PREPARING FOR TOMORROW'S NETWORK

SUMMARY ASSET MANAGEMENT PLAN 2019

Welcome to our 2019 Summary Asset Management Plan (AMP).

This Summary AMP outlines the key points from Powerco's full AMP and is a companion to the full AMP. The AMP documents are intended to provide a starting point for discussions with stakeholders and interested parties, and to provide us with feedback on the vital service that Powerco provides.

The AMP is an important part of Powerco's planning and investment framework. It describes for our customers, stakeholders, employees and partners how we will manage our electricity distribution network to deliver the standards of safety and reliability of electricity supply that our customers demand. It also allows us to engage with stakeholders on the network of the future and to test our thinking and planning for how we deliver our customers' future energy needs.

01

EXECUTIVE SUMMARY

INTRODUCING OUR 2019 ASSET MANAGEMENT PLAN

Our core business is to ensure that electricity is delivered to our customers safely, reliably and efficiently

It is essential that we continue to invest in our assets to ensure they are in appropriate condition and of sufficient capacity to meet the needs of our customers in the long term.

We also recognise that society **is facing an unprecedented challenge regarding a warming environment**. Minimising carbon emissions is a key priority for New Zealand and, by implication, for our customers.

As a company, **we are fully committed to helping New Zealand achieve its carbon reduction targets** agreed to in terms of the Paris Accord (2015), and the Government's associated target of a 100% renewable energy supply by 2035.[1] We are committed to acting in an environmentally responsible manner in all our investment decisions and operational practices – as witnessed by our recent certification to the ISO 14001[2] standard and our high GRESB[3] score.

However, our impact on carbon reduction is insignificant compared with what we can help our customers, including generators, achieve – through our role enabling them to create, use and save energy as efficiently as possible.

The key to supporting New Zealand's carbon reduction targets will be **running our network to open-access principles**, offering maximum flexibility to customers with the opportunity to innovate, connect to, and transact over our network without impediment. While future energy market arrangements are still being developed, we will ensure that the network remains safe, operates stably and provides sufficient capacity under any reasonable energy use scenario.

OUR NETWORK COMMITMENT

Delivery of our five-year Customised Price-quality Path (CPP) plan is now well under way

The first four years covered under this AMP focus strongly on how we plan to deliver to our CPP targets during the remainder of the regulatory period.

Working within our regulatory price constraints, during the past decade we lifted investment by almost 60% in response to the **ageing of our asset fleets and economic growth in our communities**. However, even at this increased level, which exceeded our regulatory allowance, there was mounting pressure for a further step change.

Sitting at the heart of our CPP application was the analysis that indicated the significant challenges we had to address in the future. These included increases in the number of assets that were approaching end-of-life, ongoing growth in the communities we serve, and increased complexity associated with ensuring stable network operation in an evolving energy environment.

Under our CPP allowance, the Commerce Commission approved expenditure of $1.27 billion[4] during the five-year period – an increase of 38% on the previous five years.

Our key commitments for the future of our electricity network, supported by the CPP allowances and described in the AMP, are summarised below.

Ensuring safe and resilient networks

We remain committed to stabilising the underlying condition and performance of our asset fleets. Our asset renewal, maintenance and vegetation investment is intended to arrest the trends we are seeing:

- In-service asset failures increasing over time for key asset fleets.

1. Under normal hydrological conditions.
2. ISO 14001 is an internationally accepted standard that provides the framework to put an effective environmental management system in place within an organisation.
3. GRESB is an independent environmental, social and governance benchmark for real assets, defining the global standard
4. Real 2016 dollars

- Increasing numbers of end-of-life, under-performing assets remaining in service.
- A poor, and deteriorating, reliability position versus our peers.
- Pockets of network performance well outside reasonably acceptable limits.
- Increasing levels of defective assets and vegetation encroachment.

Supporting growth in our communities

Our regions have been experiencing sustained population and economic growth in recent years and, as a result, we have experienced strong demand growth across parts of our networks. Some of the drivers for this growth include the following:

- Bay of Plenty – population growth and horticulture processing volumes.
- Waikato – continued dairy intensification and a shift to snap chilling.
- Taranaki – population growth and dairy intensification.
- Other regions – population growth and changing land-use patterns.

Because of this growth, there are now many locations where we have no practical way of rerouting supply in the event of a key asset failing. The risk and associated cost of a failure has become unacceptably high for our customers. Focused action is necessary, as the number of such scenarios on our networks is unacceptable.

Enabling our customers' energy choices

New technology offerings and increasing customer eagerness to take control of their energy options – and thereby reducing their own carbon footprint – are leading to a change in the way energy markets operate. Distribution utilities play a key role in facilitating these changes, while ensuring that basic delivery standards continue to be met.

We believe we will see increased application of the new technology over time, as prices reduce, suitable applications emerge in New Zealand, and the new technology becomes better understood by our customers. At present, the most promising emerging technologies include:

- Electric vehicles (EV)
- Photovoltaic cells (PV)
- Home and network scale energy storage solutions
- Advanced energy and demand management solutions
- The advent of community-based energy trading schemes

Such new solutions will bring benefits to our customers, but they will also increase complexity for distribution network operators. Issues such as local voltage fluctuations, two-way energy flows and increased load volatility will need to be anticipated and addressed. It is important we act now to understand these new technologies and ensure we can accommodate them efficiently on our networks.

IMPROVING ASSET MANAGEMENT CAPABILITY

Our operating costs and network performance compare well but there is more to be done

ISO 55001

We are **committed to obtaining certification to the ISO 55001 asset management standard** by 2020. AMCL Ltd recently conducted a gap assessment on our asset management approach against ISO 55001 and the Global Forum on Maintenance & Asset Management (GFMAM) standards.

While we are assessed as 'competent' or 'close to competent' in most areas, there are some areas where we are still classed as 'developing'.

We are in the process of preparing an action plan to address the gaps identified.

DATA QUALITY

We are committed to **improving and expanding our asset data to support ongoing decision-making and asset management improvements**. This will require increased standardisation, expanded inspections, improved information processing, and better auditing processes.

We are expanding the level of auditing we undertake in the field, as well as applying analytical tools to highlight potential deficiencies in data quality. We intend to work towards 'one source of truth' across our business and our service providers, with clear data ownership and responsibility allocations.

NEW FOUNDATIONS

New Foundations is a programme of improvements to our core enterprise systems, as we move to an SAP environment. This is a key initiative that will enable us to have the right repositories and systems to transform asset data into insightful information. Our **new enterprise resource planning system will support our ability to efficiently collect, store and analyse asset and network data** when commissioned at the start of FY20.

It is a vital component of our asset management capability enhancements and will have a significant impact on our ability to deliver our CPP commitments.

CONDITION-BASED RISK MANAGEMENT

We have developed Condition-Based Risk Management (CBRM) models for many of our key fleets. It has allowed us to **develop improved asset renewal forecasts** based on the assessment of asset condition and risk.

We have developed CBRM models for power transformer, circuit breaker, ring main unit and ground-mounted distribution transformer fleets, and are considering expanding our modelling to include underground distribution cables.

CBRM modelling has also highlighted our need to improve asset data and is helping inform our data quality improvement plans.

LOOKING BEYOND CPP

Electricity distribution networks are built to serve customers' long-term interest

While there is much deliberation about changes in the energy environment, a large majority of our customers continue to use centrally generated electricity as their key energy source. We do not predict this changing significantly in the foreseeable future. Therefore, **it would be imprudent to materially adjust investment and asset management plans now for an uncertain future**.

Accordingly, we will continue to keep a strong focus on the health, capacity and operation of our existing network, as well as expand the network to meet the increased demand of new – and often existing – customers.

While we will continue to seek out the most efficient means of limiting expenditure on asset renewal and reinforcement, including applying innovative new solutions wherever practical, we expect most of our network expenditure will remain on conventional electricity network assets and practices.

CATERING FOR THE CHANGING ENERGY ENVIRONMENT

3Ds – decarbonisation, digitisation and decentralisation

The so-called 3Ds is an important emerging energy industry theme. These present significant challenges and uncertainties for our industry. Our evolving approach to understanding and addressing this theme is outlined in our network evolution roadmap in Chapter [13] of our full AMP.

Particularly important within this AMP planning period, especially towards the latter years, **is our contribution to decarbonisation**. We are committed to operating in an environmentally sustainable way.

As our own energy use is relatively low, and we generate very little electricity, we believe we can make a much bigger contribution to our society's decarbonisation efforts through effectively planning and operating the electricity distribution network in an open-access arrangement. Assisting customers and energy providers to easily conduct energy transactions over our network would **encourage distributed and renewable generation**.

Additionally, effective demand management, energy storage and tariff incentives will help maximise the utilisation of existing energy infrastructure and defer or minimise future investment. Electricity should also offset other, less environmentally friendly, forms of energy, and the network should facilitate this, for example electric vehicles offsetting the demand for petroleum.

Realising these benefits requires us to **operate the network in an open-access manner**, with minimal impediments for customers to connect devices or transact on the network. Intense debates about the nature of such open-access networks are under way around the world.

Transitioning to an open-access network will require considerable effort and investment, particularly in providing the required visibility, controllability, flexibility and stability of all parts of the network. Given the relatively low uptake of emerging grid edge technology in New Zealand, and the immaturity of the local discussion on future market arrangements, we expect this **transition to happen beyond our CPP period**.

However, it is important to recognise that New Zealand will not be isolated from changing customer energy consumption patterns and associated emerging market arrangements, and nor would we want to be, as these changes will reflect one of the most effective means we have to **achieve our Paris Accord commitments and the Government's low carbon target**.

Therefore, we see the near-term future as the ideal time to analyse, test and prepare for the expected future changes to the energy environment. Further out in the AMP period we see the need to start significant investment to achieve the basics of the required open-access network. This will **initially focus on additional monitoring and limited automation on our network**, particularly on the Low Voltage (LV) side.

10-YEAR EXPENDITURE FORECASTS

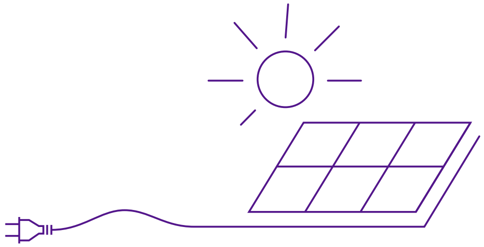
Investment of approximately $278 million per annum

The investments we propose will enable us to address asset condition and security related issues. It will also help ensure we continue to meet our customers' service expectations and support the growth of the communities we serve.

CAPITAL EXPENDITURE

Our planned capital investments for the 2019-2029 period reflect **a targeted blend of investment across growth and security, asset renewal and non-network categories**. Key highlights include the following:

- **Sustained investment in asset renewals** – post CPP expenditure is expected to stay at current CPP levels. We forecast a



Easily conducting energy transactions over our network encouraging distributed & **renewable generation** constant level of expenditure is required to manage the health of our overhead fleets.

- **Sustained investment in growth and security** – network growth investment is forecast to remain consistent with CPP levels. During the CPP our expenditure predominantly focuses on improving breaches in security of supply. Post CPP expenditure focuses more on improving voltage support on the network. We will also be investing in LV visibility improvements as we shift to an open-access network.
- **Reduction of investment in core systems and network technology** – we forecast a reduction in IT investment as we complete implementation of a new ERP system early in the CPP period, and as our core systems shift to the cloud. We will continue current levels of investment in our network evolution plan to allow for testing of new and innovative network and non-network solutions.

