to minimise the risk of utilising external subcontractors and to reduce the subcontractor hours to less than 8,000 hours per year.

Looking ahead Electra must recruit 16 replacement FTE's over the next 10 years due to 20% of the workforce approaching the age of National Superannuation entitlement. Capability and succession planning is in place to minimise that impact. Skillset capacity is set out in Chapter 10.2.2 demonstrating both current FTE's and vacancies in the process of being filled.

## 10.2.2 Forecast resource availability

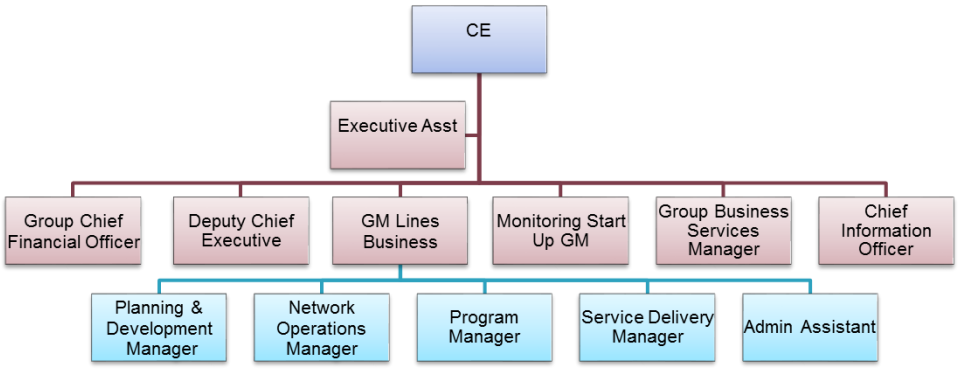
| YE 31st March | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **Electrician / jointers** | | | | | | | | | | |
| Opening number | 11 | 12 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 17 |
| Plus recruitments | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| Plus new apprentices | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| Less resignations & retirements | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| **Closing number** | **12** | **13** | **14** | **14** | **15** | **15** | **16** | **16** | **17** | **18** |
| | | | | | | | | | | |
| **Linemen** | | | | | | | | | | |
| Opening number | 26 | 29 | 29 | 29 | 31 | 31 | 32 | 32 | 32 | 32 |
| Plus recruitments | 4 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 |
| Plus new apprentices | 2 | 2 | 0 | 2 | 1 | 2 | 0 | 1 | 2 | 2 |
| Less resignations & retirements | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 |
| **Closing number** | **29** | **29** | **29** | **31** | **31** | **32** | **32** | **32** | **32** | **33** |
| | | | | | | | | | | |
| **Liveline mechanics** | | | | | | | | | | |
| Opening number | 11 | 13 | 14 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Plus recruitments | 3 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| Plus new apprentices | | | | | | | | | | |
| Less resignations & retirements | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| **Closing number** | **13** | **14** | **15** | **15** | **15** | **15** | **15** | **15** | **15** | **15** |
| | | | | | | | | | | |
| **Arborists** | | | | | | | | | | |
| Opening number | 6 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Plus recruitments | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plus new apprentices | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Less resignations & retirements | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Closing number** | **9** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** |
| | | | | | | | | | | |
| **YE 31st March** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** |
| **Electrician / jointer** | **12** | **13** | **14** | **14** | **15** | **15** | **16** | **16** | **17** | **18** |
| **Lineman / liveline** | **42** | **43** | **44** | **46** | **46** | **47** | **47** | **47** | **47** | **48** |
| **Arborist** | **9** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** |
| | | | | | | | | | | |

## 10.2.3 Expected resource shortfalls

No expected shortfall based on current and projected workloads and customer related works (3rd party).

# 10.3 Organisation structure

Electra's staff structure emphasising the Lines Business is as follows..




This emphasises the short distance between the Lines Business managers (aiding line of sight), and also the logical alignment of the 4 Lines Business managers with the asset lifecycle.

# 10.4 Delegated authorities

Delegated authorities are set out in Chapter 1.9.

# Appendix 1 – Determination references

The following table cross references the Chapters in this AMP to the Commerce Commission document; "The electricity distribution information disclosure determination 2012 (consolidated to March 2015).

| Determination ref. | Chapter(s) in this AMP |
|---|---|
| 3.1 Summary. | • Chapter 0. |
| 3.2 Background and objectives. | • Chapter 1. |
| 3.3.1 Purpose and status. | • Chapter 1.1 |
| 3.3.2 Corporate mission or vision. | • Chapter 1.2 |
| 3.3.3 Identifies documented plans. | • Chapter 1.3 |
| 3.3.4 States how documented plans relate. | • Chapter 1.4 |
| 3.3.5 Description of interaction between objectives, goals and plans. | • Chapter 1.5 |
| 3.4 Details of planning period. | • Chapter 1.6 |
| 3.5 Date of approval by directors. | • Chapter 1.7 |
| 3.6.1 Describe how stakeholder interests are identified. | • Chapter 1.8.1 |
| 3.6.2 What these interests are. | • Chapter 1.8.1 |
| 3.6.3 How these interests are accommodated in asset management practices. | • Chapter 1.8.2 |
| 3.6.4 How conflicting interests are managed. | • Chapter 1.8.3 |
| 3.7.1 Governance accountability. | • Chapter 1.9.1<br>• Chapter 1.9.4 |
| 3.7.2 Executive organisation and structure. | • Chapter 1.9.2<br>• Chapter 1.9.4 |
| 3.7.3 How field operations are managed. | • Chapter 1.9.3<br>• Chapter 1.9.4<br>• Chapter 1.9.5 |
| 3.8 Significant assumptions | • Chapter 1.16 |
| 3.9 Description of the factors that may lead to a material difference | • Chapter 1.17 |
| 3.10 Overview of asset management strategy and delivery. | • Chapter 1.10<br>• Chapter 6 for each asset category |
| 3.11 Overview of systems and information management | • Chapter 1.11 |
| 3.12 Statement covering any limitations | • Chapter 1.12 |
| 3.13.1 Description of processes used to manage routine inspections and maintenance. | • Chapter 1.13.1<br>• Chapter 1.13.2<br>• Chapter 6 for each asset category |
| 3.13.2 Description of the processes used for planning and implementing development projects. | • Chapter 1.13.3<br>• Chapter 6 for each asset category |
| 3.13.3 Description of the process used for measuring network performance. | • Chapter 1.13.4 |
| 3.14 Overview of asset management documentation, controls and review processes. | • Chapter 1.14 |
| 3.15 Overview of the communication and participation program. | • Chapter 1.15<br>• Chapter 9 |
| 4.1.1 Regions covered | • Chapter 2.1.1 |
| 4.1.2 Identification of large consumers. | • Chapter 2.1.2 |
| 4.1.3 Description of load characteristics. | • Chapter 2.1.3<br>• Chapter 3.1 |
| 4.1.4 Peak demand and energy delivered in the previous year. | • Chapter 2.1.4<br>• Chapter 3.1 |
| 4.2.1 Identify bulk supply points and embedded generation | • Chapter 3.1 |
| 4.2.2 Description of sub-transmission network. | • Chapter 3.2<br>• Chapter 3.3<br>• Chapter 6 for each asset class |
| 4.2.3 Description of distribution system. | • Chapter 3.4<br>• Chapter 3.5<br>• Chapter 6 for each asset class |
| 4.2.4 Description of distribution substations | • Chapter 3.6<br>• Chapter 6 for each asset class |
| 4.2.5 Description of LV network. | • Chapter 3.7<br>• Chapter 3.8<br>• Chapter 6 for each asset class |

