Asset Management Plan
1st April 2019 – 31st March 2029

Approved by Electra Board: 29th March 2019
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 2019, which sets out the asset management strategies and investment plans for the next 10 years. The starting point for my remarks is the great progress that Electra has made towards its strategic goals, especially the core value of safety and the strategic pillar of best in class for core business. I then want to introduce the more visible alignment of Electra's asset management strategies and programmes with Electra's group strategy and business plans, and conclude by commenting on the key workstreams going forward.

Great progress to date

Key achievements during previous years include…

- Steady progress towards a target of zero harm (zero LTI's).

  Electra is commited to ensuring the safety of its customers, its staff and contractors and the public at large, as noted in the 2018 Annual Report. Key asset management and system implications of this commitement to safety include continuing replacement of components such as pitch-filled metallic cable terminations, metal link pillar boxes, deck-mounted transformers and oil-filled switches, and the implementation of Vault as an H&S incident recording and analysis platform.

- Connecting more closely with customers

  Electra is continuing to give attention to improving customer experience, extending beyond its historical high-level focus on the core price-reliability trade-off through to broader and more frequent interactions such as real-time communication of network status and reliability, more flexible pricing options, consultation on price and reliability possibilities, technical advice, assistance with lines owned by customers and progressing with the implementation of a customer relationship management system to better track the resolution of customer enquiries. The on-going development and adoption of the Milsoft advanced distribution management system (ADMS) also remains a key aspect of this initiative.

- Maintaining Electra's current mix of high reliability and low costs

  Electra has had a comprehensive analysis based on the last 6 years disclosure data performed to better understand its costs and performance against an identified cohort comprising Aurora Energy, Network Tasman, Orion, Powerco, Unison and WEL. This analysis concludes the following…

Measure	Position with cohort	Position within overall industry
Revenue per customer	Best (lowest)	Best (lowest)
OpEx per customer	Close to best perfomer	Better than average
CapEx per customer	Close to best performer	Within best quartile
Unplanned interruptions (Class C SAIDI)	Close to best performer	Within lowest quartile
Overall reliability and cost	Highest reliability and lowest cost per customer	

Source – Electra Best in Class Update (December 2018) report from Southwest Consulting Group

  Electra's asset strategy and works programmes will continue to focus on maintaining this high reliability / low cost position within the cohort.

- Undertaking a range of tactical engineering and operational programmes to improve the core business capabilities.

  This has included targeted reliability improvements on the Northern 33kV network, implementing a risk-based vegetation management plan, further integration of remote devices and sensors to the advanced distribution management system (ADMS) to provide improved visibility of the LV network, and a network-wide protection review and standardisation programme.

  In collaboration with Chargenet, the Kapiti Coast and Horowhenua District Councils, and with support from EECA, Electra has been installing eight additional electric vehicle fast chargers across our region. This not only assists the adoption of clean fuelled vehicles, Electra is gaining practical experience in the monitoring and management of this increasingly popular technology.

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

Electra's 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 significantly alter the resulting mix of revenues and costs. Electra is examining these developments closely and is working on strategies to pre-empt the change that includes development of cost-reflective tariffs.

More visible alignment to Electra's group strategy

Electra's asset management strategies, tactical programmes and work plans have always been aligned to the wider strategic direction, we have paid attention to make that alignment more visible by setting out the linkages between the group strategy and the asset management activities at the start of Chapter 1 of this year's AMP. This is also consistent with the line-of-sight principle of ISO 55001.

Key workstreams going forward

Chapter 1.1 of this AMP sets out the key workstreams that will contribute to 2 of the 3 pillars of Electra's group strategy (providing superior customer and stakeholder experience, and best in class for core business) by facilitating the transition to a transactive network and supporting that transition with the following asset management practice improvements…

- Enhancing evidence-based investment decisions with risk and criticality dimensions to quantify and prioritise investments.
- Improving cost, risk and performance, with a view to reduce SAIDI and OpEx.
- Increased use of transport policy, energy policy, housing policy (especially warmer homes), economic and technology scenarios for demand planning and modelling.

These will in turn result in more detailed year-by-year actions included in the annual business plan and work programmes.

Electra's AMP is an important and evolving document for which 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 Material projects

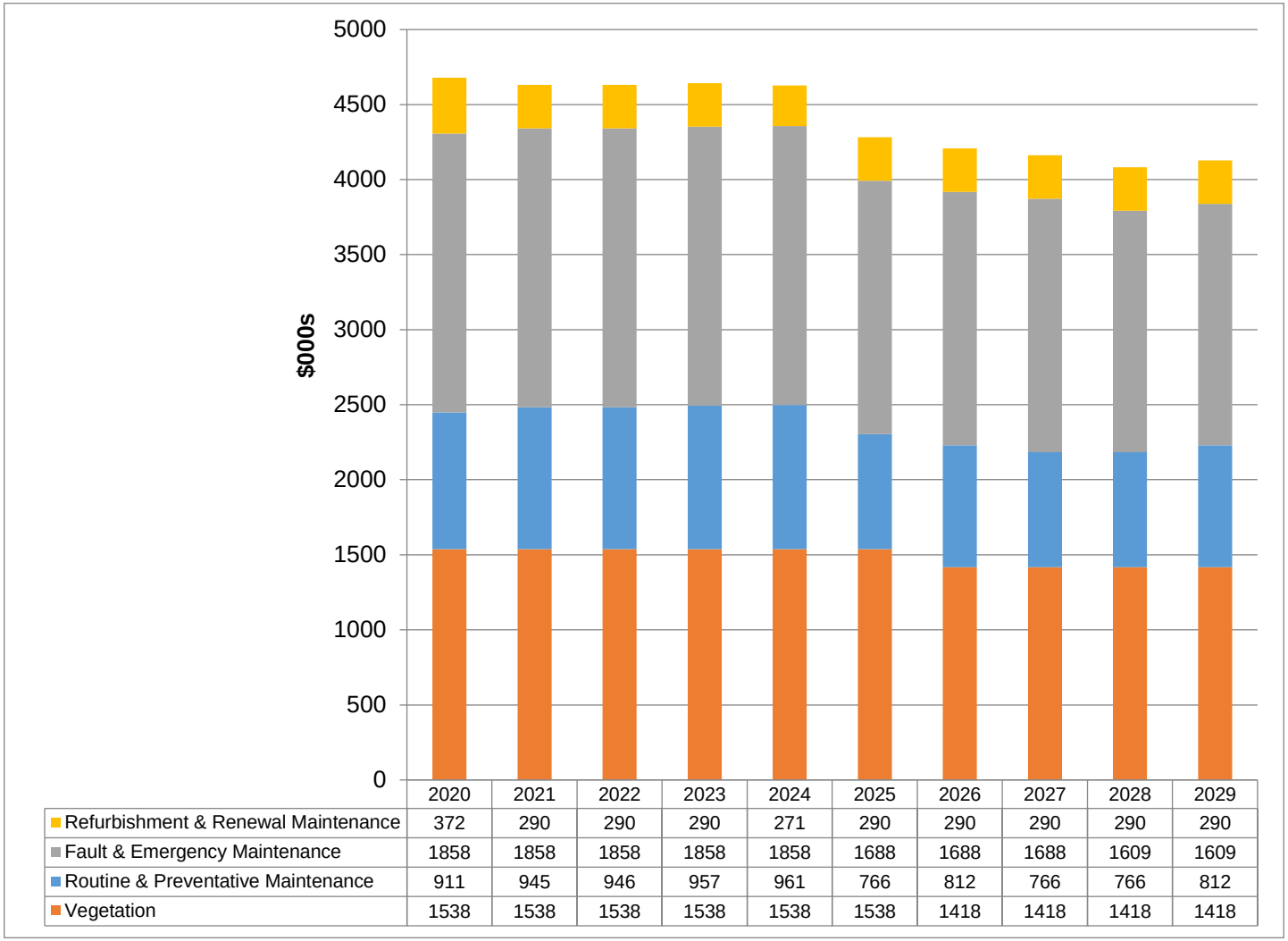
Material projects for the planning period include:

Description	Main Driver	Proposed timing	Expected cost
Install a new feeder from Waikanae Substation	Growth	2019/20	$950,000
Protection Upgrades	Quality of Supply	2019-2023	$2,350,000
Seismic upgrade of Zone Substation buildings.	Quality of Supply	2019-2022	$825,000
Install a new feeder from Otaki Substation	Growth	2021/22	$400,000
Replace 11kV switchgear Paekakariki substation	Renewal	2021/22	$350,000
Upgrade Mangahao to Levin East 33kV circuit.	Renewal	2023-2025	$1,800,000
Foxton to Levin West line section upgrade	Growth	2024-2026	$1,860,000
Power Transformer replacements	Renewal	2022/25	$1,800,000
Levin West to Levin East 33kV line section upgrade	Growth	2026	$613,300
Rebuild Raumati Zone Substation	Renewal	2023-2026	$2,658,000

0.3 Forecast expenditure

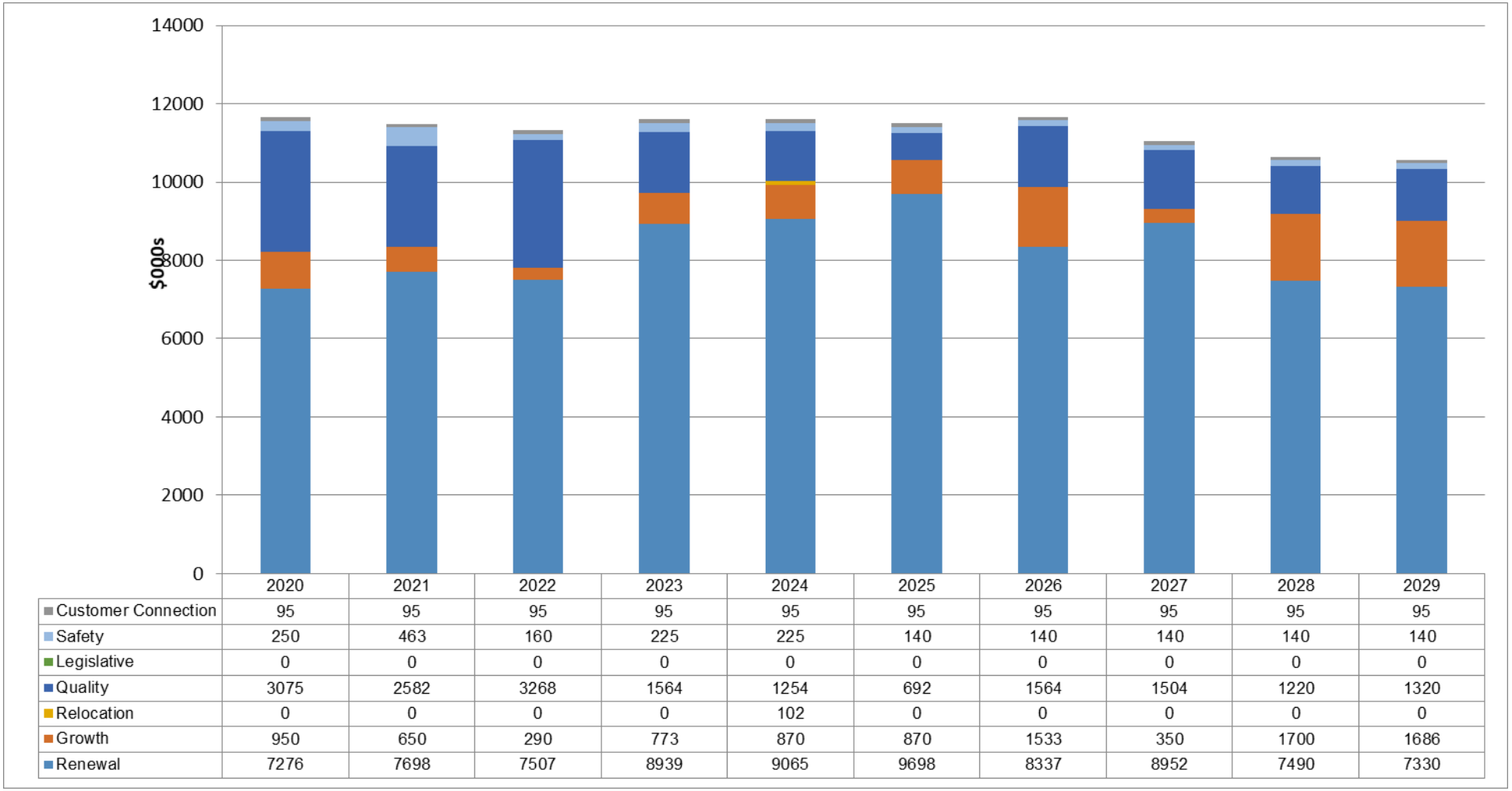
Projected capital expenditure drivers over the next 10 years are expected to be 9.4% of total for growth, 17.8% of total for reliability, safety and environment and 72.8% of total for renewal and replacement work. Capital costs are expected to average $11.3m per year over the next 10 years while operational costs are expected to average $4.4m per year over the same period. Electra has the flexibility to adjust this investment if growth accelerates beyond our expectations. The expenditure forecast is based on 2019 constant dollars.

Summary Opex forecast (year ending 31st March)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Refurbishment & Renewal Maintenance	372	290	290	290	271	290	290	290	290	290
Fault & Emergency Maintenance	1858	1858	1858	1858	1858	1688	1688	1688	1609	1609
Routine & Preventative Maintenance	911	945	946	957	961	766	812	766	766	812
Vegetation	1538	1538	1538	1538	1538	1538	1418	1418	1418	1418

Summary Capex forecast (year ending 31st March)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Customer Connection	95	95	95	95	95	95	95	95	95	95
Safety	250	463	160	225	225	140	140	140	140	140
Legislative	0	0	0	0	0	0	0	0	0	0
Quality	3075	2582	3268	1564	1254	692	1564	1504	1220	1320
Relocation	0	0	0	0	102	0	0	0	0	0
Growth	950	650	290	773	870	870	1533	350	1700	1686
Renewal	7276	7698	7507	8939	9065	9698	8337	8952	7490	7330

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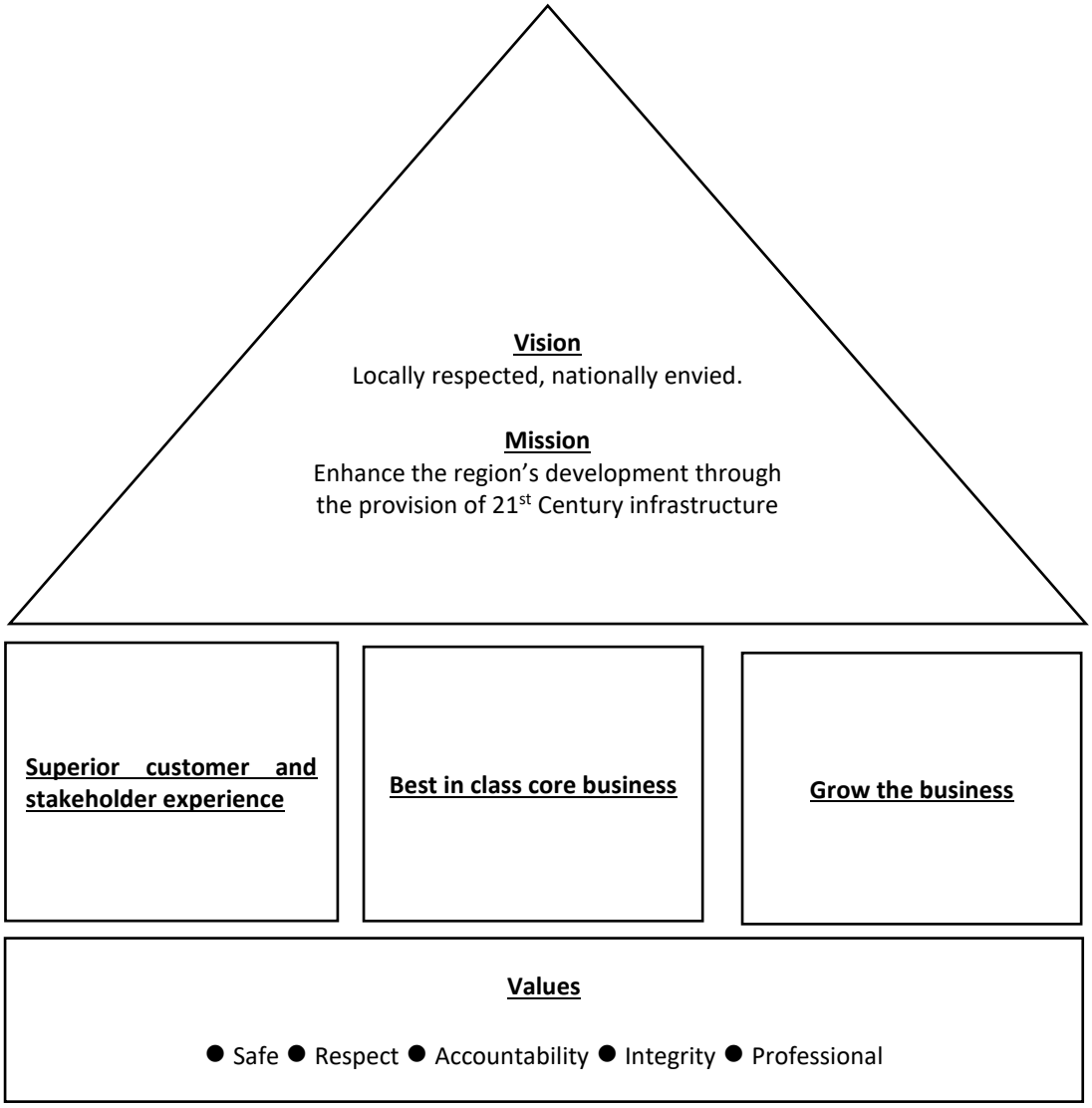
1. Background, context & objectives

1.1 Strategic context for this AMP

Electra has an on-going strategic planning process to guide its core electricity distribution business and its 5 trading subsidiaries. A key outcome of this process is Electra's strategic model…



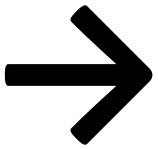
A key aspect of delivering the vision will be facilitating the transition from a largely passive, uni-directional network to a bi-directional transactive grid as follows…

Legacy business

- Assets almost totally passive.
- Primary role is connection (uni-directional electricity supply from the GXP).

Emerging future business

- Assets likely to be active.
- Increasingly bi-directional flows of electricity, information and money.

• Planned determinisitically, primarily by assuming what customers wanted. • Sub-transmission seen as most critical. • Prices set on cost-plus basis		• Planning heavily influenced by recurring and on-going customer engagement. • LV network emerging as critical. • Prices set by market, and influenced by regulatory settings. • Roles expand to increasingly include distribution system operator (DSO)

The best in class strategic pillar will also be supported by the following asset strategies…

- Development of an asset management road map aligned to ISO 55001.
- Optimising cost, risk and performance, with a view to reducing SAIDI and OpEx.
- Implementing asset criticality, with a view to all investment decisions being driven by criticality as well as condition (asset health).

The key value that will guide this transition is safety.

1.2 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 programmes 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.

1.3 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.

1.4 Key plans and documents

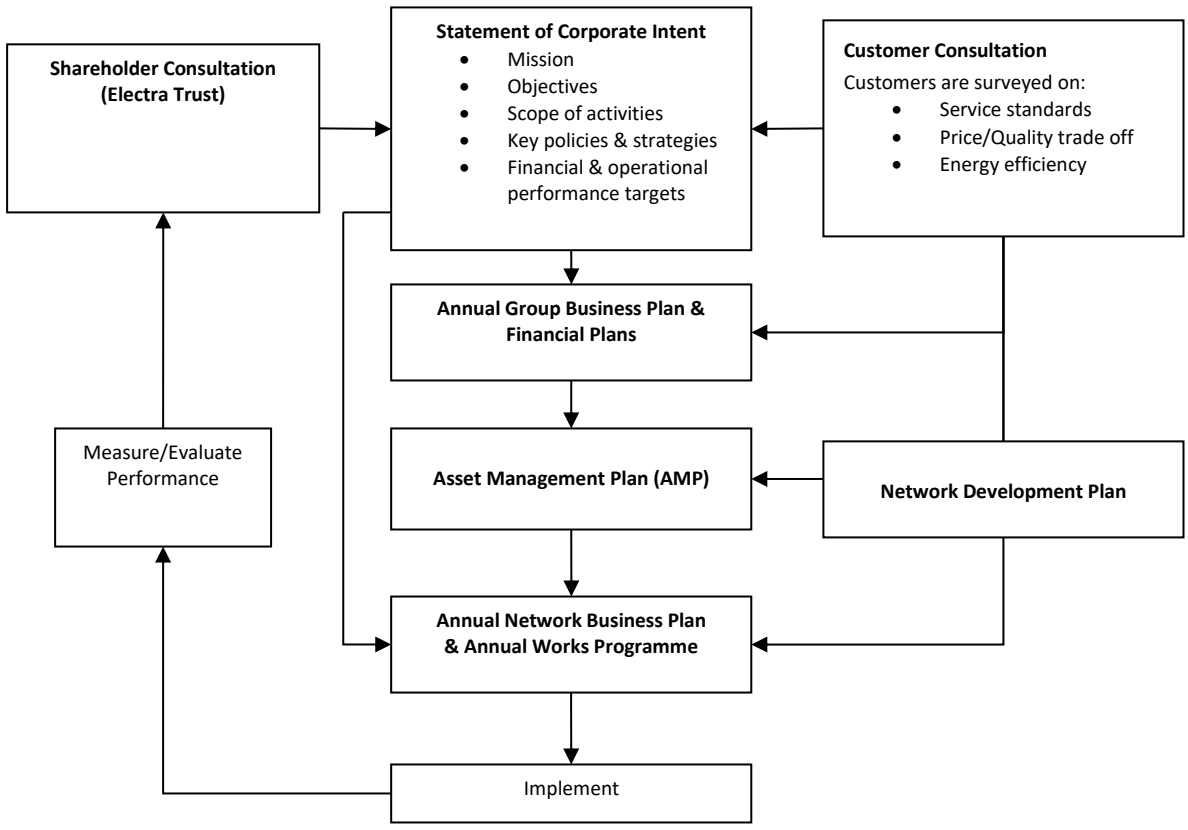
Electra's key plans and documents include…

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. The SCI is approved by the 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 programme	Define detail of specific works on a 12-month basis.

1.5 Relationships between plans and documents

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



1.6 Linkages between planning goals

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

1.7 Planning period

The planning period for this AMP is 1st April 2019 to 31st March 2029. The AMP embodies 3 levels of increasing certainty for nearer term plans.

Period	Scope	Cost	Timing
1st April 2019 – 31st March 2020	Firm, approved in principle	±5%	Quarter / month
1st April 2020 – 31st March 2025	Major components	±10%	Quarter
1st April 2025 – 31st March 2029	Indicative	±25%	Year

1.8 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 2019.

1.9 Stakeholder interests

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

1.9.1 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 • Quarterly briefings • Informal discussions with the Board and Chief Executive.
Bankers	✓				• Terms and conditions of financing arrangements

Stakeholder	Key Stakeholder Interests				How those interests are identified
	Viability	Supply Quality	Safety	Compliance	
					• Quarterly meetings • General negotiations.
Connected customers	✓	✓	✓		• Enquiries via 0800 phone number and website enquiry section • Questions and comments at AGM • Customer survey responses • Community feedback • Media comment.
Energy retailers	✓	✓			• Negotiation of terms and conditions • Pricing amendments • Regular meetings • Informal communication • Resolution of billing disputes.
Mass-market representative groups	✓	✓			• AGM • Feedback from interest groups. • Electricity Networks Assoication (ENA) focus groups
Industry representative groups	✓	✓			• Annually via meetings and conferences.
Staff & contractors	✓	✓	✓	✓	• Weekly staff meeting • Monthly contractor meetings • As required for specific projects • General workplace interactions • Performance appraisals.
Suppliers of goods & services	✓				• General interactions during service deliveries • Price and volume negotiations.
Public (as distinct from customers)			✓		• As required via 0800 phone number and website enquiry section • General interactions.
Land owners			✓	✓	• As required for specific projects.
Councils (excluding as a consumer)			✓	✓	• Monthly Emergency Management meeting • Annual planning disclosure • As required for specific projects • During and after drills and actual events.
Land Transport			✓	✓	• Reading of bulletins • Meetings to discuss specific projects.
Ministry of Business Innovation & Employment			✓	✓	• Reading of bulletins • Attending seminars • Responding to consultations.
Energy Safety Service			✓	✓	• Reading of bulletins • general interaction around safety requirements • Incident investigations.
Commerce Commission	✓	✓		✓	• Reading bulletins and determinations • Attending seminars and workshops • Complying with determinations and disclosure requirements.
Electricity Authority				✓	• Reading bulletins and determinations • Attending seminars and workshops • Complying with Code requirements.
Utilities Disputes		✓		✓	• Reading bulletins, responding to complaint investigations.
Ministry of Consumer Affairs		✓		✓	• Reading bulletins • Responding to complaint investigations.
Transpower	✓	✓	✓	✓	• Quarterly updates • Annual planning meetings • General interactions about grid connections • Discussions about specific grid connection issues such as price and capacity.

1.9.2 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. • Electra's Safety Management System (SMS) provides a structured approach to maintaining public safety. • Electra maintains safety of its staff and contractors by providing all necessary equipment, improving safe work practices, and stopping work in unsafe conditions. • 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 (Q1 2018) indicated a general satisfaction with the present supply quality.
Viability	➔	• 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 deposit at the bank plus a margin to reflect the risks to capital from opportunities associated with emerging energy technologies and regulatory settings. • Price is the key to viability, but must be managed to be in line with similar network companies, other energy options 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. • Electra discloses performance information in a timely and compliant fashion.

1.9.3 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, hazard assessments and targeted renewals 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.

1.10 Accountabilities for asset management

1.10.1 Accountability at governance level

Accountability at the governance level is by two mechanisms…

- Electra's Board directors are obliged to govern the company commercially, on behalf of the Trust as beneficial owners via Statement of Co orporate intent.

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

1.10.2 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.

1.10.3 Accountability at field operations level

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

1.10.4 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 reviewing and 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 programmes and significant projects	Responsible for detailed oversight of all works programmes.
Reporting of outages	Summary included in monthly Board reports.	Summary included in monthly Board reports, immediate involvement in major events.	Receives a report of incidents, causes and follow up actions.

1.10.5 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.

1.11 Overview of asset strategy & delivery

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

- A visible 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).
- Migration from a simple condition-based approach to a more comprehensive criticality and health (risk) based approach.
- Seeking lower cost methods of carrying out required Opex and Capex identified by the AMP.

Refer to the individual asset lifecycle strategies in Chapter 6.

1.12 Overview of systems & information

Electra is developing an asset management road map to comprehensively link the improvement and alignment of its asset management practices to…

- The implementation of the transactive grid.
- The best of class supporting initiatives.
- The elements of ISO 55001.

Electra also has the following data repositories and software that are used to capture, manage and derive insights to support its asset management decisions…

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.
ADMS (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	Integrated with other ADMS applications
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 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 Site inspection
	Age	Accurate to within 6 months post 1995 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 Accurate to within 5 years pre 1995	Documents recording installation
400V Lines	Size and Material	Accurate post 1995 70% accurate pre 1995	Documents recording installation Site inspection
	Age	Accurate to within 3 months post 1995 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 Accurate to within 5 years pre 1995	Documents recording installation
Poles	Material	Accurate	Site inspection
	Age	Accurate to within 3 months post 1995 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 Accurate to within 5 years pre 1995	Documents recording installation
Transformers	Rating, Manufacturer, Age	Accurate	Site inspection Documents recording installation
RMU's	Rating, Manufacturer, Age	Accurate	Site inspection Documents recording installation
Circuit Breakers	Rating, Manufacturer, Age	Accurate	Site inspection Documents recording installation
Other Switches	Rating, Manufacturer	Accurate	Documents recording installation
	Age	Accurate to within 3 months post 1995 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.

1.13 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 that are more complicated to predict. Electra intends to develop a more comprehensive methodology that will include consideration of emerging technologies, declining kWh consumption and increasing kW 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.

1.14 Overview of key lifecycle processes

1.14.1 Routine inspections

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

1.14.2 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.

1.14.3 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 be adopted if 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.
If 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.

1.14.4 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.

1.15 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.

1.16 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 programmes and budgets.
- The Finance team compile budgets for personnel, IT, AMP and non-network assets.
- Electra's Programme 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 programme.
- 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 programmes.

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

1.17 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

Assumption class	Assumption	What if assumption occurs	What if assumption doesn't occur ?
	The Kapiti Coast District's resident population is forecast to increase by 6,300 people over the next 15 years.		monitoring demand growth and either advancing or delaying capital projects.
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 300kW as vehicle size and range increases and 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.
	Penetration of LED streetlighting increases, leading to further reductions 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.
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.
	That the Government's climate change initiatives will see substitution of electricity for oil (transport) and coal (industrial).	Increased generation (almost certainly requiring new capacity), and increased kWh sales.	kWh consumption likely to remain similar to current levels.
	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.	

[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.

Assumption class	Assumption	What if assumption occurs	What if assumption doesn't occur ?
	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 principles 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.

1.18 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 programme) 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, introduce peak pricing to manage 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 existing budget subject to risk assessment	Currently strong
	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

[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.