Expenditure during the CPP period of the planning window is largely consistent with our CPP allowance – limited increases are foreseen resulting from increasing customer connection activity, and potential increase in the volumes of Transpower-initiated outdoor-to-indoor switchgear conversion works. Our expected capital investment during the planning period is set out below.

OPERATIONAL EXPENDITURE

Our updated operational expenditure is **in line with our previous CPP forecasts**. Key highlights include the following:

- **Addressing maintenance defects** – the backlog of outstanding maintenance defects had previously been growing at an accelerating rate. We have arrested this increase and are now reducing the size of the pool to appropriate levels during the CPP period.
- **Improved inspection techniques** – we have commenced our pole-top photography and Light Detection and Ranging (LiDAR) trials for improved asset condition and vegetation inspection. We are also continuing to implement new techniques to better understand actual asset condition and network risks. Data and information management practices will also be enhanced with our ERP implementation.
- **Asset management maturity** – we are proposing substantial improvements in the way we practise asset management to reflect industry good practice and to realise improved efficiencies in the future. To achieve this, we are bolstering our internal capabilities and skills. As part of our asset management improvements we intend to achieve ISO 55001 certification by the end of 2020.
- **Enhanced capacity** – our project delivery capacity is being increased in proportion to the uplift in construction and maintenance work proposed under the CPP. Allowance is made for additional business support staff to assist with the increased business complexity and demands anticipated with enhanced IS systems and increased work volumes.

Our expected operational expenditure during the planning period is set out below.

Figure 1: **Capital Expenditure**

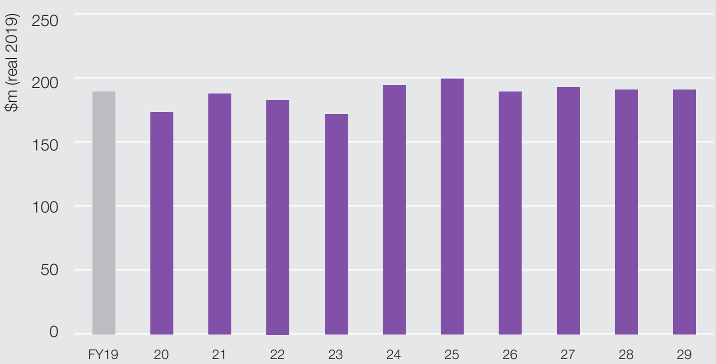
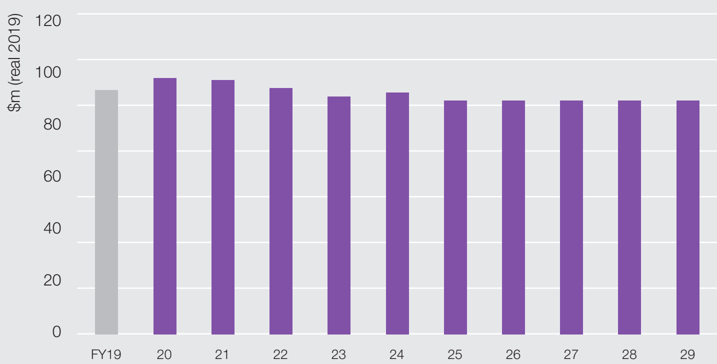


Figure 2: **Operational Expenditure**



Why an open-access network?

Our customers are increasingly concerned about the impact of their energy use on the environment. They are interested in how their electricity is generated and how they can use it most efficiently. This local interest is reflected at a national level, with one of the Government's key commitments being a goal of a carbon-neutral electricity supply.

In a fortunate convergence of improving technology and cost-efficiency, our customers have:

- more choice and the power to exercise their values.
- an increasing ability to achieve significant reductions in their energy use footprint.

A key contributor is the ability to cost effectively generate on-premise electricity, through renewable methods such as solar panels or small wind generators.

This not only reduces electricity taken from the grid, but also holds potential for exporting excess capacity to other nearby customers, or allowing customers without their own generation to buy renewably created electricity from local suppliers and communities.

Other key factors are efficiency improvements in energy-hungry devices, and the ability to switch to renewable energy sources, particularly related to transport and heating.

The limits of today's networks

The design of traditional electricity networks, however, limits the extent to which renewable generation, or large variable loads, can be accommodated.

Networks were designed for one-way power flows from large generators to end customers, who used mainly passive appliances. Connecting significant volumes of distributed generation, or large, rapidly varying loads to a network not designed for it, can at times cause serious power quality and network instability issues.

Without substantially changing the nature of distribution networks and how they operate, the only mitigation options for electricity distribution businesses (EDB) are to make major reinforcements to the network or constrain customers in what they can connect and how they can use the network.

Limiting choice is bad for customers.

Conventional network reinforcement is an expensive and, generally, inefficient solution to short-term power fluctuations. Constraining customers in what or how much they can connect to the network will greatly inhibit their ability to manage their use and reduce their electricity carbon footprint – thereby foregoing one of the more important levers New Zealand has to achieve its overall environmental targets.

Networks of tomorrow

In our view, the best way to achieve customers' goals is by operating an open-access distribution network. This will be achieved by:

- applying suitable developing technology.
- much improved visibility of power flows and utilisation.
- increased network automation.
- improved data and analytics.

Essentially this future network would allow customers to be largely unconstrained in what they can connect to the network and how they would use it to support their energy transactions – purchasing and exporting electricity.

Our role will be to ensure that networks have the capacity to cope with our customers' evolving energy needs, while remaining safe, stable and efficient.

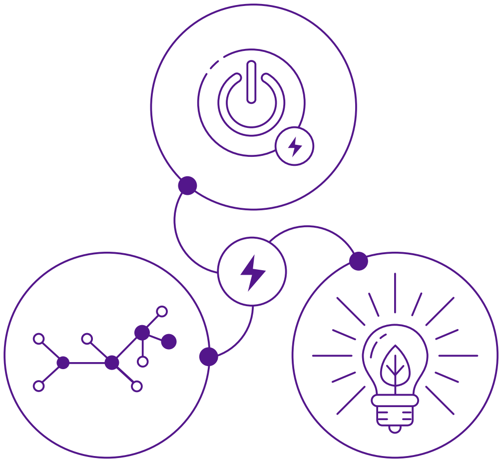
02

EVOLVING OUR NETWORKS FOR THE FUTURE

1D

Digitisation

Digitalisation is the increase in digitally enabled sensors, data and analysis available to customers, the market and asset owners



2D

Decentralisation

Decentralisation is the shift from central generation electricity to distributed devices that generate, store or consume electricity

3D

Decarbonisation

Decarbonisation is the challenge to reduce CO_2 emissions to fight climate change

THE NEED TO CHANGE

The role of energy systems in decarbonising the economy has been a strong focus across the world

New Zealand has set ambitious targets and is making quick progress to form a plan that will lead to a net zero-carbon economy by 2050. As noted by the New Zealand Productivity Commission in last year's *Low-emissions economy report, […] steps will be needed to manage growing complexity and risks to system and service providers' stability, and to ensure a level playing field for different types of technology.*

Our **Network Evolution strategy** reflects this focus. It aims to enhance the value we offer to our customers and, through this, to the wider New Zealand society, the environment, and the economy. In particular, it recognises the challenges brought by the 3Ds of the energy industry:

- **Decarbonisation** is the challenge to reduce CO_2 emissions to fight climate change.
- **Decentralisation** is the shift from central generation electricity to distributed devices that generate, store or consume electricity.
- **Digitalisation** is the increase in digitally enabled sensors, data and analysis available to customers, the market and asset owners.

We recognise that society is facing an unprecedented challenge regarding a warming environment

We are committed to being an environmentally responsible business, which is also reflected in our investment decisions and operational practices. But the biggest contribution we, and other electricity distributors, can make towards helping this cause, is by enabling and supporting our stakeholders to create, use and save energy as efficiently as possible.

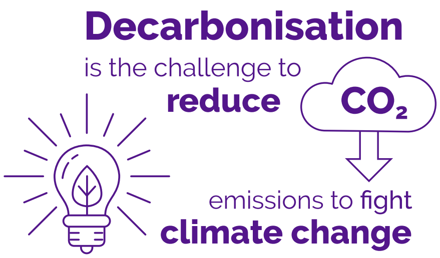
We do not subscribe to the view that distribution assets will mostly become surplus to requirements

Distribution networks provide a vital platform to support flexibility and innovation for customers' future energy use and meeting New Zealand's decarbonisation challenges.

We see that the key to supporting New Zealand's carbon reduction targets, will be running our network to open-access principles. This will offer maximum flexibility to customers (end users and generators) with the opportunity to innovate, connect to, and transact over our network without impediment. While future energy market arrangements are still being developed, we will ensure that the network remains safe, operates stably and provides sufficient capacity under any reasonable energy use scenario.

The way we design, build, and operate our network has to change

The pathway to change, however, remains filled with uncertainty. The sector is being highlighted as prone to disruption, as technology becomes cheaper, customers' needs and expectations in terms of quality of service change, and environmental pressure increases. Despite these changes, the large majority of our existing customers will continue to expect the same conventional electricity supply they have now. Therefore, we have to strike an effective balance between investing in conventional network assets to maintain expected service, and adapting to emerging technology and changing consumption patterns. We have to make long-term decisions that are economically efficient and in the best interests of our customers.



THE CHANGING ENERGY ENVIRONMENT

After almost a century, the way electricity is delivered to customers is starting to change

In a legacy system, such as New Zealand's, the flow of electricity has been almost exclusively from large generators, through transmission and distribution networks, to end customers.

New technology in generation and consumption is challenging the model of networks configured to meet peak demand, offering a one-size-fits all approach to passive or disengaged customers. This has led to more stress on the network during peak hours. We are starting to see signs of this on our network. Figure 3 demonstrates that although the overall electricity consumption for each customer has not changed materially, peak electricity demand has been steadily growing during the past decade[9].

DECARBONISATION

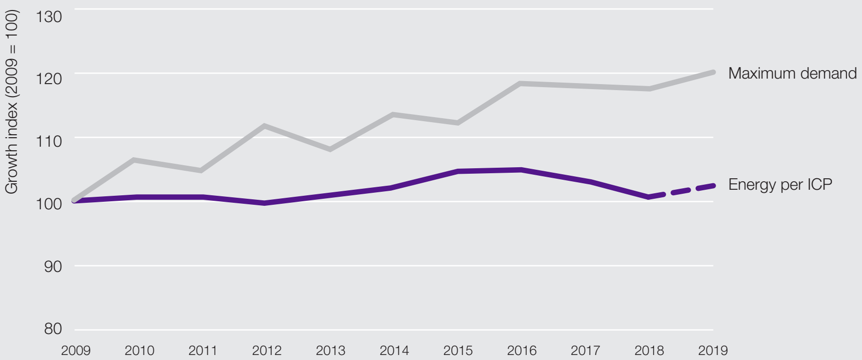
Decarbonisation is the challenge to reduce CO_2 emissions to fight climate change

The New Zealand Productivity Commission's *Low-emissions economy* report details pathways for New Zealand to reduce its carbon emissions, in line with the targets of the Paris Accord. It highlights the electricity sector as one of the main impacted sectors and an enabler to allow more carbon-intensive sectors to decarbonise, e.g. substituting petrol cars with electric vehicles.