| | |
|---|---|
| 4.2.6 Overview of secondary assets. | • Chapter 3.9 |
| 4.4 Describe network assets, including age and condition. | • Chapter 6 for each asset class |
| 4.5 Asset categories | • Chapter 6<br>• Schedules |
| 5. Identify and define a set of performance indicators. | • Chapter 4 |
| 6. Performance indicators must include SAIDI and SAIFI for the next 5 years. | • Chapter 4.1.1 |
| 7.1 Consumer oriented targets. | • Chapter 4.1.1 |
| 7.2 Indicators of asset performance etc. | • Chapter 4.2<br>• Chapter 4.3 |
| 8. Justification of target service levels. | • Chapter 4.6 |
| 9. Targets should be compared to historic values. | • Chapter 4.1 |
| 10. Where forecast expenditure is expected to materially affect performance | • |
| 11.1 Description of planning criteria and assumptions. | • Chapter 5.2 |
| 11.2 Described logically and succinctly. | • Chapter 5.2 |
| 11.3 Strategies used to promote efficiency. | • Chapter 5.3 |
| 11.4.1 Categories of assets and designs that are standardised. | • Chapter 5.3.1 |
| 11.4.2 Approach used to identify standard designs. | • Chapter 5.3.1 |
| 11.5 Description of strategies used to promote energy efficient operation. | • Chapter 5.3.2 |
| 11.6 Description of the criteria used to determine capacity | • Chapter 5.3.3 |
| 11.7 Description of the process used to prioritise development projects. | • Chapter 5.5 |
| 11.8.1 Explain load forecasting methodology. | • Chapter 5.6 |
| 11.8.2 Provide separate forecasts to at least zone substation level. | • Chapter 5.7.2 |
| 11.8.3 Identify any constraints. | • Chapter 5.4<br>• Chapter 6 for each asset class |
| 11.8.4 Discuss the impact of distributed generation. | • Chapter 5.3.4 |
| 11.9.1 Reasons for choosing selected options. | • Chapter 5.3.5 |
| 11.9.2 Alternative options considered. | • Chapter 5.3.5 |
| 11.9.3 Consideration of planned innovations | • Chapter 6 for each asset class |
| 11.10.1 Detailed description of material projects for next year. | • Chapter 5.7.1 |
| 11.10.2 Summary of project and programs for next 4 years. | • Chapter 5.7.2 |
| 11.10.3 Overview of projects for reminder of planning period. | • Chapter 5.7.3 |
| 11.11 Policies on distribution generation etc. | • Chapter 5.3.3 |
| 11.12.1 Policies on feasible or practical alternatives to network augmentation. | • Chapter 5.3.5 |
| 11.12.2 Potential for non-network solutions to address constraints. | • Chapter 5.3.5 |
| 12.1 Key drivers for maintenance planning and assumptions. | • Chapter 6 for each asset category |
| 12.2.1 Approach to inspecting assets. | • Chapter 6 for each asset category |
| 12.2.2 Identify any systemic problems. | • Chapter 6 for each asset category |
| 12.2.3 Budgets broken down by asset category. | • Chapter 6 for each asset category |
| 12.3.1 Process used to decide whether an asset is refurbished or replaced. | • Chapter 6 for each asset category |
| 12.3.2 Description of innovations that have deferred asset replacements. | • Chapter 6 for each asset category |
| 12.3.3 Description of projects for next 12 months. | • Chapter 6 for each asset category |
| 12.3.4 Summary of projects planned for next 4 years. | • Chapter 6 for each asset category |
| 12.3.5 Overview of work being considered for remainder of planning period. | • Chapter 6 for each asset category |
| 12.4 Requirement to include asset categories set out in 4.5. | • Chapter 6 |
| 13.1 Description of non-network assets. | • Chapter 7.1 |
| 13.2 Policies for those assets. | • Chapter 7.2 to 7.6 |
| 13.3 Material capital expenditure for next 5 years. | • Chapter 7.2 to 7.6 |
| 13.4 Material maintenance and renewal for next 5 years. | • Chapter 7.2 to 7.6 |
| 14.1 Methods, details and conclusions of risk analysis. | • Chapter 8.1 |
| 14.2 Strategies used to identify HILP events, and describe resilience. | • Chapter 8.2 |
| 14.3 Description of policies used to mitigate or manage risk | • Chapter 8.3 |
| 14.4 Emergency response plans | • Chapter 8.4 |
| 15.1 Review of progress against plan. | • Chapter 9.1 and 9.2 |
| 15.2 Evaluation and comparison of actual performance against target. | • Chapter 9.1 and 9.2 |
| 15.3 Evaluation of AMMAT | • Chapter 9.3 |
| 15.4 Analysis of gaps and initiatives. | • Chapter 9.3 and 9.4 |
| 16.1 Describe the processes used to ensure that the AMP is realistic. | • Chapter 10.1 |
| 16.2 Describe the organisation structure and the processes for authorisation. | • Chapter 10.2 |

# Schedule 11a – Capex forecast

| | |
|---|---|
| *Company Name* | Electra Ltd |
| *AMP Planning Period* | 1 April 2018 – 31 March 2028 |

## 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 18** | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** | **31 Mar 28** |
| | **11a(i): Expenditure on Assets Forecast** | **$000 (in nominal dollars)** | | | | | | | | | | |
| | Consumer connection | 95 | 95 | 97 | 99 | 101 | 103 | 105 | 107 | 109 | 112 | 114 |
| | System growth | 350 | - | 885 | 959 | 713 | 905 | 510 | 695 | 1,227 | 899 | 2,566 |
| | Asset replacement and renewal | 7,320 | 7,589 | 6,831 | 7,100 | 7,520 | 9,126 | 9,573 | 8,916 | 9,103 | 9,088 | 7,973 |
| | Asset relocations | - | - | - | - | 109 | - | - | - | - | - | - |
| | Reliability, safety and environment: | | | | | | | | | | | |
| | Quality of supply | 1,036 | 2,978 | 3,060 | 2,711 | 2,365 | 1,374 | 1,391 | 1,190 | 1,392 | 1,421 | 1,230 |
| | Legislative and regulatory | - | - | - | - | - | - | - | - | - | - | - |
| | Other reliability, safety and environment | 213 | 420 | 231 | 472 | 307 | 125 | 100 | 102 | 104 | 106 | 60 |
| | **Total reliability, safety and environment** | 1,249 | 3,398 | 3,291 | 3,183 | 2,672 | 1,498 | 1,491 | 1,292 | 1,496 | 1,528 | 1,290 |
| | **Expenditure on network assets** | 9,014 | 11,081 | 11,104 | 11,340 | 11,115 | 11,632 | 11,679 | 11,009 | 11,936 | 11,626 | 11,943 |
| | Expenditure on non-network assets | 1,824 | 1,298 | 1,289 | 875 | 1,637 | 736 | 902 | 895 | 738 | 1,036 | 980 |
| | **Expenditure on assets** | 10,838 | 12,379 | 12,393 | 12,215 | 12,751 | 12,369 | 12,581 | 11,904 | 12,673 | 12,663 | 12,923 |
| | | | | | | | | | | | | |
| *plus* | Cost of financing | 60 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |
| *less* | Value of capital contributions | 137 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| *plus* | Value of vested assets | 792 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 |
| | | | | | | | | | | | | |
| | **Capital expenditure forecast** | 11,553 | 13,593 | 13,607 | 13,429 | 13,965 | 13,583 | 13,795 | 13,118 | 13,887 | 13,877 | 14,137 |
| | | | | | | | | | | | | |
| | Assets commissioned | | | | | | | | | | | |

| | | *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 18** | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** | **31 Mar 28** |
| | | **$000 (in constant prices)** | | | | | | | | | | |
| | Consumer connection | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| | System growth | 350 | - | 867 | 920 | 670 | 833 | 460 | 613 | 1,061 | 761 | 2,128 |
| | Asset replacement and renewal | 7,320 | 7,589 | 6,691 | 6,811 | 7,065 | 8,398 | 8,628 | 7,871 | 7,871 | 7,696 | 6,613 |
| | Asset relocations | - | - | - | - | 102 | - | - | - | - | - | - |
| | Reliability, safety and environment: | | | | | | | | | | | |
| | Quality of supply | 1,036 | 2,978 | 2,996 | 2,600 | 2,222 | 1,263 | 1,254 | 1,050 | 1,204 | 1,204 | 1,020 |
| | Legislative and regulatory | - | - | - | - | - | - | - | - | - | - | - |
| | Other reliability, safety and environment | 213 | 420 | 227 | 453 | 288 | 115 | 90 | 90 | 90 | 90 | 50 |
| | **Total reliability, safety and environment** | 1,249 | 3,398 | 3,223 | 3,053 | 2,510 | 1,378 | 1,344 | 1,140 | 1,294 | 1,294 | 1,070 |
| | **Expenditure on network assets** | 9,014 | 11,081 | 10,875 | 10,878 | 10,442 | 10,704 | 10,526 | 9,719 | 10,320 | 9,845 | 9,906 |
| | Expenditure on non-network assets | 1,824 | 1,298 | 1,263 | 840 | 1,538 | 678 | 813 | 790 | 638 | 878 | 813 |
| | **Expenditure on assets** | 10,838 | 12,379 | 12,138 | 11,718 | 11,979 | 11,382 | 11,339 | 10,508 | 10,958 | 10,723 | 10,719 |