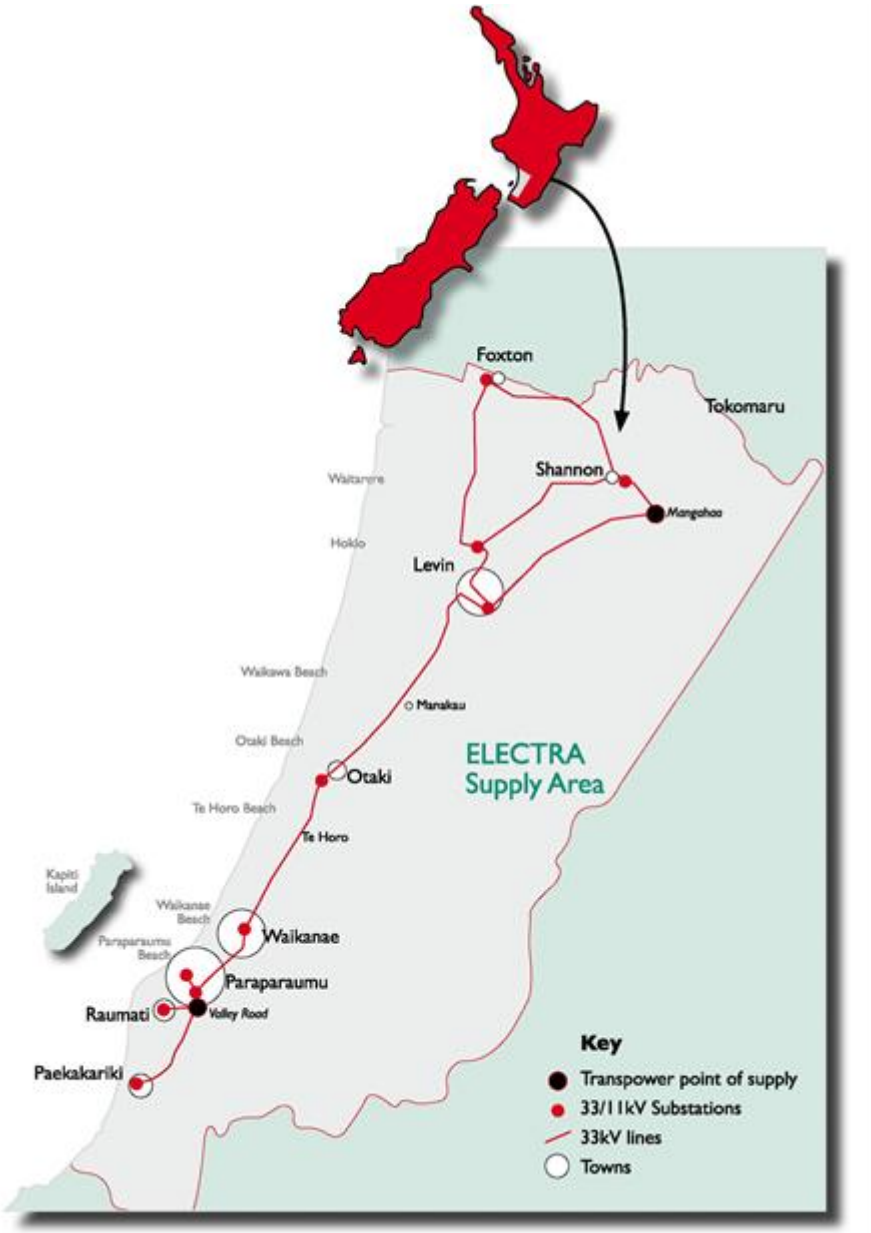
Class of cause	Cause	Result	Possible response(s)	Ability to recover costs of response
Performance	Migration of tree trimming from a responsive approach to a planned approach may reduce SAIDI to below forecasts.	Possible that actual SAIDI will be below long-term targets	Reduce tree trimming budget in 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 programme	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 with Electra's key account manager, 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 embedded Mangahao generation supplying Levin, Foxton and Shannon in a ring configuration. 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.

- A southern network supplied predominantly from Valley Road GXP, and supplying Paekakariki, Paraparaumu, Raumati, Waikanae and Otaki by a double spur configuration. 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 2018 are….

Parameters	Quantity
Number of connected customers	45,437
Electra maximum demand	104 MW
Annual electricity conveyance	442 GWh
Line and cable length	2,275 km
Number of zone substations	10
Number of distribution substations	2,527
Network asset valuation	$175m

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 102 MW. • Embedded hydro station of 38 MW (Mangahao). • About 470 solar installations with a total capacity of 1.8MW.
Sub-transmission	• 2 circuits of 14km of overhead 110kV line that will be repurposed and operated at 33kV. • 151km of overhead 33kV line • 29.3km of underground 33kV cable
	• 4 zone substations supplied from Mangaho GXP. • 5 zone substations supplied from Valley Road GXP. • 1 zone substation that can be supplied from either Valley Road or Mangahao.
Distribution network	• 845 km of overhead line • 237 km of underground cable.
Distribution substations	• 2,545 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 (2018)
Mangahao	30	36.5
Paraparaumu	120	65.5

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	29.3%	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	29.3%	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	24.8%	Nil
	Valley Road – Waikanae 2	600	21.9%	Nil.
	Valley Road – Para West	530	40.9%	Nil
	Valley Road – Paraparaumu 1	600	19.8%	Nil
	Valley Road – Paraparaumu 2	600	19.8%	Nil
	Valley Road - Paekakariki	600	6.7%	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 • Indoor switchgear • Built in 2010.	(n-1)	2,005	Mix of urban load in Shannon and rural load toward Tokomaru and Opiki.	• No known issues • Performing within specification

Zone Substation	Description	Security	ICP's	Nature of Load	Performance & risk concerns
Foxton	• Dual-transformer • High-level steel structure outdoor • Significantly rebuilt in 2004.	(n-1)	3,644	Predominantly urban load in Foxton with some rural load in all directions.	• No known issues • Performing within specification
Levin East	• Dual transformer • High-level steel structure • Built in 1990.	(n-1)	6,401	Predominantly urban, although with some rural load to the south and east of Levin.	• No known issues • Performing within specification
Levin West	• Dual transformer • High-level steel structure • Built in 1974.	(n-1)	5,564	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 • Performing within specification
Otaki	• Dual transformer • Indoor substation • Built in 1994	(n-1)	6,306	Predominantly urban load in Otaki with some rural load in Otaki Gorge, Manakau, Te Horo and Waikawa Beach.	• No known issues • Performing within specification
Waikanae	• Dual-transformer • Indoor substation • Built in 1996	(n-1)	7,283	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 • Performing within specification
Paraparaumu	• Dual-transformer • High-level concrete pole outdoor • Built in 1970, rebuilt in 2015	(n-1)	4,480	Dense urban load in the eastern and central parts of Paraparaumu, some rural load on the immediate outskirts of Paraparaumu.	• Performing within specification • Increased inspection frequency for 1 transformer.
Paraparaumu West	• Dual-transformer • Indoor substation • Built in 2002.	(n-1)	5,394	Dense urban load in central and western parts of Paraparaumu.	• No known issues • Performing within specification
Raumati	• Dual-transformer • High-level steel structure outdoor substation • Built in 1988	(n-1)	4,092	Dense urban load in and around Raumati.	• No known issues • Performing within specification
Paekakariki	• Single transformer • High-level outdoor substation • Built 1982 • *Single transformer and 33 kV feeder is backed up by 11 kV feeder except for KiwiRail traction substation on n security and backed up by other KiwiRail supplies to the north and south	(n-1)*	921	Mix of light urban and semi-rural load around Paekakariki.	• No known issues • 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 10 years	3%
Foxton	4 outdoor SF6 circuit breakers	One at 11 years Three at 15 years	9%
Levin East	6 outdoor SF6 circuit breakers	One at 3 years Two at 9 years One at 11 years One at 15 years One at 31 years	18%

Zone Substation	Description & number	Age (years)	Typical loading
Levin West	5 outdoor SF6 circuit breakers	One at 18 years One at 11 years One at 9 years Two at 6 years	19%
Otaki	5 indoor SF6 circuit breakers	Four at 23 years 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 One at 11 years	9%
Paraparaumu West	5 indoor SF6 circuit breakers	Five at 17 years	8%
Raumati	5 outdoor SF6 circuit breakers	One at 30 years One at 29 years One at 13 years One at 10 years One at 9 years	7%
Paekakariki	1 outdoor oil circuit breaker	One at 9 years	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	24%
Levin East	Two 11.5/23 MVA	ONAN, ONAF	39	45	46%
Levin West	Two 11.5/23 MVA	ONAN, ONAF	7	18	47%
Otaki	Two 11.5/23 MVA	ONAN, ONAF	42	42	42%
Waikanae	Two 11.5/23 MVA	ONAN, ONAF	22	22	54%
Paraparaumu	Two 11.5/18/23 MVA	ONAN, ONAF, OFAF	48	48	49%
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, and in any case that load can be quickly shifted to Foxton on the 11kV if the constraint emerges.

3.3.3 Outgoing switchgear

Outgoing switchgear (11kV) is as follows…

Zone Substation	Description & number	Age	Typical loading
Shannon	7 Reyrolle LMVP	Seven at 11 years	13%
Foxton	7 Reyrolle LMVP	Seven at 14 years	16%
Levin East	8 South Wales SF6 1 Reyrolle LMVP	Eight at 29 years One at 12 years	22%
Levin West	9 Reyrolle LMVP	One at 6 years Two at 7 years Six at 18 years	21%
Otaki	8 Reyrolle LMVP	Five at 23 years Three at 22 years	24%
Waikanae	9 Reyrolle LMVP	Nine at 22 years One at 8 years	23%
Paraparaumu	10 Reyrolle LMVP	Ten at 3 years	22%

Zone Substation	Description & number	Age	Typical loading
Paraparaumu West	8 Reyrolle LMVP	One at 11 years Seven at 16 years	22%
Raumati	7 Reyrolle LMVP	Four manufactured during 2018 One at 21 years Two at 13 years	21%
Paekakariki	3 Reyrolle LMT oil 1 Reyrolle LMVP	Three at 36 years One at 5 years	7%

3.3.4 Buildings

Buildings are as follows…

Zone Substation	General description	Age	Condition grade
Shannon	Timber Framed	14	Normal deterioration monitored in normal inspection cycle.
Foxton	Masonry Shear Walls	30	Normal deterioration monitored in normal inspection cycle.
Levin East	Masonry Shear Walls	31	Normal deterioration monitored in normal inspection cycle.
Levin West	Masonry Shear Walls	46	Normal deterioration monitored in normal inspection cycle.
Otaki	Timber Framed	27	Normal deterioration monitored in normal inspection cycle.
Waikanae	Timber Framed	24	Normal deterioration monitored in normal inspection cycle.
Paraparaumu	Masonry Shear Walls	5	Good or as new condition.
Paraparaumu West	Timber Framed	18	Normal deterioration monitored in normal inspection cycle.
Raumati	Masonry Shear Walls	32	Normal deterioration monitored in normal inspection cycle.
Paekakariki	Masonry Shear Walls	38	Normal deterioration monitored in normal inspection cycle.

3.4 Distribution lines & cables

Electra has 845km of 11kV overhead lines and 237km 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	123	27	149
Levin West	124	25	149
Shannon	184	9	193

Zone Substation	Distribution network length (km)		
	Overhead	Underground	Total
Foxton	102	16	119
Paraparaumu	26	33	59
Paraparaumu West	7	31	38
Raumati	12	13	25
Waikanae	64	42	106
Paekakariki	16	6	22
Otaki	186	37	223
Total	**845**	**237**	**1,083**

3.5 Distribution switchgear

Electra has 2,573 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.

Identified systemic issues include…

- 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 524km of overhead LV (400V) and 494km of underground LV connecting its distribution substations to its customers, with an associated 10,926 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	81	54	135
Levin West	139	51	139
Shannon	71	10	81
Foxton	65	19	85
Paraparaumu	18	64	83
Paraparaumu West	12	81	94

Zone Substation	LV network length (km)		
	Overhead	Underground	Total
Raumati	26	33	59
Waikanae	48	117	165
Paekakariki	10	4	14
Otaki	104	60	164
Total	**524**	**494**	**1,018**

3.8 Customer connections

The consumer connection assets connect Electra's 45,723 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 delivered basic functions 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 to 100,000 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.

Benefits have included…

- Quicker restoration of faults, including through quicker dispatch of fault crews.
- Estimation of technical losses.
- Improved demand and load flow analysis that is likely to allow deferral of asset upgrades.
- Improved information available to customers.
- Automated telephone and website updates during major events.
- Reduced call volumes due to customers accessing the web outage viewer.
- Enhanced data capture.

Current initiatives include…

- Re-engineering Electra's asbuilt processes to a pre-build process enabling the ADMS model to reflect the real time network state
- Implementing a switching scheduler application
- Building an LV data model to reflect the customer phase connections and provide a building block to improved LV network management.

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 has commenced a programme 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	$36,823,000	20.9%
Distribution and LV lines	$36,788,000	20.9%
Zone substations	$29,616,000	16.8%
Distribution substations and transformers	$26,338,000	15%
Other network assets	$12,798,000	7.3%
Sub transmission cables	$10,196,000	5.8%
Distribution switchgear	$12,427,000	7.1%
Sub transmission lines	$8,290,000	4.7%
Non-network assets	$2,659,000	1.5%
Total	**$175,934,000**	**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 inevitably means 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 →				
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
SAIDI	67.4	139.3	100.1	89.3	121.73	83.0	83.0	83.0	83.0	83.0
SAIFI	1.3	2.25	1.16	1.49	2.08	1.66	1.66	1.66	1.66	1.66
CAIDI	52	62	86	60	58.52	50.0	50.0	50.0	50.0	50.0

Comments on the historical performance include…

- 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 resilience of its 33kV network, and resulted in specific programme 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 →				
		2019/20	2020/21	2021/22	2022/23	2023/24
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.

Electra shares the view of an ENA study that identified the ease of connection and timely planned outage notification as two key opportunities to positively impact our customer experience.

4.2 Asset performance levels

Electra's asset performance levels include…

- Load factor.
- Capacity utilisation.
- Network losses.

Electra's historical and forecast performance values are…

Measure	← Actual (historical)					Forecast →				
	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Load factor	54%	53%	56%	48%	49%	50%	50%	50%	50%	50%
Capacity utilisation	26%	26%	25%	31%	31%	33%	33%	33%	33%	33%
Network losses	7.5%	7.4%	6.7%	6.7%	8.4%	6.7%	6.7%	6.7%	6.6%	6.6%

* Actual for 2018/19 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 Distribution Services Input Methodologies Determination 2012 (in as much as that Determination applies to an exempt EDB).
- 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.
- Facilitating and possibly contributing EV charging infrastructure
- Facilitating the installation of renewable generation

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, but have also revealed a preference for better information particularly estimated supply restoration times.
- 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 to Section 5 for Electra's current security of supply targets 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 programmes ….

Issue / concern	Requirement	Programme	Linkage to AMP programmes
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 • 5.7.3 • 6.3 • 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 • 5.7.2
New connections leading to more customers interrupted by any single fault.	• Reduce the number of customers effected by an unplanned interruption. • Reduce the time to restore supply may result from increased interconnection.	Increase network sectionalisation.	• 5.4 • 5.7.1 • 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	• 6.8 • 6.9
Tree trimming was responsive.	• Improve value of tree-trimming programme 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. It also provided insight into 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 programme 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. In 2018 Electra engaged a protection specialist to review the protection schemes and develop a strategy, starting with the Southern network. The objectives of that strategy were 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 that 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 these conductors also contributes 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, from 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 rather than rating cross arms from ground.

4.8.6 Reduce number of risky assets

Electra has developed programmes to mitigate risk when assets are considered to have an unacceptable risk of in-service failure. This approach is consistenet with Electra's public Safety Management System (SMS) which is audited annually. Essentially this starts with prioritisation to reduce risk to public, staff and contractors.

Assets such as pitch filled metal pot heads, metallic link pillar boxes, deck mounted transformer structures are included and are removed where risk cannot be managed adequately. Higher prospective consequence areas of high population density: schools, pools, kindergartens, town centres have already been completed.

Asset criticality assessment, cited throughout this AMP, is being applied to Electra's condition assessments to further enhance risk assessment and develop mitigations.

4.8.7 Migration to planned tree trimming

Electra's vegetation management programme has evolved over recent years During 2018 Electra has overlaid an additional analytical tool, over and above the requirements of the Electricity (Hazards from Trees) Regulations, to systematically identify the greatest risk to customer service and safety from trees close to network.

The resulting tactical programme strongly reflects 2 of this AMP's 4 strategic themes:

- Continuing to implement approaches which improve cost, risk and performance
- Implement asset criticality (and the associated medium-term goal of the asset criticality framework driving all network investment decision).

During 2018 we developed a strategic vegetation management programme using data from historical tree work to identify areas of greatest prospective SAIDI risk and developed an initial plan of work for those areas over the next three years. Key features of this strategic improvement include:

- Leveraging the tree regulations to deliver safety and performance outcomes
- Tree cutting driven from routine and customer requested survey.
- Improve network performance where impacted by vegetation

➔

- Risk rather than performance based management of safety and SAIDI.
- Progressively reduce reactive trimming, and instead proactively cutting trees back and engaging with tree owners to implement longer term solutions.
- Systematically reduce risk in network sections between automated switches and circuit breakers.
- Leverage data of historical tree work to strategically develop a work programmeme to systematically reduce vegetation based SAIDI and safety risk

The key features of our strategic vegetation management programme link to the strategic goal of reducing SAIDI as follows…

Feature	Improve Safety & SAIDI		Reduce OpEx	
	Reduce number of customers at risk	Reduce outage duration	Reduce work volume	Reduce unit costs
Key driver will be trees that effect the largest number of customers.	●	●		
Augment responsive tree work with plans to reduce risk by feeder section.	●			●
Engage with tree owners to implement longer term solutions.	●		●	
Stronger connection of tree data with network data	●	●	●	●

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).

Electra has been in discussion regarding developments and opportunities with product and service providers, as well as individually with other EDBs and collegially through the ENA and EEA.

The ENA work has developed some helpful groupings of consumers based on values and behaviours; Prosumer, Off grid, Grid as Back Up, Set and Forget. This is consistent with how Electra articulated its view of smart grid in the 2018/19 AMP.

The discussions with individual providers and EDBs have advanced Electra's thinking in the future development of products and services to it's consumers. Together with organisational changes to strengthen Electra's capabilities to develop new customer products, Electra will now be developing a trial to collaboratively test technologies and price options that enable consumers with options to better manage their energy and enable Electra to manage load from new technologies such as electrivc vehicle chargers.

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		

Asset category	System Growth (consider adding capacity)	
	Capacity trigger	Voltage trigger
	• 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 some 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.

System level	Load type	First fault	Second fault
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 446 known embedded generation sites on the Electra network with a combined capacity of about 1,526 kW. There are likely to be few occasions when that 1,526kW 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 and other 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

Class of option	Specific approach	Description
		advanced software to thermally re-rate heavily-loaded lines. 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 (Low Investment Options)

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

- Smart technology on the network.
- Smart technology in the homes and businesses of our customers.
- Back office systems for the processing of information exchange with the above smart technologies.
- Web based systems serving information for rule based customer and Electra decisions.
- Customer engagement and product offerings.

Electra has identified a range of 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 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, including such services as the We R@Home platform.

- 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 of 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 many of the 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 2031/32).

Constraint	Description	Intended Remedy
Shannon - Foxton - Levin West 33kV circuit	When load is above 35MVA and the Levin East 33kV circuit(s) trip, the Shannon – Foxton – Levin East 33kV circuit will overload.	Re-configure and 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 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, but possibly with some offset by solar at customer sites. 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.

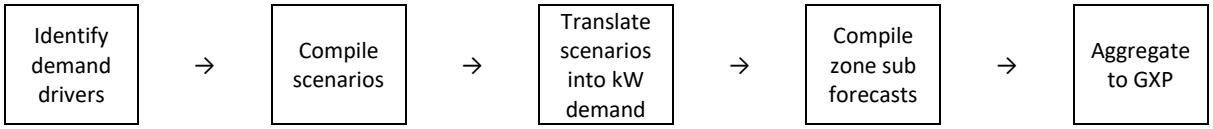
5.6 Demand forecasts

Historically Electra has used a simple linear projection of recent zone substation demand growth rates to forecast demand, and has supplemented these 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, noting that this could range from negative (predominantly exporting) to very high (home-based EV charging).

- 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 programme	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 discourage 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	Minimal

Class of driver	Detailed driver	Impact on demand per customer	Impact on number of customers
		also possibility of disrupting existing kWh-based revenue model	
	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…

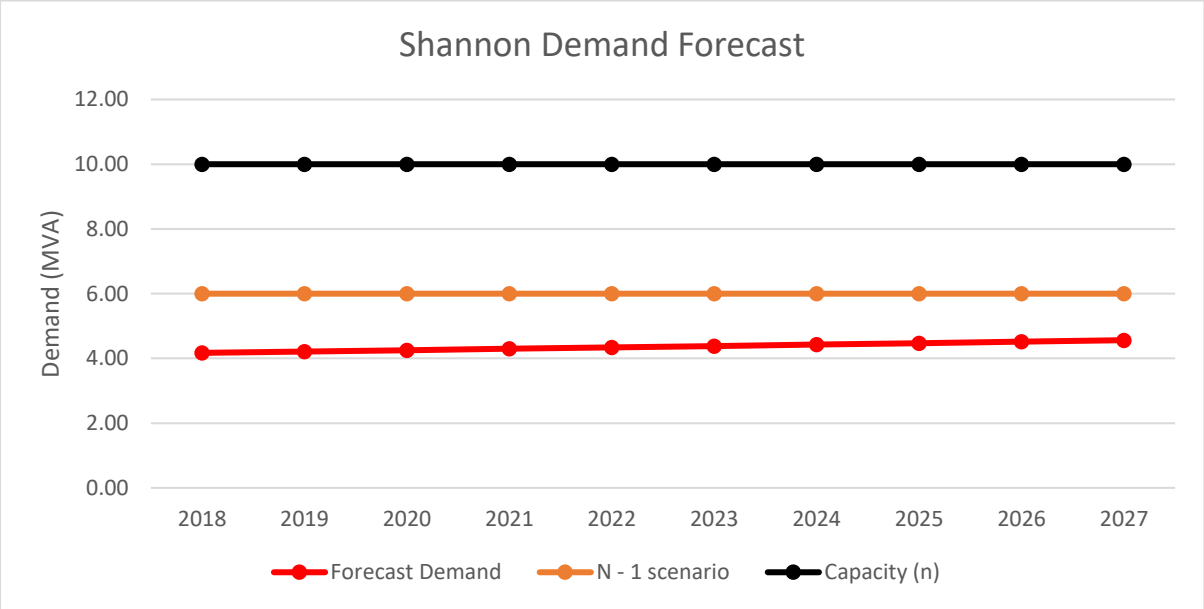
Specific technology	Mode of operation	Implications for Electra
Conventional, well understood loads	Consumption	• Increasing demand per customer.
Inverter heat pumps	Consumption	• Increasing peak demand, but with no commensurate increase in kWh. • Declining load factor • Declining power factor. • Increasing harmonics.
Roof top solar	Injection	• Possible off-set of GXP demand (but probably not during peak periods). • Possible increase in peak loading of some feeders, possibly leading to export congestion. • Over voltages during periods of high generation and low demand. • Increased bi-directional power flows that require changes to protection and control settings. • Reduced kWh sales if located behind the meter. • 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. • 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. • 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

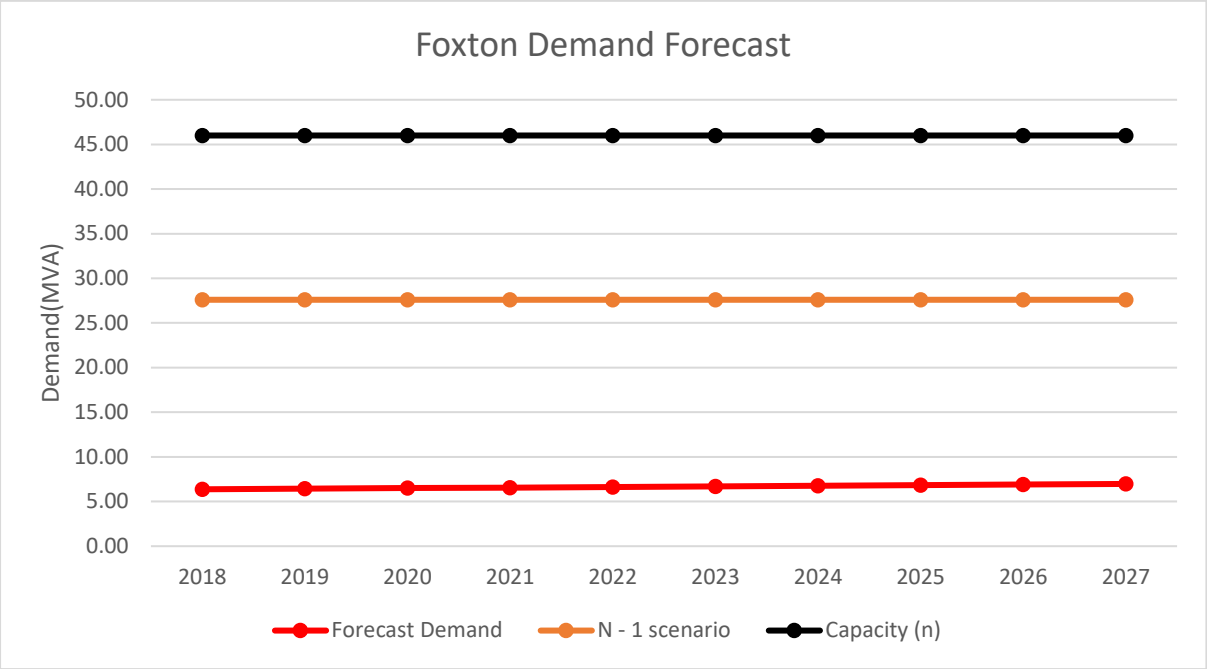
5.6.3 Zone substation demand forecasts

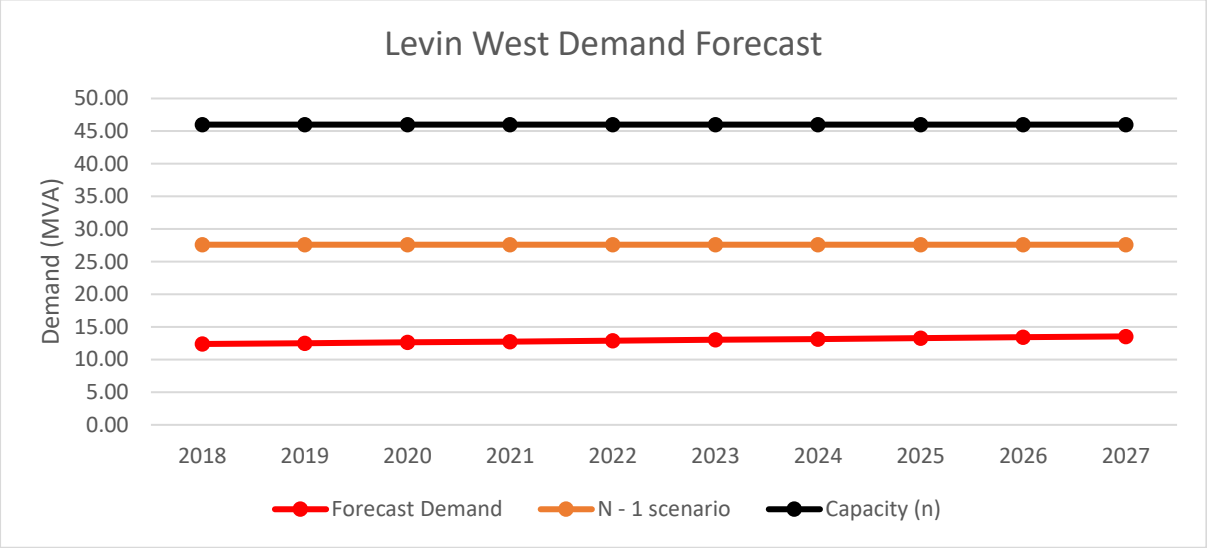
Electra's zone substation demand forecasts are set out below based on the following growth assumptions…

Zone Substation	Rate and Nature of Growth	Provision for Growth
Shannon	About 0.5% per year, mainly lifestyle blocks around Tokomaru.	None required.

Zone Substation	Rate and Nature of Growth	Provision for Growth
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.