Most electricity distribution utilities do not generate significant electricity and are not themselves large electricity users. Therefore, our main role is to **encourage and accommodate carbon reduction initiatives** by offering end-users and generators the technical solutions and services that this policy decision requires.

[9] Annual compound growth in the average consumption per Installation Control Point (ICP, all categories) since FY11 has been 1.2%, while the coincident network peak demand during the same period has grown by 1.9% per year.

Figure 3: **Average electricity consumption and demand on our network**



Note: The figures are based on electricity drawn from grid exit points (GXPs) and do not include the impact of distributed generation. The 2019 consumption is a projection of expected consumption.

DECENTRALISATION

Decentralisation is the shift from central generation electricity to distributed devices that generate, store or consume electricity

Customers expect the ability to offset their own electricity consumption or to sell surplus electricity, while maintaining a connection to our network to cover the times that their devices cannot generate, for example at night.

This requires us to maintain electricity connections at full capacity, even if average consumption levels reduce. It will require us **to consider alternative pricing structures in future**, particularly if we are to avoid charging other customers more as a result.

Concentrated clusters of new distribution edge devices[10], such as solar photovoltaic (PV) generators or electric vehicles, can also cause voltage stability or other power quality issues. Older networks, in particular, which were not designed for potential two-way power-flows or rapidly changing, high-peak demands, will need intervention, otherwise we will have to limit the connection of such devices. This would be a last resort and an undesirable situation, as we would not only inhibit customer flexibility, but we would also run counter to achieving carbon reduction targets.

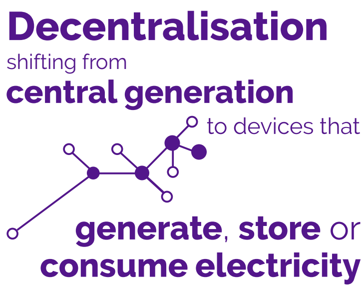
DIGITALISATION

Digitalisation is the increase in digitally enabled sensors, data and analysis available to customers, the market and asset owners

Digitalisation will help our stakeholders to understand and manage their energy demand profiles, and also allow them to conduct energy transactions over our network.

The cost of data capture, storage and communication continues to decrease. Low-cost sensors and communication mediums, eg Long Range Wide Area Network (LoRaWAN), are becoming mainstream. With it, artificial intelligence, blockchain, and other capabilities have become more prominent as computing processing power increases.

For asset managers, this trend offers major opportunities to efficiently increase visibility of network condition, utilisation and operational conditions. It will allow us to enhance our service offering, improve network utilisation and reduce potential instability issues that could arise from connecting edge devices. This all would contribute to more efficient and stable network utilisation and support cost effective delivery.



[10] Distribution edge devices are new types of end-customer loads connected to the distribution network that were not traditionally prevalent and have characteristics that can cause power signal distortion in different ways to traditional, mainly resistive, customer loads. It includes local generation, particularly PV, electric vehicles, energy storage devices, and the like.

OBSERVATIONS OF THE NETWORK

While we know that around the world there are many examples of how the 3Ds are fundamentally changing the industry, **the speed of the change in New Zealand is still uncertain**. In the section below we explore our observations and their practical implications for our network, starting with high-level consumption trends, and distribution edge devices.

CONSUMPTION TRENDS

As described before, while peak demand is still increasing slowly, the average consumption per Installation Control Point (ICP) remains relatively consistent. This is mainly because of:

- **Energy efficiency** – modern household appliances are becoming more energy efficient and improved building efficiency standards also contribute to lower energy use.
- **Energy awareness** – customers are increasingly aware of their energy consumption and many are taking active steps to reduce it.
- **Local generation** – significant improvements in efficiency, along with major reductions in cost, are making it economically and technically viable to bring electricity generation closer to the source of consumption.

We believe this trend will remain true for the next two to three years and that our network will be able to accommodate these changes in the short term. However, i**n the longer term, network stability and capacity could be at risk.**

SOLAR PHOTOVOLTAIC GENERATION

The uptake of PV follows the sun – our network is not always sunny

Residential PV generation is growing rapidly across the world. Uptake rates between countries vary, but have been particularly pronounced in Germany, parts of Australia, the United Kingdom, Denmark and some US states, such as California. This has broadly been in direct response to government mandates to achieve low carbon emission targets, encouraged by way of subsidies, tax incentives or feed-in tariffs (buy-back of excess power generated) to customers. Regardless of the initial driver, the scale of uptake has supported large-scale manufacture and resulted in reduced costs.

By contrast, **the uptake of PV in New Zealand, while growing substantially on an annual basis, is still at a much lower level**. The Electricity Authority reported that from 2016 to 2018 New Zealand had an increase in capacity of 32%.

PV uptake on our network is small – with total PV connection just 1.1% of our ICPs. Recent trends on our network are shown in Figure 4 and Figure 5.[11]

International literature suggests that when PV penetration reaches about 10% on a network, issues associated with the variability of its output could become material, requiring some form of network investment.[12] At **current growth rates, this still appears to be some distance off on our network.**

[11] Electricity Authority, www.emi.ea.govt.nz.
[12] This relates to issues such as excessive voltage rise at periods of low load, and voltage fluctuations with potential to create network instability. The impact could be reduced if modern inverters allowing volt/VAR correction, or energy storage devices are in wide use.

Figure 4: **PV uptake on our network (percentage of ICPs)**

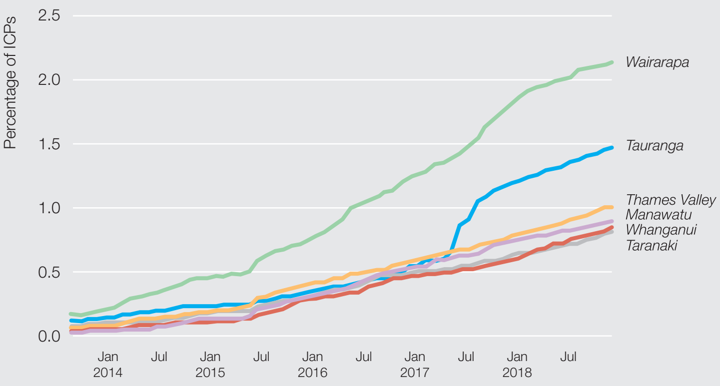
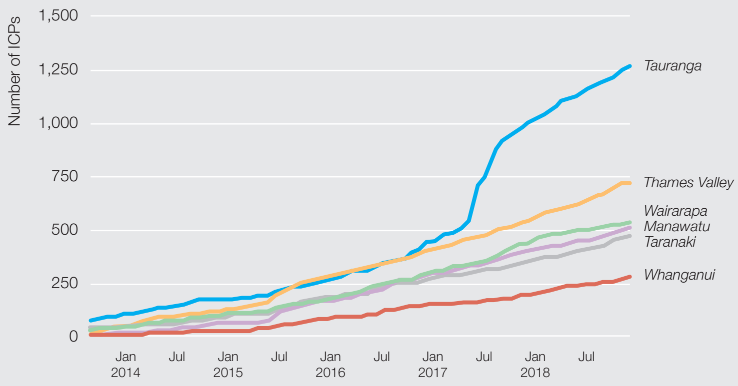


Figure 5: **PV uptake on our network (number of ICPs)**



ELECTRIC VEHICLES

EVs will change the network – but not in the short term

The use of EVs (full electric or plug-in hybrid) is still in its relative infancy in New Zealand, with a total of 11,000 vehicles registered at the end of 2018. With its high proportion of renewable electricity generation, New Zealand is well placed to achieve major carbon emissions reductions from switching its vehicle fleet from conventional fuel to electricity.

As the government incentivises and promotes their use and penetration numbers can rise, the potential for localised power quality issues also increases within the low voltage network. To facilitate EV charging, particularly at peak demand times and with fast chargers, could require substantial network reinforcement.

In 2018, we commissioned a study in collaboration with Unison and Orion to model the impact of EV charging on residential ICP demand[13]. It showed that, without any form of control, the demand could increase significantly, as shown in Figure 6.

The study suggested that this increase in demand can be mitigated by the introduction of smart charging. Figure 7 shows how smart EV charging can influence the demand profile.

EV uptake and demand response capability at a household level is hard to assess as customers are not currently required to notify the network operator when they have purchased an EV or installed non-significant chargers, i.e. those that do not require a change in their electricity supply. This lack of visibility has an impact on the efficacy of network investment and reinforcement to accommodate the capacity and quality challenges introduced through EV charging. **We are working with wider industry groups to both address the lack of visibility and to improve our ability to monitor and predict EV uptake increases.**

[13] For example, Electric Vehicles in New Zealand: From Passenger to Driver, published by Dr Allan Miller and Scott Lemon, EPECentre, University of Canterbury.

Figure 6: **Impact of EV charging on an average household demand profile**

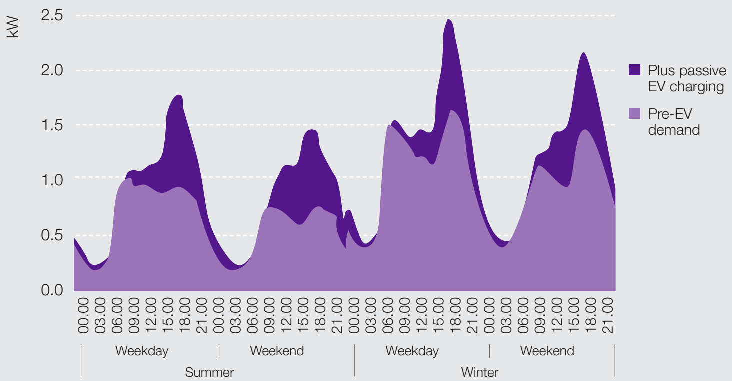
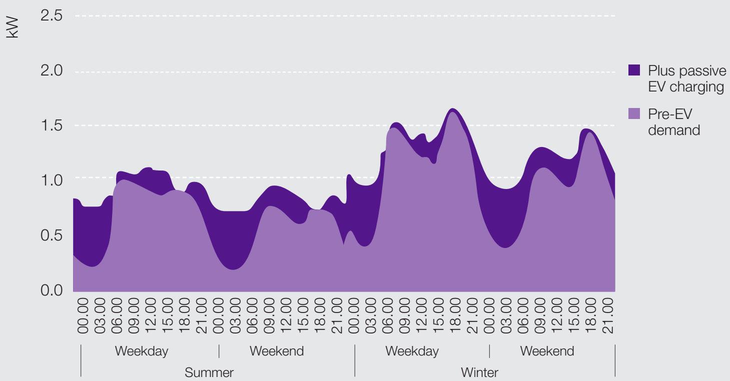


Figure 7: **Impact of smart EV charging on an average household demand profile**



02. Evolving our networks for the future

ENERGY STORAGE

Energy storage will be an enabler for the New Energy Future

The main focus of energy storage is use for battery storage capacity, which is increasing at a significant rate – mainly in utility scale applications. There are many other forms of storage such as compressed air storage and pumped water storage and various forms of heat storage are also receiving attention, but generally for large scale applications only.

Residential scale applications are expanding rapidly, but the overall storage capacity associated with these is still relatively small. Other than the installation cost, uptake rates for domestic storage systems are also very sensitive to factors such as (the absence of) feed-in tariffs, subsidies, the cost of electricity, and the reliability of supply.