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

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

| | 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 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 | 31 Mar 24 | 31 Mar 25 | 31 Mar 26 | 31 Mar 27 | 31 Mar 28 |
| **Difference between nominal and constant price forecasts** | $000 | | | | | | | | | | |
| Consumer connection | - | - | 2 | 4 | 6 | 8 | 10 | 13 | 15 | 17 | 19 |
| System growth | - | - | 18 | 39 | 43 | 72 | 50 | 81 | 166 | 138 | 438 |
| Asset replacement and renewal | - | - | 141 | 289 | 455 | 728 | 945 | 1,045 | 1,232 | 1,392 | 1,360 |
| Asset relocations | - | - | - | - | 7 | - | - | - | - | - | - |
| Reliability, safety and environment: | | | | | | | | | | | |
| Quality of supply | - | (0) | 63 | 111 | 143 | 110 | 137 | 139 | 188 | 218 | 210 |
| Legislative and regulatory | - | - | - | - | - | - | - | - | - | - | - |
| Other reliability, safety and environment | - | - | 4 | 19 | 19 | 10 | 10 | 12 | 14 | 16 | 10 |
| **Total reliability, safety and environment** | - | (0) | 68 | 130 | 162 | 120 | 147 | 151 | 203 | 234 | 220 |
| **Expenditure on network assets** | - | (0) | 229 | 462 | 673 | 928 | 1,153 | 1,291 | 1,616 | 1,781 | 2,037 |
| Expenditure on non-network assets | - | (0) | 27 | 36 | 99 | 59 | 89 | 105 | 100 | 159 | 167 |
| **Expenditure on assets** | - | (0) | 255 | 498 | 772 | 987 | 1,242 | 1,396 | 1,716 | 1,940 | 2,205 |

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |

## 11a(ii): Consumer Connection

| *Consumer types defined by EDB** | $000 (in constant prices) | | | | | |
|---|---|---|---|---|---|---|
| All | 95 | 95 | 95 | 95 | 95 | 95 |
| [EDB consumer type] | | | | | | |
| [EDB consumer type] | | | | | | |
| [EDB consumer type] | | | | | | |
| [EDB consumer type] | | | | | | |
| *include additional rows if needed | | | | | | |
| **Consumer connection expenditure** | 95 | 95 | 95 | 95 | 95 | 95 |
| *less* Capital contributions funding consumer connection | | | | | | |
| **Consumer connection less capital contributions** | 95 | 95 | 95 | 95 | 95 | 95 |

## 11a(iii): System Growth

| | | | | | | |
|---|---|---|---|---|---|---|
| Subtransmission | - | - | - | 460 | 460 | 460 |
| Zone substations | - | - | - | - | - | - |
| Distribution and LV lines | - | - | - | - | - | - |
| Distribution and LV cables | 350 | - | 867 | 460 | 210 | 373 |
| Distribution substations and transformers | - | - | - | - | - | - |
| Distribution switchgear | - | - | - | - | - | - |
| Other network assets | - | - | - | - | - | - |
| **System growth expenditure** | 350 | - | 867 | 920 | 670 | 833 |
| *less* Capital contributions funding system growth | | | | | | |
| **System growth less capital contributions** | 350 | - | 867 | 920 | 670 | 833 |

| | | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|---|
| for year ended | | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |

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

| | $000 (in constant prices) | | | | | |
|---|---|---|---|---|---|---|
| Subtransmission | 337 | 432 | 432 | 1,080 | 1,056 | 1,056 |
| Zone substations | 619 | 531 | 408 | 81 | 171 | 1,519 |
| Distribution and LV lines | 3,433 | 4,090 | 3,418 | 3,495 | 3,859 | 3,857 |
| Distribution and LV cables | 75 | 658 | 492 | 328 | 328 | 328 |
| Distribution substations and transformers | 1,331 | 1,122 | 1,289 | 1,295 | 1,128 | 1,114 |
| Distribution switchgear | 378 | 422 | 362 | 242 | 235 | 235 |
| Other network assets | 1,147 | 334 | 290 | 290 | 290 | 290 |
| **Asset replacement and renewal expenditure** | 7,320 | 7,589 | 6,691 | 6,811 | 7,065 | 8,398 |
| *less* Capital contributions funding asset replacement and renewal | | | | | | |
| **Asset replacement and renewal less capital contributions** | 7,320 | 7,589 | 6,691 | 6,811 | 7,065 | 8,398 |

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |

## 11a(v): Asset Relocations

| *Project or programme** | $000 (in constant prices) | | | | | |
|---|---|---|---|---|---|---|
| Alternative Supply - Waterfall Rd, Paekakariki | | | | | 102 | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| *include additional rows if needed | | | | | | |
| All other project or programmes - asset relocations | | | | | | |
| **Asset relocations expenditure** | - | - | - | - | 102 | - |
| *less* Capital contributions funding asset relocations | | | | | | |
| **Asset relocations less capital contributions** | - | - | - | - | 102 | - |

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |

## 11a(vi): Quality of Supply

| *Project or programme** | $000 (in constant prices) | | | | | |
|---|---|---|---|---|---|---|
| Protection Work | - | 550 | 550 | 750 | 750 | - |
| Improving Network Interconnectivity | 363 | 1,453 | 1,222 | 1,076 | 698 | 664 |
| Network Automation and Sectionalisation | 510 | 520 | 470 | 520 | 520 | 520 |
| Fault Locator | 81 | 80 | 79 | 79 | 79 | 79 |
| Seismic Strengthening | - | 175 | 175 | 175 | 175 | - |
| *include additional rows if needed | | | | | | |
| All other projects or programmes - quality of supply | 82 | 200 | 500 | - | - | - |
| **Quality of supply expenditure** | 1,036 | 2,978 | 2,996 | 2,600 | 2,222 | 1,263 |
| *less* Capital contributions funding quality of supply | | | | | | |
| **Quality of supply less capital contributions** | 1,036 | 2,978 | 2,996 | 2,600 | 2,222 | 1,263 |

## 11a(vii): Legislative and Regulatory

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |
| *Project or programme** | $000 (in constant prices) | | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| *include additional rows if needed | | | | | | |
| All other projects or programmes - legislative and regulatory | | | | | | |
| **Legislative and regulatory expenditure** | - | - | - | - | - | - |
| *less* Capital contributions funding legislative and regulatory | | | | | | |
| **Legislative and regulatory less capital contributions** | - | - | - | - | - | - |

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

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |
| *Project or programme** | $000 (in constant prices) | | | | | |
| Arc Flash Protection | - | - | - | 303 | - | - |
| Replacement of Deck Transformers | 153 | 170 | 77 | - | 153 | - |
| Replacement of Pitchfilled Potheads | 60 | 60 | 60 | 60 | 60 | 40 |
| Upgrade Transformer Room | - | 100 | - | - | - | - |
| Steel Link Pillar Removal | - | 90 | 90 | 90 | 75 | 75 |
| *include additional rows if needed | | | | | | |
| All other projects or programmes - other reliability, safety and environment | - | | | | | |
| **Other reliability, safety and environment expenditure** | 213 | 420 | 227 | 453 | 288 | 115 |
| *less* Capital contributions funding other reliability, safety and environment | | | | | | |
| **Other reliability, safety and environment less capital contributions** | 213 | 420 | 227 | 453 | 288 | 115 |

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

| | Current Year CY | CY+1 | CY+2 | CY+3 | CY+4 | CY+5 |
|---|---|---|---|---|---|---|
| for year ended | 31 Mar 18 | 31 Mar 19 | 31 Mar 20 | 31 Mar 21 | 31 Mar 22 | 31 Mar 23 |
| **Routine expenditure** | | | | | | |
| *Project or programme** | $000 (in constant prices) | | | | | |
| Vehicles | 135 | 40 | 175 | 152 | - | 40 |
| Tools, Plant & Other Machinery | 38 | 38 | 38 | 38 | 38 | 38 |
| Furniture | | 37 | | | | |
| [Description of material project or programme] | | | | | | |
| [Description of material project or programme] | | | | | | |
| *include additional rows if needed | | | | | | |
| All other projects or programmes - routine expenditure | | | | | | |
| **Routine expenditure** | 173 | 115 | 213 | 190 | 38 | 78 |
| **Atypical expenditure** | | | | | | |
| *Project or programme** | | | | | | |
| Retailer Billing | 120 | 123 | | | | |
| ADMS | 427 | 200 | | | | |
| Other IT Initiatives to Improve Asset Management | 1,104 | 860 | 350 | | 1,500 | 600 |
| Smart Grid Platform | - | | 200 | 200 | | |
| Asset Management System in Cloud + Upgrade of ERP Platform | - | | 500 | 450 | | |
| *include additional rows if needed | | | | | | |
| All other projects or programmes - atypical expenditure | | | | | | |
| **Atypical expenditure** | 1,651 | 1,183 | 1,050 | 650 | 1,500 | 600 |
| **Expenditure on non-network assets** | 1,824 | 1,298 | 1,263 | 840 | 1,538 | 678 |