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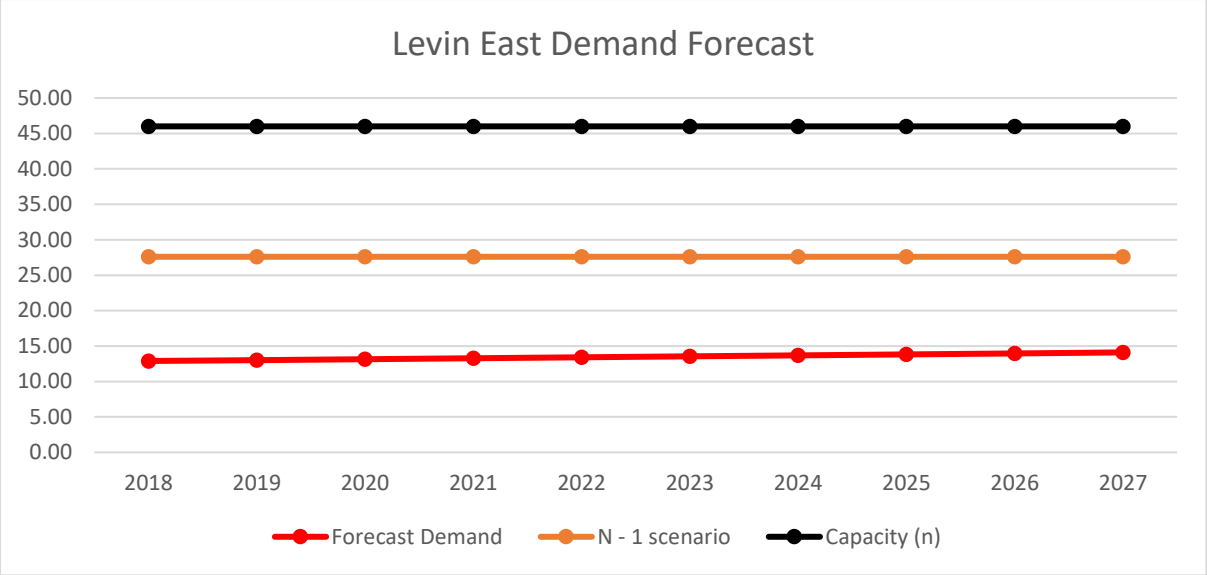
25.00
20.00
15.00
10.00
5.00
0.00
Demand (MVA)
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


Levin East Demand Forecast
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25.00
20.00
15.00
10.00
5.00
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2018
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2020
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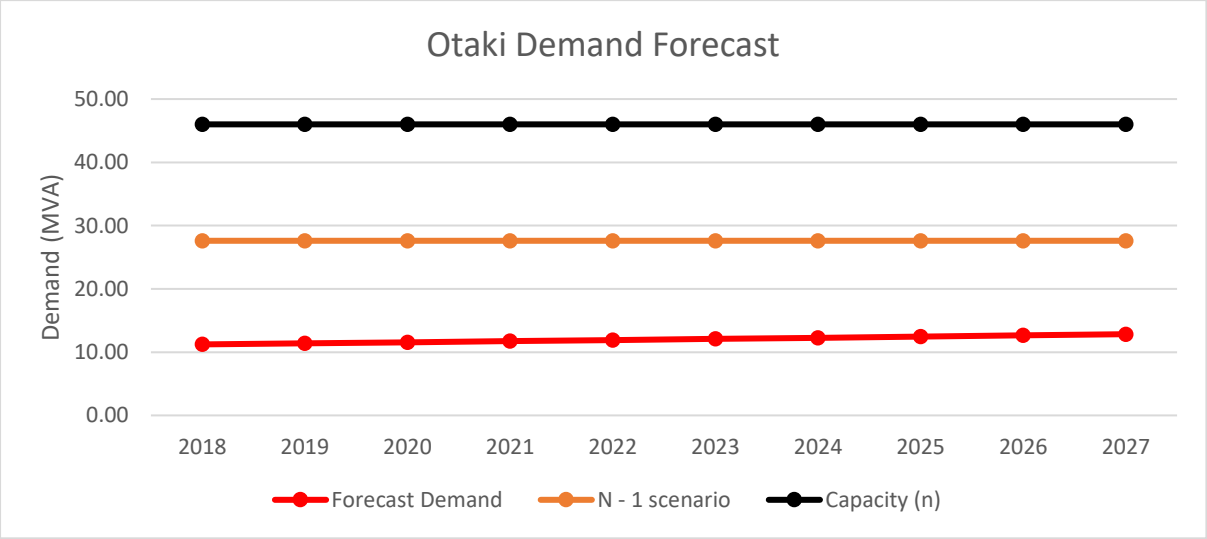
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


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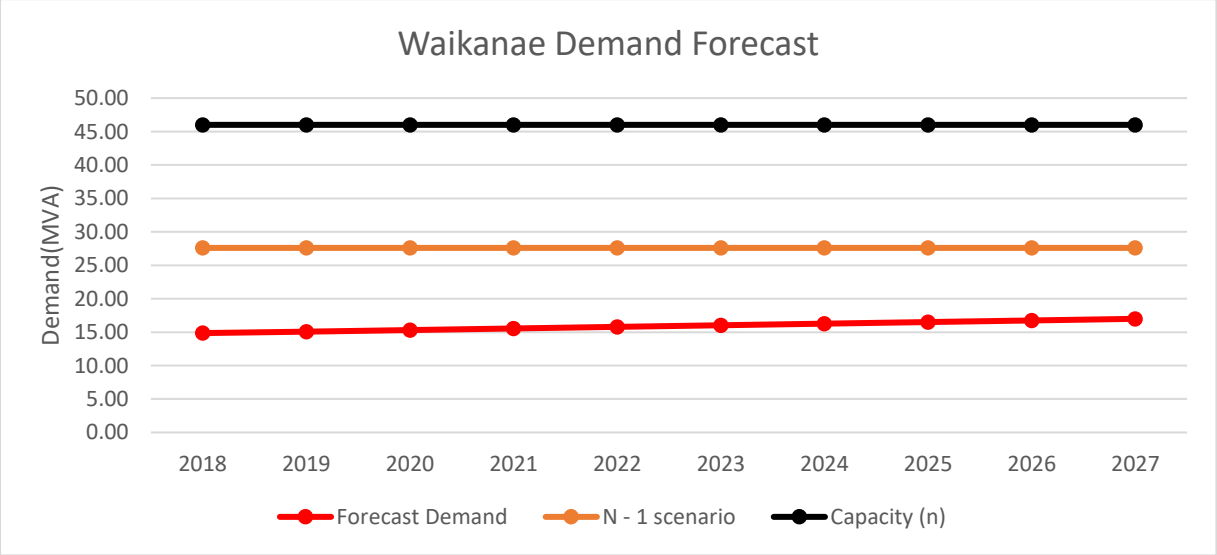
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


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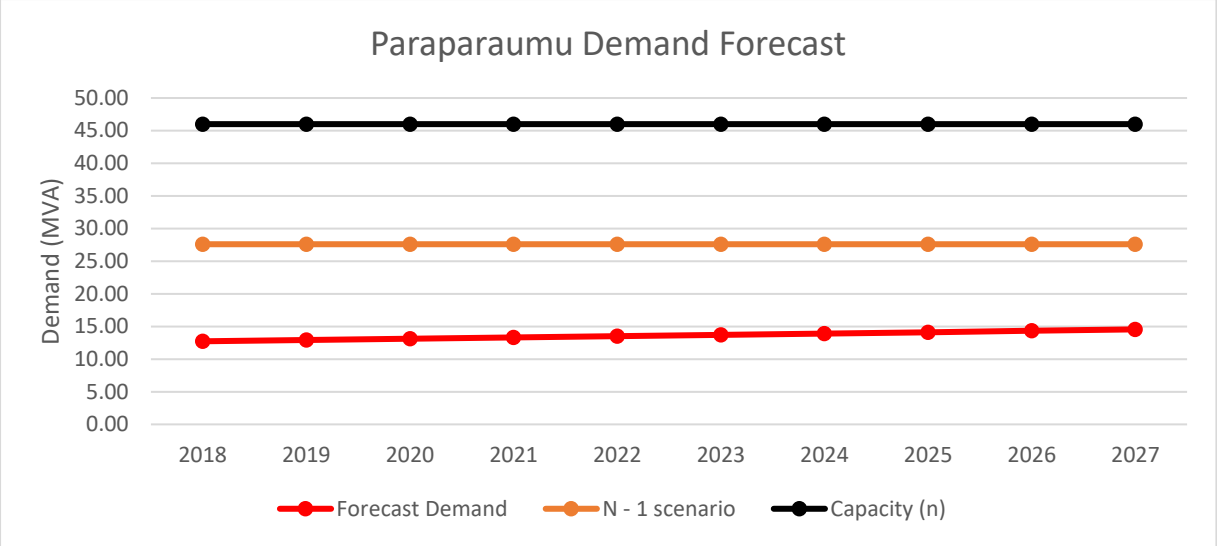
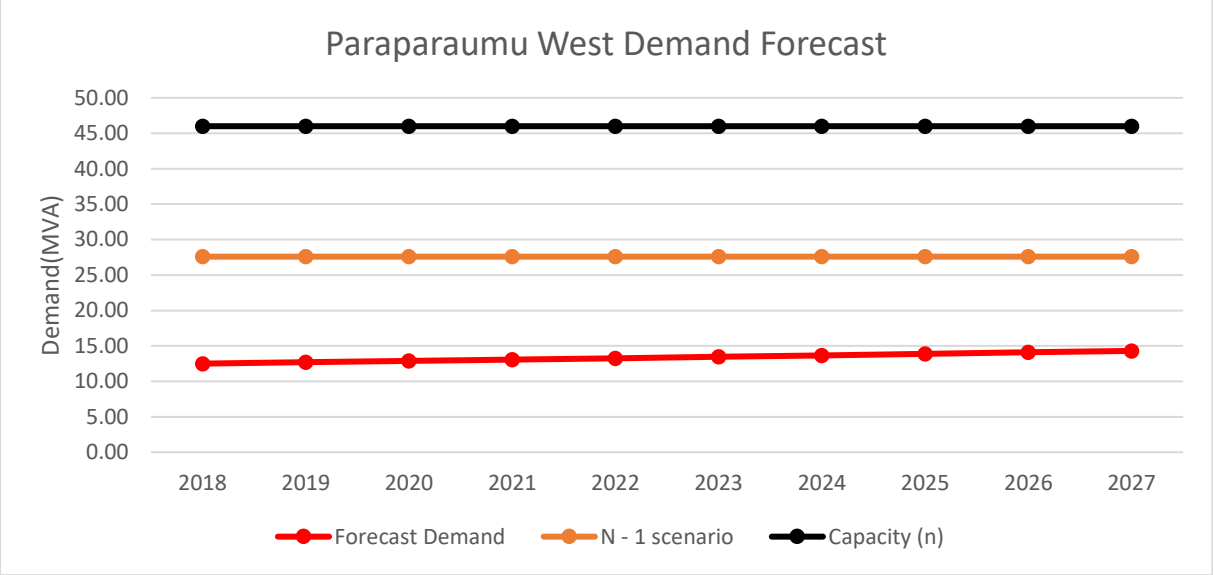
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)


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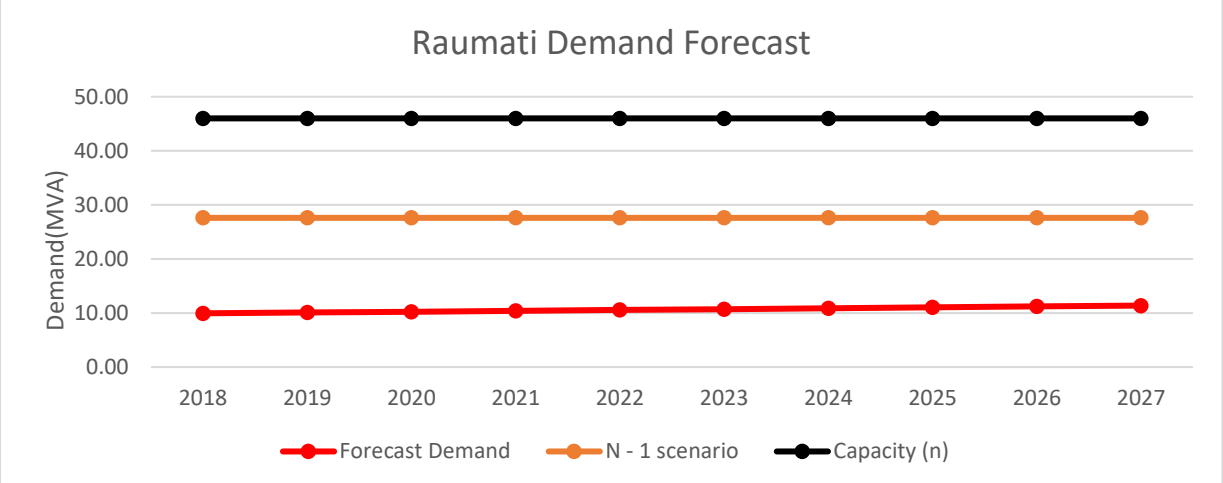
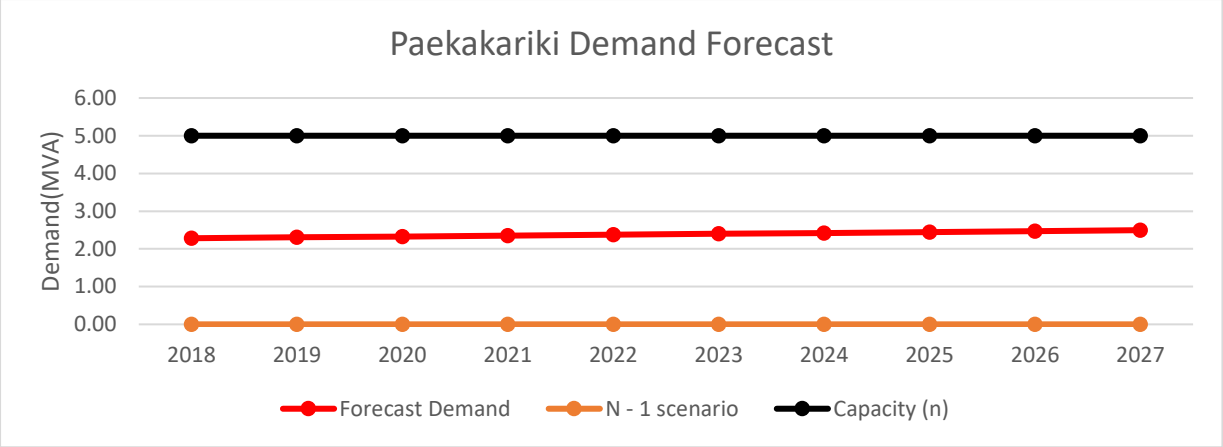
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

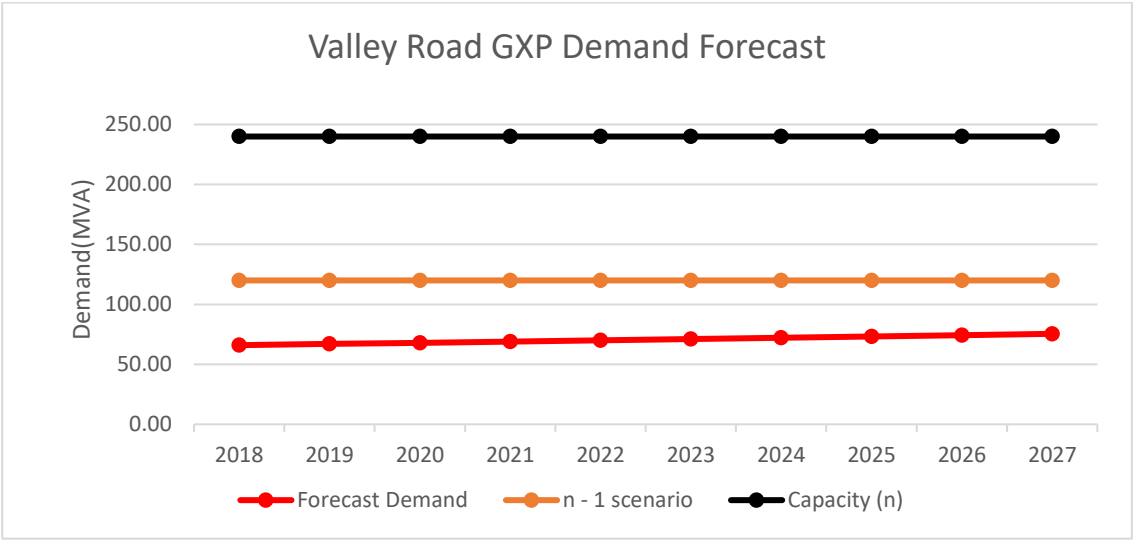

Raumati Demand Forecast
Demand(MVA)
50.00
40.00
30.00
20.00
10.00
0.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Forecast Demand
N - 1 scenario
Capacity (n)

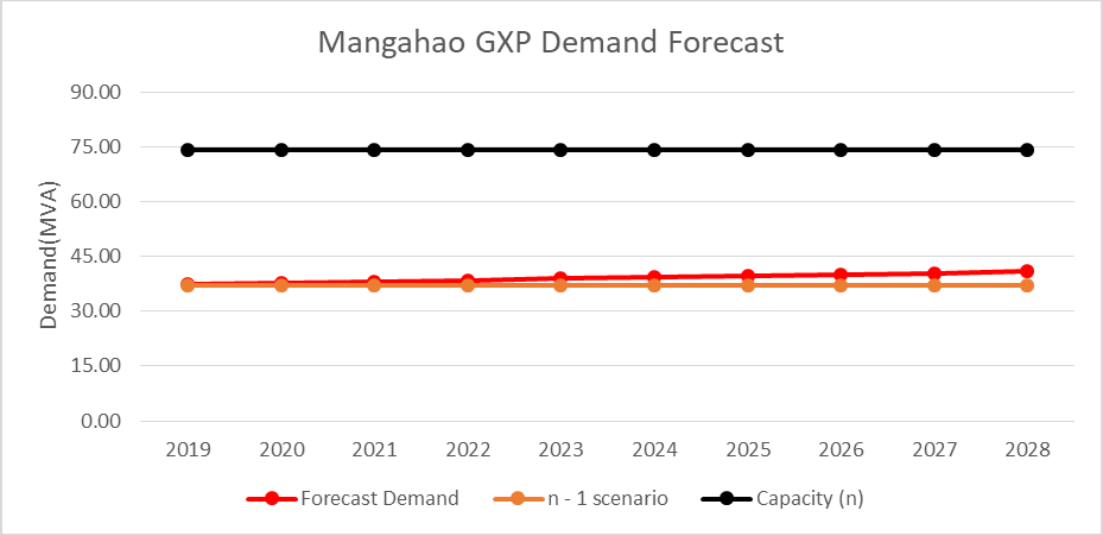


5.6.4 GXP demand forecasts

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 2030 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

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 400 EV's in Kapiti and 50 in Horowhenua by about 2021, again with an even mix of peak and off-peak charging.	Expect 640 EV's in Kapiti and 160 in Horowhenua by about 2021, with an even mix of peak and off-peak recharging.	Expect 1,000 EV's in Kapiti and 200 in Horowhenua by about 2021, with an even mix of peak and off-peak charging.

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

Driver	Low scenario	Mid (base) scenario	High scenario
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.

[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 2019/20 year

Non-material projects (<$200,000) for the 2019/20 are…

Ref.	Description	Category	Cost
1	Install an additional feeder from Waikanae ZS.	Growth	$ 950,000
2	New Levin East to Mangahao connection (carry over)	Quality	$ 670,000
3	Substation protection work	Quality	$ 550,000
4	Install 4th feeder from Shannon	Quality	$275,000
5	Seismic strengthening of Zone Substation Building	Quality	$275,000
6	Automation of switchgear	Quality	$270,000
7	Network sectionalisation	Quality	$250,000
8	Change 33kV/11kV arms to avoid bird related outages	Quality	$200,000

Alternative options considered include…

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
1	Install an additional feeder to Park Avenue to supply increasing load.	Growth	$950,000	• 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. • 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. • 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. • Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted. • Any connected solar or batteries may not be of reliable source due to intermittency of supply.

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
2	New Levin East to Mangahao connection- extend ex-110kV line. (carry over)	Quality	$670,000	• Unacceptable security risk to Levin East and Otaki under contingency scenario	Install station class battery banks and/or generators.	• Construct a new feeder between Levin and Mangahao. • Repurpose the ex-110kVline to create a link between Levin east and Mangahao GXP.	• Repurpose ex-110kVline to establish a link between Levin East and Mangahao which is the most cost effective and reliable solution.
3	Substation protection work	Quality	$550,000	• Slow operating protection		• Upgrade to digital SEL relays.	• Upgrade to digital SEL relays. • Inadequate protection operating speed is both an operational and a safety risk.
4	New 11kV feeder from Shannon Substation to alleviate low voltage issues at end of feeder 119 on winter evenings.	Quality	$275,000	• Customers will endure poor power quality.	Encourage customers to uptake solar and / or battery storage.	• Add new feeder.	• Add new feeder, to split feeder 119 which will improve voltage profile of entire feeder. • Furthermore, 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. • Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted. • Any connected solar or batteries may not be of reliable source due to intermittency of supply.
5	Seismic strengthening of Zone Substation Building	Quality	$275,000	• 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	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. • 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.
7	Install sectionalisers on specified feeders to reduce	Quality	$250,000	• Continue with existing feeder sections.		• Install line sectionalisers on specific feeder locations.	• Sectionalise feeders. • As more customers are added to feeders, the number of customers

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
	number of customers affected by faults.						effected by a fault will also increase, which is undesirable. Sectionalising will reduce the number of customers affected.
8	Change 33kV/11kV arms to avoid bird related outages	Quality	$200,000	• 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. • Hendrix cables are expensive compared to reconfiguration and would require easements.

* includes "low investment" options.

Non-material projects (<$200,000) for the 2019/20 are…

Ref.	Description	Category	Cost
9	Network sectionalisation with Entec switches (carry over)	Quality	$150,000
10	Mangahao ODID	Quality	$150,000
11	Link between feeder 652 and 632 (BTW S186 & P285)	Quality	$90,000
12	Install LV -power quality monitors	Quality	$75,000
13	Install additional permanent fault locators	Quality	$51,106
14	Link LV network where gaps exist	Quality	$40,772
15	Fault locator comm's	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	
9	Network sectionalisation (carry over) for Entec switches	Quality	$150,000	• Continue with existing manual switching arrangements.		• Automate specific switches.	• Automate specific switches. • 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.

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
10	Mangahao ODID	Quality	$150,000	• 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.
11	Link between Feeders 652 and 632 (between S186 & P285) to provide alternative circuit.	Quality	$90,000	• Continue with existing unmeshed feeders.	•	• Install link between Feeders 652 and 632.	• Install link between Feeders 652 and 632. • Being able to back-feed un-faulted sections of both feeders provides an opportunity to reduce restoration times.
12	Install LV -power quality monitors	Quality	$75,000	• Continue with no visibility of LV power quality information.	• Install smart sensors on selected distribution transformers.		• Install LV PQ monitors on selected transformers. • 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.
13	Install additional permanent fault locators to allow quicker location of faults.	Quality	$51,106	• Rely on existing telemetered devices to locate faults.		• Install fault locators	• Install fault locators. • Quicker location of faulted section of feeder is consistent with strategy of improving reliability.
14	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. • Allow supply restoration in switching time rather than repair time.
15	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. • 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 2020/21 to 2023/24

Development projects proposed for 2020/21 to 2023/24 include…

Ref.	Description	Category	Cost
1	Substation Protection Work	Quality	$ 1,800,000

Ref.	Description	Category	Cost
2	Automation of Switchgear	Quality	$ 1,080,000
3	Network sectionalisation	Quality	$ 1,000,000
4	Upgrade to butterfly- Foxton to Levin West 33kV	Growth	$ 620,000
5	Seismic Strengthening Zone Substation Buildings	Quality	$ 550,000
6	Alternative supply between W468 & Z50	Quality	$ 511,056
7	Additional Ripple Plant	Quality	$ 500,000
8	Install cable Switch gear close Ring at Hokio beach road-underground LV (CABLES)	Quality	$ 465,000
9	T106 to T57 install cable close Ring	Quality	$ 408,845
10	Additional feeder	Growth	$ 400,000
11	New feeder to offload C3 and C4 at Foxton	Growth	$ 400,000
12	Q91 to P271 Close up ring	Quality	$ 306,634
13	Cable replacement between W97 & W98	Growth	$ 250,000
14	Install 5th feeder from Paraparaumu West	Growth	$ 250,000
15	Install ring feed cable to back up L21 to L332	Quality	$ 250,000
16	New feeder from Shannon Substation	Growth	$ 250,000
17	Link between W42 and W293 -Pram Airport and install CFC.	Quality	$ 235,000
18	Install Switch Gear and reconfigure	Quality	$ 205,200
19	Install additional fault locators - Permanent	Quality	$ 204,424
20	Install LV -power quality monitors	Quality	$ 175,000
21	Link LV network where gaps exist to reduce fault restoration times.	Quality	$ 163,088
22	Install cable and Switch gear close Ring at Mill Road	Quality	$ 153,317
23	Cable installation between W494 and W502	Quality	$ 122,653
24	2nd transformer (cold standby)	Quality	$ 120,000
25	Fault locator comm's	Quality	$ 113,568
26	Install cable Switch gear close Ring at Hokio Beach Road -underground LV(SWITCHGEAR)	Quality	$ 90,000
27	Replace W300 Switch Gear and close ring W532	Quality	$ 65,000
28	Install new cable Switch gear close ring upgrade conductor to T180	Quality	$ 40,000

Alternative options considered include…

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
1	Substation Protection Work	Quality	$ 1,800,000	• Slow operating protection		• Upgrade to digital SEL relays.	• Upgrade to digital SEL relays. • Inadequate protection operating speed is both an operational and a safety risk.
2	Automation of Switchgear	Quality	$ 1,080,000	• Continue with existing manual switching arrangements.		• Automate specific switches.	• Automate specific switches. • 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.

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
							• These devices will provide network data, which will help to improve network investment decisions of future.
3	Network sectionalisation	Quality	$ 1,000,000	• Continue with existing feeder sections.		• Install line sectionalisers on specific feeder locations.	• Sectionalise feeders. • 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	Upgrade to butterfly- Foxton to Levin West 33kV to remove constraint if Levin East circuit trips.	Growth	$ 620,000	• Leave section of Bee in place.	• Install station class battery banks in substations to supply load during contingency.	• Replace section of Bee with Butterfly.	• Replace section of Bee with Butterfly. • Leaving the section of Bee in place limits the capacity of this circuit should the Levin East 33kV circuit trip, which is unacceptable. • Whole life cost of battery banks doesn't justify the investment.
5	Seismic Strengthening Zone Substation Buildings	Quality	$ 550,000	• 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 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. • Being able to back-feed un-faulted sections of both feeders provides an opportunity to reduce restoration times.
7	Ripple Plant installation at Otaki to cover whole network if either of the existing plants are out of service.	Quality	$ 500,000	• Ripple Plant installation at Otaki to cover whole network if either of the existing plants are out of service.	• Ripple Plant installation at Otaki to cover whole network if either of the existing plants are out of service.	• Ripple Plant installation at Otaki to cover whole network if either of the existing plants are out of service.	• Ripple Plant installation at Otaki to cover whole network if either of the existing plants are out of service.

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
8	Install cable and switchgear to close ring at specified locations and underground the LV to allow quicker restoration of faults.	Quality	$ 465,000	• Retain existing spur configuration.		• Install ring feed cable.	• Install ring feed cable. • Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability
9	T106 to T57 install cable close Ring	Quality	$ 408,845	• Retain existing spur configuration		• Install ring feed cable.	• Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability
10	Additional feeder- Otaki	Growth	$ 400,000	• 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. • 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. • 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. • Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted. • Any connected solar or batteries may not be of reliable source due to intermittency of supply.
11	New feeder to offload C3 and C4 at Foxton	Growth	$ 400,000	• 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. • 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. • 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.

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
							• Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted. • Any connected solar or batteries may not be of reliable source due to intermittency of supply.
12	Install cable and switchgear to close ring at specified locations and underground the LV to allow quicker restoration of faults.	Quality	$ 306,634	• Retain existing spur configuration.		• Install ring feed cable.	• Install ring feed cable. • Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability
13	Replace cable between W97 & W98 to allow load growth.	Growth	$ 250,000	• Retain existing cable.	•	• Replace existing cable with larger cable.	• Replace existing cable with larger cable. • 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.
14	Install a fifth feeder to Matai Rd to supply increasing load.	Growth	$ 250,000	• Allow load and customer numbers on existing feeders to increase.	•	• Add new feeder.	• Add new feeder. • 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. • 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.
15	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. • Meshing of circuits allows reduced restoration times.
16	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. • Simply adding more customers will increase its asset utilisation and risk of in-service failure. This is inconsistent with Electra's policy on

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
							asset loading and increasing asset capacity. • 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. • Customer uptake of solar and / or batteries are on an ad-hoc basis and cannot be predicted. • Any connected solar or batteries may not be of reliable source due to intermittency of supply.
17	Link between W42 and W293 -Pram Airport and install CFC.	Quality	$ 235,000	• Continue with existing spur network arrangement	• Install backup generators/battery for redundancy.	• Install a cable section to close the ring	• Install ring feed cable. • Diesel generators and battery solutions are not cost effective. • Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability
18	Install Switch Gear and reconfigure	Quality	$ 205,200	• Retain existing spur configuration.		• Install a ring main unit and improve the back-feed capability.	• Install an RMU. • Meshing of circuits allows reduced restoration times
19	Install additional fault locators - Permanent	Quality	$ 204,424	• Rely on existing telemetered devices to locate faults.		• Install fault locators	• Install fault locators. • Quicker location of faulted section of feeder is consistent with strategy of improving reliability.
20	Install LV -power quality monitors	Quality	$ 175,000	• Continue with no visibility of LV power quality information.	• Install smart sensors on selected distribution transformers.		• Install LV PQ monitors on selected transformers. • 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.
21	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. • Allow supply restoration in switching time rather than repair time.

Ref.	Description and purpose of project	Category	Cost	Options considered			Option chosen and reason
				Do-Nothing	Non-Network	Network	
22	Install cable and Switch gear close Ring at Mill Road	Quality	$ 153,317	• Retain existing spur configuration.		• Install ring feed cable.	• Install ring feed cable. • Meshing of circuits allows reduced restoration times which is consistent with Electra's strategy of improving reliability
23	Cable installation between W494 and W502	Growth	$ 122,653	• Retain existing cable.		• Replace existing cable with larger cable.	• Replace existing cable with larger cable. • 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	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 Paekakariki that could be livened in 6 to 8 hours.	• Relocate a transformer from another substation to keep as a cold standby at Paekakariki. • 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.
25	Install comms on specified fault locators to allow remote indication.	Quality	$ 113,568	• Retain existing spur configuration.		• Install ring feed cable.	• Install ring feed cable. • Meshing of circuits allows reduced restoration times.
26	Install cable Switch gear close Ring at Hokio Beach Road - underground LV(SWITCHGEAR)	Quality	$ 90,000	• 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. • Remote indication of faults allows quicker directing of fault men to faults, reducing restoration times.
27	Replace W300 Switch Gear 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. • Meshing of circuits allows reduced restoration times.
28	Install new cable Switch gear close ring upgrade conductor to T180	Quality	$ 40,000	• Retain existing spur configuration.		• Install ring feed cable.	• Install ring feed cable. • Meshing of circuits allows reduced restoration times.

* includes "low investment" options.