Although the cost of battery storage systems has reduced substantially in recent years and is anticipated to decline further in the foreseeable future, for the vast majority of individual customers it is still significantly more expensive than conventional grid-supplied electricity (by comparable capacity).

In some instances, mainly in remote rural areas, the installation of combined generation and battery storage units is economically feasible and uptake rates in these cases may accelerate. It is also noted that the combination of effective storage and local, mainly PV, generation offers customers a significant degree of flexibility in how they procure and use electricity, which in some cases may override decisions based on economic factors alone.

In the longer term, our view is that **energy storage systems, both at utility and residential scale, will have a valuable role in the provision and use of electricity.**

DEMAND MANAGEMENT

New Zealand is been a world leader in demand management

For years, New Zealand has been using water heaters as controllable load. Considerable debate is under way on whether these load control systems should be maintained, expanded, or replaced with newer technology. Hot water control systems continue to play an important part in managing peak demand on our network and avoiding transmission peak charging to our customers.

With improving communications systems and more intelligent home devices, **new opportunities are opening up for demand management on the customer side of the electricity meter.** While it is not our intent to become involved in customer products, such as home area networks, we will continue to pursue demand management solutions where these offer economic alternatives to network reinforcement.

DISTRIBUTION NETWORKS OF THE FUTURE

The future nature of electricity distribution networks is being widely debated around the world. **We subscribe to the New Zealand-specific Network Transformation Roadmap** developed by the Electricity Network Association (ENA)[14]. It is backed up by international research in similar jurisdictions, particularly Australia and the United Kingdom.

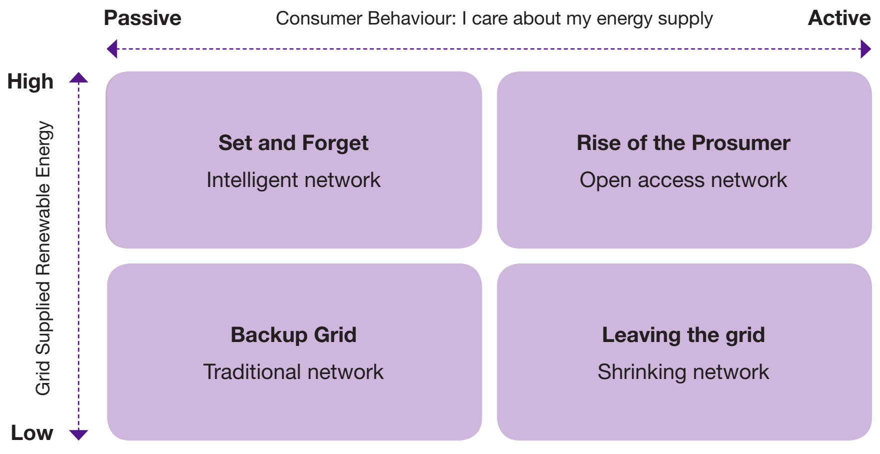
As described in the ENA's study, we recognise that the network of the future will be influenced by two main factors:

- **Customer behaviour** – how engaged are customers with their energy supply?
- **Technology** – how much renewable electricity, and associated edge devices, is connected to the grid?

Using this dichotomy, four scenarios were created and are summarised in Figure 8.

14. Source: ENA, "Network Transformation Roadmap", https://www.ena.org.nz/dmsdocument/403, 2018

Figure 8: **Network transformation scenarios adapted from ENA with evolution pathways**



These purposely extreme scenarios are intended to provide clarity in thinking and assessment. It is unlikely that any of these will arise by themselves. A more feasible outcome, however, will be a mix of customer outcomes, possibly leaning more in one direction. To respond to these scenarios, we have devised four possible evolution pathways that can meet each of the challenges and requirements.

TRADITIONAL NETWORK

This is largely the distribution network that we are accustomed to. It has the following characteristics:

- Physical assets convey electricity from bulk electricity supply points to customers.
- Passive customers
- Distributors do not participate in energy markets and are compensated only for the assets they provide and operate
- Networks and their components are largely passive
- Substantial degree of redundancy built in
- Assets are sized for peak demand
- Large localised concentrations of EV and PV can compromise stability

Traditional networks suit the "Backup Grid" scenario.

INTELLIGENT NETWORK

This is the often-touted 'smart grid', which is based on the traditional network with extended capabilities for monitoring, measurement, control and automation – and the associated communications network and information systems to support this. There is also a shift from centralised to de-centralised control, relying more on the local 'intelligence' of modern devices.

While the network relies on physical assets to convey electricity from bulk electricity supply points to customers and the majority of customers remain passive, there are some differences from the traditional network:

- Distributors still do not participate in energy markets, but are compensated for the reliability of service and for energy efficiency improvements[15].
- Intelligent devices are widespread throughout the network. These allow visibility of power flows, asset loading, and asset and network performance. They also provide control of devices, which in turn allows much greater network automation.
- Networks can be reconfigured in real-time to respond to demand patterns, or operational events.
- It is possible to safely increase network utilisation to much higher levels and automation allows network reconfiguration after faults, or self-healing networks, that can provide substantial reliability improvements

Intelligent networks will suit the 'Set and Forget' scenario.

OPEN-ACCESS NETWORK

This next stage expands on the capabilities of the Intelligent Network to allow widespread local generation sources, with associated two-way power flows. It also ensures open-access arrangements for customers to allow them to transact over the network and to connect any device they wish within acceptable safety and reliability limits.

It still relies on physical assets to convey electricity from bulk electricity supply points to the customers, as well as from customer to customer, or customer to bulk supply point.

Intelligent networks will suit the **'Set & Forget'** scenario

[15] This is to ensure that incentives exist to find optimally efficient solutions, rather than stick to traditional network investment solutions.

NZ's networks will change,
but when and how are uncertain

- Customers are actively involved in energy acquisition, generation, and consumption management
- Opportunity for multiple sources of distributed generation devices, and other customer side devices.
- Distributor is not involved in transactions across the network
- Network provides the functionality to maintain stability, quality and protection under a range of operating scenarios, including the use of large-scale energy storage
- Revenue earned through electricity conveyance, and other network services – reflecting for example, the cost to connect distributed generation, maintain stability, and provide flexible open-access functionality
- Distributors transact with customers for value that customers can add to the operation of the network – for example for demand management capability, and electricity buy-back
- Network investments and asset sizing will reflect evolving electricity demand patterns
- Customer pricing evolves to reflect a far larger degree of individualisation than in the past
- Customers can connect their EV and PV and maximise their utilisation

Open-access networks will suit the "Rise of the Prosumer" scenario.

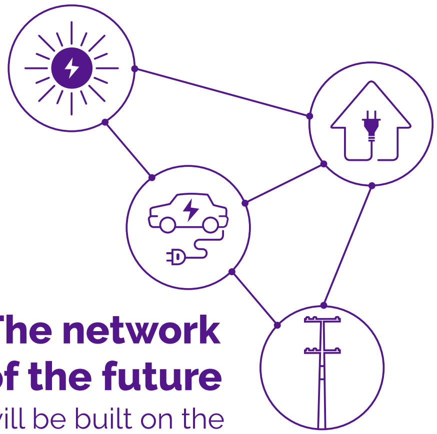
SHRINKING NETWORK

The shrinking network describes the situation where it may make sense for a customer's primary electricity supply to be derived from sources other than the grid – mass defection will then occur. The level of investment on the associated network would drop to a minimum as it would be economically impossible to maintain anything other than an adequate level of safety and meet our minimum legal obligations.

There are few existing larger scale examples of this scenario around the world, and none we are aware of in New Zealand. However, it is potentially possible when individual households, local communities and industries build their own power generation and energy storage facilities, particularly where they are somewhat isolated from the grid.

We also facilitate decommissioning of long rural feeders supplying isolated loads through use of its Base Power alternative, albeit only for individual or very small groups of customers. This benefits both us and the customer.

The shrinking network scenario aligns with the "Leaving the Grid" scenario.



The network of the future
will be built on the
network of today

Map of the Summary AMP

03

OUR NETWORK

OUR PLACE IN THE ELECTRICITY SECTOR

In terms of both supply area and network length, our network is the largest of any single distributor in New Zealand.

Our place in New Zealand's electricity sector is illustrated below.

Figure 9: **Our place in the electricity sector**

GENERATION

Electricity is generated across New Zealand using water (hydro), wind, geothermal, gas and coal stations.[16]

TRANSMISSION (national grid)

This electricity is transported from generators to distribution networks using the national grid, owned and operated by Transpower.

DISTRIBUTION

Electricity is distributed to homes and businesses via distribution networks.

Powerco is one of 29 distribution companies.

RETAIL

Retailers buy electricity from generators and sell it to homes and businesses.

REGIONAL NETWORKS

Our network includes two separate regions; Eastern and Western. Both networks contain a range of urban and rural areas, although both are predominantly rural.

Table 1 provides summary statistics relating to our assets in the Eastern and Western regions.

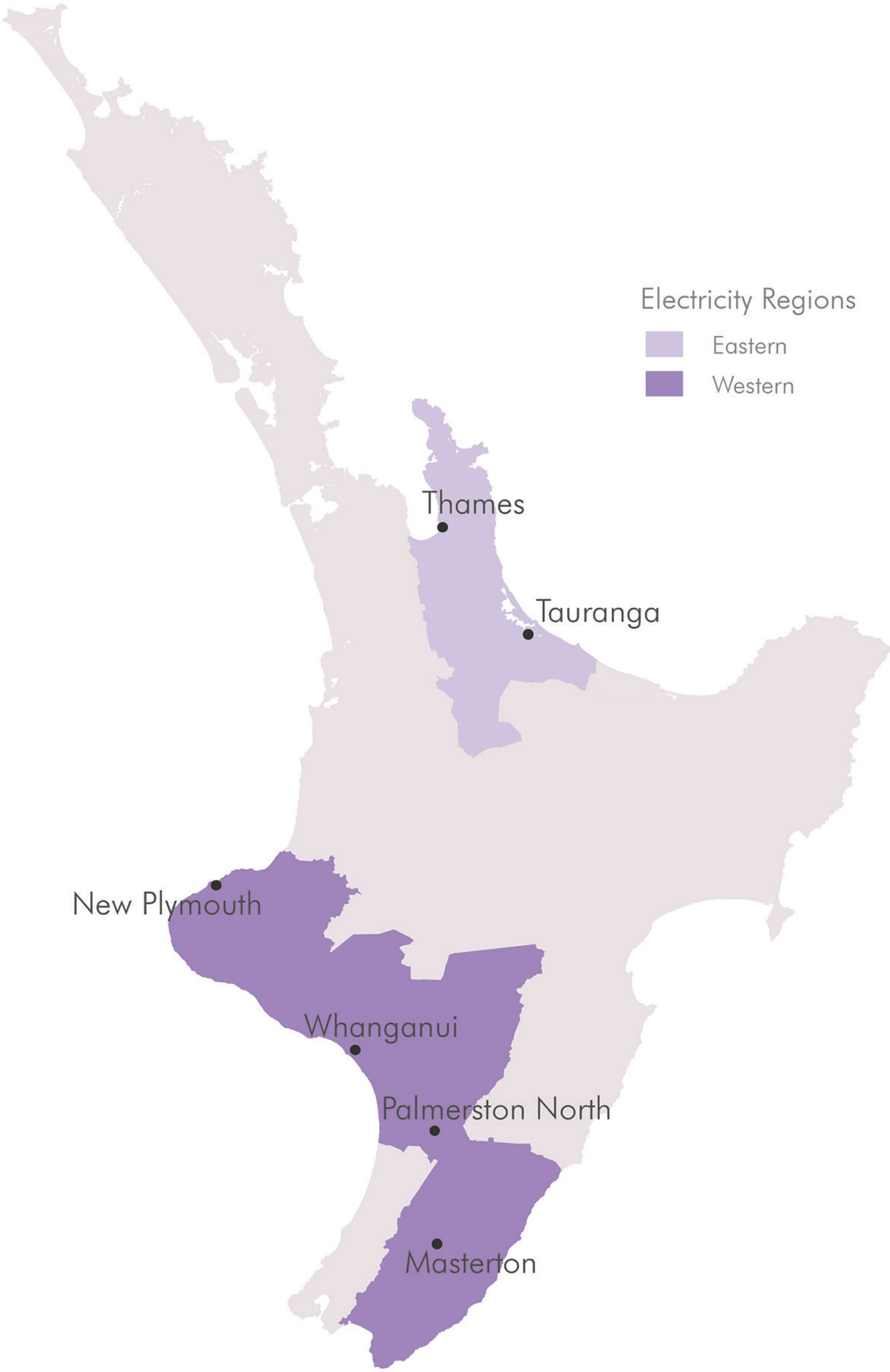
Figure 10 provides a geographical overlay of these regions.