# Schedule 11b – OpEx forecast

| | |
|---|---|
| *Company Name* | Electra Ltd |
| *AMP Planning Period* | 1 April 2018 – 31 March 2028 |

## 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* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | | *Current Year CY* | *CY+1* | *CY+2* | *CY+3* | *CY+4* | *CY+5* | *CY+6* | *CY+7* | *CY+8* | *CY+9* | *CY+10* |
| 8 | for year ended | **31 Mar 18** | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** | **31 Mar 28** |
| 9 | **Operational Expenditure Forecast** | **$000 (in nominal dollars)** | | | | | | | | | | |
| 10 | Service interruptions and emergencies | 2,256 | 1,858 | 1,898 | 1,937 | 1,797 | 1,834 | 1,873 | 1,912 | 1,861 | 1,900 | 1,939 |
| 11 | Vegetation management | 1,591 | 1,358 | 1,386 | 1,415 | 1,445 | 1,475 | 1,506 | 1,538 | 1,570 | 1,603 | 1,637 |
| 12 | Routine and corrective maintenance and inspection | 1,016 | 1,121 | 1,054 | 1,040 | 1,062 | 1,084 | 1,162 | 943 | 963 | 983 | 1,004 |
| 13 | Asset replacement and renewal | 458 | 341 | 348 | 355 | 363 | 370 | 358 | 386 | 394 | 403 | 411 |
| 14 | **Network Opex** | 5,321 | 4,678 | 4,686 | 4,748 | 4,666 | 4,764 | 4,899 | 4,779 | 4,788 | 4,888 | 4,991 |
| 15 | System operations and network support | 2,438 | 3,111 | 3,176 | 3,243 | 3,311 | 3,381 | 3,452 | 3,524 | 3,598 | 3,674 | 3,751 |
| 16 | Business support | 3,968 | 4,625 | 4,722 | 4,821 | 4,923 | 5,026 | 5,131 | 5,239 | 5,349 | 5,462 | 5,576 |
| 17 | **Non-network opex** | 6,406 | 7,736 | 7,898 | 8,064 | 8,234 | 8,407 | 8,583 | 8,763 | 8,947 | 9,135 | 9,327 |
| 18 | **Operational expenditure** | 11,727 | 12,414 | 12,584 | 12,812 | 12,900 | 13,171 | 13,482 | 13,543 | 13,735 | 14,024 | 14,318 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 18** | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** | **31 Mar 28** |
| 21 | | **$000 (in constant prices)** | | | | | | | | | | |
| 22 | Service interruptions and emergencies | 2,256 | 1,858 | 1,858 | 1,858 | 1,688 | 1,688 | 1,688 | 1,688 | 1,609 | 1,609 | 1,609 |
| 23 | Vegetation management | 1,591 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 | 1,358 |
| 24 | Routine and corrective maintenance and inspection | 1,016 | 1,121 | 1,032 | 997 | 997 | 997 | 1,047 | 832 | 832 | 832 | 832 |
| 25 | Asset replacement and renewal | 458 | 341 | 341 | 341 | 341 | 341 | 323 | 341 | 341 | 341 | 341 |
| 26 | **Network Opex** | 5,321 | 4,678 | 4,589 | 4,554 | 4,384 | 4,384 | 4,416 | 4,219 | 4,139 | 4,139 | 4,139 |
| 27 | System operations and network support | 2,438 | 3,111 | 3,111 | 3,111 | 3,111 | 3,111 | 3,111 | 3,111 | 3,111 | 3,111 | 3,111 |
| 28 | Business support | 3,968 | 4,625 | 4,625 | 4,625 | 4,625 | 4,625 | 4,625 | 4,625 | 4,625 | 4,625 | 4,625 |
| 29 | **Non-network opex** | 6,406 | 7,736 | 7,736 | 7,736 | 7,736 | 7,736 | 7,736 | 7,736 | 7,736 | 7,736 | 7,736 |
| 30 | **Operational expenditure** | 11,727 | 12,414 | 12,325 | 12,290 | 12,120 | 12,120 | 12,152 | 11,955 | 11,875 | 11,875 | 11,875 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | **Subcomponents of operational expenditure (where known)** | | | | | | | | | | | |
| 32 | Energy efficiency and demand side management, reduction of | | | | | | | | | | | |
| 33 | 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 18** | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** | **31 Mar 24** | **31 Mar 25** | **31 Mar 26** | **31 Mar 27** | **31 Mar 28** |
| 41 | **Difference between nominal and real forecasts** | **$000** | | | | | | | | | | |
| 42 | Service interruptions and emergencies | - | - | 39 | 79 | 109 | 146 | 185 | 224 | 252 | 291 | 331 |
| 43 | Vegetation management | - | - | 29 | 58 | 87 | 118 | 149 | 180 | 213 | 246 | 279 |
| 44 | Routine and corrective maintenance and inspection | - | - | 22 | 42 | 64 | 86 | 115 | 111 | 130 | 151 | 171 |
| 45 | Asset replacement and renewal | - | - | 7 | 14 | 22 | 30 | 35 | 45 | 53 | 62 | 70 |
| 46 | **Network Opex** | - | - | 96 | 193 | 282 | 380 | 484 | 560 | 648 | 749 | 851 |
| 47 | System operations and network support | - | - | 65 | 132 | 200 | 270 | 341 | 413 | 487 | 563 | 640 |
| 48 | Business support | - | - | 97 | 196 | 298 | 401 | 506 | 614 | 724 | 837 | 951 |
| 49 | **Non-network opex** | - | - | 162 | 328 | 498 | 671 | 847 | 1,027 | 1,211 | 1,399 | 1,591 |
| 50 | **Operational expenditure** | - | - | 259 | 522 | 780 | 1,051 | 1,331 | 1,588 | 1,860 | 2,148 | 2,443 |

# Schedule 12a – Asset condition

| | |
|---|---|
| *Company Name* | Electra Ltd |
| *AMP Planning Period* | 1 April 2018 – 31 March 2028 |

## 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* | | | | | Asset condition at start of planning period (percentage of units by grade) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Voltage | Asset category | Asset class | Units | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade unknown | Data accuracy (1–4) | % of asset forecast to be replaced in next 5 years |
| 10 | All | Overhead Line | Concrete poles / steel structure | No. | | 1.50% | 93.40% | 5.10% | | 3 | 2.50% |
| 11 | All | Overhead Line | Wood poles | No. | - | 37.78% | 62.22% | - | | 3 | 44.00% |
| 12 | All | Overhead Line | Other pole types | No. | | | | | | N/A | |
| 13 | HV | Subtransmission Line | Subtransmission OH up to 66kV conductor | km | | 9.50% | 89.15% | 1.35% | | 4 | 10.00% |
| 14 | HV | Subtransmission Line | Subtransmission OH 110kV+ conductor | km | | | | | | N/A | |
| 15 | HV | Subtransmission Cable | Subtransmission UG up to 66kV (XLPE) | km | | | 79.70% | 20.30% | | 4 | 4.00% |
| 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 | | | | | | N/A | |
| 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. | | - | 50.00% | 50.00% | | 4 | - |
| 25 | HV | Zone substation Buildings | Zone substations 110kV+ | No. | | | | | | N/A | |
| 26 | HV | Zone substation switchgear | 22/33kV CB (Indoor) | No. | | | 50.00% | 50.00% | | 4 | - |
| 27 | HV | Zone substation switchgear | 22/33kV CB (Outdoor) | No. | | - | 90.48% | 9.52% | | 4 | - |
| 28 | HV | Zone substation switchgear | 33kV Switch (Ground Mounted) | No. | | | | | | N/A | |
| 29 | HV | Zone substation switchgear | 33kV Switch (Pole Mounted) | No. | | 7.00% | 45.00% | 48.00% | | 3 | 8.00% |
| 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. | | 5.19% | 82.31% | 12.50% | | 3 | 10.38% |
| 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) | | | | | | |