5.7.3 Development projects for 2024/25 to 2028/29

Development projects proposed for 2024/25 to 2028/29 include…

Ref.	Description	Category	Cost
1	New zone sub to back up Foxton and Shannon and load growth and possible new grid exit point	Growth	$ 1,725,000.00
2	Automation of Switchgear	Quality	$ 1,610,000.00
3	Rural substation around Waikawa.	Growth	$ 1,311,056.00
4	Close 11kV Rings	Growth	$ 1,250,000.00
5	Upgrade to butterfly Foxton to Levin West	Growth	$ 1,240,000.00
6	Install conductor and close Ring	Quality	$ 1,022,112.00
7	Network sectionalisation	Quality	$ 1,000,000.00
8	LVE-Mangahao connection-ex-110kV LINE	Quality	$ 800,000.00
9	Upgrade to butterfly -Levin East to Levin West	Growth	$ 613,267.00
10	Tesla Protection Work	Quality	$ 600,000.00
11	Sub-division extensions	Customer Connection	$ 473,200.00
12	Install new cable Switchgear close ring upgrade conductor to T180	Quality	$ 360,000.00
13	Alternative supply between W38 & W39	Quality	$ 306,633.00
14	Install additional fault locators - Permanent	Quality	$ 255,530.00
15	Link LV network where gaps exist	Quality	$ 203,860.00
16	Fault locator comm's	Quality	$ 141,960.00

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. • 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.

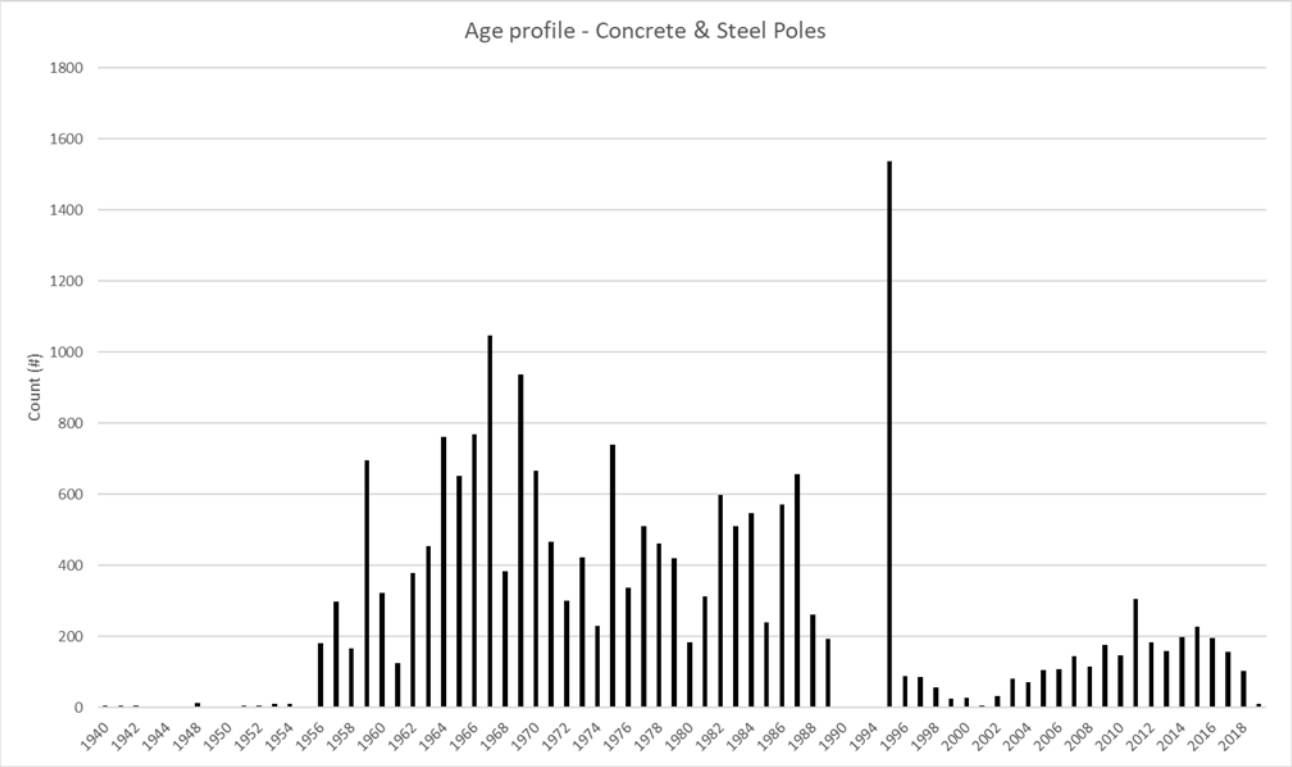
Summary of asset class

Electra has 20,252 concrete poles and 32 steel poles on its network. These range in age from new to 79 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	1,940	Each	9.55%	No known concerns but observed that heavily loaded poles are deteriorating faster.
Solid concrete	18,310	Each	90.28%	No known concerns but observed that heavily loaded poles are deteriorating faster.
Spun concrete	2	Each	0.01%	
Steel	20	Each	0.10%	

Sub-class	Number	Unit	Percent	Key features of sub-class
Oclyte	12	Each	0.06%	
Total	**20,284**	Each	**100%**	



Condition

Condition:	Grade 1	Grade 2	Grade 3	Grade 4	Grade unknown	Data accuracy	Percent forecast for replacement over next 5 years
		2.3%	92.70%	5.0%	-	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 programme 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 & programmes

Projects & programmes 2019/20

Ref.	Location	Description	Category	Cost
1	All	400V Pole Replacements - Inspection Driven	Renewal	$204,000
2	All	11kV Pole Replacements - Inspection Driven	Renewal	$302,400
3	All	33kV Pole Replacements - Inspection Driven	Renewal	$150,000
4	All	Fault/Urgent defect replacement	Renewal	$50,000

Projects & programmes 2020/21 to 2023/24

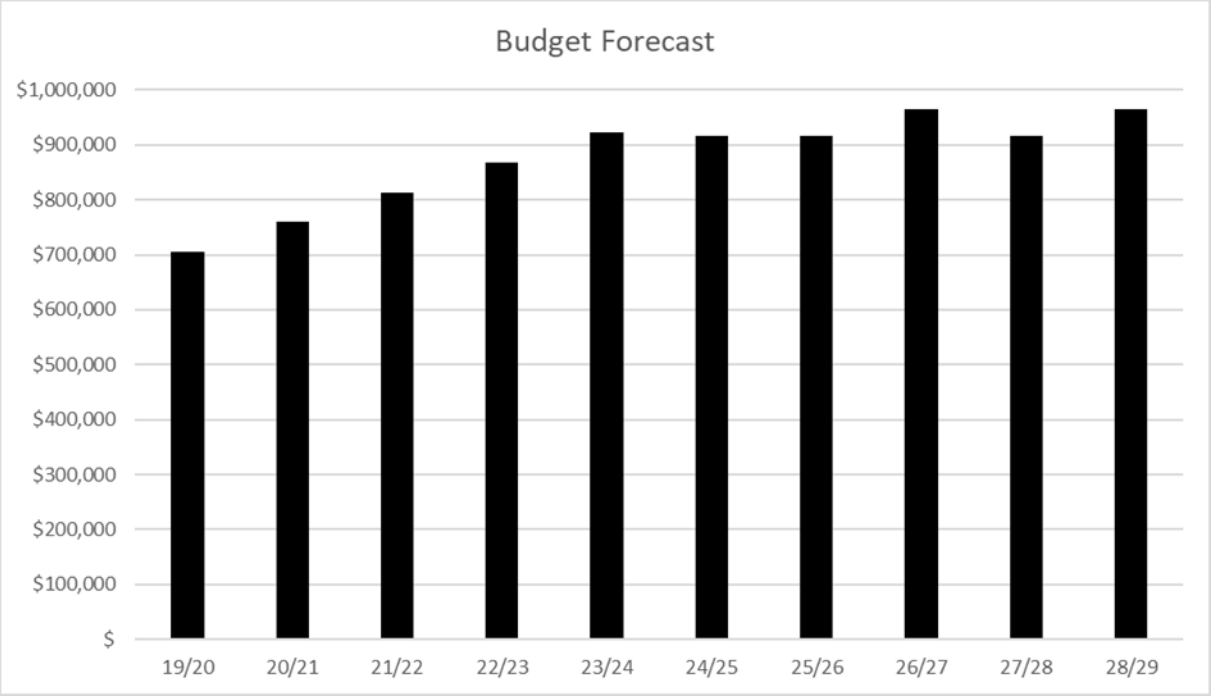
#	Location	Description	Category	Cost
1	All	400V Pole Replacements - Inspection Driven	Renewal	$815,000
2	All	11kV Pole Replacements - Inspection Driven	Renewal	$1,750,000
3	All	33kV Pole Replacements - Inspection Driven	Renewal	$600,000
4	All	Fault/Urgent defect replacement	Renewal	$200,000

Projects & programmes 2024/25 to 2028/29

Ref	Location	Description	Category	Cost
1	All	400V Pole Replacements - Inspection Driven	Renewal	$1,019,000
2	All	11kV Pole Replacements - Inspection Driven	Renewal	$2,811,000
3	All	33kV Pole Replacements - Inspection Driven	Renewal	$600,000
4	All	Fault/Urgent defect replacement	Renewal	$250,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$706k	$760k	$814k	$868k	$922k	$916k	$916k	$966k	$916k	$966k



6.2 Wooden poles

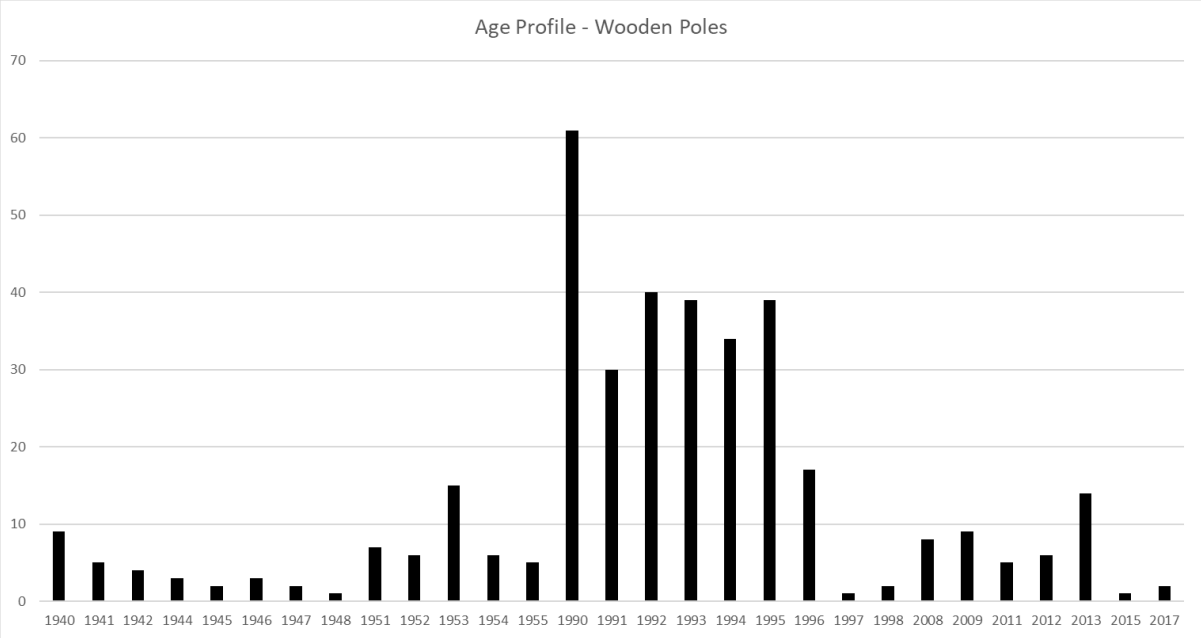
Key features of Electra's wood pole management are as follows.

Summary of asset class

Electra has 14 hardwood poles on its 11kV network. There are records of a further 1,129 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	822	Each	72%	
Hard wood	307	Each	28%	
Total	**1,129**	**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	-	40.00%	60.00%	-	-	3	45.00%

Systemic issues & mitigation

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

Electra has been 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 & programmes

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

Budget forecast

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

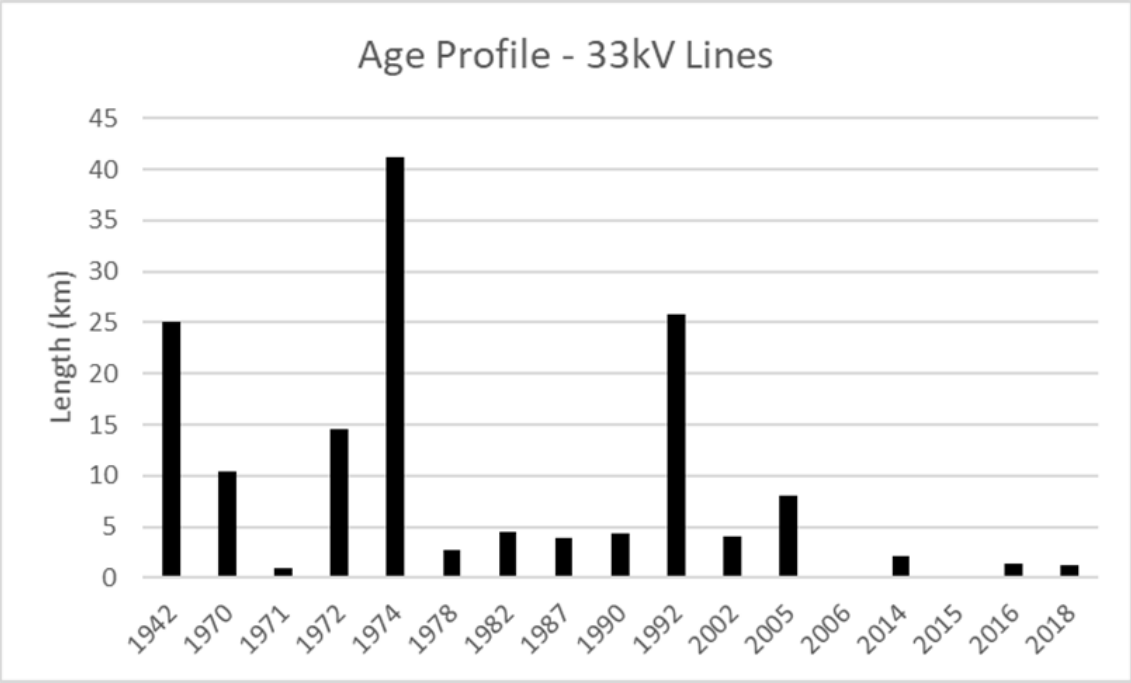
6.3 Overhead conductor

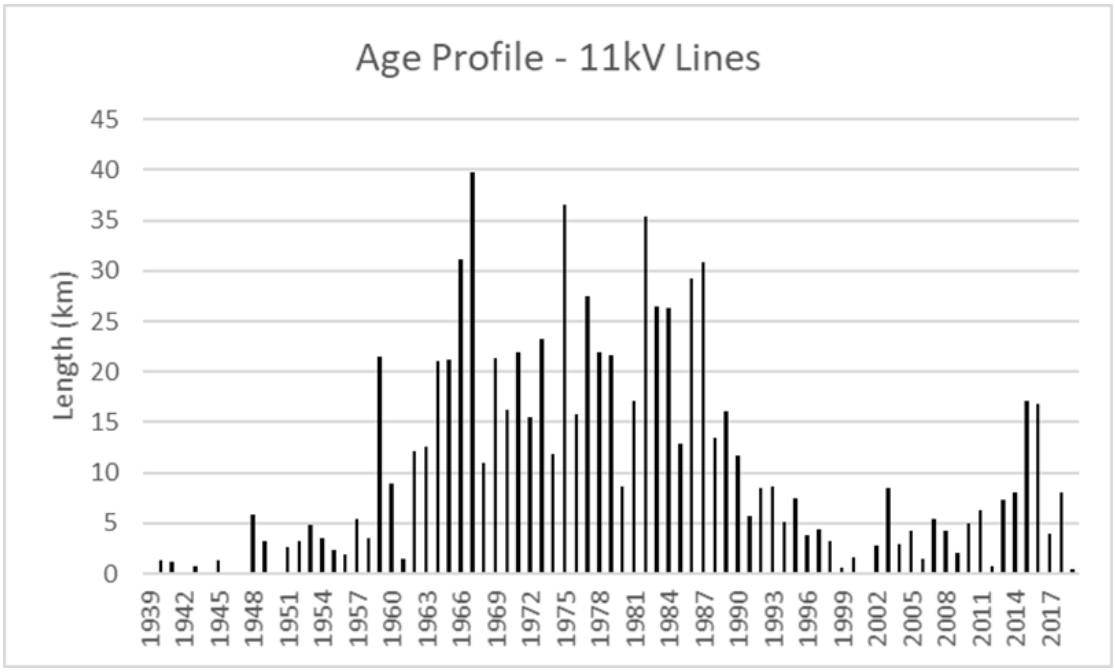
Key features of Electra's overhead conductor management are as follows.

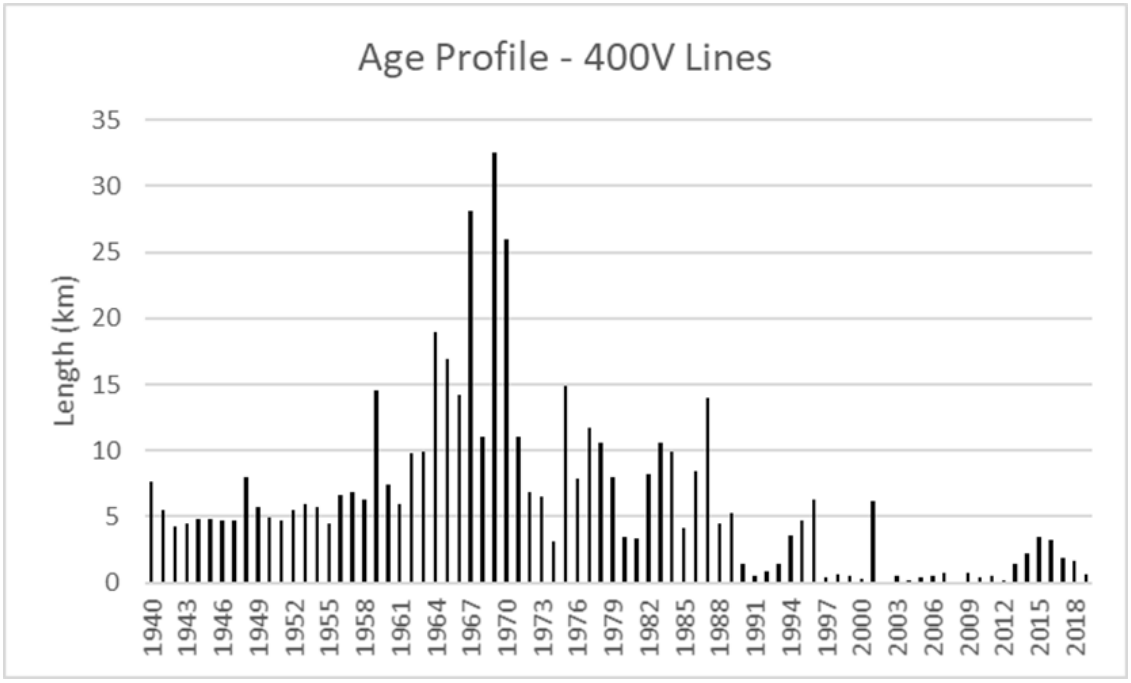
Summary of asset class

Electra has 151 km of 33kV overhead conductor, 845 km of 11kV overhead conductor, and 524 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%	87.9%	2.6%		4	10.0%
11kV conductor		8.20%	82.4%	9.40%		3	8.5%
LV conductor		3.0%		2.3%	94.70%	2	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 deep 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 & programmes

Projects & programmes 2019/20

Ref	Location	Description	Category	Cost
1	All	400V Reconductors	Renewal	$525,000
2	All	Carry Over Bucket	Renewal	$200,000
3	All	Inspection Driven Conductor Replacements	Renewal	$51,000
4	Union St, Foxton	Reconfigure structures outside Foxton Substation	Renewal	$250,000
5	Manakau STH RD, Otaki	Replace 2.5km of 16mm Cu with Bee	Renewal	$240,000
6	Donovan RD, Paraparamu	Replace 25mm Cu with Gopher (0.3km)	Renewal	$42,000
7	Seddon St, Waikanae	Upgrade 1 km of line along Seddon Street	Renewal	$100,000
8	Bartholomew Rd, Levin	Upgrade 1.2km of Cu along Bartholomew and Middlesex Street	Renewal	$115,000
9	Oturoa Rd, Levin	Upgrade 1.2km to Bee SH1-Otruroa till ABS F8 & change it to an Entec	Renewal	$155,000
10	Johnston St, Foxton	Upgrade 600m of Rango with Bee up to c172 CB	Renewal	$75,000
11	SH57, Shannon	Upgrade 700m of Cu on from end of feeder up to pole 43515Z	Renewal	$95,000
12	Seaview Rd, Paraparaumu	Upgrade 700m of line along Seaview Road	Renewal	$80,000
13	Winchester St, Levin	Upgrade 950m OF Cu along Winchester street/Roosevelt Street	Renewal	$100,000

Projects & programmes 2020/21 to 2023/24

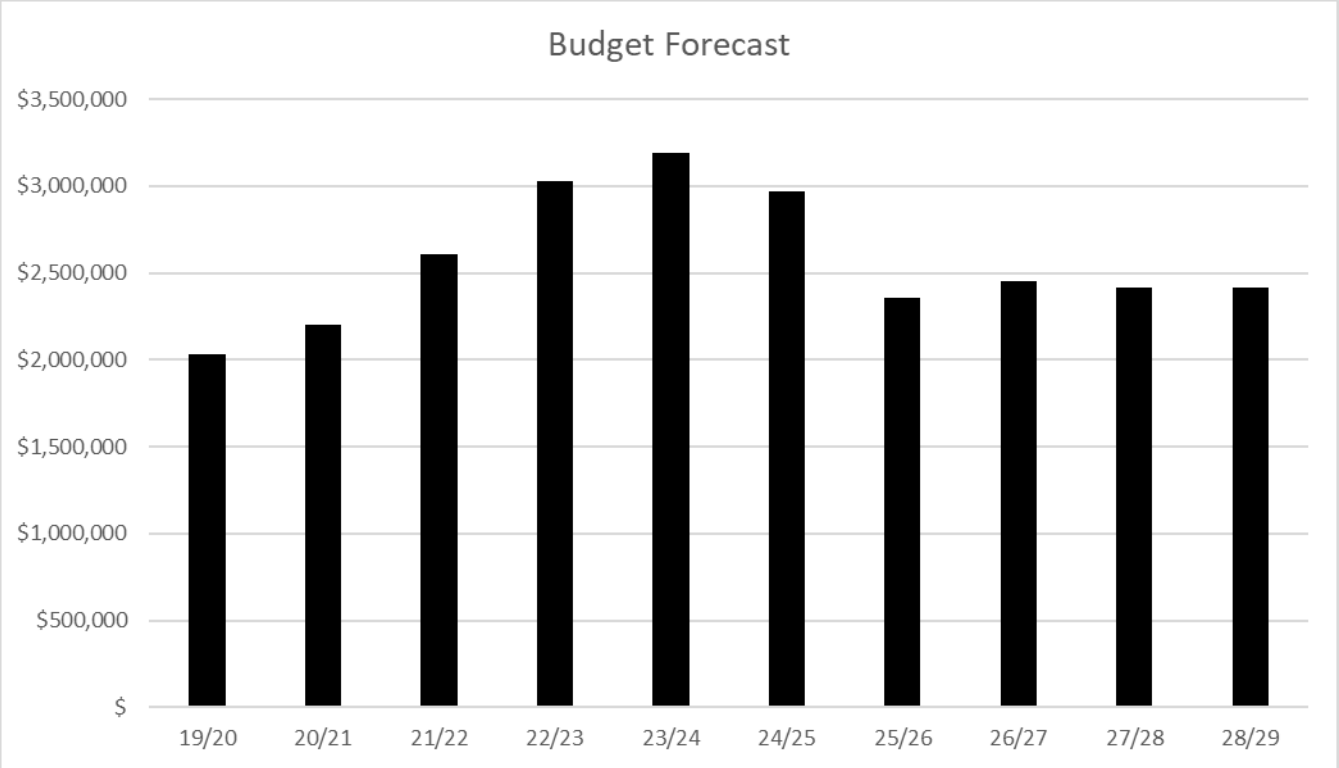
Ref	Location	Description	Category	Cost
1	All	400V Reconductors	renewal	$2,100,000
2	All	Inspection Driven Conductor Replacements	renewal	$1,252,000
3	Kuku beach road	Upgrade 2km of Cu along Kuku beach road-swan arms	renewal	$200,000
4	H219 to L224	Check conductor size upgrade to Bee	renewal	$480,000
5	Te Manuao Rd	Replace 16mm Cu with Bee (1km)	renewal	$110,000
6	Valley Rd	Replace 16mm Cu with Gopher (1.5km)	renewal	$150,000
7	Rata Rd	Replace 16mm Cu with Gopher (1km)	renewal	$90,000
8	Lindsay Rd	Replace 16mm Cu with Gopher (2km)	renewal	$180,000
9	Foxton Shannon Rd	Replace 35mm Cu with Bee	renewal	$1,227,000
10	Stafford Street	Upgrade 2km of Cu along Stafford Street	renewal	$400,000
11	Donovan Rd	Replace 25mm Cu with Gopher (0.3km)	renewal	$92,000
12	Domain Rd	Replace 16mm Cu with Gopher (0.5km)	renewal	$41,000
13	Otaihanga Rd	Replace 16mm Cu with Gopher (1.5km)	renewal	$92,000
14	Whakahoro Rd	Replace 16mm Cu with Gopher (1km)	renewal	$61,000
15	Old Hautere Rd	Replace 16mm Cu with Gopher (2km)	renewal	$123,000
16	Bryce St	Replace 16mm Cu with Gopher (2km)	renewal	$123,000
17	Kuku Beach Rd	Replace 16mm Cu with Gopher (4km)	renewal	$245,000
18	SH1 South	Replace 25mm Cu with Bee	renewal	$511,000
19	School Rd	Replace 16mm Cu with Bee (3km)	renewal	$307,000
20	Hautere Cross Rd	Replace 16mm Cu with Bee (4km)	renewal	$307,000
21	Puriri St	Replace 16mm Cu with Gopher (1.5km)	renewal	$123,000
22	Tui Cres	Replace 16mm Cu with Gopher (1km)	renewal	$82,000
23	Engles Rd	Replace 16mm Cu with Gopher (2km)	renewal	$123,000
24	Vista Rd, McLeavy Rd	Replace extension arms, reconductor and connect	renewal	$153,000
25	SH1 Waitarere Beach Rd to Koputaroa Rd	Replace Mink with Bee (2.5km)	renewal	$153,000
26	Mangahao to Levin East 33Kv	Upgrade to Butterfly double circuit	renewal	$1,800,000
27	Newth Rd	Reconductor with Bee	renewal	$511,000

Projects & programmes 2024/25 to 2028/29

Ref	Location	Description	Category	Cost
1	All	400V Reconductors	Renewal	$2,925,000
2	All	Inspection Driven Conductor Replacements	Renewal	$8,655,000
3	Ngaio Rd	Replace 16mm Cu with Bee	Renewal	$123,000
4	Mangahao to Levin East 33kV	Upgrade to Butterfly double circuit	Renewal	$900,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	2,028k	2,202k	2,610k	3,030k	3,193k	2,966k	2,355k	2,455k	2,414k	2,414k



6.4 Pole-top hardware

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

Summary of asset class

Electra has 41,024 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	6,601	Each	14.64%	
Soft wood	71	Each	0.16%	
Tallow wood	34,297	Each	76.39%	
Steel	165	Each	0.37%	
Steel box section	3,849	Each	8.54%	
Polymer	42	Each	0.09%	
Unknown	13	Each	0.03%	
Total	**45,038**	**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 flat 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 & programmes

Projects & programmes 2019/20

#	Location	Description	Category	Cost
1	All	Fault/Urgent defect replacement of cross arms	Renewal	$81,566
2	All	Inspection Driven Crossarm Replacements-11kV	Renewal	$780,000

#	Location	Description	Category	Cost
3	All	Inspection Driven Crossarm Replacements-400V	Renewal	$620,000
4	All	Inspection Driven Crossarm Replacements- 33kV	Renewal	$200,000