Table 1: **Asset population summary (2018)**

MEASURE	EASTERN	WESTERN	COMBINED
Customer connections	159,680	179,134	338,814
Overhead circuit network length (km)	7,177	14,560	21,737
Underground circuit network length (km)	3,318	2,955	6,273
Zone substations	51	69	120
Peak demand (MW)	466	433	897
Energy throughput (GWh)	2,701	2,398	5,099

[16] Distributed generation is a growing trend but still only a very small proportion of total generation.

Figure 10: **The regions we cover**



EASTERN REGION

The Eastern region consists of two zones – Valley and Tauranga – which have differing geographical and economic characteristics presenting diverse asset management challenges.

For planning and pricing purposes we divide this region into two zones:

- **Valley** includes a diverse range of terrains from the rugged and steep forested coastal peninsula of Coromandel to the plains and rolling country of eastern and southern Waikato. Economic activity in these areas is dominated by tourism and farming respectively.

  From a planning perspective, **this region presents significant challenges in terms of maintaining reliability** on feeders supplying sparsely populated areas in what is often remote, difficult-to-access terrain.

  Investment priorities have focused on improving network security and resilience, and developing better remote control and monitoring facilities.

- **Tauranga** is a **rapidly developing coastal region**, with horticultural industries, a port and a large regional centre at Tauranga.

  The principal **investment activities in this region have been associated with accommodating the rapid urban growth in Tauranga**, maintaining safe and reliable supplies to the port, and supplying new businesses.

The Valley and Tauranga zones are discussed in more detail in Chapter 3.3 of the full AMP.

WESTERN REGION

The Western region comprises four network zones. Similar to the Eastern region, these zones have differing geographical and economic characteristics, presenting various asset management challenges. Because of the age of the network and, in particular, the declining asset health of overhead lines, **extensive asset renewal is required in this region**. This renewal is about double the cost compared with what is required in the Eastern region on an annual basis.

- **Taranaki**, which is situated on the west coast plains, is exposed to high winds and rain. The area has significant agricultural activity, oil and gas exploration and production, and some heavy industry.
- **Whanganui** includes the surrounding Rangitikei and is a rural area exposed to westerly sea winds on the coast and snow storms in high country areas. It is predominantly agriculture based with some industry.
- **Palmerston** includes rural plains and high country areas exposed to prevailing westerly winds. It is mainly agricultural with logistical industries, and has a university, with associated research facilities, in the large regional centre of Palmerston North.
- **Wairarapa** is more sheltered and is predominantly plains and hill country. It has a mixture of agricultural, horticultural and viticulture industries.

The four Western region zones are discussed in more detail in Chapter 3.4 of the full AMP.

NETWORK ASSETS

We have categorised our electricity assets into 25 fleets. We use the term *'asset fleet'* to describe a group of assets that share technical characteristics and investment drivers. We group the **25 asset fleets into seven portfolios**, as set out below.

- Overhead structures
- Overhead conductor
- Underground cables
- Zone substations
- Distribution transformers
- Distribution switchgear
- Secondary systems

The large number of assets in certain fleets, eg poles, gives an indication of the scale of our network and the work we undertake on it.

Table 2: **Asset population summary (2018)**

ASSET TYPE	POPULATION
Overhead structures	
Poles	264,146
Crossarms	424,505
Overhead conductor	
Subtransmission (km)	1,507
Distribution (km)	14,804
LV (km)	5,110
Underground cables	
Subtransmission (km)	169
Distribution (km)	2,051
LV (km)	4,456
Zone substations	
Power transformers	191
Indoor switchboards	121
Buildings	160
Distribution assets	
Transformers	35,245
Switchgear	41,927
Secondary systems	
Zone substation protection relays	1,782
Remote terminal units	297

The large number of

assets

gives an indication of the scale of

our network

04

OUR CUSTOMERS

Growth across all customer segments has **exceeded forecasts**

The expectations of our customers guide our investment and network delivery

We are proud to serve more than 335,000 diverse groups of households, businesses and communities. Our customer base includes:

- 23 electricity retailers who operate on our network trading as 32 brands
- 337,137 homes and businesses comprising:
  - Residential consumers and small businesses – 'mass market'
  - Medium-size commercial businesses
  - Large commercial or industrial businesses
- 21 directly contracted industrial businesses, including large distributed generators
- 19 local territorial authorities and the New Zealand Transport Agency

The table below sets out the proportions of our customer base and contrasts with the volume of electricity they use – this illustrates the significant electricity consumption of our larger customers.

Our customers are distributed relatively evenly across our network regions

The largest regional concentrations are in the Bay of Plenty, Taranaki and Manawatu, each having a large urban centre – Tauranga, New Plymouth and Palmerston North respectively.

During the past three years, **growth across all of our customer segments has exceeded our forecasts**. We have had to refine our forecast load estimates and increase network capacity. Our customer connection teams and processes have been bolstered to ensure we meet this growing need and continue to provide good customer service.

EMBEDDED GENERATORS

We provide direct network connections for a number of embedded generators

Sixteen of these have export capacity over 1MW, while a further four are classed as industrial cogeneration, where generated power is wholly or partly consumed on-site.

In addition, there are approximately 2,900 distributed generation installations of less than 1MW capacity connected to our network. The combined capacity of these smaller generators is just over 14MW. Of these, nearly all are domestic photovoltaic (PV) panel installations of less than 10kW capacity.

The uptake rate of small scale distributed generation (SSDG) on our network has risen from about 10 to 70 installations per month in the past four years as prices of PV and inverter technologies has dropped.

Table 3: **Number of customers (ICPs) and electricity delivered**

CUSTOMER TYPE	ICPS	% OF TOTAL ICPS	ELECTRICITY DELIVERED (GWH)	% OF TOTAL ELECTRICITY DELIVERED
Mass market	335,094	99.4	2,640	54.5
Commercial	1,419	0.4	252	5.2
Large commercial / industrial	624	0.2	1,955	40.3
Total	337,137	100%	4,847	100%

We have a policy to **support and facilitate the appropriate development of distributed generation**, while ensuring appropriate control given the potential local impacts on network operation.

ELECTRICITY RETAILERS

We operate an interposed model

That means retailers purchase our services, bundle them with energy supply and the cost of accessing the transmission grid, and provide a bundled price for delivered energy to their customers. We have agreements with 23 retailers used by our customers.

Given the importance we place on our relationship with electricity retailers, we have a dedicated relationship management team that focuses on providing them with a high level of commercial and operational support. This helps them provide a quality bundled service to customers and seamlessly resolve any supply issues on their behalf. **Working with retailers to deliver a simple and effective energy supply for customers is a key part of what we do.**

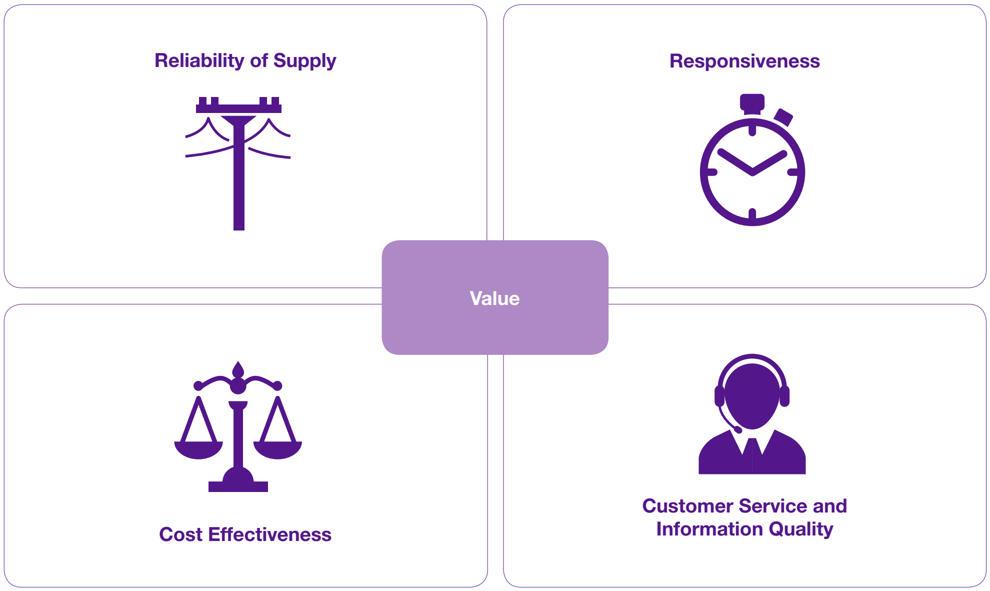
OTHER STAKEHOLDERS

We provide network services to a range of other stakeholders. Amongst a range of other stakeholders we work with:

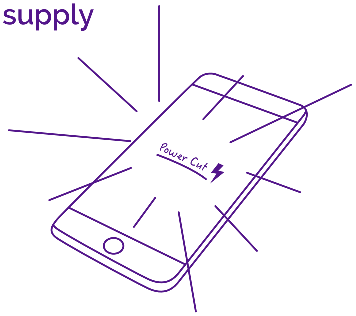
- the New Zealand Transport Agency and territorial local authorities that require us to move our lines or cables for roading projects,
- House relocation companies requiring us to switch off our lines during their operations,
- Developers requiring connection services to housing developments.

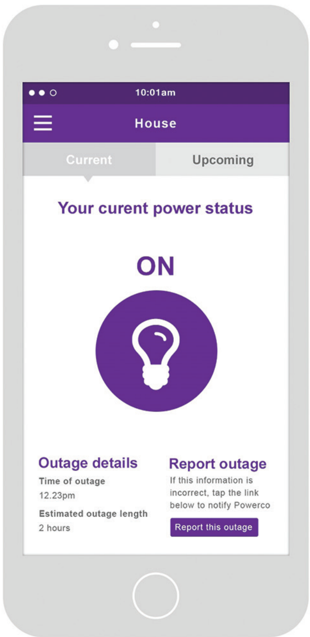
CUSTOMER SERVICE PRIORITIES

We use a variety of means to engage with our customers and capture their feedback. What customers tell us they value can be captured four key service dimensions below.