| | Voltage | Asset category | Asset class | Units | Grade 1 | Grade 2 | Grade 3 | Grade 4 | 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. | | | 90.00% | 10.00% | | 4 | 5.20% |
| 40 | HV | Distribution Line | Distribution OH Open Wire Conductor | km | | 9.40% | 85.10% | 5.50% | | 3 | 10.02% |
| 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 | | | 61.30% | 38.70% | | 3 | - |
| 44 | HV | Distribution Cable | Distribution UG PILC | km | | 1.63% | 98.37% | - | | 3 | 2.00% |
| 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. | | 3.00% | 85.00% | 12.00% | | 4 | 3.00% |
| 47 | HV | Distribution switchgear | 3.3/6.6/11/22kV CB (Indoor) | No. | | 12.00% | 78.00% | 10.00% | | 4 | 12.00% |
| 48 | HV | Distribution switchgear | 3.3/6.6/11/22kV Switches and fuses (pole mounted) | No. | | 3.00% | 66.00% | 31.00% | | 3 | 5.00% |
| 49 | HV | Distribution switchgear | 3.3/6.6/11/22kV Switch (ground mounted) - except RMU | No. | | | | | | N/A | |
| 50 | HV | Distribution switchgear | 3.3/6.6/11/22kV RMU | No. | | 8.00% | 52.00% | 40.00% | | 3 | 10.00% |
| 51 | HV | Distribution Transformer | Pole Mounted Transformer | No. | | 5.00% | 61.00% | 34.00% | | 4 | 7.00% |
| 52 | HV | Distribution Transformer | Ground Mounted Transformer | No. | | 5.60% | 52.90% | 41.50% | | 4 | 8.00% |
| 53 | HV | Distribution Transformer | Voltage regulators | No. | | | | | | N/A | |
| 54 | HV | Distribution Substations | Ground Mounted Substation Housing | No. | | | | | | N/A | |
| 55 | LV | LV Line | LV OH Conductor | km | | 2.60% | | 1.20% | 96.20% | 3 | 4.00% |
| 56 | LV | LV Cable | LV UG Cable | km | | - | | 44.00% | 56.00% | 3 | 2.00% |
| 57 | LV | LV Streetlighting | LV OH/UG Streetlight circuit | km | | | | | 100.00% | 3 | 2.00% |
| 58 | LV | Connections | OH/UG consumer service connections | No. | | 10.80% | 42.20% | 15.00% | 32.00% | 2 | 12.00% |
| 59 | All | Protection | Protection relays (electromechanical, solid state and numeric) | No. | | 10.00% | 55.00% | 35.00% | | 4 | 15.00% |
| 60 | All | SCADA and communications | SCADA and communications equipment operating as a single system | Lot | | 10.00% | 70.00% | 20.00% | | 3 | 15.00% |
| 61 | All | Capacitor Banks | Capacitors including controls | No. | | | | | | N/A | |
| 62 | All | Load Control | Centralised plant | Lot | | | 50.00% | 50.00% | | 4 | - |
| 63 | All | Load Control | Relays | No. | | | | | 100.00% | 3 | 10.00% |
| 64 | All | Civils | Cable Tunnels | km | | | | | | N/A | |

# Schedule 12b – Capacity forecast

| | |
|---|---|
| *Company Name* | Electra Ltd |
| *AMP Planning Period* | 1 April 2018 – 31 March 2028 |

## 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*

### 12b(i): System Growth - Zone Substations

| *Existing Zone Substations* | Current Peak Load (MVA) | Installed Firm Capacity (MVA) | Security of Supply Classification (type) | Transfer Capacity (MVA) | Utilisation of Installed Firm Capacity % | Installed Firm Capacity +5 years (MVA) | Utilisation of Installed Firm Capacity + 5yrs % | Installed Firm Capacity Constraint +5 years (cause) | Explanation |
|---|---|---|---|---|---|---|---|---|---|
| Shannon | 4 | 5 | N-1 | 6 | 83% | 5 | 87% | No constraint within +5 years | |
| Foxton | 6 | 23 | N-1 | 4 | 27% | 23 | 29% | No constraint within +5 years | |
| Levin West | 12 | 23 | N-1 | 12 | 53% | 23 | 56% | No constraint within +5 years | |
| Levin East | 13 | 23 | N-1 | 12 | 56% | 23 | 60% | No constraint within +5 years | |
| Otaki | 11 | 23 | N-1 | 4 | 48% | 23 | 58% | Subtransmission circuit | |
| Waikanae | 15 | 23 | N-1 | 12 | 64% | 23 | 68% | No constraint within +5 years | |
| Paraparaumu | 13 | 23 | N-1 | 16 | 55% | 23 | 59% | No constraint within +5 years | |
| Paraparaumu West | 12 | 23 | N-1 | 8 | 54% | 23 | 58% | No constraint within +5 years | |
| Raumati | 10 | 23 | N-1 | 12 | 43% | 23 | 46% | No constraint within +5 years | |
| Paekakariki | 2 | - | N-1 (Switched) | 6 | - | - | - | No constraint within +5 years | Automatic changeover to Raumati using fault monitors and motorised switches |
| [Zone Substation_11] | | | | | - | | | [Select one] | |
| [Zone Substation_12] | | | | | - | | | [Select one] | |
| [Zone Substation_13] | | | | | - | | | [Select one] | |
| [Zone Substation_14] | | | | | - | | | [Select one] | |
| [Zone Substation_15] | | | | | - | | | [Select one] | |
| [Zone Substation_16] | | | | | - | | | [Select one] | |
| [Zone Substation_17] | | | | | - | | | [Select one] | |
| [Zone Substation_18] | | | | | - | | | [Select one] | |
| [Zone Substation_19] | | | | | - | | | [Select one] | |
| [Zone Substation_20] | | | | | - | | | [Select one] | |

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

# Schedule 12c – Demand forecast

| | |
|---|---|
| *Company Name* | Electra Ltd |
| *AMP Planning Period* | 1 April 2018 – 31 March 2028 |

## 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*

### 12c(i): Consumer Connections

*Number of ICPs connected in year by consumer type*

**Number of connections**

| | for year ended | *Current Year CY* **31 Mar 18** | *CY+1* **31 Mar 19** | *CY+2* **31 Mar 20** | *CY+3* **31 Mar 21** | *CY+4* **31 Mar 22** | *CY+5* **31 Mar 23** |
|---|---|---|---|---|---|---|---|
| *Consumer types defined by EDB** | | | | | | | |
| All | | 450 | 380 | 380 | 380 | 400 | 400 |
| [EDB consumer type] | | | | | | | |
| [EDB consumer type] | | | | | | | |
| [EDB consumer type] | | | | | | | |
| [EDB consumer type] | | | | | | | |
| **Connections total** | | 450 | 380 | 380 | 380 | 400 | 400 |

**include additional rows if needed*

**Distributed generation**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Number of connections | 65 | 80 | 100 | 110 | 120 | 120 |
| | Capacity of distributed generation installed in year (MVA) | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |

### 12c(ii) System Demand

| | | for year ended | *Current Year CY* **31 Mar 18** | *CY+1* **31 Mar 19** | *CY+2* **31 Mar 20** | *CY+3* **31 Mar 21** | *CY+4* **31 Mar 22** | *CY+5* **31 Mar 23** |
|---|---|---|---|---|---|---|---|---|
| **Maximum coincident system demand (MW)** | | | | | | | | |
| | GXP demand | | 104 | 104 | 105 | 107 | 108 | 109 |
| *plus* | Distributed generation output at HV and above | | | | | | | |
| | **Maximum coincident system demand** | | 104 | 104 | 105 | 107 | 108 | 109 |
| *less* | Net transfers to (from) other EDBs at HV and above | | | | | | | |
| | **Demand on system for supply to consumers' connection points** | | 104 | 104 | 105 | 107 | 108 | 109 |
| **Electricity volumes carried (GWh)** | | | | | | | | |
| | Electricity supplied from GXPs | | 443 | 434 | 433 | 431 | 430 | 428 |
| *less* | Electricity exports to GXPs | | | | | | | |
| *plus* | Electricity supplied from distributed generation | | | | | | | |
| *less* | Net electricity supplied to (from) other EDBs | | | | | | | |
| | **Electricity entering system for supply to ICPs** | | 443 | 434 | 433 | 431 | 430 | 428 |
| *less* | Total energy delivered to ICPs | | 413 | 405 | 404 | 403 | 401 | 399 |
| | **Losses** | | 30 | 29 | 29 | 28 | 29 | 29 |
| | **Load factor** | | 49% | 48% | 47% | 46% | 45% | 45% |
| | **Loss ratio** | | 6.8% | 6.7% | 6.7% | 6.6% | 6.8% | 6.7% |

# Schedule 12d – Reliability forecast

| | |
|---|---|
| *Company Name* | **Electra Ltd** |
| *AMP Planning Period* | **1 April 2018 – 31 March 2028** |
| *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 18** | **31 Mar 19** | **31 Mar 20** | **31 Mar 21** | **31 Mar 22** | **31 Mar 23** |
| *10* | **SAIDI** | | | | | | |
| *11* | Class B (planned interruptions on the network) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| *12* | Class C (unplanned interruptions on the network) | 68.0 | 68.0 | 68.0 | 68.0 | 68.0 | 68.0 |
| *13* | **SAIFI** | | | | | | |
| *14* | Class B (planned interruptions on the network) | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| *15* | Class C (unplanned interruptions on the network) | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 |

# Schedule 13 – Asset management maturity

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**SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY**

This schedule requires information on the EDB'S self-assessment of the maturity of its asset management practices .