Projects & programmes 2020/21 to 2023/24

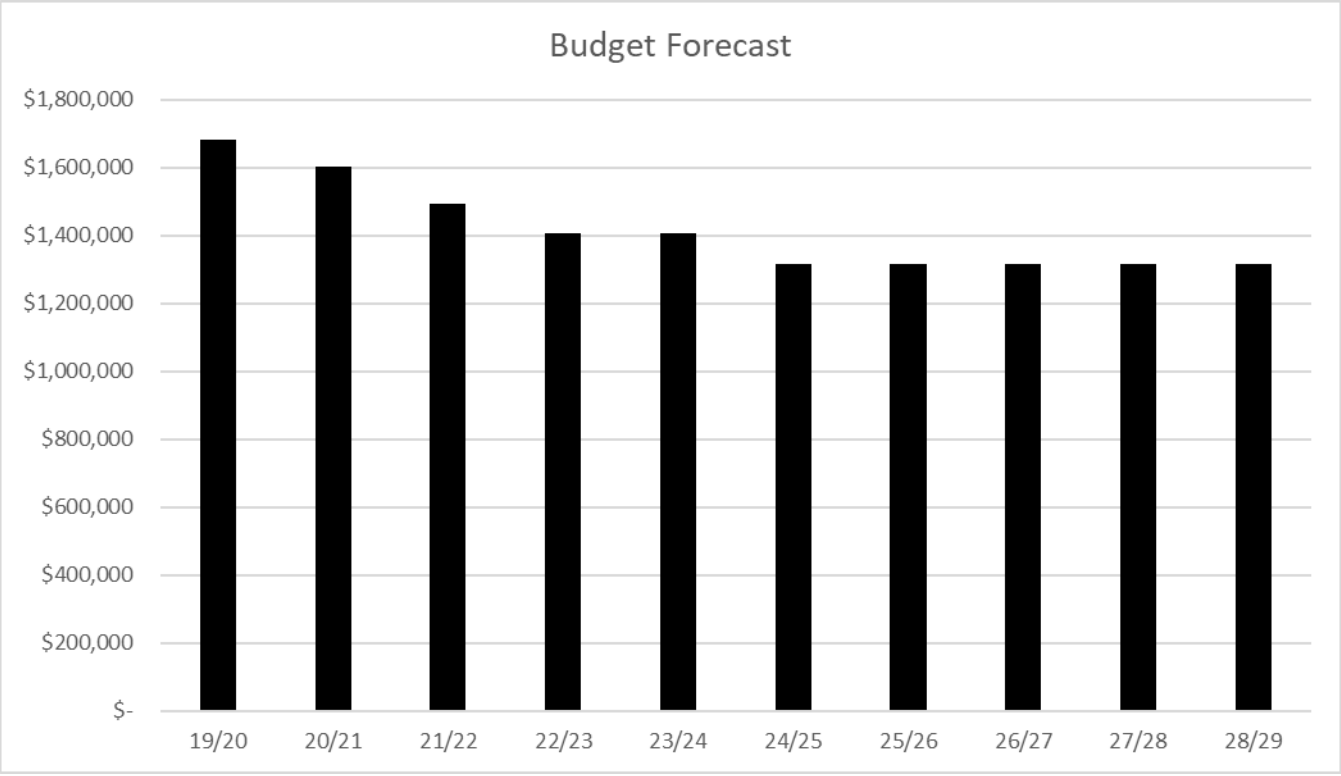
#	Location	Description	Category	Cost
1	All	Inspection Driven Cross arm Replacements – 11kV	Renewal	$2,700,000
2	All	Inspection Driven Cross arm Replacements – 400V	Renewal	$2,081,000
3	All	Inspection Driven Cross arm Replacements – 33kV	Renewal	$800,000
4	All	Fault/Urgent defect replacement of cross arms	Renewal	$326,000

Projects & programmes 2024/25 to 2028/29

#	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	$538,300
4	All	Fault/Urgent defect replacement of cross arms	Renewal	$408,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$1.681m	$1.601m	$1.492m	$1.407m	$1.407m	$1.315m	$1.315m	$1.315m	$1.315m	$1.315m



6.5 33kV cable

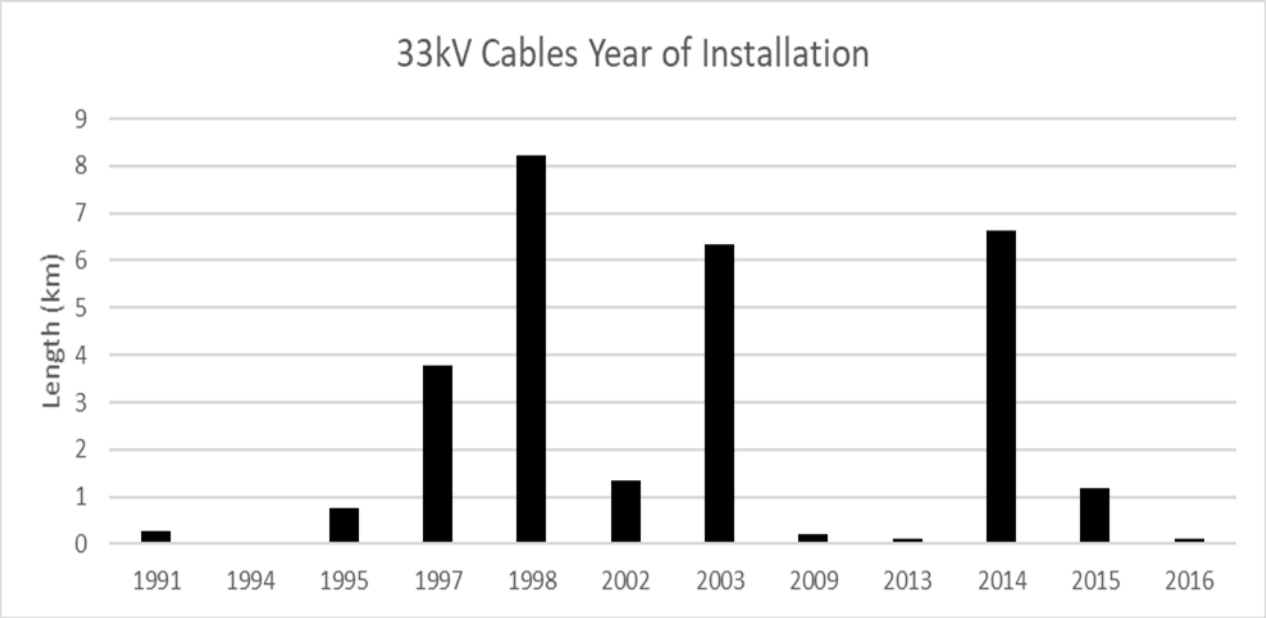
Key features of Electra's 33kV cable fleet are as follows.

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 mm² aluminium XLPE	6.1	km	20.8%	
630 mm² aluminium XLPE	17.7	km	60.1%	
800 mm² aluminium XLPE	5.6	km	19.1%	
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 & programmes

No major 33kV cable projects or programmes are planned.

6.6 11kV cable

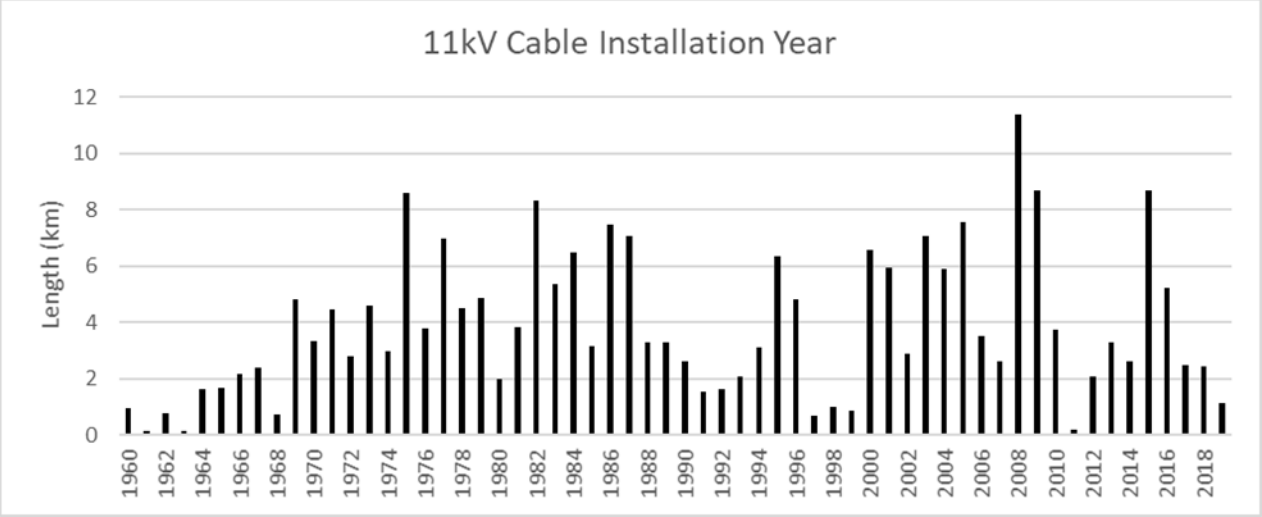
Key features of Electra's 11kV cable management are as follows.

Summary of asset class

Electra has 237 km of 11kV cable.

Population and age profile

Sub-class	Number	Unit	Percent	Key features of sub-class
PILC	119	km	50.2%	
XLPE, PVC or HDPE	118	km	49.8%	
Total	**237**	**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	-	-	91.20%	8.8%	-	3	-
PILC	-	2.0%	98%	-	-	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 & programmes

Projects & programmes 2019/20

Ref	Location	Type of Work	Category	Cost
1	All	Design Line/Cable Jobs	Renewal	$150,000
2	All	Replace pitch filled potheads with Raychem terminations	Safety	$60,000
3	All	Fault/Urgent defect replacement of 11kV cables	Renewal	$60,000

Projects & programmes 2020/21 to 2023/24

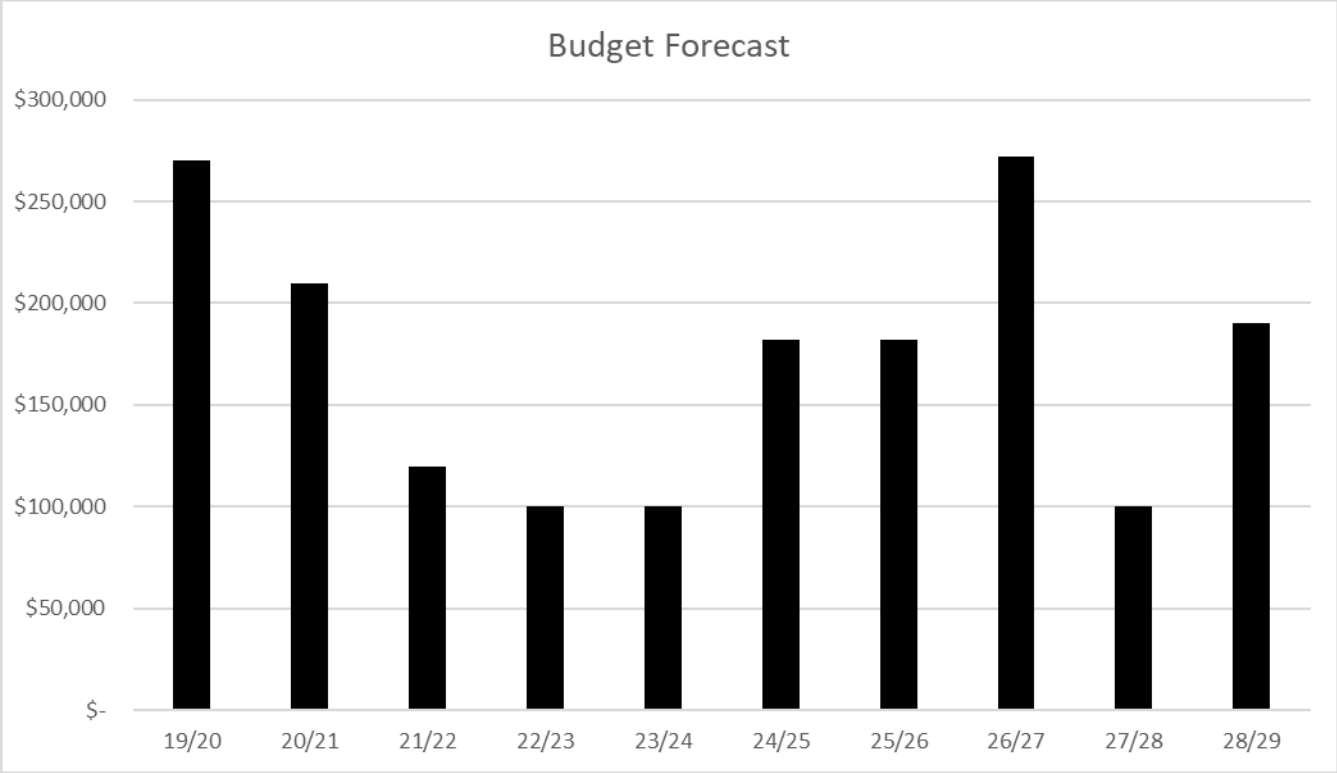
Ref	Location	Type of Work	Category	Cost
1	Bath St, Levin	Replace 11kV cable E313-E83	Renewal	$90,000
2	All	Replace pitch filled potheads with Raychem terminations	Safety	$200,000
3	All	Fault/Urgent defect replacement of 11kV cables	Renewal	$240,000

Projects & programmes 2024/25 to 2028/29

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	$200,000
3	All	Fault/Urgent defect replacement of 11kV cables	Renewal	$480,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$270k	$210k	$120k	$100k	$100k	$182k	$182k	$272k	$100k	$190k



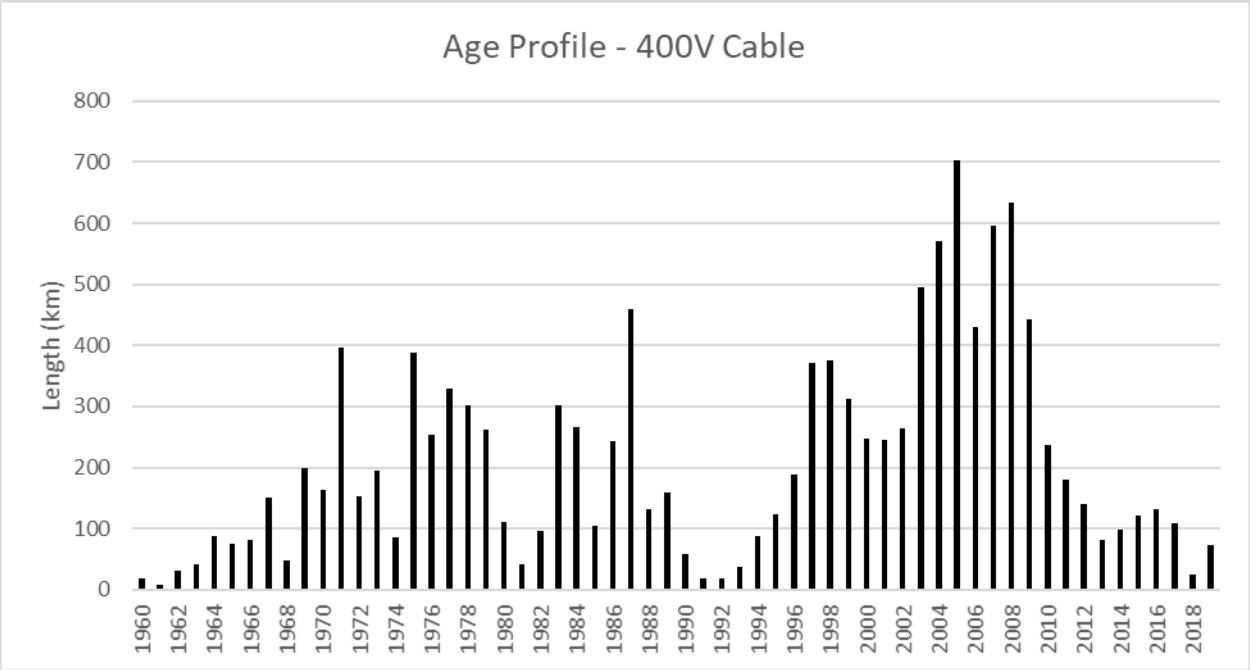
6.7 LV cable

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

Summary of asset class

Electra has 494 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
			35.00%	9.00%	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 & programmes

Projects & programmes 2019/20

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

Projects & programmes 2020/21 to 2023/24

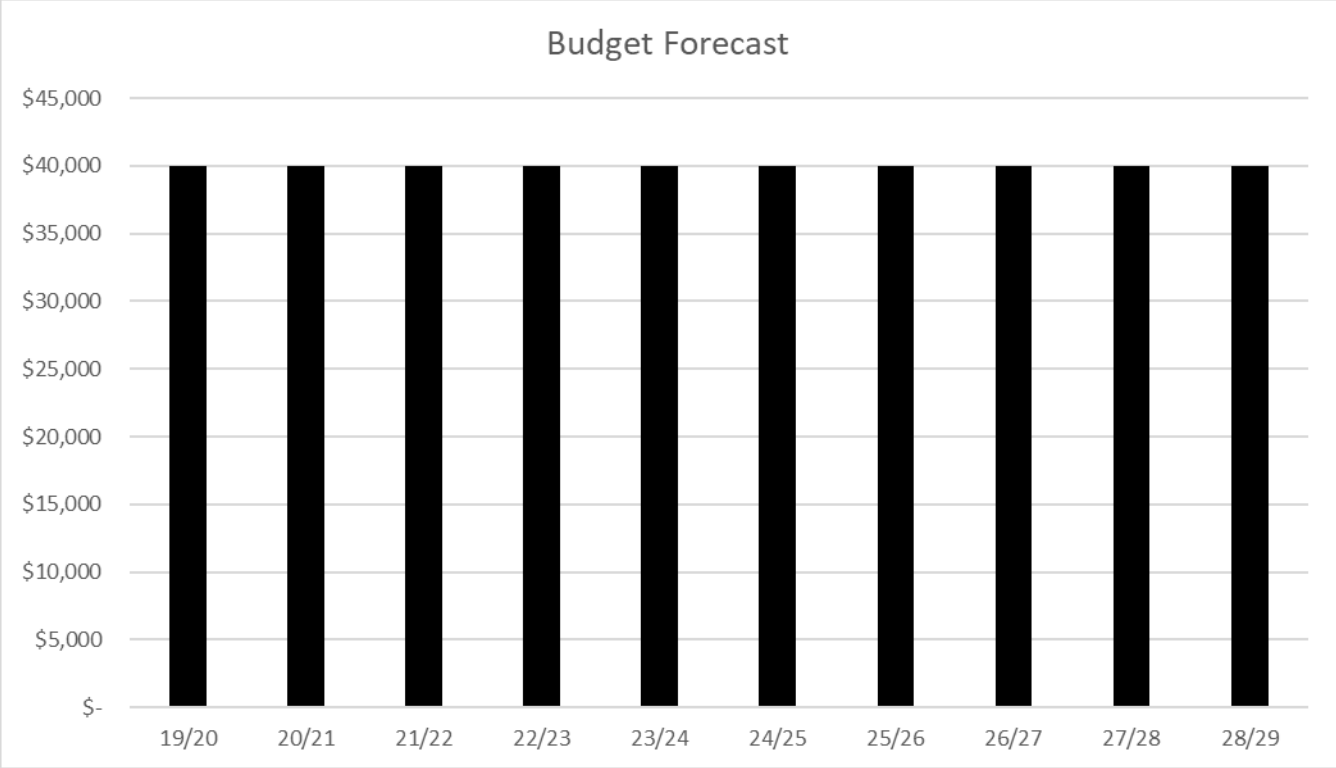
Ref	Location	Type of Work	Category	Cost
1	All	Fail/Urgent defect replacement of 400V/Streetlight cables	Renewal	$160,000

Projects & programmes 2024/25 to 2028/29

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

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$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.

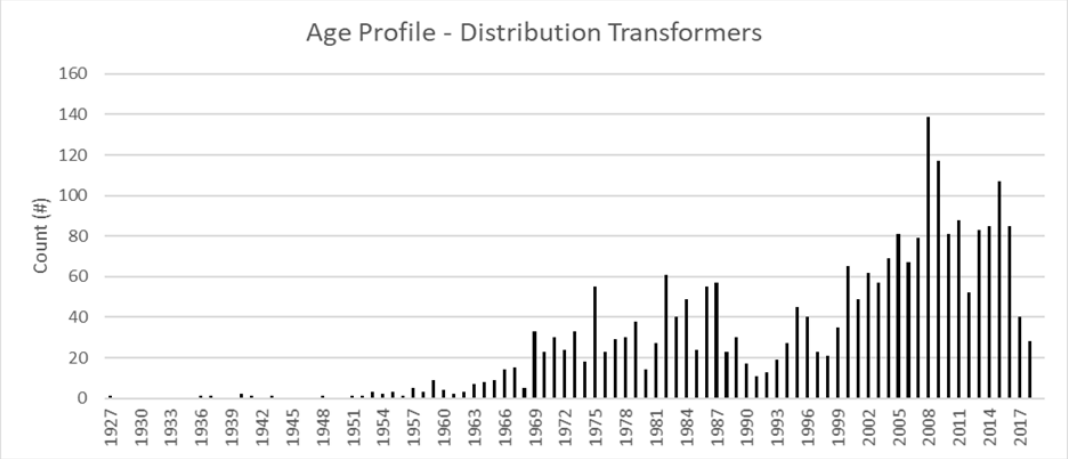
Summary of asset class

Electra has 1,603 overhead distribution transformers and 942 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	21	0	21
1-phase 30kVA	8	1	9
1-phase 50kVA	0	0	0
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	78	0	78

Substation Rating	Pole Mounted (Quantity)	Ground Mounted (Quantity)	Total (Quantity)
3-phase 25kVA	7	0	7
3-phase 30kVA	869	28	897
3-phase 50kVA	358	58	416
3-phase 75kVA	2	0	2
3-phase 100kVA	214	106	320
3-phase 150kVA	2	1	3
3-phase 200kVA	25	214	239
3-phase 250kVA	0	19	19
3-phase 300kVA	4	408	412
3-phase 500kVA	0	85	85
3-phase 750kVA	0	14	14
3-phase 1000kVA	0	8	8
Total	**1, 603**	**942**	**2,545**

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	-	4.0%	74.0%	22.00%	-	4	4.0%
Ground mounted	-	4%	55%	41%	-	4	4.0%

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 & programmes

Projects & programmes 2019/20

Ref	Location	Constraint Description	Category	Cost
1	All	Ground Transformer Replacements	Renewal	$600,000
2	Totara St	Upgrade transformer room G177	Renewal	$100,000
3	All	Pole Transformer Replacements	Renewal	$182,000
4	All	Ground Transformer Faults	Renewal	$150,000

Ref	Location	Constraint Description	Category	Cost
5	All	Pole Transformer Faults	Renewal	$105,000
6	Gladstone Rd	Rebuild deck transformer G334	Safety	$45,000
7	Gladstone Rd	Rebuild deck transformer G76	Safety	$45,000

Projects & programmes 2020/21 to 2023/24

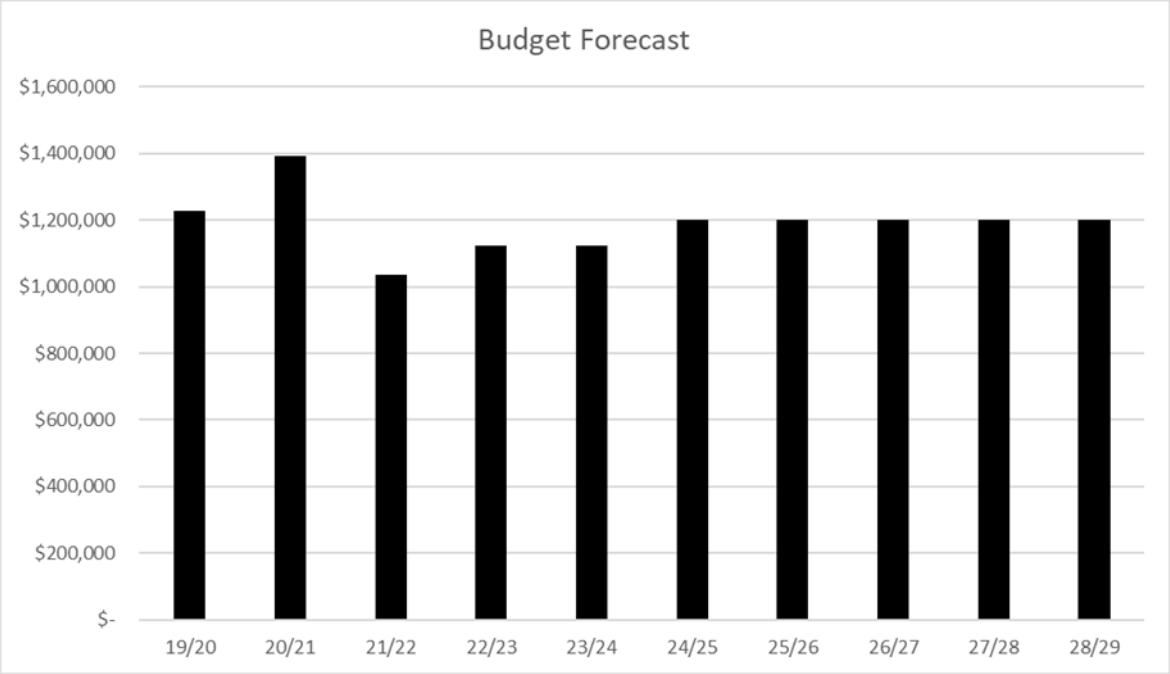
Ref	Location	Constraint Description	Category	Cost
1	All	Ground Transformer Replacements	Renewal	$2,400,000
2	Kimberley Rd	Upgrade transformer room G97	Renewal	$100,000
3	Bruce Rd	Upgrade transformer room H176	Renewal	$100,000
4	All	Pole Transformer Replacements	Renewal	$728,000
5	Kirk St	Replace deck transformer M12	Renewal	$85,000
6	S133	Replace with ground mount Transformer Check	Renewal	$72,000
7	All	Ground Transformer Faults	Renewal	$600,000
8	All	Pole Transformer Faults	Renewal	$420,000
9	Whirokino Rd	Rebuild deck transformer C23	Safety	$85,000
10	Tararua Rd	Replace deck transformer G326 with single pole 200kVA	Safety	$85,000

Projects & programmes 2024/2 to 2028/29

#	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	$817,690

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$1.227m	$1.394m	$1.037m	$1.122m	$1.122m	$1.201m	$1.201m	$1.201m	$1.201m	$1.201m



6.9 Distribution switchgear

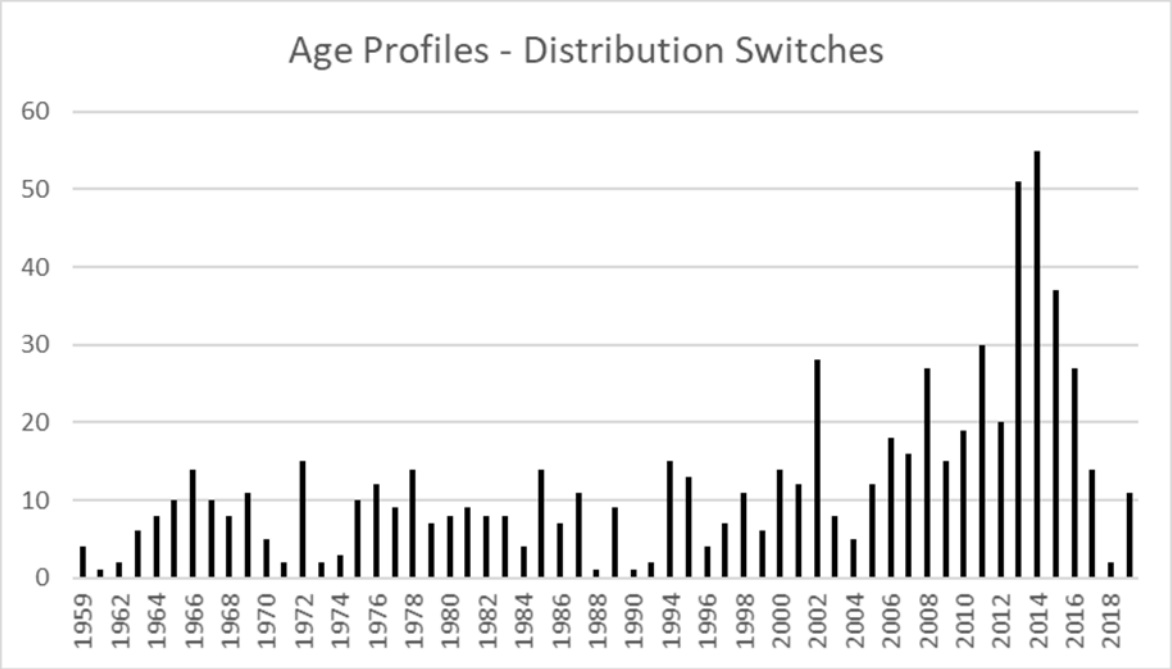
Key features of Electra's distribution switchgear management are as follows.

Summary of asset class

Electra has 2,573 individual items that are broadly classified as distribution switches.