Our customers value
timely and accurate
information about their
electricity supply





RELIABILITY OF SUPPLY

Customers place a high value on reducing or avoiding outages. This is especially true for different groups, for different reasons – and our approach to asset management is to better understand these differences, so we can align our investment plans.

Resilience is similarly important, as our customers expect our network to be able to withstand storms and for supply to be restored within a reasonable period. This will become a **growing challenge on our largely rural and often remote network as climate change impacts on us**.

RESPONSIVENESS

Unplanned outages occur for a variety of reasons. Some of these are considered to be within our control, such as equipment failures. Others are beyond our control, such as lightning strikes or vehicles hitting poles. Those **outages that are within our control are easier to foresee and prevent, and we do everything we reasonably can to eliminate them.**

When an unplanned outage does occur, our customers expect us to respond quickly to reduce their impact and potential safety risks.

COST EFFECTIVENESS

While our customers recognise the importance of investing in the network to ensure that it is safe and reliable, they are also concerned about the price of electricity. **Delivering efficient and effective value and control over our costs is paramount at Powerco**.

CUSTOMER SERVICE AND INFORMATION QUALITY

Our customers value timely and accurate information about their electricity supply. Advances in mobile technology and social media have created an expectation that information should be readily available through a number of alternative communication channels.

The most important information for residential customers is communication about power cuts. Information on upcoming planned power cuts is important to 90% of residential respondents. Information relating to unexpected power cuts is also highly valued by 78% of respondents. The results are similar for business customers who place even greater value on each of these aspects.

HOW CUSTOMER FEEDBACK INFLUENCES OUR STRATEGY

Feedback from our customers on what they value is a cornerstone of our asset management process

Our plans have been developed to ensure we invest prudently in our networks so that we continue to deliver the level of service our customers require in the long term. This includes our commitment to our customers to ensure the safety of our assets, and to deliver stable reliability outcomes over time.

Feedback from our customers can be grouped as follows:

SAFE AND RELIABLE NETWORKS

Feedback is unequivocal that customers want their electricity delivered safely, reliably and efficiently

It is therefore essential that we invest in our assets to ensure they are in appropriate condition, are safe and reliable, and meet the needs of our customers.

We continually monitor key indicators such as asset health, fault rates, and supply quality to guide our investment and ensure customer expectations are being met. Our current asset management plan is allowing us to increase the level of investment to ensure safety and reliability is in line with the expectations of our customers.

FACILITATING CUSTOMER GROWTH

Our regions have been experiencing sustained population and economic growth

As we have experienced sustained demand growth across many of our networks there are many locations where we have no practical way of rerouting supply in the event of a key asset failing, and where the cost of such a failure is increasingly becoming unacceptably high for our customers. Because this situation affects our ability to provide a secure, stable power supply, our **customers recognise the need to continue to expand and augment the capacity of our network** to cope with demand growth.

ENABLING OUR CUSTOMERS' ENERGY CHOICES

Customers want more flexibility and choice

Customers want different options for the services we offer and the way we communicate with them.

While not a strong theme in customer feedback, we are aware that new technology offerings, combined with an increasing consumer willingness to take more control of their energy options, is leading to a change in the way energy markets operate.

This change means we must learn about these new technologies and new energy solutions to **enable our networks to support and accommodate the future choices of our customers**. This has influenced our strategy to invest in resources to study customer trends and emerging requirements, so we can prepare our network to accommodate them.

LINKING CUSTOMER FEEDBACK TO OUR ASSET MANAGEMENT PROCESS

Our asset management links the service levels our customers tell us they require to our investments

Our network growth and development strategies aim to provide just-in-time capacity by using best industry practice to predict probable load growth and customer demographics. This enables us to meet demand growth without providing more capacity than is needed.

Similarly, our asset renewal strategies aim to ensure appropriate asset condition and maintain current levels of reliability in the longer term. We aim to achieve this via effective management of the health of our asset fleets through targeted maintenance and renewal.

We have clear plans to adapt to changing customer needs in the face of technological change and to ensure that we are able to anticipate and accommodate customer needs beyond traditional distribution services.

Customers are our key influencer for setting our asset management objectives and investment plans

05

ASSET MANAGEMENT STRATEGY

Our Corporate Objectives define what we strive to do as an organisation

Our priorities have been framed around three central themes:

- Customer orientation
- Operational excellence
- New Energy Future

The Corporate Objectives are further expanded into a set of asset management objectives. The Asset Management Objectives are unique for each of our fleets but are centred around a set of five universal criteria:

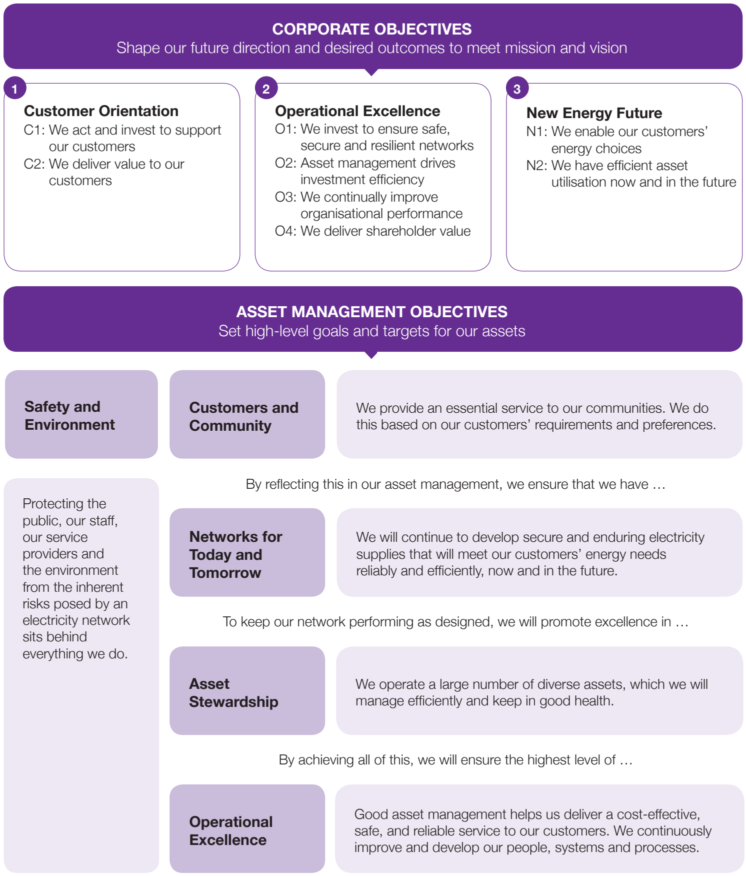
- Safety and Environment
- Customer and Community
- Networks for Today and Tomorrow
- Asset Stewardship
- Operational Excellence

How this fits together and guides us is illustrated below.

These five Asset Management Objectives sit at the heart of our Asset Management Strategy. They reflect our lifecycle asset management approach which considers all aspects of asset decision-making and activities from inception to decommissioning. Our Asset Management Strategy sets the direction for managing our electricity network assets. It has been developed to achieve the following aims:

1. **Support the delivery of best value to our customers** while sustaining an appropriate commercial return for our shareholders.
2. **Help us achieve our core function as a lifeline utility** by safely and reliably delivering electricity to our customers.
3. **Drive our continuous improvement programme** to ensure we continue to be an efficient, forward-thinking network business.
4. **Ensure our asset management practices deliver on the overall Corporate Objectives.**

Figure 11: **Our Asset Management Objectives**



NETWORK TARGETS

We gauge our performance in delivering our Asset Management Objectives by monitoring a set of key targets. We have **designed our targets framework to drive improvement** in the way we run our business, our networks, and the services we provide to our customers.

AM OBJECTIVE	INDICATOR	FY19 ACTUAL	FY20 TARGET	COMMENTS
Safety and Environment	LTIFR	2.47	2.02	LTIFR has improved during the historical period. We did not achieve our targets in FY18 but expect to achieve the target by FY20.
	Safety Programme Delivery	95%		
	ISO 14001:2015	95%	Improve score	We have continually met our targets ahead of schedule since FY17
Customers and Community	Reliability is acceptable or better	93%	>90%	We have been consistent in delivering to our customer's expectations since 2012 onwards
	Overall supply quality meets expectations	97%	>95%	
Networks for Today and Tomorrow	Unplanned SAIDI	171.0	166.0	Unplanned interruption targets are based on pre CPP targets. We expect to deliver an improvement in performance for our customers.
	Unplanned SAIFI	1.96	2.09	
	Planned SAIDI	68.4	84.9	We forecast an increase in planned interruptions as we ramp up works to deliver CPP
	Planned SAIFI	0.31	0.37	
	Feeder reliability compliance with standard	78%	70%	Feeder classes F2-F5 exceeded our target of 70% in 2018, but performance of feeder class F1 has deteriorated since the last AMP
	Increase in LV monitoring points	-	1,000 new points	This is a new metric in line with ensuring we transition to an open access network
Asset Stewardship	6.6, 11, 22kV overhead lines	31.3 faults 20.3 interruptions	<16 faults <10 interruptions	A major portion of our capital expenditure is being used to target distribution overhead assets. These numbers (although high) are just starting to stabilise after year on year increases from 2013 onwards. Our subtransmission and underground assets are performing in line with expectations
	6.6, 11, 22kV underground cables	5.8 faults 5.8 interruptions	<4 faults <4 interruptions	
	33, 66kV overhead lines	8 faults 3.9 interruptions	<9 faults <5 interruptions	
	33, 66kV underground cables	0.6 faults 0.6 interruptions	<1.7 faults <1.5 interruptions	
	Distribution transformer utilisation	28%	30%	
	Zone transformer utilisation	51.6%	50%	Utilisation has fallen very slightly due to some significant upgrades (eg new Subs at Pyes Pa and Wairakei and Mokoia)
	Network energy losses	5.4%	6%	
Operational Excellence	Self-assessed maturity level		Achieve a self-assessed Asset Management Maturity Assessment Tool (AMMAT) score of at least 3.0 by 2020.	
	ISO 55001 certification		Achieve ISO 55001 certification by 2020.	

ASSET MANAGEMENT IMPROVEMENTS

We are always looking at how to improve our asset management practices

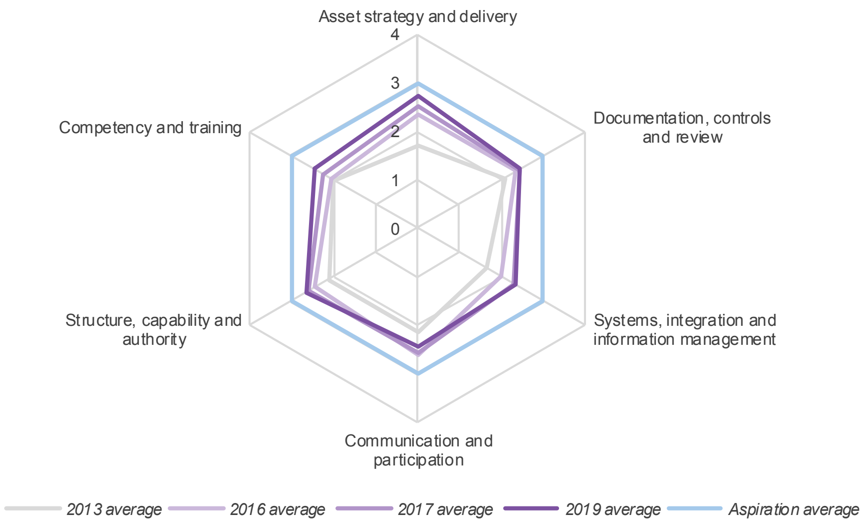
Regulation requires us to assess ourselves against the Asset Management Maturity Assessment Tool (AMMAT[6]) self-assessment questionnaire. We have been constantly tracking ourselves against this since 2013.