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 3 | Asset management policy | To what extent has an asset management policy been documented, authorised and communicated? | 2 | A specific Asset Management Policy was prepared and signed off by the Board of Directors in the 2012/13 year. It has been included as part of both the Network and Group Strategic Plans.Electra's Strategic Plan was examined,it embodies good line-of-sight, and includes SWOT and PESTLE analyses. | | Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it. | Top management. The management team that has overall responsibility for asset management. | The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication. |
| 10 | Asset management strategy | What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders? | 2 | There is no obvious AM Strategy, however the strategic plan and the AMP clearly embody a cohesive set of strategies that link to the goal areas. | | In setting an organisation's asset management strategy, it is important that it is consistent with any other policies and strategies that the organisation has and has taken into account the requirements of relevant stakeholders. This question examines to what extent the asset management strategy is consistent with other organisational policies and strategies (eg, as required by PAS 55 para 4.3.1 b) and has taken account of stakeholder requirements as required by PAS 55 para 4.3.1 c). Generally, this will take into account the same polices, strategies and stakeholder requirements as covered in drafting the asset management policy but at a greater level of detail. | Top management. The organisation's strategic planning team. The management team that has overall responsibility for asset management. | The organisation's asset management strategy document and other related organisational policies and strategies. Other than the organisation's strategic plan, these could include those relating to health and safety, environmental, etc. Results of stakeholder consultation. |
| 11 | Asset management strategy | In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship? | 2 | The strategy for each asset class described in Chapter 6 of the AMP explicitly considers condition, age and systemic issues. Refer to Q26 below. | | Good asset stewardship is the hallmark of an organisation compliant with widely used AM standards. A key component of this is the need to take account of the lifecycle of the assets, asset types and asset systems. (For example, this requirement is recognised in 4.3.1 d) of PAS 55). This question explores what an organisation has done to take lifecycle into account in its asset management strategy. | Top management. People in the organisation with expert knowledge of the assets, asset types, asset systems and their associated life-cycles. The management team that has overall responsibility for asset management. Those responsible for developing and adopting methods and processes used in asset management | The organisation's documented asset management strategy and supporting working documents. |
| 26 | Asset management plan(s) | How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems? | 2 | Chapter 6 of the 2017 AMP clearly shows that the condition and life cycle of major asset classes are considered. There is direct line-of-sight from the asset age and condition to the policies, the management tactics and the resulting work program. | | The asset management strategy need to be translated into practical plan(s) so that all parties know how the objectives will be achieved. The development of plan(s) will need to identify the specific tasks and activities required to optimize costs, risks and performance of the assets and/or asset system(s), when they are to be carried out and the resources required. | The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. | The organisation's asset management plan(s). |

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## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 27 | Asset management plan(s) | How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery? | 2 | | | Plans will be ineffective unless they are communicated to all those, including contracted suppliers and those who undertake enabling function(s). The plan(s) need to be communicated in a way that is relevant to those who need to use them. | The management team with overall responsibility for the asset management system. Delivery functions and suppliers. | Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication. |
| 29 | Asset management plan(s) | How are designated responsibilities for delivery of asset plan actions documented? | 2.5 | Chapter 1.9 of the 2017 AMP documents the responsibilities for AM. | | The implementation of asset management plan(s) relies on (1) actions being clearly identified, (2) an owner allocated and (3) that owner having sufficient delegated responsibility and authority to carry out the work required. It also requires alignment of actions across the organisation. This question explores how well the plan(s) set out responsibility for delivery of asset plan actions. | The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team. | The organisation's asset management plan(s). Documentation defining roles and responsibilities of individuals and organisational departments. |
| 31 | Asset management plan(s) | What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)?<br><br>(Note this is about resources and enabling support) | 2 | Refer to Q40 also. | | It is essential that the plan(s) are realistic and can be implemented, which requires appropriate resources to be available and enabling mechanisms in place. This question explores how well this is achieved. The plan(s) not only need to consider the resources directly required and timescales, but also the enabling activities, including for example, training requirements, supply chain capability and procurement timescales. | The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team. If appropriate, the performance management team. Where appropriate the procurement team and service providers working on the organisation's asset-related activities. | The organisation's asset management plan(s). Documented processes and procedures for the delivery of the asset management plan. |
| 33 | Contingency planning | What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities? | 3 | Electra has various guidelines for Escalation Of Events and Major Network Events that define escalation actions, key roles and communication requirements. Evidence of supply restoration after the November 2016 earthquake was examined, noting repairs. | | Widely used AM practice standards require that an organisation has plan(s) to identify and respond to emergency situations. Emergency plan(s) should outline the actions to be taken to respond to specified emergency situations and ensure continuity of critical asset management activities including the communication to, and involvement of, external agencies. This question assesses if, and how well, these plan(s) triggered, implemented and resolved in the event of an incident. The plan(s) should be appropriate to the level of risk as determined by the organisation's risk assessment methodology. It is also a requirement that relevant personnel are competent and trained. | The manager with responsibility for developing emergency plan(s). The organisation's risk assessment team. People with designated duties within the plan(s) and procedure(s) for dealing with incidents and emergency situations. | The organisation's plan(s) and procedure(s) for dealing with emergencies. The organisation's risk assessments and risk registers. |

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## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 37 | Structure, authority and responsibilities | What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)? | 3 | Chapter 1.9 of the 2017 AMP shows the current structure, demonstrating alignment to the asset life cycle. | | In order to ensure that the organisation's assets and asset systems deliver the requirements of the asset management policy, strategy and objectives responsibilities need to be allocated to appropriate people who have the necessary authority to fulfil their responsibilities. (This question, relates to the organisation's assets eg, para b), s 4.4.1 of PAS 55, making it therefore distinct from the requirement contained in para a), s 4.4.1 of PAS 55). | Top management. People with management responsibility for the delivery of asset management policy, strategy, objectives and plan(s). People working on asset-related activities. | Evidence that managers with responsibility for the delivery of asset management policy, strategy, objectives and plan(s) have been appointed and have assumed their responsibilities. Evidence may include the organisation's documents relating to its asset management system, organisational charts, job descriptions of post-holders, annual targets/objectives and personal development plan(s) of post-holders as appropriate. |
| 40 | Structure, authority and responsibilities | What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management? | 3 | A sucession planning model and a talent matrix were examined (HRs database), however this stops short of a specific numbers of each staff category required over the timeframe.For asset mangagemnt work a process is established and followed by contracting division by forecasting labour requirement over the AMP period | | Optimal asset management requires top management to ensure sufficient resources are available. In this context the term 'resources' includes manpower, materials, funding and service provider support. | Top management. The management team that has overall responsibility for asset management. Risk management team. The organisation's managers involved in day-to-day supervision of asset-related activities, such as frontline managers, engineers, foremen and chargehands as appropriate. | Evidence demonstrating that asset management plan(s) and/or the process(es) for asset management plan implementation consider the provision of adequate resources in both the short and long term. Resources include funding, materials, equipment, services provided by third parties and personnel (internal and service providers) with appropriate skills competencies and knowledge. |
| 42 | Structure, authority and responsibilities | To what degree does the organisation's top management communicate the importance of meeting its asset management requirements? | 2.5 | There is a fortnightly Progress To Plan meeting to ensure that works are completed to target. There is also a monthly Lines business unit meeting that includes field staff that deals with operational issues (eg. issuing of latest schematics), | | Widely used AM practice standards require an organisation to communicate the importance of meeting its asset management requirements such that personnel fully understand, take ownership of, and are fully engaged in the delivery of the asset management requirements (eg, PAS 55 s 4.4.1 g). | Top management. The management team that has overall responsibility for asset management. People involved in the delivery of the asset management requirements. | Evidence of such activities as road shows, written bulletins, workshops, team talks and management walk-abouts would assist an organisation to demonstrate it is meeting this requirement of PAS 55. |
| 45 | Outsourcing of asset management activities | Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy? | 2 | The Undergound Line Construction Standard was examined. | | Where an organisation chooses to outsource some of its asset management activities, the organisation must ensure that these outsourced process(es) are under appropriate control to ensure that all the requirements of widely used AM standards (eg, PAS 55) are in place, and the asset management policy, strategy objectives and plan(s) are delivered. This includes ensuring capabilities and resources across a time span aligned to life cycle management. The organisation must put arrangements in place to control the outsourced activities, whether it be to external providers or to other in-house departments. This question explores what the organisation does in this regard. | Top management. The management team that has overall responsibility for asset management. The manager(s) responsible for the monitoring and management of the outsourced activities. People involved with the procurement of outsourced activities. The people within the organisations that are performing the outsourced activities. The people impacted by the outsourced activity. | The organisation's arrangements that detail the compliance required of the outsourced activities. For example, this this could form part of a contract or service level agreement between the organisation and the suppliers of its outsourced activities. Evidence that the organisation has demonstrated to itself that it has assurance of compliance of outsourced activities. |