Population and age profile

Sub-class	Number	Percent
Ground mount switches	148	5.8%
Auto reclosers	43	1.7%
Air break switches	343	13.3%
In-line drop-out fuses	2039	79.2%
Total	**2,573**	**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)		2.50%	77.50%	20.00%		4	2.50%
Indoor circuit breakers		5.12%	76.88%	18.00%		4	5.20%
Pole mounted switches & fuses		3.50%	90.5%	6.00%		3	4.500%
Ring main units		6.0%	88.50%	5.5%		3	6.5%

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 & programmes

Projects & programmes 2019/20

Ref	Location	Description	Category	Cost
1	All	Replace oil switches	Renewal	$250,000
2	All	Urgent DDO/ABS Replacement	Renewal	$30,000
3	All	ABS new & renewals	Renewal	$110,000

Projects & programmes 2020/21 to 2023/24

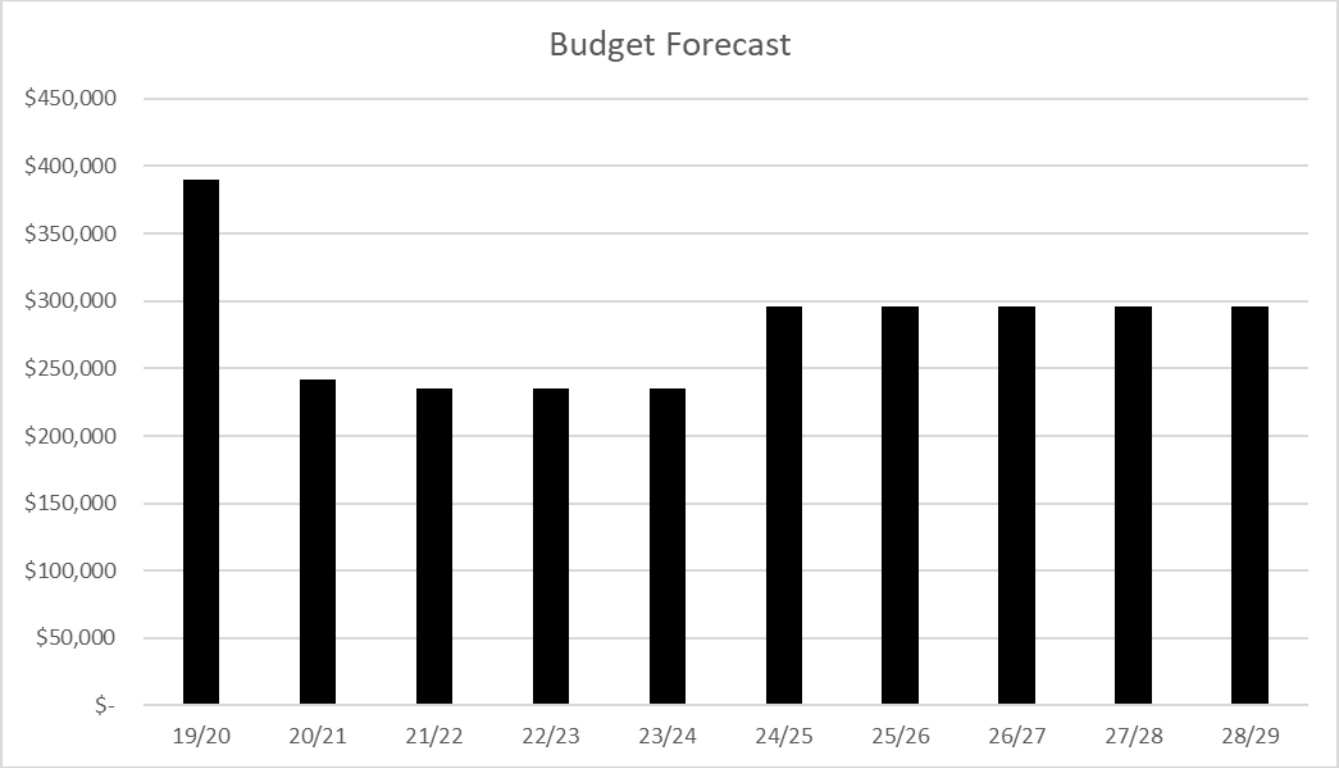
Ref	Location	Description	Category	Cost
1	All	Replace Ring Main Units	Renewal	$498,000
2	All	ABS new & renewals	Renewal	$328,000
3	All	Urgent DDO/ABS Replacement	Renewal	$120,000

Projects & programmes 2024/25 to 2028/29

Ref	Location	Description	Category	Cost
1	All	Replace Ring Main Units	Renewal	$920,000
2	All	ABS new & renewals	Renewal	$410,000
3	All	Urgent DDO/ABS Replacement	Renewal	$150,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$390k	$242k	$235k	$235k	$235k	$296k	$296k	$296k	$296k	$296k



6.10 Zone substation transformers

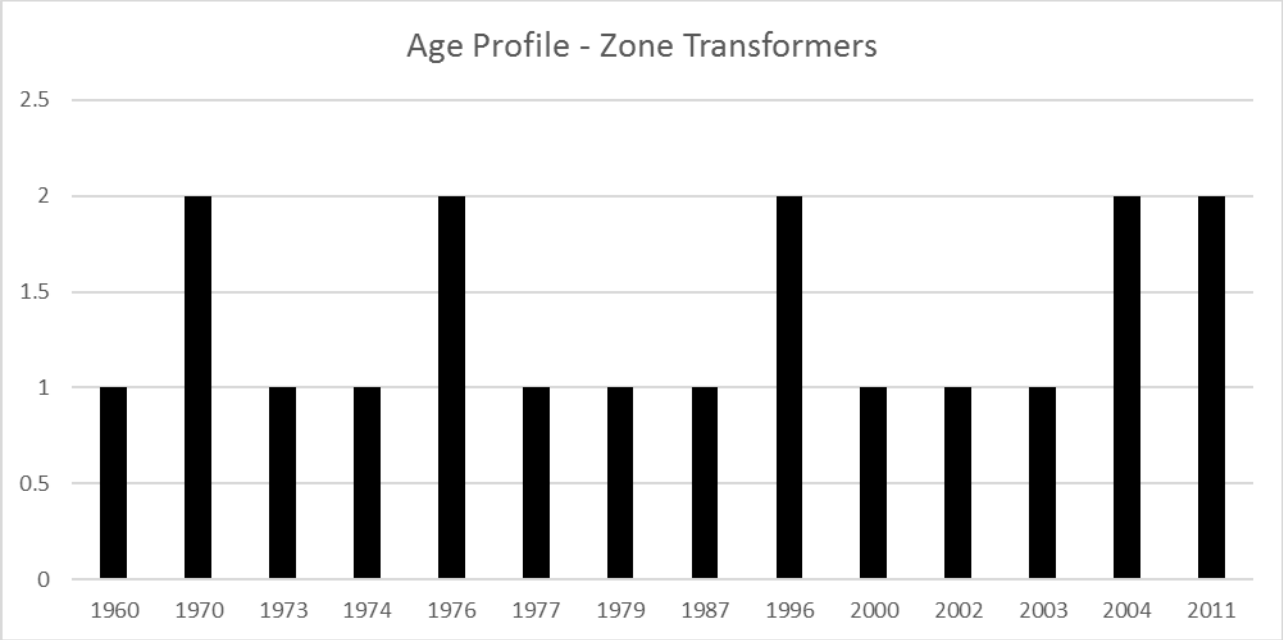
Key features of Electra's zone substation transformers management are as follows.

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 systemic 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 & programmes

Projects & programmes 2019/20

None

Projects & programmes 2020/21 to 2023/24

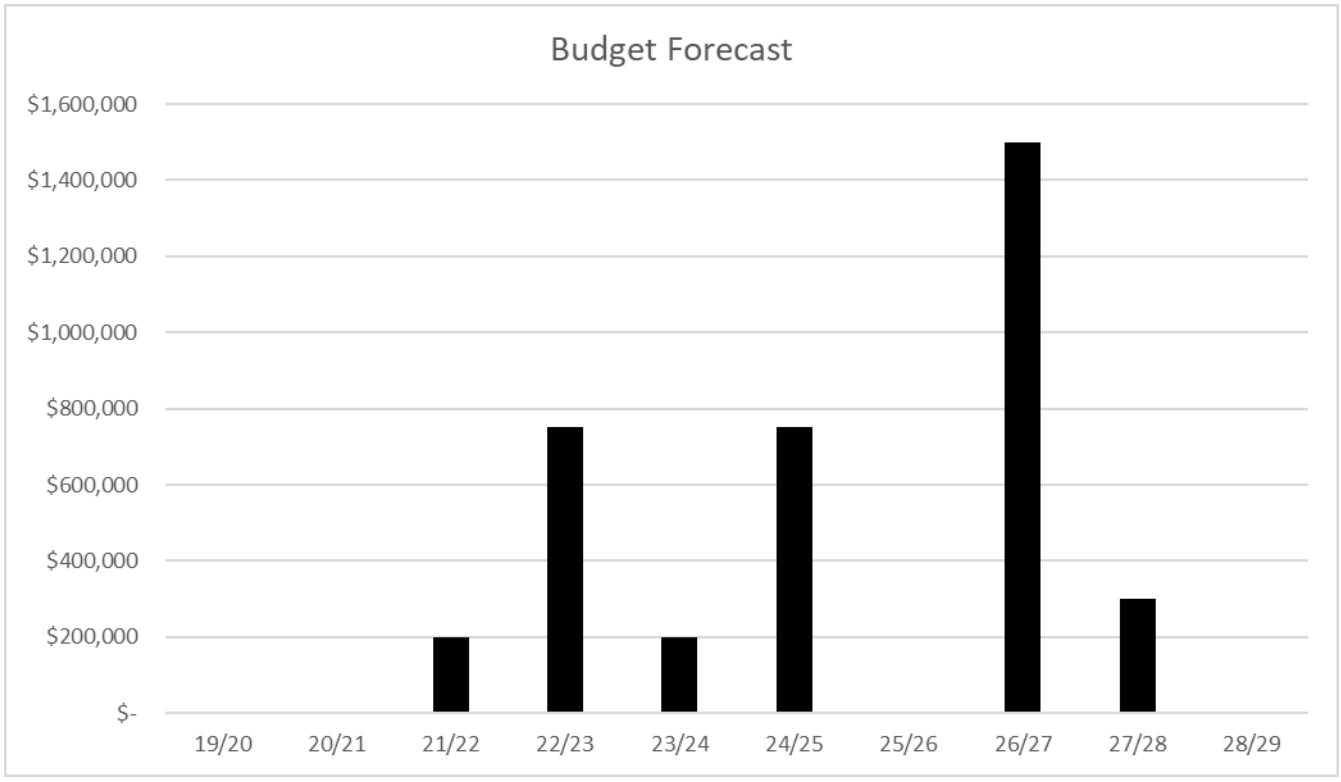
#	Location	Description	Category	Cost
1	Levin East Substation	Power Transformer Replacement	Renewal	$950,000
2	Paekakariki Substation	Power Transformer Replacement	Renewal	$200,000

Projects & programmes 2024/25 to 2028/29

#	Location	Description	Category	Cost
1	Paekakariki Substation	Power Transformer Replacement	Renewal	$750,000
2	Paraparaumu Substation	Power Transformer Replacement	Renewal	$900,000
3	Levin East Substation	Power Transformer Replacement	Renewal	$900,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$0	$0	$200	$750k	$200k	$750k	$0	$1,500k	$300k	$0



6.11 Zone substation switchgear

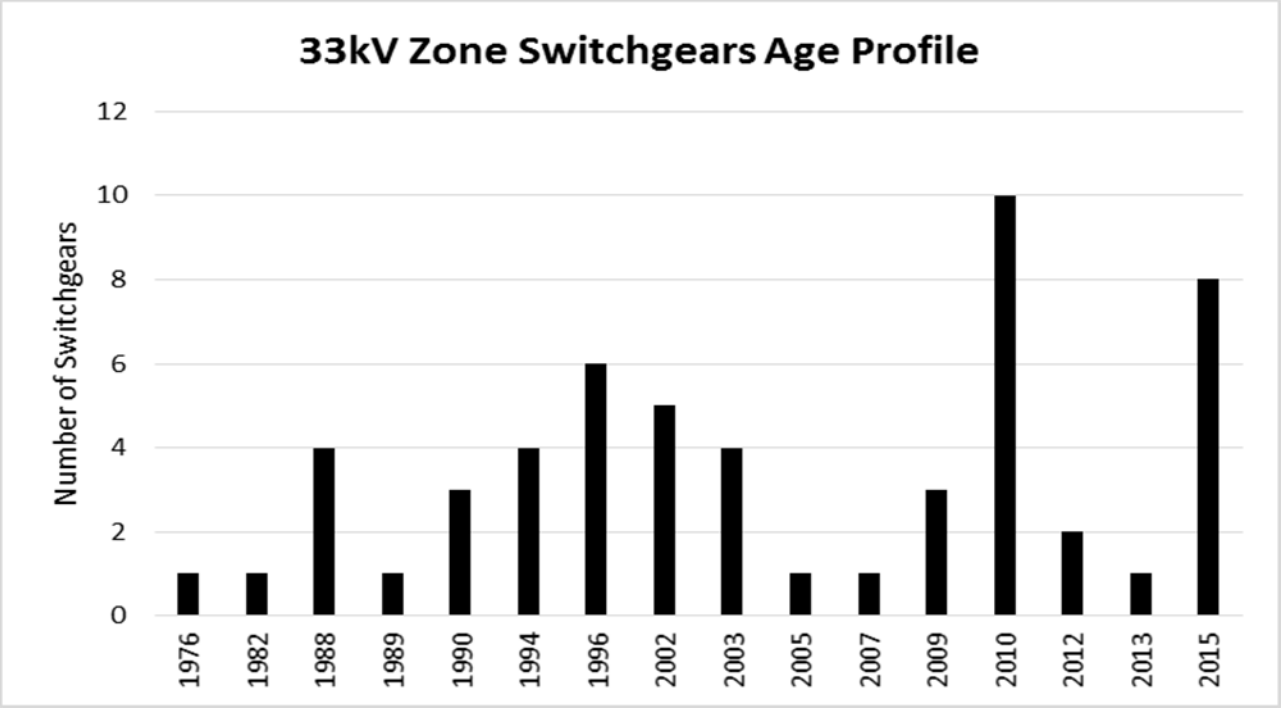
Key features of Electra's zone substation switchgear management are as follows.

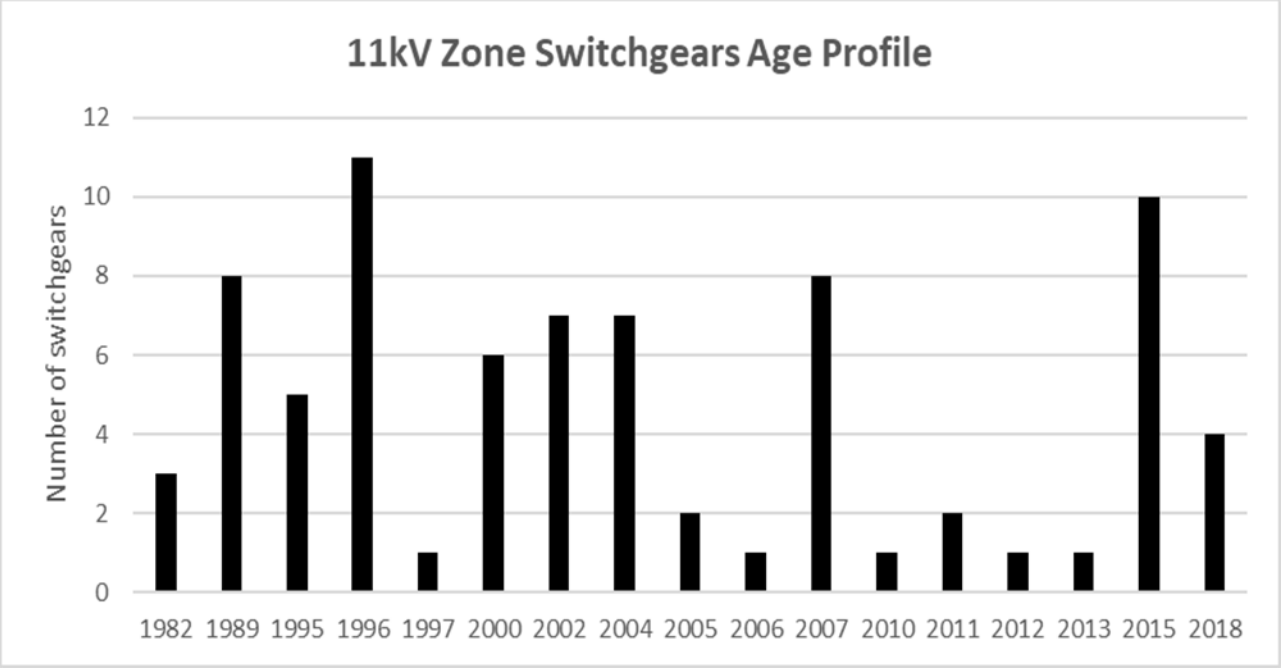
Summary of asset class

Electra has 56 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	26.12%	
33kV SF6 (outdoor)	21	Each	15.67%	
11kV oil	3	Each	2.24%	
11kV vacuum	67	Each	50.00%	
11kV SF6	8	Each	5.97%	
Total	**134**		**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		5.00%	75.00%	20.00%		3	5.0%

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 & programmes

Projects & programmes 2019/20

Ref	Location	Description	Category	Cost
1	All	Unplanned Capital	Renewal	$31,000

Projects & programmes 2020/21 to 2023/24

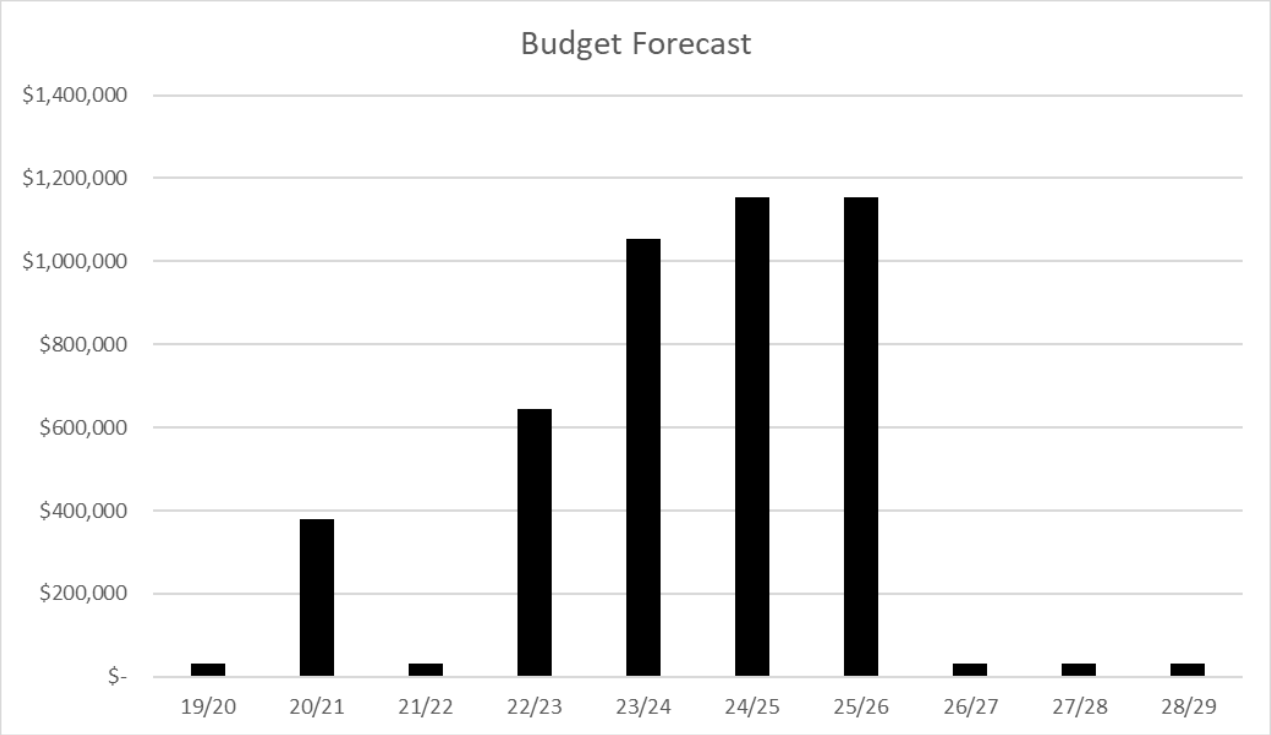
#	Location	Description	Category	Cost
1	All	Unplanned Capital	Renewal	$122,000
2	Paekakariki Substation	CB replacement	Renewal	$350,000
3	Matai Rd, Raumati	Rebuild Substation	Renewal	$1,635,000

Projects & programmes 2024/25 to 2028/29

#	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	$1,022,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$31k	$381k	$31k	$644k	$1,053k	$1,115k	$1,155k	$31k	$31k	$31k



6.12 Load control plant

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

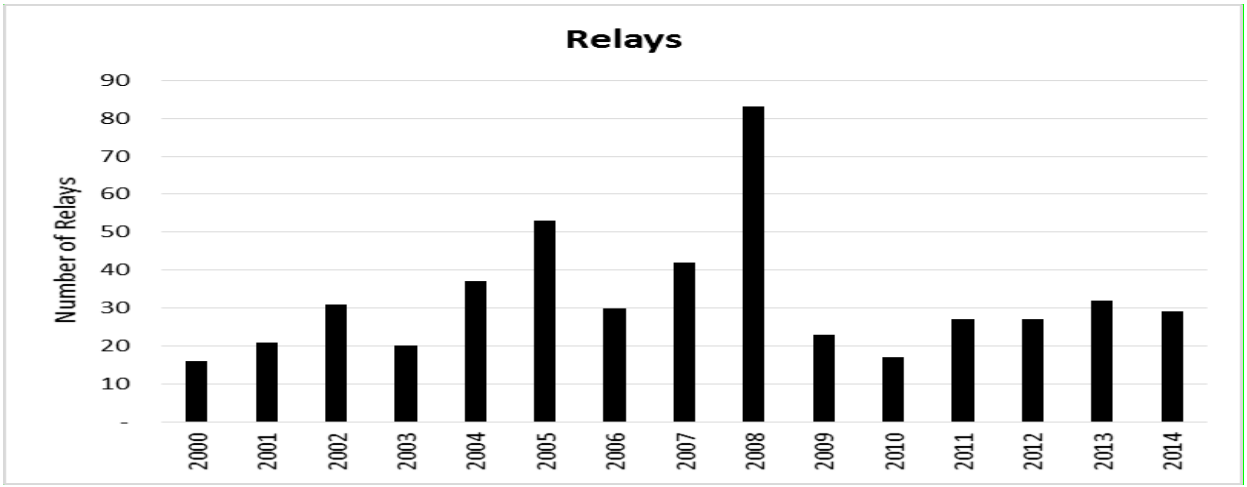
Summary of asset class

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 & programmes

There are no major load control or relay programmes 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

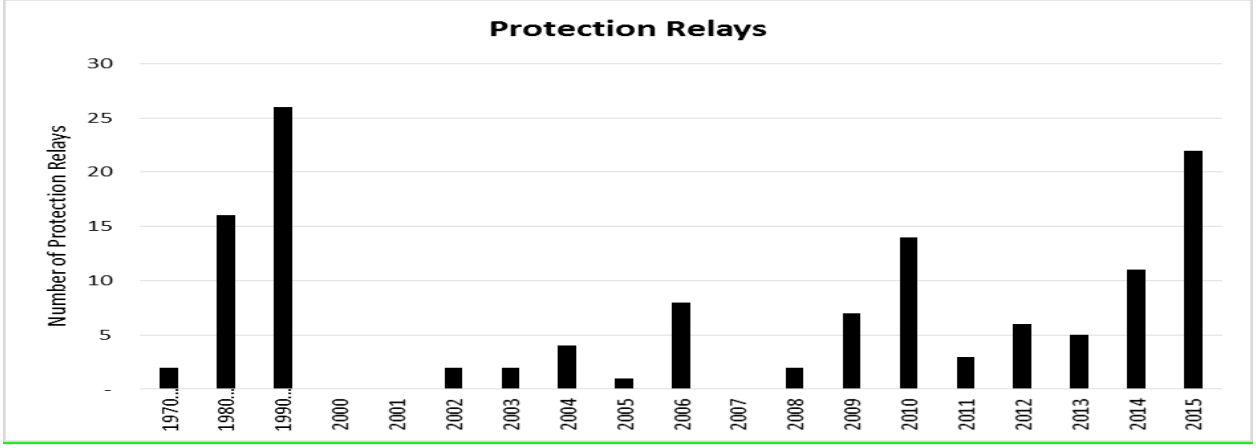
Electra's key protection systems include…

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.

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 & programmes

Projects & programmes 2019/20

None

Projects & programmes 2020/21 to 2023/24

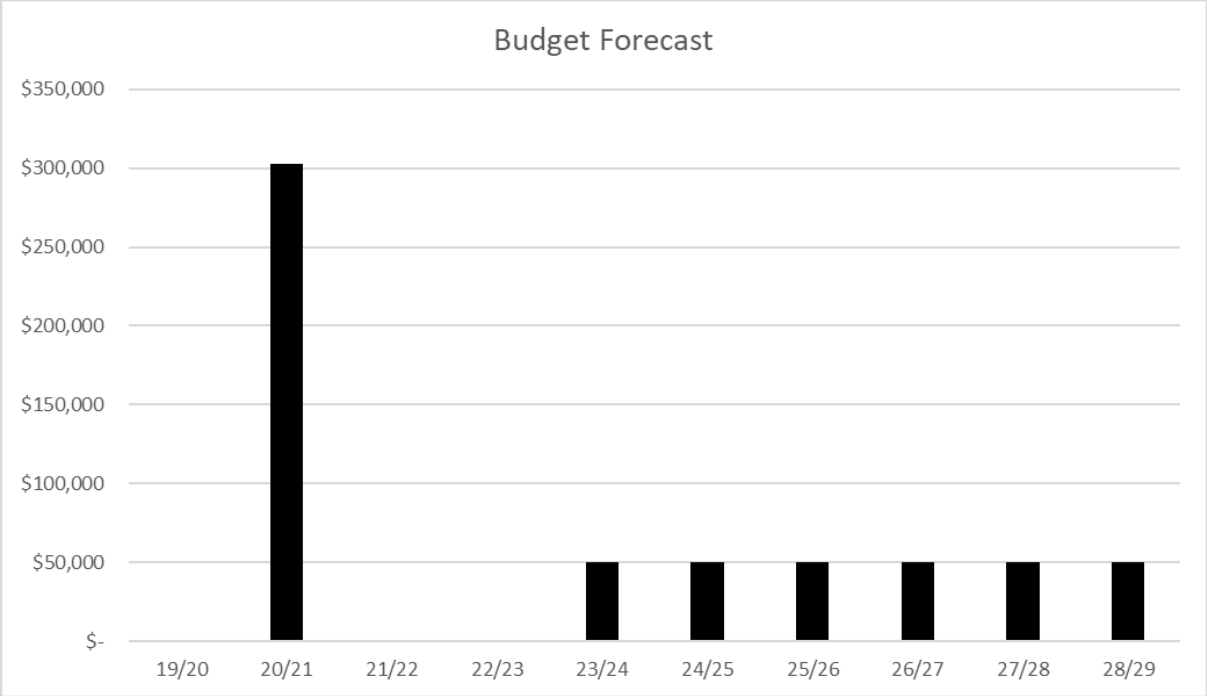
Ref	Location	Description	Category	Cost
1	All	33kV protection	Renewal	$50,000
2	Zone Substations	Arc Flash Protection	Safety	$303,000

Projects & programmes 2024/25 to 2028/29

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

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$0k	$303k	$0k	$0k	$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 (Catapult) 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 & programmes

Projects & programmes 2019/20

#	Location	Description	Category	Cost
1	Control Centre	SCADA upgrade	Renewal	$175,000
2	All	Comms general- FMS	Renewal	$300,000

Projects & programmes 2020/21 to 2023/24

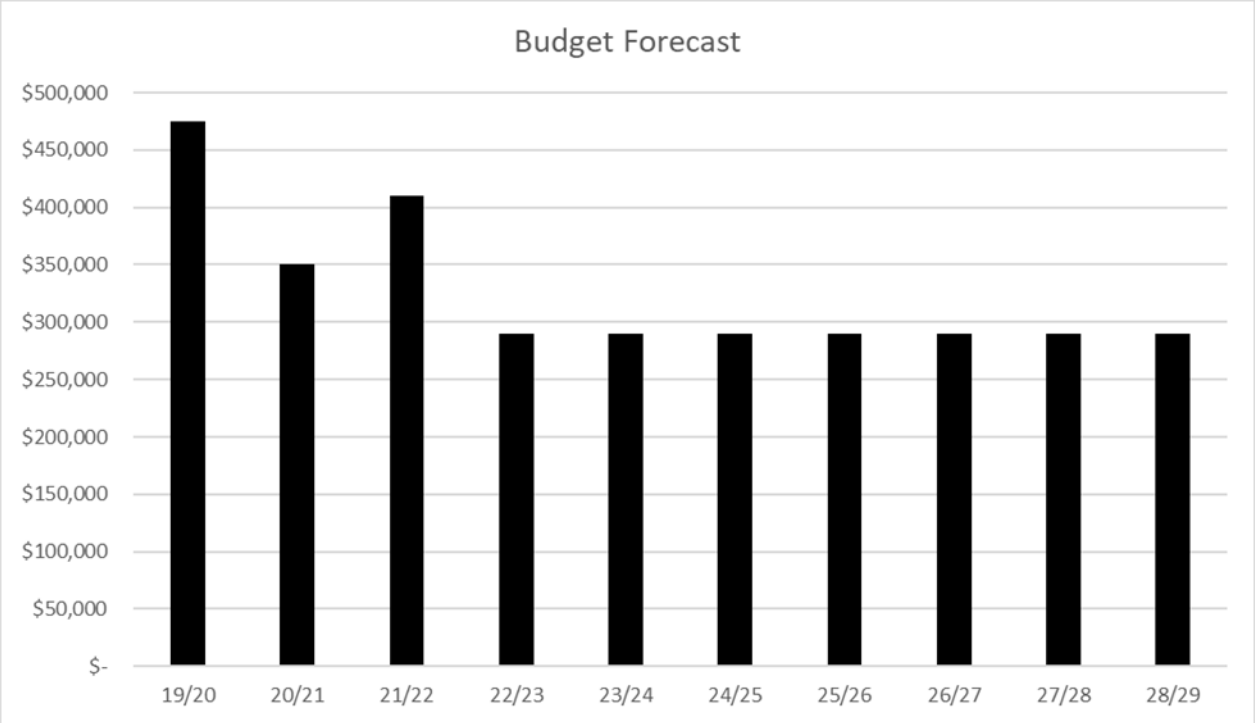
Ref	Location	Description	Category	Cost
1	Control Centre	Scada upgrade	Renewal	$700,000
2	All	Comms general- FMS	Renewal	$640,000

Projects & programmes 2024/25 to 2028/29

Ref	Location	Constraint Description	Category	Cost
1	Control Centre	Scada upgrade	Renewal	$875,000
2	All	Comms general- FMS	Renewal	$575,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$503k	$378k	$438k	$318k	$318k	$318k	$318k	$318k	$318k	$318k



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

Electra, through the ENA, is submitting suggested changes to the Electricity (Hazards from trees) Regulations to reduce the current high cost of vegetation management.

Capacity, security & reliability constraints

Not applicable.

Key design parameters

Not applicable.

Management tactics

Maintenance drivers

- Safety to the public, to customers, and to Electra personnel.
- Mitigate 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

- Graded by encroachment and estimated time to reach encroachment zone; one year, three years.