The AMMAT assessment demonstrated that we constantly improved the way we managed our assets. However, we were only comparing ourselves with our previous performance. Therefore in 2018, we employed asset management consultant AMCL Ltd to undertake an **independent external review of our asset management systems**.

AMCL undertook a gap assessment as benchmarked against ISO 55001. This allowed us to understand how we performed compared to international best practices.

This allowed for an honest reappraisal of our asset management maturity when considered in the light of AMCL's feedback. For example, we have reduced our AMMAT assessment in the areas of corporate dissemination of strategy and objectives, competency management, asset management system documentation, information management, and achievement of continuous improvement. However, notwithstanding ACML's feedback, we believe **we have achieved many improvements in asset management practices**.

Figure 12: **Summary of AMMAT self-assessment scores by assessment area**



IMPROVEMENT INITIATIVES

AMCL justified the scores by commenting on the strengths and deficiencies in our current practice. The identified deficiencies focused principally on:

- Needing to better define the Asset Management System
- Making clearer the links between corporate objectives and day-to-day operations
- Better role and governance definition with respect to ISO 55001 implementation
- The improvements needed to our risk management framework
- Better training and competence frameworks
- Information quality
- Management of change
- Operational planning and control, for example our defect management processes

We have **formulated action plans to address these deficiencies**. These will have a positive impact on our AMMAT scoring and benefit customers.

The improvement initiatives are outlined in Table 4 on the next page.

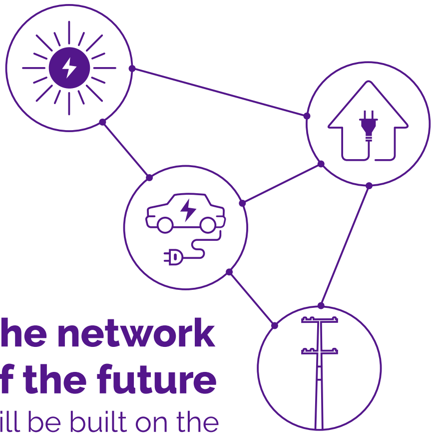
Table 4: **Asset management maturity improvement initiatives completion by FY21**

INITIATIVE	OUTCOME
Asset Management System	Refine the Asset Management System to include: – scope definition – roles and responsibilities – risk management frameworks – better align organisational and Asset Management Objectives – the means of developing a resourcing strategy
Asset Management Policy	To provide guidance on the requirements of Asset Management System framework and governance, and the means of communicating the Asset Management Policy to people throughout the organisation.
Asset Management Strategy	Assess relative positions of asset plans with respect to Asset Management Objectives, setting maturity levels and resource priorities, and establishing review cycles. Develop a lifecycle approach to maintenance strategy, critical spares strategy, and sustainable development strategy.
Process mapping	Link end-to-end project process maps with Asset Management System.
Risk management frameworks	Risks and controls are to be aligned with the Asset Management System and corporate risk management framework. Provide clarity around the 'as low as reasonably practical' (ALARP) risk appetite and how it is used to inform decision-making. Clarify how asset risks are captured, tracked over time and fed back into fleet management plans and business decisions.
Training and competency frameworks	Develop an asset management and project management competency framework.
Information management framework	Develop a management system that effectively manages, governs and assures that necessary asset information quality parameters are being met, and that data is being continuously improved.
Change management	Provide tools and staff to enable management of change to be improved in all processes.
Continual improvement	Develop and authorise an Asset Management Improvement Plan.
Defect management	Continue to improve defects management systems.
Incident investigation	Resolve incident close-out processes and improve points of incorrect management of incidents.
Document management	Refine how documents are controlled and where they are stored.
Strategic resourcing strategy	Develop an enterprise Resource Management Plan.
Supply chain	Develop a procurement and supply chain strategy.

[6] AMMAT is a means to derive asset management maturity scoring for Information Disclosure purposes

06

MAINTAINING A SAFE AND RESILIENT NETWORK



The network of the future will be built on the **network of today**

The network of the future will be built on the network of today

The decision to renew network assets considers multiple factors, but at the heart is investing to maintain a network that will provide the foundations for customers to live their lives where they are dependent on the network to support them.

Drivers for renewal expenditure can include condition, non-condition and operational reasons. The drivers also vary between fleets since each fleet has different functionality and serves a different purpose on the network. Often an investment programme will be driven by more than one of these factors.

- **Asset Condition and health:** As custodians of the electricity network, it is our responsibility to manage the network in perpetuity. Therefore, we are responsible for addressing asset deterioration to ensure that our assets remain in a safe and serviceable condition for long-term capability and operation.
- **Safety:** Some of our fleets, such as our overhead structures and overhead conductor renewal, focus on mitigating safety risks to staff, service providers and the public. We isolate or minimise hazards as much as reasonably practicable.
- **Environment:** Some of our assets can pose environmental risks, particularly those that contain oil or sulphur hexafluoride (SF6). These risks can drive us to either mitigate the risks, such as through upgrades to oil bunding and containment systems, or to replace assets where the increased failure likelihood leads to unacceptable environmental risk.
- **Reliability:** This includes renewal of assets with known failure modes/type issues where a particular asset type/model is found to fail prematurely.
- **Resilience:** Our understanding of how assets perform in extreme events, such as storms and earthquakes, is always improving. This increased understanding is reflected in our design standards and applied to new assets installed on the network. The new design standards are not typically retroactively applied to our legacy assets. However, in some instances where the risk is deemed to be unacceptable, it may be necessary to renew assets to the new standards.
- **Obsolescence:** Renewal may be warranted when existing assets are assessed to be obsolete. This can occur when an existing asset is incompatible with our modern systems and standards, and lacks significant functionality when compared with modern equivalent assets. Or, when spares may no longer be available to support the asset, or the asset may no longer be supported by the manufacturer.

HOW WE FORECAST FOR RENEWALS

Renewals forecasting is not a one-size fits all, we are always challenging our forecasting approaches

We use a variety of methods for forecasting renewals investments, with the different approaches applied to different asset fleets, depending on the characteristics of the asset and the renewal drivers. For example:

- Information availability limits our ability to use some forecasting methods for some asset types.
- A more complex method may be warranted where future renewals expenditure is expected to be high, while lower expenditure asset types will have simpler methods applied.

- Some renewal drivers only suit certain forecast methods, such as obsolescence.

The quantity of asset replacement in these forecasts informs the shorter-term investment planning process, which in turn identifies the assets for replacement and scopes the project activities. The forecasting methods used are outlined below:

- **Condition-Based Risk Management:** Condition-Based Risk Management (CBRM) is a modelling methodology that tests asset renewal forecasts based on the combination of asset condition and risk. CBRM is a mature and widely used methodology that now forms the basis of the UK regulator Ofgem's (Office of Gas and Electricity Markets) mandatory condition and risk reporting scheme[17].
- **Survivor analysis:** For large fleets with reliable historical end-of-life data, future replacement volumes may be forecast using survivor curves. A survivor curve model uses information on previous end-of-life asset replacements to build a probabilistic replacement rate curve, which produces a likelihood of failure for an asset of a given age. The replacement rate curve can then be applied to the current population of assets to predict the future number of replacements.
- **Specified projects/programmes:** This approach identifies specific projects or programmes that meet specified renewal criteria. We often use this approach where assets have 'type' issues or are obsolete, and to mitigate safety risks or meet seismic standards.
- **Historical Rate and Trend analysis:** Where it is difficult to individually assess sites or assets to determine renewal needs, we may estimate annual renewal volumes based on the historical rate or trend. For example, we use the historical rate to estimate the number of pillar box renewals required because of motor vehicle incidents.
- **Failure rate reduction:** This approach is used only for forecasting distribution reconductoring requirements. The approach determines the amount of conductor renewal that will be required to achieve good practice reliability for the asset type, assuming we replace conductors in order of failure risk. Actual replacements are then targeted based on the key risk factors – in this case, age, type, and coastal proximity.
- **Age-Based:** Where we have a large population of assets but do not have sufficient data to develop survivor models or use condition-based forecasting, we may use a more simplistic age-based forecast approach.

NETWORK OPEX PLANNING

Network operations ensures the day-to-day safe and reliable control of our network

Network operations' primary roles are to ensure the safe continuous supply of electricity to customers through monitoring, switching and load control, and providing contractor access for works required for the development and maintenance of the network. This centres on our 24/7 Network Operations Centre (NOC) and a dispatch centre that communicates with retailers and the public.

Maintenance of the network involves monitoring and managing the condition of the network to a safe working condition. It includes routine visual inspections, testing and measurement, routine preventive maintenance, and restoration tasks to remedy defects, degradation or failure.

Network operating expenditure (Opex) consists of three categories of work:

- **Maintenance:** Our maintenance activities are categorised into three categories:
  - **Preventive Maintenance and Inspection**[18] – routine maintenance activities such as testing, inspecting and routine maintenance.
  - **Corrective Maintenance** – restoring asset condition or rectifying defects identified through inspection and testing tasks.
  - **Reactive Maintenance** – responding to faults and other network incidents, including immediate work to make a situation safe, or to repair failed assets
- **Vegetation management:** Preventing trees and other vegetation from interfering with our assets, particularly overhead lines, is an essential activity necessary to ensure that our network remains safe and reliable. It is also a legislative requirement to maintain mandated clearance distances between vegetation and our lines.
- **System Operations and Network Support (SONS)**: SONS relates mainly to our people – salaries, wages and supporting expenditure. It also covers related network support expenses, such as professional advice, engineering reviews, quality assurance, and network running costs.

17. DNO Common Network Asset Indices Methodology (Jan 2017) https://www.ofgem.gov.uk/system/files/docs/2017/05/dno_common_network_asset_indices_methodology_v1.1.pdf
18. Our Preventive Maintenance and Inspection portfolio was previously named Routine Corrective Maintenance and Inspections (RCI). The corrective maintenance component of this work is now part of our Corrective Maintenance portfolio. This change has been made to better reflect the drivers for these activities and the way we plan and deliver these works. Our Information Disclosure schedules reflect the RCI definitions, also consistent with our historical disclosures.

07

PLANNING FOR A GROWING NETWORK

INVESTMENT TRIGGERS

We invest to grow the network when customers' needs demand it

Our network has faced consistent demands from customers to meet their needs for electricity. How we can keep up with those demands and make the correct decisions come through our investment triggers being met by certain criteria. We then review options to invest in the network, or to deliver via non-network options, to restore appropriate levels of capacity or reliability. Growth and security investment triggers (by voltage level) include:

- GXPs/transmission spurs that exceed security criteria as outlined above.
- Subtransmission and zone substations that exceed security criteria.
- Distribution feeders that exceed guidelines or planning parameters related to voltage profile, thermal capacity of any given section of feeder, and number of connections.