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## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 48 | Training, awareness and competence | How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)? | 3 | KPA Review documents for the Contract Supervisor and for the Field Staff were inspected. These clearly link performance requirements to Electra's values and specific competency requirements. The documents inspected were drafts, and show evidence of review. | | There is a need for an organisation to demonstrate that it has considered what resources are required to develop and implement its asset management system. There is also a need for the organisation to demonstrate that it has assessed what development plan(s) are required to provide its human resources with the skills and competencies to develop and implement its asset management systems. The timescales over which the plan(s) are relevant should be commensurate with the planning horizons within the asset management strategy considers e.g. if the asset management strategy considers 5, 10 and 15 year time scales then the human resources development plan(s) should align with these. Resources include both 'in house' and external resources who undertake asset management activities. | Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers. | Evidence of analysis of future work load plan(s) in terms of human resources. Document(s) containing analysis of the organisation's own direct resources and contractors resource capability over suitable timescales. Evidence, such as minutes of meetings, that suitable management forums are monitoring human resource development plan(s). Training plan(s), personal development plan(s), contract and service level agreements. |
| 49 | Training, awareness and competence | How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies? | 2.5 | The Competency Framework (on HR's database) was inspected. | | Widely used AM standards require that organisations to undertake a systematic identification of the asset management awareness and competencies required at each level and function within the organisation. Once identified the training required to provide the necessary competencies should be planned for delivery in a timely and systematic way. Any training provided must be recorded and maintained in a suitable format. Where an organisation has contracted service providers in place then it should have a means to demonstrate that this requirement is being met for their employees. (eg, PAS 55 refers to frameworks suitable for identifying competency requirements). | Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers. | Evidence of an established and applied competency requirements assessment process and plan(s) in place to deliver the required training. Evidence that the training programme is part of a wider, co-ordinated asset management activities training and competency programme. Evidence that training activities are recorded and that records are readily available (for both direct and contracted service provider staff) e.g. via organisation wide information system or local records database. |
| 50 | Training, awareness and competence | How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience? | 2.5 | Refer to Q48. The KPA Review documents for the Contract Supervisor and for the Field Staff inspected clearly link performance requirements to Electra's values and specific job competencies, and then assess actual performance against those values and required competencies. | | A critical success factor for the effective development and implementation of an asset management system is the competence of persons undertaking these activities. organisations should have effective means in place for ensuring the competence of employees to carry out their designated asset management function(s). Where an organisation has contracted service providers undertaking elements of its asset management system then the organisation shall assure itself that the outsourced service provider also has suitable arrangements in place to manage the competencies of its employees. The organisation should ensure that the individual and corporate competencies it requires are in place and actively monitor, develop and maintain an appropriate balance of these competencies. | Managers, supervisors, persons responsible for developing training programmes. Staff responsible for procurement and service agreements. HR staff and those responsible for recruitment. | Evidence of a competency assessment framework that aligns with established frameworks such as the asset management Competencies Requirements Framework (Version 2.0); National Occupational Standards for Management and Leadership; UK Standard for Professional Engineering Competence, Engineering Council, 2005. |

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## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 53 | Communication, participation and consultation | How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers? | 2 | Refer to Q42. This meeting ensures that the importance of the works program staying on time and on budget is clearly emphasised. Operational "red flag" issues are communicated to all staff and contractors via a Network Group Advisory Notice (NGAN #64 was inspected, and demonstrated a high level of document control). | | Widely used AM practice standards require that pertinent asset management information is effectively communicated to and from employees and other stakeholders including contracted service providers. Pertinent information refers to information required in order to effectively and efficiently comply with and deliver asset management strategy, plan(s) and objectives. This will include for example the communication of the asset management policy, asset performance information, and planning information as appropriate to contractors. | Top management and senior management representative(s), employee's representative(s), employee's trade union representative(s); contracted service provider management and employee representative(s); representative(s) from the organisation's Health, Safety and Environmental team. Key stakeholder representative(s). | Asset management policy statement prominently displayed on notice boards, intranet and internet; use of organisation's website for displaying asset performance data; evidence of formal briefings to employees, stakeholders and contracted service providers; evidence of inclusion of asset management issues in team meetings and contracted service provider contract meetings; newsletters, etc. |
| 59 | Asset Management System documentation | What documentation has the organisation established to describe the main elements of its asset management system and interactions between them? | 2 | | | Widely used AM practice standards require an organisation maintain up to date documentation that ensures that its asset management systems (ie, the systems the organisation has in place to meet the standards) can be understood, communicated and operated. (eg, s 4.5 of PAS 55 requires the maintenance of up to date documentation of the asset management system requirements specified throughout s 4 of PAS 55). | The management team that has overall responsibility for asset management. Managers engaged in asset management activities. | The documented information describing the main elements of the asset management system (process(es)) and their interaction. |
| 62 | Information management | What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system? | 2 | In regard to critical or dangerous situations, Network Group Advisory Notice #64A advising of potentially dangerous substation, and NGAN #64B advising of remediation were inspected. | | Effective asset management requires appropriate information to be available. Widely used AM standards therefore require the organisation to identify the asset management information it requires in order to support its asset management system. Some of the information required may be held by suppliers.<br><br>The maintenance and development of asset management information systems is a poorly understood specialist activity that is akin to IT management but different from IT management. This group of questions provides some indications as to whether the capability is available and applied. Note: To be effective, an asset information management system requires the mobilisation of technology, people and process(es) that create, secure, make available and destroy the information required to support the asset management system. | The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Operations, maintenance and engineering managers | Details of the process the organisation has employed to determine what its asset information system should contain in order to support its asset management system. Evidence that this has been effectively implemented. |
| 63 | Information management | How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent? | 3 | | | The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale.<br><br>This question explores how the organisation ensures that information management meets widely used AM practice requirements (eg, s 4.4.6 (a), (c) and (d) of PAS 55). | The management team that has overall responsibility for asset management. Users of the organisational information systems. | The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls. |

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## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 64 | Information management | How has the organisation's ensured its asset management information system is relevant to its needs? | 2 | | | Widely used AM standards need not be prescriptive about the form of the asset management information system, but simply require that the asset management information system is appropriate to the organisations needs, can be effectively used and can supply information which is consistent and of the requisite quality and accuracy. | The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Users of the organisational information systems. | The documented process the organisation employs to ensure its asset management information system aligns with its asset management requirements. Minutes of information systems review meetings involving users. |
| 69 | Risk management process(es) | How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle? | 2 | The PSMS Policy was examined, and it is noted that this policy references a wide range of policies aimed at ensuring conformance and minimising risks at the design, construction, commissioning and operating phases of the asset life cycle. The PSMS Internal Audit and external Revalidation are key processes for identifying asset and asset management risks, and are performed in accordance with auditing standards. The PSMS Internal Audit from | | Risk management is an important foundation for proactive asset management. Its overall purpose is to understand the cause, effect and likelihood of adverse events occurring, to optimally manage such risks to an acceptable level, and to provide an audit trail for the management of risks. Widely used standards require the organisation to have process(es) and/or procedure(s) in place that set out how the organisation identifies and assesses asset and asset management related risks. The risks have to be considered across the four phases of the asset lifecycle (eg, para 4.3.3 of PAS 55). | The top management team in conjunction with the organisation's senior risk management representatives. There may also be input from the organisation's Safety, Health and Environment team. Staff who carry out risk identification and assessment. | The organisation's risk management framework and/or evidence of specific process(es) and/ or procedure(s) that deal with risk control mechanisms. Evidence that the process(es) and/or procedure(s) are implemented across the business and maintained. Evidence of agendas and minutes from risk management meetings. Evidence of feedback in to process(es) and/or procedure(s) as a result of incident investigation(s). Risk registers and assessments. |
| 79 | Use and maintenance of asset risk information | How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs? | 2.5 | The TELARC Revalidation of January 2016 included an assessment of 2 contractors skills and competencies, and noted that Electra has also performed further contractor competency audits. | | Widely used AM standards require that the output from risk assessments are considered and that adequate resource (including staff) and training is identified to match the requirements. It is a further requirement that the effects of the control measures are considered, as there may be implications in resources and training required to achieve other objectives. | Staff responsible for risk assessment and those responsible for developing and approving resource and training plan(s). There may also be input from the organisation's Safety, Health and Environment team. | The organisations risk management framework. The organisation's resourcing plan(s) and training and competency plan(s). The organisation should be able to demonstrate appropriate linkages between the content of resource plan(s) and training and competency plan(s) to the risk assessments and risk control measures that have been developed. |
| 82 | Legal and other requirements | What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system? | 3 | Electra uses Comply With to maximise its legal and regulatory compliance. The draft report from November 2016 was inspected, and various corrective actions were noted. People and Capability Manager confirmed that these are being actioned. | | In order for an organisation to comply with its legal, regulatory, statutory and other asset management requirements, the organisation first needs to ensure that it knows what they are (eg, PAS 55 specifies this in s 4.4.8). It is necessary to have systematic and auditable mechanisms in place to identify new and changing requirements. Widely used AM standards also require that requirements are incorporated into the asset management system (e.g. procedure(s) and process(es)) | Top management. The organisations regulatory team. The organisation's legal team or advisors. The management team with overall responsibility for the asset management system. The organisation's health and safety team or advisors. The organisation's policy making team. | The organisational processes and procedures for ensuring information of this type is identified, made accessible to those requiring the information and is incorporated into asset management strategy and objectives |