Defect correction

- Public safety defects – mitigations established and corrective action scheduled within 1 week of identification.
- Early engagement with customers during survey encouraging proactive management prior to encroachment.
- Within notice zones; target timelines as set out in Electricity (Hazards from Trees) Regulations

Refurbishment

- Not applicable.

Renewal

- Customers are encouraged to replace fast growing species with slow growing natives.
- Low growing species such as toitoi 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 & programmes

During 2018 Electra has investigated methods and specific technologies for migrating its tree trimming from a responsive 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 closest to zone substations and out to the first automated switch. Feeder sections have been prioritised by the greatest improvement in vegetation based risk.

This programme has been enabled by insights developed from historical inspection data and Electra's geospatial network model.

Projects & programmes 2019/20

Ref	Location	Type of Work	Category	Cost

1	All	Vegetation control (not faults)	Vegetation	$1, 538,000

Projects & programmes 2020/21 to 2023/24

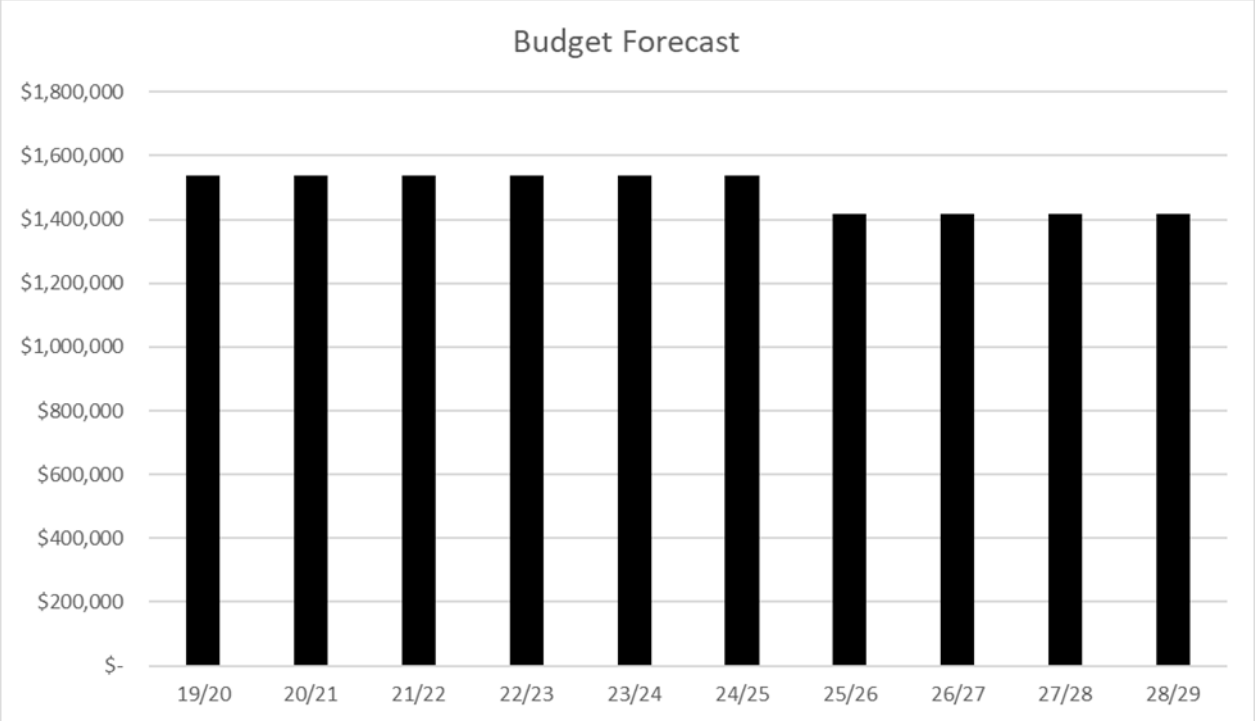
Ref	Location	Type of Work	Category	Cost
1	All	Vegetation control (not faults)	Vegetation	$6,150,000

Projects & programmes 2024/25 to 2028/29

Ref	Location	Type of Work	Category	Cost
1	All	Vegetation control (not faults)	Vegetation	$7,208,000

Budget forecast

Budget	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
	$1, 538	$1,538	$1,538	$1,538	$1,538	$1,538	$1,418	$1,418	$1,418	$1,418



6.16 Summary of inspections and maintenance

Inspections and maintenance for all asset classes are summarised below.

Operations & Maintenance (Current $000)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
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	120	145	145	145	145	-	-	-	-	-
Annual line inspection	105	70	70	80	34	34	80	34	34	80
Zone Substations										
Inspections	24	24	24	24	24	24	24	24	24	24
Planned Maintenance	411	368	368	368	399	368	368	368	368	368
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	- 14	- 14	- 14	- 14	- 14	- 14	- 14	- 14	- 14
Fault restoration	926	926	926	926	926	755	755	755	676	676
Vegetation control	1,538	1,538	1,538	1,538	1,538	1,538	1,418	1,418	1,418	1,418
Planned Transformer maintenance	142	142	142	142	142	142	142	142	142	142
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	203	207	208	209	209	209	209	209	209	209
Ripple Maintenance	19	19	19	19	19	19	19	19	19	19
Total Operations & Maintenance	**4,679**	**4,631**	**4,632**	**4,643**	**4,628**	**4,282**	**4,208**	**4,162**	**4,082**	**4,128**

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.	$355,900 (NBV)	Fault dispatch work would be disrupted Criticality would be about 12 hours.
	In-house outage management and job dispatch system.		Fault dispatch work would be disrupted. Criticality is about 12 hours.
	SCADA – iFix (Catapult, marketed by GE).	$1,866,000 (NBV)	Real-time operations would require manual HV switching. Criticality is minutes.
AM systems	NIMS – based on ESRI GIS, but largely in-house.	$1,357,000 (NBV)	Existing work could continue, but new jobs couldn't be created. Criticality is about 30 days.
	Milsoft ADMS suite	$347,000 (NBV)	
Buildings	• Head office (Levin). •	$1,388,000 (NBV)	• Head office critical over the long-term, but short-term alternatives for control room and other critical work have been established. •
Office furniture	• Desks & work stations • Chairs	$27,000 (NBV)	• Not critical as easily replaced.
Vehicles	• Cars • Vans • 2WD Utes • 4WD Utes	$77,000 (NBV)	• Not critical as alternatives can be arranged.
Tools, plant & machinery	• Hand tools • Power tools	$40,000 (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.

	Focus	Threat	ICT Initiatives in Response
External Factors	Opportunities	Customers seek accurate and timely info. Reduce procurement and operational costs Growth potential in subsidiaries New business in technology centric business	CRM, Integrations and correct data Collaborate with CIO's in other ELB's Support and develop acquisitions Search and bring to the table
	Threats	Cyber and physical threats to operation Disruption of significant regional disasters Data Breach / Disclosure	Collaborate, strength, educate & test Plan and prepare and practice Controls, classification & education
Internal Factors	Strengths	ICT operation and management expertise Modern business information systems Progressive company strategy	Document and teach for succession Leverage and develop tools Research, innovate and learn
	Weaknesses	Limited business intelligence and analytics Phased ADMS implementation ICT dept lacking expertise in all systems	Investigate, select and develop Develop and extend Education and mentoring

Figure 1.: Needs Analysis Survey. Source: Electra ISSP 2018

Electra desires to serve its 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:

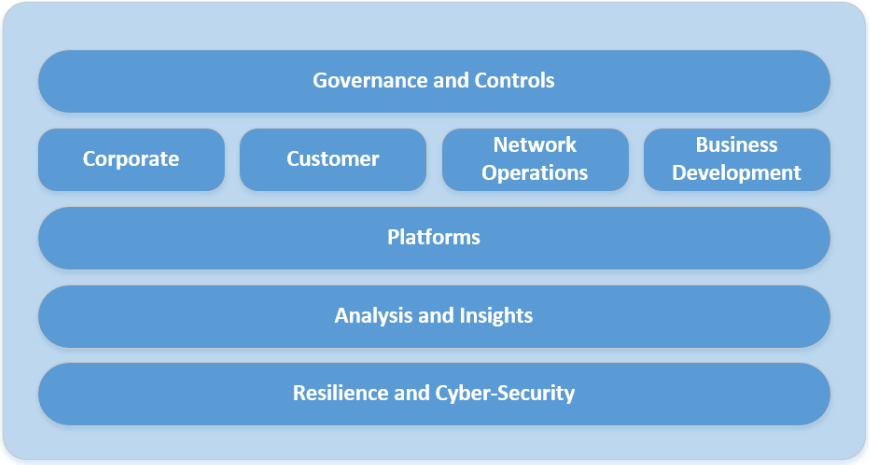


Figure 2.: Electra ICT Asset and Capability framework. Source: Electra ISSP 2018

Each asset class provides business services, being:

ICT Asset Class	Business Services
Governance and Controls	Contributes to the overarching strategic direction of Electra. Aligns business decision making and ICT investment. Provides frameworks, planning and controls.
Corporate	Supports the effective operation of business support functions, including finance, human resources and payroll, health & safety and knowledge management.
Customer	Enables customers to interact with Electra – to understand outages, advise of concerns/incidents and to request new connections
Network Operations	Supports the safe and effective operation of our electricity distribution network. Contributes to an integrated information sharing and efficient use of resources. ICT provides guidance on best practice.
Business Development	Support the operation and growth of existing businesses. Identify and drive creation of new businesses.
Platforms	Underpins delivery and management of Electra's ICT services – both our Cloud and on-premise operating environments including hardware, software and services.
Analysis and Insights	Provide platform, expertise and training to enable the analysis of datasets and creation of performance graphs.
Cyber-Security and Resilience	Ensure our ICT services availability and enables response to threats and risks through establishing and maintaining 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 Last 12 months
Horizon 2 Next 12 months, reasonably foreseeable, enables the known
Horizon 3 Following 12 months (months 13-24). Expected, foreseeable not proximate

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.

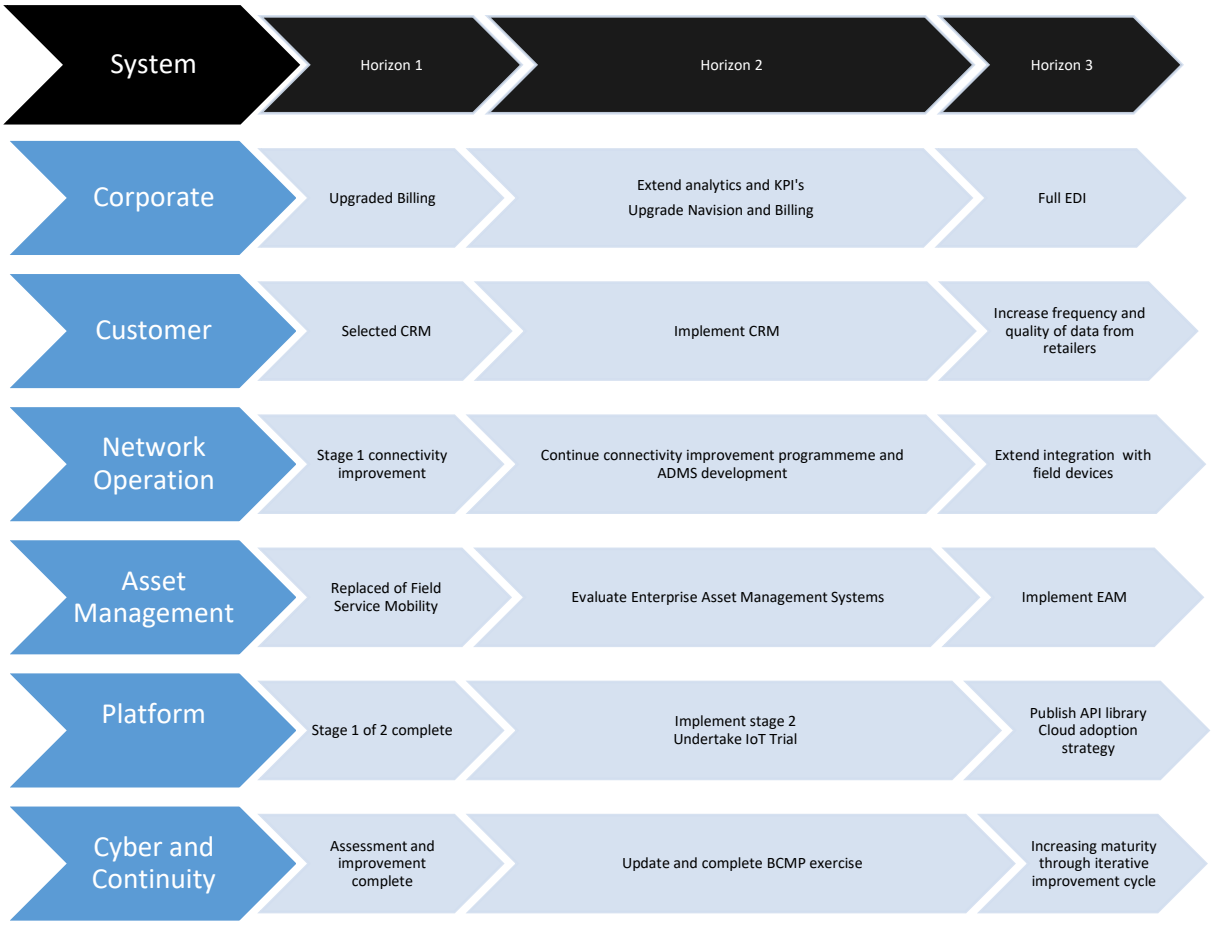


Figure 3.: ISSP Horizons. Source: Electra ISSP 2018

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.

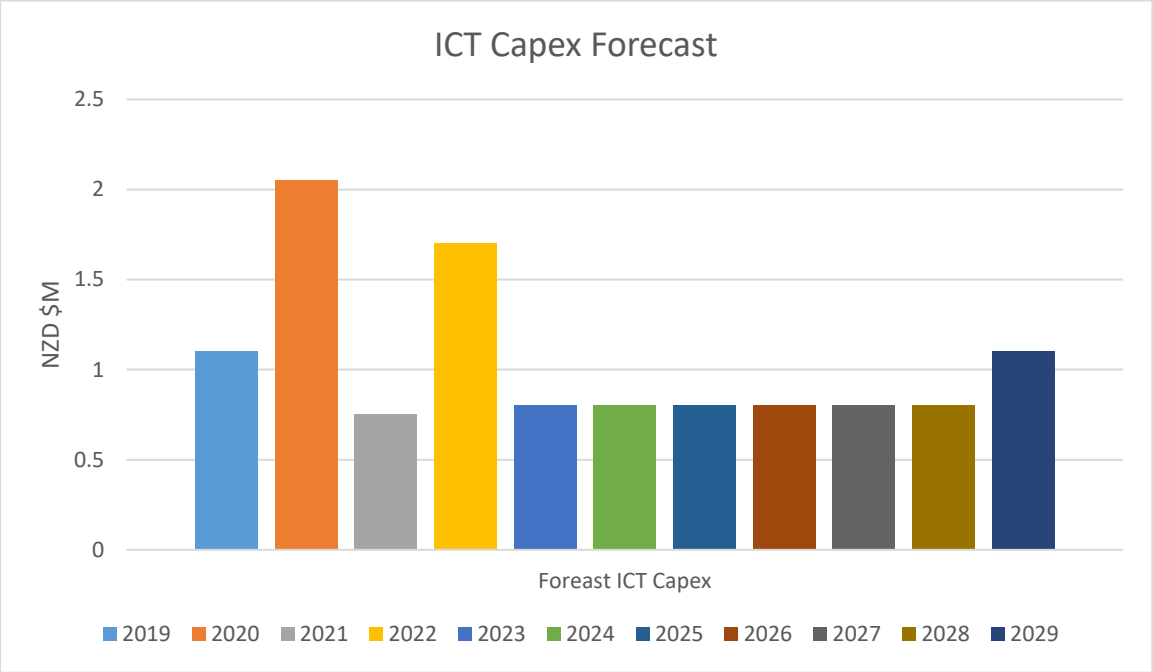
Electra is already realising the benefits of improved communication with our customers and greater visibility of processes than span the company. A data quality improvement programmeme continues to improve the completeness of the underlying information. Electra has implemented the Clevest Field Service Management platform that provides the field crews with greater visibility and the ability to update and restore customer outages.

Electra has begun a trial of Industrial Internet of Things (IoT) to provide real-time measurement of information such as voltage, current and state. This information will improve decision making and

communication with the customer. This involves deployment of a range of technologies within our electricity network and can only be achieved with the support of our vendors and customers.

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 investment in the 2020 financial year reflects the anticipated implementation of the Microsoft Customer Relationship Management system. In the same financial year we will also be replacing the existing Microsoft Dynamics Navision financial system with the latest Cloud Computing version of Navision.

In 2022 provision has been made to replace or upgrade the SCADA Control system that has been in operation for over decade. This is an essential part of the ADMS solution that was not included in the upgrade in 2018.

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. In 2018 the company undertook an extensive assessment and improvement programme with a New Zealand leading provider. This improved Electra's existing ICT controls to provide piece of mind to staff and customers. Further initiatives are planned for 2019 that will improve our maturity and preparedness.

7.3 Buildings & property

Asset class	Key policies	Strategies & initiatives
Buildings	• Head office (Levin). • Depot (Levin) • 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 • Chairs • 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. • Cars (diesel) – replace after 160,000km or 4 years • Vans and Utes – replace after 160,000km or 6 years. • 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 • Power tools • 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 24 major risks to the group. Those relevant to the operation of the network are tabled below.

Master Risk	Risk Description	Nov 2018 Score
G1	**Fatality or serious harm to people**	**165**
	Risk associated with staff and contractors working on the Electra Network and generation plant in the field	165
	Risks to staff or the public from the use of vehicles or heavy mobile equip.	165
	Risk to the public associated with the Electra Network and Generation	120
	Risks associated with Electra Services in the field	56
G2	**Inadequate business continuity and disaster recovery management**	**115**
	Inefficient response, restoration and communication to stakeholders	112
	Inadequate and/or limited insurance cover for extreme events	115
	Unauthorised cyber access, threat or misrepresentation into ICT/SCADA	115
	Loss of data and company records	60
G3	**Inability to maintain economic return / discount contribution related to core business**	**100**
	Historic pricing tariffs threaten medium-term economic return	80
	Continued reduced electricity consumption	80
	Exposure to avoidable peak demand costs	100
G4	**Failure to anticipate and plan for technological change**	**112**
	Technological advances threaten businesses established markets	112
	Poor data management (access, analysis and decision making)	82.5
	Lack of timely investment in beneficial technological innovation	80
G5	**Failure to maintain stakeholder relationships**	**80**
	Decline of company's reputation	70
	Lack of contract and contractor management	60
	Major customer disputes and litigation by our customers	50
	Inadequate skills and aptitude for the role (individual)	80
G6	**Poor long-term positioning and performance**	
	Failure to maintain a portfolio of core and non-core businesses	70

	Failure of businesses to achieve profitability expectations	80
G7	**Inability to manage political and regulatory change**	**80**
	Increased ComCom, EA costs and any potential industry reform	80
G8	**Inadequate commercial and financial management**	**80**
	Inadequate group funding strategy leading to liquidity risk	80
	Risk of material fraud resulting in financial loss	70
	Inadequate Due Diligence on acquisition	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 Risk and Audit committee comprised of Electra Directors. From this analysis, Electra identified the critical elements and plans that were required to manage these risks.

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 2018.

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 Section 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 6.

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 following regulatory risks are also noted…

- Uncertainty associated with a current government initiated electricity pricing review

- Uncertainty of how regulators may interact with emerging energy technologies

- Uncertainty of the direction that transmission pricing will take, particularly in relation to the impact of emerging technologies.

Electra is proactively collaborating and growing capabilities to adapt to the opportunities and risks presented by the above. By gaining experience in these new technologies and developing new

products and services for our customers, Electra is taking action rather than waiting for change to be emposed.

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. • 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. • 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 • All zone transformers have individual oil containment with oil spill kits located at each zone substation in case of other spills • Where a distribution transformer or switchgear has leaked, all affected ground is removed and suitably disposed of in accordance with local by-laws. • VESDA sniffer systems for fire containment are installed at each zone substation's switchgear building • All zone transformers and switchboards have annual diagnostic testing to locate potential faults before they occur.

Activity	How risks are managed
Buildings and Zone Substations	• All major projects, such as a new zone substation, are specifically designed for their location – electrically and structurally. • All buildings are built to the relevant building code. • Electra has seismically engineered bracing on all power transformers at zone substations, with seismic bracing for switchgear and other components as required. • 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. • Electra completed security fences at the remaining zone substations in 2004. • 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. • 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 • Underground cables are specified to withstand through short-circuit faults along with capacity requirements. • 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. • 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 • 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 - (30 minutes to 3 hours)	• SCADA or field switching • Field repairs	• No major work required – e.g. clearing tree branch off line • Time depends on cause and available personnel and extent of switching
Medium - (3 hours to 12 hours)	• SCADA or field switching (most consumers are restored by switching) • Field repairs	• Equipment damaged – e.g. pole hit by car, transformer needs changing, overhead line needs repairs or replacing • Time depends on cause and available personnel and extent of switching
Long - (12 hours to 48 hours)	• SCADA or field switching (most consumers restored by switching) • Field repairs	• Major equipment damaged – e.g. loss of a zone substation, replacing part or all of a damaged 33kV bus. • 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

Regular review of Electra's level of Cyber Security Maturity and level of preparedness.

9. Performance evaluation

9.1 Works delivery performance

This section outlines Electra's progress against budgeted targets for the year ending 31st March 2018.

9.1.1 Maintenance Plan

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

Category	2017/18 Actual ($000)	2017/18 Budget ($000)	Variance ($000)	Variance (%)	Reasons for variances
Fault and emergency maintenance	2,164	2,256	92	4%	No material variation.
Vegetation Management	1,640	1,591	-49	-3%	No material variation.
Routine and corrective maintenance	1,070	1,016	-54	-5%	No material variation.
Replacement and renewal Maintenance	438	458	20	4%	No material variation.
System operations	2,335	2,438	103	4%	No material variation.
Business support	4,424	3,968	-456	-11%	Over budget due to additional overhead management support costs not being forecasted.
Total	**12,071**	**11,727**	**-344**	**-3%**	

Overall, Electra was over its maintenance budget by 3% for the 2017/18 year. Individual variances in different categories are shown above in the table. Material variation in business support was due to overhead management support costs not being budgeted correctly.

A dollar value of approximately $100,000 has been used as a threshold for material variation.

9.1.2 Development Plan

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

Category	2017/18 Actual ($000)	2017/18 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	407	350	-57	-16%	No material variation.
Reliability, safety and environment	1,379	1,249	-130	-10%	Expenditure in this category was over forecast mainly due to Tararua Road 33kV project which was rolled over from previous disclosure year and consequential works from Tongariro Street substation rebuild.
Asset replacement and renewal	8,810	7,320	-1,490	-20%	Expenditure in this category was over forecast mainly due to additional pole and crossarm activity and an overspend in the reconductoring of Ngaio Road.
Asset relocation	11	0	-11	-	No planned relocations at the time of forecasting.
Total[ii]	**10,606**	**9,014**	**-1,592**	**-18%**	

The variance was largely due to purchasing the 110kV line from Transpower which was budgeted in the previous disclosure year, and spend on distribution line works (mainly pole and cross-arm replacements). Expenditure in this cross-arm category was up due to the engagement of subcontractors to meet the workplan.

9.2 Network business performance

9.2.1 Customer service performance (reliability)

Electra's actual performance against target performance for the 2017/18 year for the key customer service attributes is as follows.

Attribute	Measure	2017/18 Target	2017/18 Actual	Comment
Network Reliability	SAIDI	83.0	121.73	Main contributor towards SAIDI was a latent protection issue on 15th July resulted in cascade tripping from the feeder fault. This affected supply to Paraparaumu, Raumati and Paekakariki which added SAIDI of 21.10 minutes and SAIFI of 0.293. Subsequent expert inquiry and re-engineering of protection settings has addressed setting issues identified
	SAIFI	1.66	2.08	Non-Compliant (as above)
	CAIDI	50	58.5	Non-Compliant
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 2017/18 year for the key asset and regulatory measures are as follows.

Attribute	Measure	2017/18 Target	2017/18 Actual	Comment
Industry performance	Electricity Distribution Information Disclosure Determination 2012 and subsequent amendments	Compliant	Compliant	AMP assessed as generally compliant and above industry average
Financial Efficiency	Capital expenditure per: • total circuit length • connection point	 $2,834 $174	 $5,148 $272	
	Operational expenditure per: • total circuit length • connection point	 $2,614 $160	 $5,306 $264	
Energy Delivery Efficiency	Load factor (units entering network / maximum demand * hours in year)	54%	49%	
	Loss ratio (units lost / units entering network)	6.6%	8.4%	Non-technical loss identification programme underway to address the issue.
	Capacity utilisation (maximum demand / installed transformer capacity)	34%	31.3%	

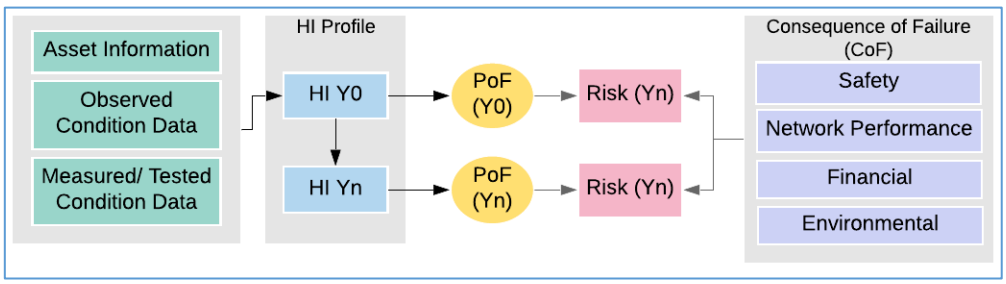
9.3 Asset management practice performance

Significant aspects of the AMMAT which Electra wishes to improve during the 2019/20 year are as follows. Minor aspects may also be improved as Electra looks at this body of work more closely.

Practice cluster	Proposed improvements
Asset management policy	• Summarise the key features of the approved AM policy into the AMP and include a graphic that strengthens the line-of-sight principle.
Asset management strategy	• Consider expanding the approved AM Policy into a strategy as a specific document that bridges the gap between the AM Policy and the AMP.
Asset management plan	• Continue to refine the lifecycle approach taken in Chapter 6 of the March 2018 AMP. • Formalise the communication of the AMP and its key themes to service delivery staff.
Training, awareness & competence	• Build on the concepts and models being developed to improve the long-term work force plans, particularly for service delivery staff.
Communication, participation & consultation	• Develop a strategy that ensures all critical asset management decisions are appropriately communicated.
AM system documentation	• Improve the quality of AM information by developing a strategy that starts with identification of what information is actually needed for key AM activities and decisions.

Electra currently uses asset condition (health) as the basis for most of its asset renewal and replacement decisions, and is currently developing an asset risk management model (ARMM) to better predict the health of its sub-transmission and distribution lines.

During the 2019 year Electra plans to extend this ARMM to include asset criticality, which is one of the strategic themes that Electra has adopted…



Criticality Index relates to consequence of failure (CoF). When an asset fails, there will be an associated impact resulting from the failure. The cricticality of an asset is a relative measure of its CoF compared with the average for its asset type. The objective of this workstream is to have all network investment decisions driven by the asset health and criticality framework.

10. Works delivery

10.1 Resourcing policy & strategy

10.1.1 Resourcing approach

Key features of Electra's resourcing strategy include:

- Forecasting the annual hours required for the three key occupational classes of electrician / jointer, lineman / live line mechanic, and arborist.
- Identify the annual available man-hours for each of the three occupational classes, including new hires, apprentices, 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's resourcing is guided by the following principles:

- The majority of network construction, operation and maintenance will be performed by internal staff.
- Contractors will be engaged for well-defined tasks such as trenching, directional drilling or concreting where their rates are cost competitive.
- 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 ICT content for its field work that includes programming and device interconnection
- Adjusting field crew makeup, leveraging the skills and experience of older people for works inspection and scoping while enabling younger workers to step up to work team leadership.
- Forecast AMP spends by other EDB's is putting upward pressure on field services wages.
- Retention of workers upon completion of training.

10.1.4 Specific resourcing plans

Current service delivery utilisation is about 76%, rising 2% in each of the last 2 years. Utilisation and productivity are areas of continued focus. Reporting, feedback and process developments aim to lift this to 85%.

Electra has a programme of annually recruiting 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.

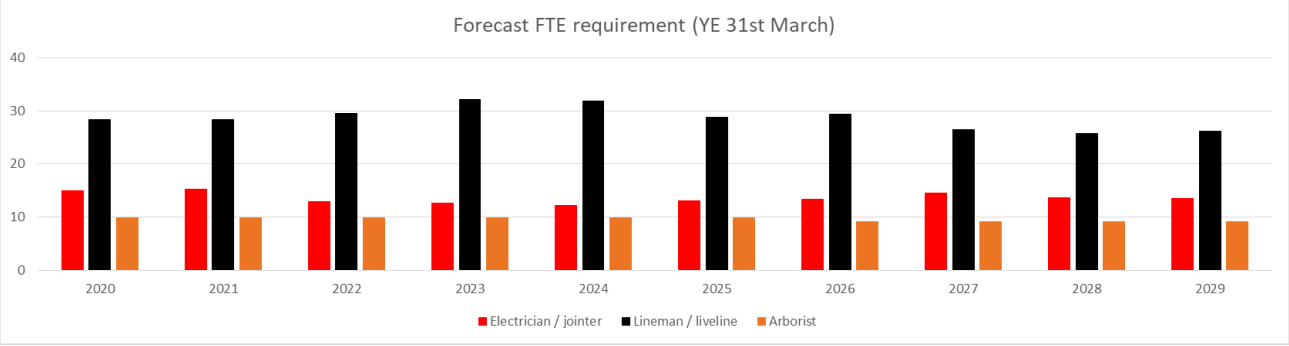
Part of the capability matrix is to upskill 30% of the workforce to be multiskilled in different disciplines to accommodate for peak periods.

10.2 Required resources to deliver works

10.2.1 Forecast resource requirements

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 Section 10.2.2 demonstrating both current FTE's and vacancies in the process of being filled.

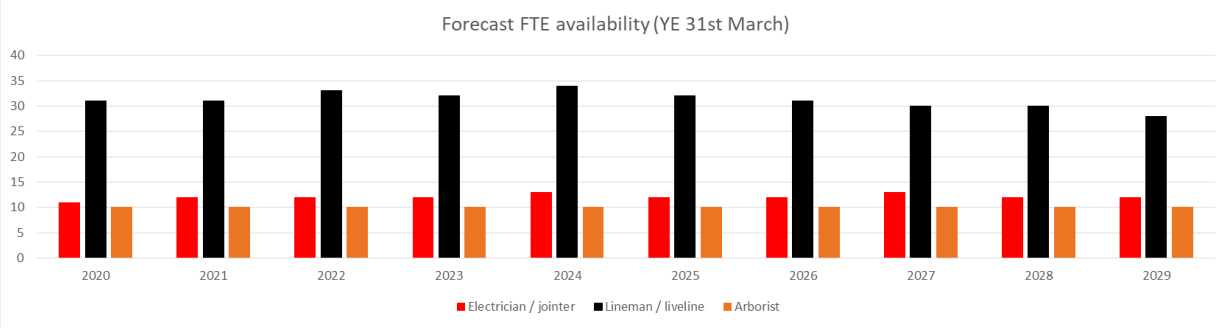
YE 31st March	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Electrician / jointer	15	15	13	13	12	13	13	15	14	13
Lineman / liveline	28	28	30	32	32	29	29	26	26	26
Arborist	10	10	10	10	10	10	9	9	9	9
Total	**53**	**53**	**52**	**55**	**54**	**52**	**52**	**50**	**49**	**49**



10.2.2 Forecast resource availability

YE 31st March	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Electrician / joiners										
Opening number	10	11	12	12	12	13	12	12	13	12

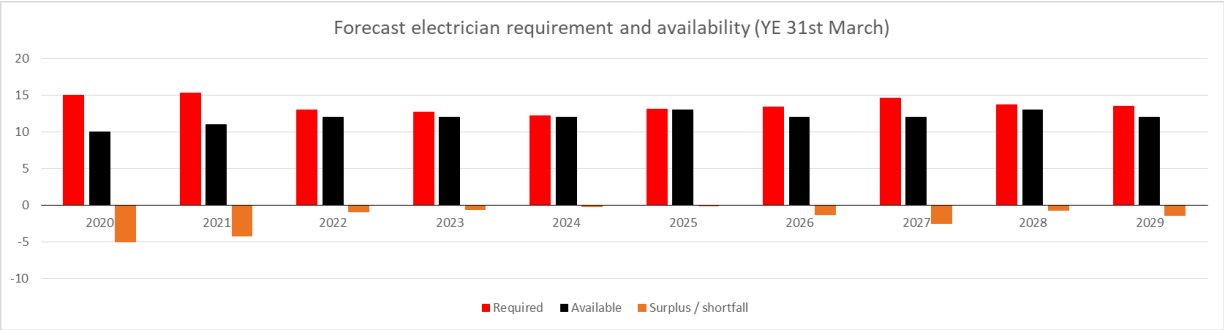
Plus recruitments	1	0	1	0	0	0	1	0	0	1
Plus new apprentices	0	1	0	0	1	0	0	1	0	0
Less resignations & retirements	0	0	1	0	0	1	1	0	1	1
Closing number	**11**	**12**	**12**	**12**	**13**	**12**	**12**	**13**	**12**	**12**
Linemen										
Opening number	19	19	19	21	20	21	20	20	19	19
Plus recruitments	2	1	0	1	0	1	0	1	0	1
Plus new apprentices	0	0	2	0	2	0	2	0	2	0
Less resignations & retirements	2	1	0	2	1	2	2	2	2	2
Closing number	**19**	**19**	**21**	**20**	**21**	**20**	**20**	**19**	**19**	**18**
Liveline mechanics										
Opening number	11	12	12	12	12	13	12	11	11	11
Plus recruitments	1	0	1	1	0	0	0	0	0	0
Plus new apprentices		1			1			1		
Less resignations & retirements	0	1	1	1	0	1	1	1	0	1
Closing number	**12**	**12**	**12**	**12**	**13**	**12**	**11**	**11**	**11**	**10**
Arborists										
Opening number	10	10	10	10	10	10	10	10	10	10
Plus recruitments	0	0	0	0	0	0	0	0	0	0
Plus new apprentices	0	0	0	0	0	0	0	0	0	0
Less resignations & retirements	0	0	0	0	0	0	0	0	0	0
Closing number	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
YE 31st March	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Electrician / jointer	**11**	**12**	**12**	**12**	**13**	**12**	**12**	**13**	**12**	**12**
Lineman / liveline	**31**	**31**	**33**	**32**	**34**	**32**	**31**	**30**	**30**	**28**
Arborist	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**

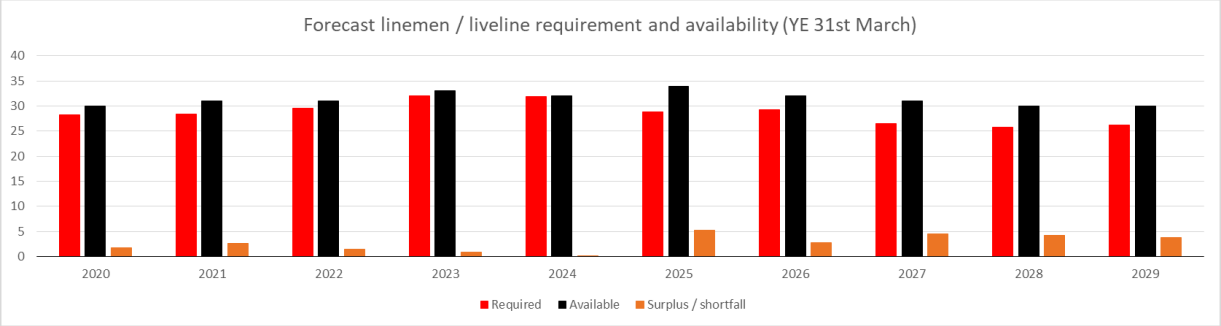


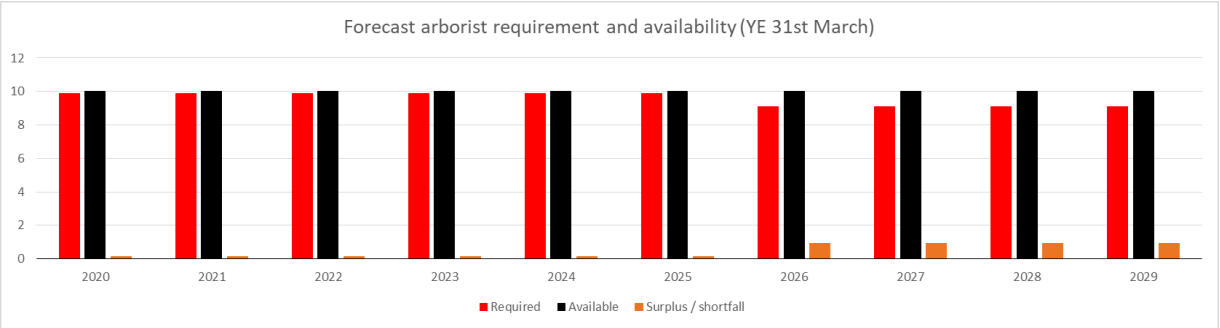
10.2.3 Expected resource shortfalls

YE 31st March	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Electrician / jointer										
Required	15	15	13	13	12	13	13	15	14	13

Available	10	11	12	12	12	13	12	12	13	12
Surplus / shortfall	-5	-4	-1	-1	0	0	-1	-3	-1	-1
Linemen / liveline										
Required	28	28	30	32	32	29	29	26	26	26
Available	30	31	31	33	32	34	32	31	30	30
Surplus / shortfall	2	3	1	1	0	5	3	5	4	4
Arborist										
Required	10	10	10	10	10	10	9	9	9	9
Available	10	10	10	10	10	10	10	10	10	10
Surplus / shortfall	0	0	0	0	0	0	1	1	1	1



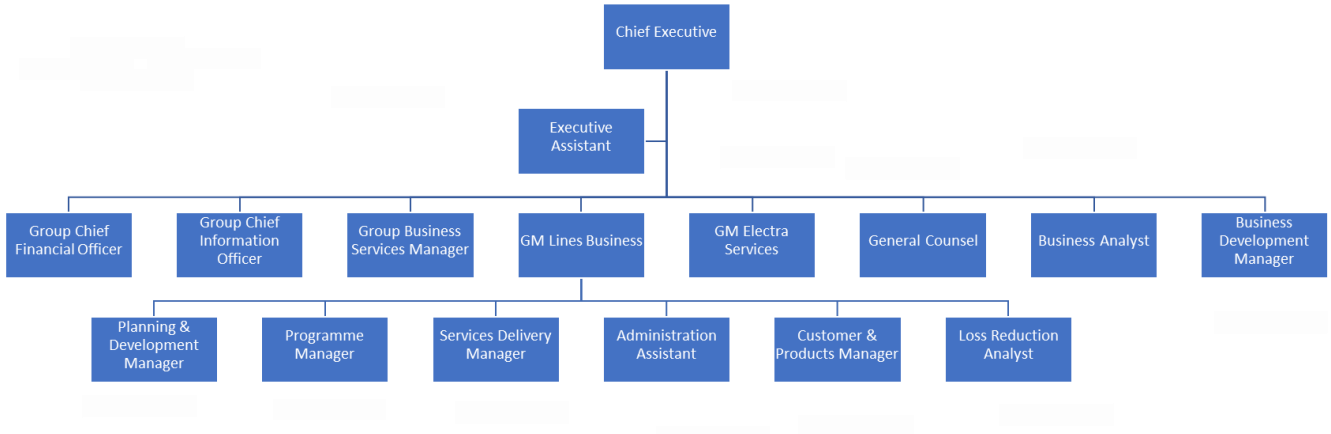




The forecast shortfall of electrician / jointers can be offset by re-deploying multi-skilled line mechanics who can perform jointing work, and potentially also re-deploying the 6 FTE's allocated to third-party work to Electra work.

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 Attachment A of the Electricity Distribution Information Disclosure Determination 2012 (consolidated to 3 April 2018).

Determination ref.	Chapter(s) in this AMP
3.1 Summary.	• Chapter 0.
3.2 Background and objectives.	• Chapter 1.
3.3.1 Purpose statement.	• Chapter 1.2
3.3.2 Corporate mission or vision.	• Chapter 1.3
3.3.3 Identifies documented plans.	• Chapter 1.4
3.3.4 States how documented plans relate.	• Chapter 1.5
3.3.5 Description of interaction between objectives, goals and plans.	• Chapter 1.6
3.4 Details of planning period.	• Chapter 1.7
3.5 Date of approval by directors.	• Chapter 1.8
3.6.1 Describe how stakeholder interests are identified.	• Chapter 1.9.1
3.6.2 What these interests are.	• Chapter 1.9.1
3.6.3 How these interests are accommodated in asset management practices.	• Chapter 1.9.2
3.6.4 How conflicting interests are managed.	• Chapter 1.9.3
3.7.1 Governance accountability.	• Chapter 1.10.1
3.7.2 Executive organisation and structure.	• Chapter 1.10.2 • Chapter 1.10.4
3.7.3 How field operations are managed.	• Chapter 1.10.3 • Chapter 1.10.4 • Chapter 1.10.5
3.8.1 Significant assumptions to be quantified where possible	• Chapter 1.17
3.8.2 Clearly identified	• Chapter 1.17
3.8.3 Description of changes proposed	• Not applicable
3.8.4 Sources of uncertainty	• Chapter 1.17
3.8.5 Price inflator assumptions	• Included in schedules
3.9 Description of the factors that may lead to a material difference	• Chapter 1.18
3.10 Overview of asset management strategy and delivery.	• Chapter 1.11 • Chapter 6 for each asset category
3.11 Overview of systems and information management	• Chapter 1.12
3.12 Statement covering any limitations	• Chapter 1.13
3.13.1 Description of processes used to manage routine inspections and maintenance.	• Chapter 1.14.1 • Chapter 1.14.2 • Chapter 6 for each asset category
3.13.2 Description of the processes used for planning and implementing development projects.	• Chapter 1.14.3 • Chapter 6 for each asset category
3.13.3 Description of the process used for measuring network performance.	• Chapter 1.14.4
3.14 Overview of asset management documentation, controls and review processes.	• Chapter 1.15
3.15 Overview of the communication and participation programme.	• Chapter 1.16
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 • Chapter 3.1
4.1.4 Peak demand and energy delivered in the previous year.	• Chapter 2.1.4 • 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 • Chapter 3.3 • Chapter 6 for each asset class
4.2.3 Description of distribution system.	• Chapter 3.4 • Chapter 3.5 • Chapter 6 for each asset class
4.2.4 Description of distribution substations	• Chapter 3.6 • Chapter 6 for each asset class
4.2.5 Description of LV network.	• Chapter 3.7 • Chapter 3.8 • Chapter 6 for each asset class
4.2.6 Overview of secondary assets.	• Chapter 3.9

Determination ref.	Chapter(s) in this AMP
4.4 Describe network assets, including age and condition.	• Chapter 6 for each asset class
4.5 Asset categories	• Chapter 6 • 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 • 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	• Not applicable
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 5.3.5
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 5.6.3
11.8.3 Identify any constraints.	• Chapter 5.4 • 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 programmes 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
16.1 Describe the processes used to ensure that the AMP is realistic.	• Chapter 10.1 and 10.2
16.2 Describe the organisation structure and the processes for authorisation.	• Chapter 10.3 • Chapter 1.10.4

Schedule 11a – Capex forecast

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029

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 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**	**31 Mar 29**
	11a(i): Expenditure on Assets Forecast		**$000 (in nominal dollars)**										
	Consumer connection		95	95	96	98	100	102	104	106	108	110	112
	System growth		-	950	662	301	818	938	956	1,717	399	1,976	1,997
	Asset replacement and renewal		7,589	7,276	7,844	7,795	9,458	9,773	10,655	9,333	10,213	8,707	8,683
	Asset relocations		-	-	-	106	-	-	-	-	-	-	-
	Reliability, safety and environment:												
	Quality of supply		3,128	3,075	2,631	3,393	1,655	1,352	761	1,750	1,715	1,419	1,564
	Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
	Other reliability, safety and environment		420	250	472	166	238	243	154	157	160	163	166
	Total reliability, safety and environment		3,548	3,325	3,102	3,560	1,893	1,595	915	1,907	1,875	1,581	1,730
	Expenditure on network assets		11,231	11,646	11,706	11,860	12,268	12,408	12,629	13,063	12,595	12,374	12,522
	Expenditure on non-network assets		1,298	2,515	1,854	1,804	886	936	988	938	1,298	1,009	1,063
	Expenditure on assets		12,529	14,161	13,560	13,664	13,155	13,344	13,618	14,001	13,893	13,383	13,585
plus	Cost of financing		109	100	100	100	100	100	100	100	100	100	100
less	Value of capital contributions		95	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080
plus	Value of vested assets		1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
	Capital expenditure forecast		13,743	14,381	13,780	13,884	13,375	13,564	13,838	14,221	14,113	13,603	13,805
	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 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**	**31 Mar 29**
		$000 (in constant prices)										
	Consumer connection	95	95	95	95	95	95	95	95	95	95	95
	System growth	-	950	650	290	773	870	870	1,533	350	1,700	1,686
	Asset replacement and renewal	7,589	7,276	7,698	7,507	8,939	9,065	9,698	8,337	8,952	7,490	7,330
	Asset relocations	-	-	-	102	-	-	-	-	-	-	-
	Reliability, safety and environment:											
	Quality of supply	3,128	3,075	2,581	3,268	1,563	1,253	692	1,564	1,504	1,220	1,320
	Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
	Other reliability, safety and environment	420	250	463	160	225	225	140	140	140	140	140
	Total reliability, safety and environment	3,548	3,325	3,044	3,428	1,788	1,478	832	1,704	1,644	1,360	1,460
	Expenditure on network assets	11,231	11,646	11,487	11,421	11,594	11,507	11,495	11,668	11,041	10,645	10,571
	Expenditure on non-network assets	1,298	2,515	1,820	1,738	838	868	900	838	1,138	868	900
	Expenditure on assets	12,529	14,161	13,307	13,159	12,432	12,375	12,395	12,506	12,178	11,513	11,471

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 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**	**31 Mar 29**
Difference between nominal and constant price forecasts	**$000**										
Consumer connection	-	-	2	4	5	7	9	11	13	15	17
System growth	-	-	12	11	45	68	86	183	49	276	311
Asset replacement and renewal	-	-	146	288	519	709	957	997	1,261	1,217	1,353
Asset relocations	-	-	-	4	-	-	-	-	-	-	-
Reliability, safety and environment:											
Quality of supply	(0)	0	50	125	92	99	68	187	212	198	244
Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
Other reliability, safety and environment	-	-	9	6	13	18	14	17	20	23	26
Total reliability, safety and environment	(0)	0	58	132	105	117	82	204	231	221	270
Expenditure on network assets	(0)	0	219	438	674	901	1,134	1,395	1,555	1,730	1,951
Expenditure on non-network assets	-	-	35	67	49	68	89	100	160	141	163
Expenditure on assets	(0)	0	253	505	723	969	1,223	1,495	1,715	1,871	2,115

	Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
for year ended	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**

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]						
**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

*include additional rows if needed

11a(iii): System Growth

Subtransmission	-	-	-	-	-	620
Zone substations	-	-	-	-	-	-
Distribution and LV lines	-	-	-	-	400	-
Distribution and LV cables	-	950	650	290	373	250
Distribution substations and transformers	-	-	-	-	-	-
Distribution switchgear	-	-	-	-	-	-
Other network assets	-	-	-	-	-	-
System growth expenditure	-	950	650	290	773	870
less Capital contributions funding system growth						
System growth less capital contributions	-	950	650	290	773	870

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended		31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
11a(iv): Asset Replacement and Renewal	**$000 (in constant prices)**						
Subtransmission		432	682	432	432	1,332	1,332
Zone substations		531	131	481	331	1,494	1,403
Distribution and LV lines		3,890	3,734	4,132	4,485	3,973	4,191
Distribution and LV cables		658	478	418	328	328	328
Distribution substations and transformers		1,122	1,037	1,294	937	937	937
Distribution switchgear		422	390	242	235	235	235
Other network assets		534	825	700	760	640	640
Asset replacement and renewal expenditure		7,589	7,276	7,698	7,507	8,939	9,065
less Capital contributions funding asset replacement and renewal							
Asset replacement and renewal less capital contributions		7,589	7,276	7,698	7,507	8,939	9,065

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended		31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
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 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
11a(vi): Quality of Supply							
*Project or programme**	**$000 (in constant prices)**						
Protection Work		550	550	750	750	300	102
Improving Network Interconnectivity		1,453	1,351	837	1,144	664	552
Network Automation and Sectionalisation		670	670	520	520	520	520
Fault Locator		80	79	79	79	79	79
Seismic Strengthening		175	275	275	275	-	
*include additional rows if needed							
All other projects or programmes - quality of supply		200	150	120	500	-	-
Quality of supply expenditure		3,128	3,075	2,581	3,268	1,563	1,253
less Capital contributions funding quality of supply							
Quality of supply less capital contributions		3,128	3,075	2,581	3,268	1,563	1,253

11a(vii): Legislative and Regulatory

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
*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 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
*Project or programme**	$000 (in constant prices)					
Arc Flash Protection	-	-	303	-	-	
Replacement of Deck Transformers	170	90	-	-	85	85
Replacement of Pitchfilled Potheads	60	60	60	60	40	40
Upgrade Transformer Room	100	-	-	-	-	
Steel Link Pillar Removal	90	100	100	100	100	100
*include additional rows if needed						
All other projects or programmes - other reliability, safety and environment	-					
Other reliability, safety and environment expenditure	420	250	463	160	225	225
less Capital contributions funding other reliability, safety and environment						
Other reliability, safety and environment less capital contributions	420	250	463	160	225	225

11a(ix): Non-Network Assets

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
Routine expenditure						
*Project or programme**	$000 (in constant prices)					
Office Buildings, Depots, & Workshops	37	100	-	-	-	-
Vehicles	40	100	32	-	-	30
Tools, Plant & Other Machinery	38	38	38	38	38	38
[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	115	238	70	38	38	68
Atypical expenditure						
*Project or programme**						
Retailer Billing	123					
ADMS	200	850	1,000	1,000	-	-
Other IT Initiatives to Improve Asset Management	860	363	500	700	800	800
NAV Upgrade	-	950	-	-	-	-
Smart Grid Platform	-	-	250	-	-	-
CRM replacement	-	114	-	-	-	-
*include additional rows if needed						
All other projects or programmes - atypical expenditure						
Atypical expenditure	1,183	2,277	1,750	1,700	800	800
Expenditure on non-network assets	1,298	2,515	1,820	1,738	838	868

Schedule 11b – OpEx forecast

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029

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 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**	**31 Mar 29**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions and emergencies	1,858	1,858	1,894	1,930	1,966	2,004	1,855	1,890	1,926	1,870	1,906
11	Vegetation management	1,358	1,538	1,567	1,597	1,627	1,658	1,689	1,587	1,617	1,648	1,679
12	Routine and corrective maintenance and inspection	1,121	911	963	982	1,013	1,036	842	909	874	890	962
13	Asset replacement and renewal	341	372	295	301	307	292	318	325	331	337	343
14	**Network Opex**	4,678	4,679	4,719	4,810	4,913	4,990	4,704	4,711	4,748	4,745	4,890
15	System operations and network support	3,111	3,050	3,108	3,167	3,227	3,288	3,351	3,415	3,480	3,546	3,613
16	Business support	4,625	5,430	5,533	5,638	5,745	5,855	5,966	6,079	6,195	6,312	6,432
17	**Non-network opex**	7,736	8,480	8,641	8,805	8,973	9,143	9,317	9,494	9,674	9,858	10,045
18	**Operational expenditure**	12,414	13,159	13,360	13,615	13,885	14,133	14,021	14,204	14,422	14,603	14,935

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 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**	**31 Mar 29**
21		**$000 (in constant prices)**										
22	Service interruptions and emergencies	1,858	1,858	1,858	1,858	1,858	1,858	1,688	1,688	1,688	1,609	1,609
23	Vegetation management	1,358	1,538	1,538	1,538	1,538	1,538	1,538	1,418	1,418	1,418	1,418
24	Routine and corrective maintenance and inspection	1,121	911	945	946	957	961	766	812	766	766	812
25	Asset replacement and renewal	341	372	290	290	290	271	290	290	290	290	290
26	**Network Opex**	4,678	4,679	4,631	4,632	4,643	4,628	4,282	4,208	4,162	4,082	4,128
27	System operations and network support	3,111	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050
28	Business support	4,625	5,430	5,430	5,430	5,430	5,430	5,430	5,430	5,430	5,430	5,430
29	**Non-network opex**	7,736	8,480	8,480	8,480	8,480	8,480	8,480	8,480	8,480	8,480	8,480
30	**Operational expenditure**	12,414	13,159	13,111	13,112	13,123	13,108	12,762	12,688	12,642	12,562	12,608

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 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**	**31 Mar 29**
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	-	35	71	108	145	167	202	238	261	297
43	Vegetation management	-	-	29	59	89	120	152	169	200	230	262
44	Routine and corrective maintenance and inspection	-	-	18	36	56	75	76	97	108	124	150
45	Asset replacement and renewal	-	-	6	11	17	21	29	35	41	47	54
46	**Network Opex**	-	-	88	178	270	362	423	503	586	663	762
47	System operations and network support	-	-	58	117	177	238	301	365	430	496	563
48	Business support	-	-	103	208	315	425	536	649	765	882	1,002
49	**Non-network opex**	-	-	161	325	493	663	837	1,014	1,194	1,378	1,565
50	**Operational expenditure**	-	-	249	503	762	1,025	1,259	1,517	1,780	2,041	2,327

Schedule 12a – Asset condition

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029

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	H1	H2	H3	H4	H5	Grade unknown	Data accuracy (1–4)	% of asset forecast to be replaced in next 5 years
10	All	Overhead Line	Concrete poles / steel structure	No.		2.30%	75.45%	17.25%	5.00%		3	2.50%
11	All	Overhead Line	Wood poles	No.		40.00%	60.00%	-		-	2	45.00%
12	All	Overhead Line	Other pole types	No.							N/A	
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km		9.50%	62.74%	25.16%	2.60%		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			41.99%	30.71%	27.30%		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%	30.00%	20.00%		4	-
25	HV	Zone substation Buildings	Zone substations 110kV+	No.							N/A	
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.			40.00%	10.00%	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.			75.50%	15.00%	9.50%		3	-
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.		5.00%	35.00%	40.00%	20.00%		3	5.00%
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.							N/A	

Asset condition at start of planning period (percentage of units by grade)

	Voltage	Asset category	Asset class	Units	H1	H2	H3	H4	H5	Grade unknown	Data accuracy (1–4)	% of asset forecast to be replaced in next 5 years
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.		5.20%	63.30%	21.00%	10.50%		4	5.20%
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km		8.20%	76.15%	6.25%	9.40%		3	8.50%
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		-	61.70%	29.50%	8.80%		3	-
44	HV	Distribution Cable	Distribution UG PILC	km		2.00%	90.00%	8.00%			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.		2.50%	62.50%	15.00%	20.00%		4	2.50%
47	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.		5.12%	52.88%	24.00%	18.00%		4	5.20%
48	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.		3.50%	78.80%	11.70%	6.00%		3	4.50%
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.		6.00%	48.50%	40.00%	5.50%		4	6.50%
51	HV	Distribution Transformer	Pole Mounted Transformer	No.		4.00%	20.00%	54.00%	22.00%		4	4.00%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.		4.00%	45.00%	10.00%	41.00%		4	5.00%
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		3.00%	-	-	2.30%	94.70%	2	4.00%
56	LV	LV Cable	LV UG Cable	km				35.00%	9.00%	56.00%	2	2.00%
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km						100.00%	2	1.00%
58	LV	Connections	OH/UG consumer service connections	No.		10.00%		42.00%	15.00%	33.00%	2	10.00%
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.		10.00%	45.00%	10.00%	35.00%		4	15.00%
60	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot		10.00%	30.00%	30.00%	30.00%		3	12.00%
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 2019 – 31 March 2029

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	84%	5	87%	No constraint within +5 years	
Foxton	7	23	N-1	4	28%	23	30%	No constraint within +5 years	
Levin West	13	23	N-1	12	56%	23	58%	No constraint within +5 years	
Levin East	13	23	N-1	12	57%	23	60%	No constraint within +5 years	
Otaki	12	23	N-1	4	51%	23	58%	No constraint within +5 years	
Waikanae	15	23	N-1	12	66%	23	70%	No constraint within +5 years	
Paraparaumu	13	23	N-1	16	58%	23	62%	No constraint within +5 years	
Paraparaumu West	13	23	N-1	8	55%	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 2019 – 31 March 2029

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 19**	*CY+1* **31 Mar 20**	*CY+2* **31 Mar 21**	*CY+3* **31 Mar 22**	*CY+4* **31 Mar 23**	*CY+5* **31 Mar 24**
*Consumer types defined by EDB**						
All	395	420	430	435	450	450
[EDB consumer type]						
[EDB consumer type]						
[EDB consumer type]						
[EDB consumer type]						
Connections total	395	420	430	435	450	450

**include additional rows if needed*

Distributed generation

Number of connections	95	110	120	130	140	150
Capacity of distributed generation installed in year (MVA)	0.4	0.4	0.4	0.5	0.5	0.5

12c(ii) System Demand

	for year ended	*Current Year CY* **31 Mar 19**	*CY+1* **31 Mar 20**	*CY+2* **31 Mar 21**	*CY+3* **31 Mar 22**	*CY+4* **31 Mar 23**	*CY+5* **31 Mar 24**
Maximum coincident system demand (MW)							
GXP demand		72	75	76	77	78	79
plus Distributed generation output at HV and above		30	30	30	30	30	30
Maximum coincident system demand		102	105	106	107	108	109
less Net transfers to (from) other EDBs at HV and above							
Demand on system for supply to consumers' connection points		102	105	106	107	108	109
Electricity volumes carried (GWh)							
Electricity supplied from GXPs		374	372	371	370	370	369
less Electricity exports to GXPs							
plus Electricity supplied from distributed generation		73	73	73	73	73	73
less Net electricity supplied to (from) other EDBs							
Electricity entering system for supply to ICPs		446	445	444	443	443	442
less Total energy delivered to ICPs		415	414	415	414	414	413
Losses		31	31	29	29	29	29
Load factor		50%	48%	48%	47%	47%	46%
Loss ratio		7.0%	6.9%	6.6%	6.6%	6.6%	6.5%

Schedule 12d – Reliability forecast

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029
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*
8							
9	for year ended	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**
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

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029
Asset Management Standard Applied	PASS 55

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	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?	2.5	Chapter 6 of the 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).

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029
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
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?	2.5			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 1.10 of the 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)? (Note this is about resources and enabling support)	2.5	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?	2.5	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.

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029
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
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 1.10 of the 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.

Company Name	Electra Ltd
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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. 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. 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.

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029
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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 2019 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. Electra completed 2018 Comply With survey with wider scope and tighter compliance.		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.Electra's standards closely follow the Powerco standards to help lower costs for suppliers, contractors, training and our engineering		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.

Company Name	Electra Ltd
AMP Planning Period	1 April 2019 – 31 March 2029
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.