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## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 88 | Life Cycle Activities | How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities? | 2.5 | Electra has Standards for design and construction of works to minimise non-conformance. A wide range of operating policies ensure compliant operation. | | Life cycle activities are about the implementation of asset management plan(s) i.e. they are the "doing" phase. They need to be done effectively and well in order for asset management to have any practical meaning. As a consequence, widely used standards (eg, PAS 55 s 4.5.1) require organisations to have in place appropriate process(es) and procedure(s) for the implementation of asset management plan(s) and control of lifecycle activities. This question explores those aspects relevant to asset creation. | Asset managers, design staff, construction staff and project managers from other impacted areas of the business, e.g. Procurement | Documented process(es) and procedure(s) which are relevant to demonstrating the effective management and control of life cycle activities during asset creation, acquisition, enhancement including design, modification, procurement, construction and commissioning. |
| 91 | Life Cycle Activities | How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance? | 2 | The Underground Line Construction Standard was examined. | | Having documented process(es) which ensure the asset management plan(s) are implemented in accordance with any specified conditions, in a manner consistent with the asset management policy, strategy and objectives and in such a way that cost, risk and asset system performance are appropriately controlled is critical. They are an essential part of turning intention into action (eg, as required by PAS 55 s 4.5.1). | Asset managers, operations managers, maintenance managers and project managers from other impacted areas of the business | Documented procedure for review. Documented procedure for audit of process delivery. Records of previous audits, improvement actions and documented confirmation that actions have been carried out. |
| 95 | Performance and condition monitoring | How does the organisation measure the performance and condition of its assets? | 2 | The first step in managing asset performance is through the use of design and construction standards, material specifications and auditing of completed works. | | Widely used AM standards require that organisations establish implement and maintain procedure(s) to monitor and measure the performance and/or condition of assets and asset systems. They further set out requirements in some detail for reactive and proactive monitoring, and leading/lagging performance indicators together with the monitoring or results to provide input to corrective actions and continual improvement. There is an expectation that performance and condition monitoring will provide input to improving asset management strategy, objectives and plan(s). | A broad cross-section of the people involved in the organisation's asset-related activities from data input to decision-makers, i.e. an end-to end assessment. This should include contactors and other relevant third parties as appropriate. | Functional policy and/or strategy documents for performance or condition monitoring and measurement. The organisation's performance monitoring frameworks, balanced scorecards etc. Evidence of the reviews of any appropriate performance indicators and the action lists resulting from these reviews. Reports and trend analysis using performance and condition information. Evidence of the use of performance and condition information shaping improvements and supporting asset management strategy, objectives and plan(s). |
| 99 | Investigation of asset-related failures, incidents and nonconformities | How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated? | 2 | NGAN's 64A and 64B (Totara St transformer station safety issue) were examined. The Process For Investigation Of Network Incidents Involving Public Safety was examined. | | Widely used AM standards require that the organisation establishes implements and maintains process(es) for the handling and investigation of failures incidents and non-conformities for assets and sets down a number of expectations. Specifically this question examines the requirement to define clearly responsibilities and authorities for these activities, and communicate these unambiguously to relevant people including external stakeholders if appropriate. | The organisation's safety and environment management team. The team with overall responsibility for the management of the assets. People who have appointed roles within the asset-related investigation procedure, from those who carry out the investigations to senior management who review the recommendations. Operational controllers responsible for managing the asset base under fault conditions and maintaining services to consumers. Contractors and other third parties as appropriate. | Process(es) and procedure(s) for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances. Documentation of assigned responsibilities and authority to employees. Job Descriptions, Audit reports. Common communication systems i.e. all Job Descriptions on Internet etc. |

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| *AMP Planning Period* | 1 April 2018 – 31 March 2028 |
| *Asset Management Standard Applied* | PASS 55 |

## SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

| Question No. | Function | Question | Score | Evidence—Summary | User Guidance | Why | Who | Record/documented Information |
|---|---|---|---|---|---|---|---|---|
| 105 | Audit | What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))? | 3 | The PSMS Internal Audit and the TELARC Revalidation have been inspected. The AMMAT was refreshed in January 2017. Various consultants have been engaged to assess various aspects of Electra's AM activity, and recommend improvements. | | This question seeks to explore what the organisation has done to comply with the standard practice AM audit requirements (eg, the associated requirements of PAS 55 s 4.6.4 and its linkages to s 4.7). | The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit teams, together with key staff responsible for asset management. For example, Asset Management Director, Engineering Director. People with responsibility for carrying out risk assessments | The organisation's asset-related audit procedure(s). The organisation's methodology(s) by which it determined the scope and frequency of the audits and the criteria by which it identified the appropriate audit personnel. Audit schedules, reports etc. Evidence of the procedure(s) by which the audit results are presented, together with any subsequent communications. The risk assessment schedule or risk registers. |
| 109 | Corrective & Preventative action | How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance? | 2 | The Undergound Line Construction Standard was examined. The Process For Investigation Of Network Incidents Involving Public Safety from the PSMS was examined. | | Having investigated asset related failures, incidents and non-conformances, and taken action to mitigate their consequences, an organisation is required to implement preventative and corrective actions to address root causes. Incident and failure investigations are only useful if appropriate actions are taken as a result to assess changes to a businesses risk profile and ensure that appropriate arrangements are in place should a recurrence of the incident happen. Widely used AM standards also require that necessary changes arising from preventive or corrective action are made to the asset management system. | The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit and incident investigation teams. Staff responsible for planning and managing corrective and preventive actions. | Analysis records, meeting notes and minutes, modification records. Asset management plan(s), investigation reports, audit reports, improvement programmes and projects. Recorded changes to asset management procedure(s) and process(es). Condition and performance reviews. Maintenance reviews |
| 113 | Continual Improvement | How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle? | 2 | The memo from GM Lines Business in December 2016 includes a commitment to investigate several safety, reliability and resiliance improvements within the existing cost base. | | Widely used AM standards have requirements to establish, implement and maintain process(es)/procedure(s) for identifying, assessing, prioritising and implementing actions to achieve continual improvement. Specifically there is a requirement to demonstrate continual improvement in optimisation of cost risk and performance/condition of assets across the life cycle. This question explores an organisation's capabilities in this area—looking for systematic improvement mechanisms rather that reviews and audit (which are separately examined). | The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. Managers responsible for policy development and implementation. | Records showing systematic exploration of improvement. Evidence of new techniques being explored and implemented. Changes in procedure(s) and process(es) reflecting improved use of optimisation tools/techniques and available information. Evidence of working parties and research. |
| 115 | Continual Improvement | How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation? | 2.5 | Presence of external contractors was noted on various occassions. Attendance of Electra staff at industry events has been observed. Comparative analysis work was examined. | | One important aspect of continual improvement is where an organisation looks beyond its existing boundaries and knowledge base to look at what 'new things are on the market'. These new things can include equipment, process(es), tools, etc. An organisation which does this (eg, by the PAS 55 s 4.6 standards) will be able to demonstrate that it continually seeks to expand its knowledge of all things affecting its asset management approach and capabilities. The organisation will be able to demonstrate that it identifies any such opportunities to improve, evaluates them for suitability to its own organisation and implements them as appropriate. This question explores an organisation's approach to this activity. | The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. People who monitor the various items that require monitoring for 'change'. People that implement changes to the organisation's policy, strategy, etc. People within an organisation with responsibility for investigating, evaluating, recommending and implementing new tools and techniques, etc. | Research and development projects and records, benchmarking and participation knowledge exchange professional forums. Evidence of correspondence relating to knowledge acquisition. Examples of change implementation and evaluation of new tools, and techniques linked to asset management strategy and objectives. |