The **identification of an investment trigger does not automatically result in a project**. For growth and security planning, we prioritise the identified needs according to the risk exposed by the constraint. This assists with the ranking and timing of related investments. Given capital and capacity constraints, low risk projects, or projects with low economic value are often deferred.

To gauge whether our security criteria are effective in achieving our customers' desired service levels, we need to interpret their feedback on the more general price/quality trade-off, and consider any other industry benchmarks, trends or comparisons.

For example, we have aligned our security standards with the industry's guideline document produced by the Electricity Engineers' Association (EEA). In turn, this EEA guide seeks to set security levels aligned with the United Kingdom standard P2/6, while recognising the characteristics of the New Zealand industry and networks.

The EEA guide to security of supply introduces two approaches to security, and the underlying issue of reliability:

- A deterministic N-x security classification
- A probabilistic, reliability-based approach

In cases where there is clearly no economic option, we generally do not invest to provide higher than N security. Rural substations fed by a single circuit or with a single transformer, serving a small load, often fall into this category. For these the outage consequences can usually be managed operationally.

NETWORK SECURITY STANDARDS

Our security standards allow the network to grow to support our customers' growth

The amount of redundancy on our network is determined by the zone substation security classification. These are determined at a Zone Substation level as effective tailoring of security standards for individual customers, especially mass market, is impractical. The level of redundancy is defined by the amount of load restored, and the time in which the load is restored.

Our zone substation security classification starts by classifying each of the 11kV feeders supplied by the substation. The feeder classification is derived by the predominant customer on each

11kV feeder and are ranked F1-F5, with F1 feeders representing the most critical loads. Zone substations with multiple types of feeders are attribute the highest feeder rating to the zone substation.

We also consider the maximum demand at the substation based on historic demand at the zone substation. A combination of the feeder type and substation demand determines the security class. The security class is used to determine the restoration time and extent for the site.

At the quantum of load encountered at our zone substation we allow for enough redundancy so that an outage on the single largest circuit or transformer can occur without resulting in supply interruption. This is achieved by either installing full system back-up at the zone substation, or by re-routing supply from a different source. This level of redundancy is referred to as N-1, where the numeric number (i.e. “1”) represents the number of coincident outages that can occur during periods of peak demand without extended loss of supply to customers.

Zone substation security levels are used to qualify the time allowed to restore supply by network reconfiguration after an asset has failed. Three of our five security classes are qualified by the allowable switching time before all load is to be restored. For an N-2 event (i.e. failure of primary and back-up systems), we plan for a contingent level of service. The restoration targets assigned to each of the security classes are set out in Table 6.

The first four classes (AAA to A1) all require either full or switched N-1 capacity, ie it must be possible to supply the peak load on the substation even with the loss of the single largest normal supply circuit or transformer. The different security classes simply mandate different restoration times.

The A2 class requires only N security. Supply can therefore be via a single circuit or transformer with limited or no backup. This class only applies to a few remote rural zone substations where alternative supply cannot be economically justified.

Table 5: **Zone substation security class**

FEEDER (LOAD) TYPE	ZONE SUBSTATION MAXIMUM DEMAND			
	< 1 MVA	1 – 5 MVA	5 – 12 MVA	>12 MVA
F1 – Large Industrial	AA	AA	AA+	AAA
F2 – Commercial/CBD	A1	AA	AA+	AAA
F3 – Urban Residential	A2	AA	AA	AA
F4 – Rural	A2	A1	A1	n/a
F5 – Remote Rural	A2	A2	A1	n/a

Table 6: **Security class restoration targets**

SECURITY CLASS	TARGETED RESTORATION CAPABILITY FOR	
	1ST EVENT (N-1)	2ND EVENT (N-2)
AAA	100% – without break	> 50% in < 60 mins, remainder in repair time
AA+	100% – restored in < 15 secs	> 50% in < 60 mins, remainder in repair time
AA	100% – restored in < 60 mins	Full restoration only after repairs
A1	100% – unlimited switching time	Full restoration only after repairs
A2	Full restoration only after repairs	Full restoration only after repairs

08

EXPENDITURE FORECASTS

Our long-term planning is focused on post-CPP years

CAPITAL EXPENDITURE

Many of our asset fleets expenditures are forecast to stay at current CPP investment levels, recognising the ongoing need for reinvestment to maintain the network. We expect to see a reduction in Zone substation and secondary systems expenditures, as well as distribution switchgear post CPP.

Network Growth and Security expenditure is also forecast to remain relatively constant post CPP.

Expenditure on Major Projects is expected to drop to approximately 75% of CPP levels as we complete fixing major security of supply breaches on the network.

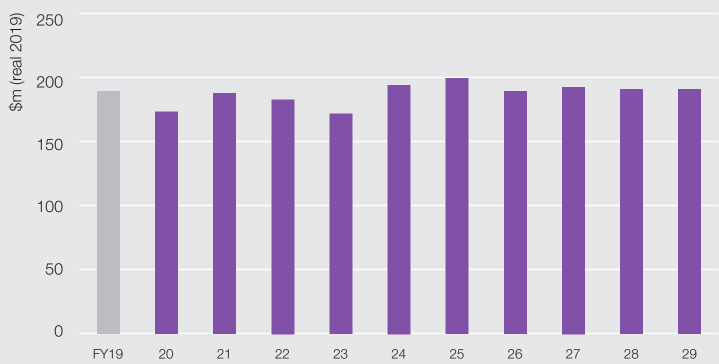
We are forecasting an increase expected in Minor Project expenditure – mainly to keep up with expected demand growth. We have limited visibility five or more years out on new growth requirements, but based on experience, it is unrealistic (and unhelpful) to think this expenditure will fall away[19]. Accordingly, we have included a somewhat conservative allowance for the post CPP forecast, with some marginal projects being included late in the forecast period. There is a small probability

Table 7: **Total forecast Capex for the planning period ($m real 2019)**

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Growth and Security	60.1	56.3	62.8	66.5	60.5	79.9	88.3	79.9	81.7	87.5	83.8
Renewals	89.8	87.1	89.8	90.1	87.0	86.9	83.4	83.5	83.2	82.1	82.4
Other network	15.2	18.0	19.0	17.5	16.3	14.3	16.9	17.2	18.1	14.8	17.8
Non-network	24.2	12.8	16.2	9.7	9.0	12.5	10.4	8.9	9.5	7.1	6.7
CAPEX forecast	189.3	174.1	187.8	183.7	172.7	193.5	198.9	189.4	192.5	191.4	190.7

[19] Traditionally, as we gain more visibility of future growth intents in next AMP periods, new, more firmly committed projects tend to come up for later periods.
[20] Although the local debate about the shape of open access networks and associated market arrangements are only starting to emerge, it is already in full swing in many international jurisdictions, with that in Australia and the UK of particular relevance to us.

Figure 13: **Total forecast Capex for the planning period**



that some of these projects may drop out as we improve our understanding of the constraints and devise appropriate solutions (but similarly unforeseen growths may arise elsewhere on the network).

The major uplift forecast in post CPP expenditure is on network visibility investments

This is necessary should we transition to an open access network. In the AMP we discuss how this transition is essential for distribution networks to support the country meeting its Paris Accord and government renewable energy targets. This will be achieved by enabling our customers to innovate, transact over and connect to the network in an unconstrained manner, while we can continue to run it safely and stably. In turn this will encourage increased use of renewable generation, improve energy efficiency and optimise the utilisation of energy infrastructure. It is also an essential enabler for any likely future distribution system operator arrangement.

We recognise that **this increased expenditure forecast on transitioning to an open access network is likely to receive considerable scrutiny and will involve much debate and analysis**. This is especially the case as the major benefit from the intended investment will be societal, and in the longer term.

Constructing a conventional business case to justify the expenditure based on short term customer needs and benefits will be difficult – particularly as New Zealand uptake rates of potentially disrupting distribution edge devices is still very low. The emerging debate[20] about open access network arrangements suggests that it is inevitable that distribution businesses should move in this direction – a conclusion with which we broadly concur – but there seems to be little consideration of the associated technical requirements and cost implications. Providing better transparency around this is important not only to better inform the debate, but also to advise stakeholders at an early stage of the likely future costs.

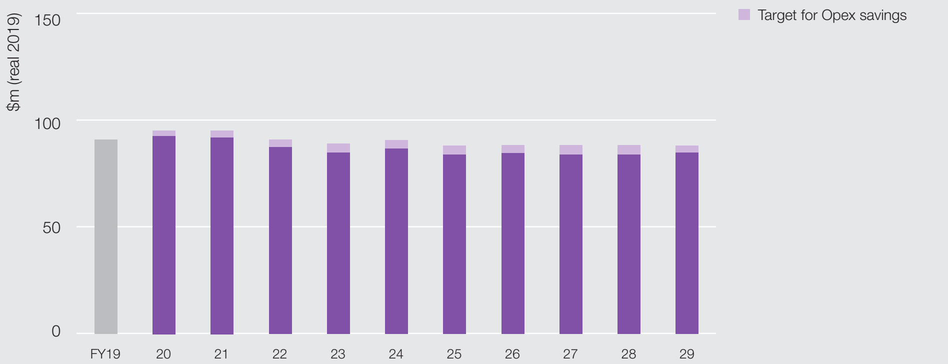
This additional expenditure forecast, which will be further refined over time as our information and understanding of the emerging market improves, will be mainly on metering, automation and communications. It will address particularly the LV networks, where we currently have limited to no visibility, but where most of the initial network demand and potential associated instability is anticipated to arise.

We will continue to pursue a relatively low-cost network transformation programme to ensure we reap maximum benefit from technology and customer developments

Table 8: Total forecast Opex for the planning period ($m real 2019)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Network	59.1	62.4	62.5	59.7	58.3	58.0	55.3	55.8	55.2	55.3	55.5
Non-network	31.8	32.5	31.9	31.2	30.2	32.5	32.4	32.5	32.5	32.6	32.6
OPEX forecast	**90.9**	**94.9**	**94.5**	**90.9**	**88.4**	**90.5**	**87.7**	**88.3**	**87.7**	**87.9**	**88.1**
Target OPEX		92.0	91.1	87.3	84.7	86.7	83.9	84.5	83.9	84.1	84.3

Figure 14: Total forecast Opex for the planning period



OPERATING EXPENDITURE

Our Opex forecast is relatively stable during the planning period.

Higher levels of expenditure during the earlier years of the planning period are designed to address our backlog in defects, allow more sophisticated condition assessment techniques, and allow us to reach sustainable levels of vegetation management. It includes investment in our people to ensure we can undertake our work programmes and lift asset management maturity.

Opex levels are higher than historical levels because of increased expenditure in our corrective maintenance portfolio to address a high number of end-of-life component replacements (defects) and increases in our SONS portfolio to support increasing work volumes and our advancement of asset management capabilities.

Towards the end of the period we expect to reach a stable level of network Opex. This reflects the reduction of our defect backlog, expected benefits of increased renewals, our cyclical vegetation programme being embedded, and efficiencies in our asset management approach.

Our non-network Opex forecast includes expenditure related to the divisions that support our electricity business. Our forecast expenditure is consistent with historical costs during the planning period. Increases in Opex because of a transition to cloud-based services and increases to cyber security costs are partially offset by a reduction in Opex through capitalisation of leases.

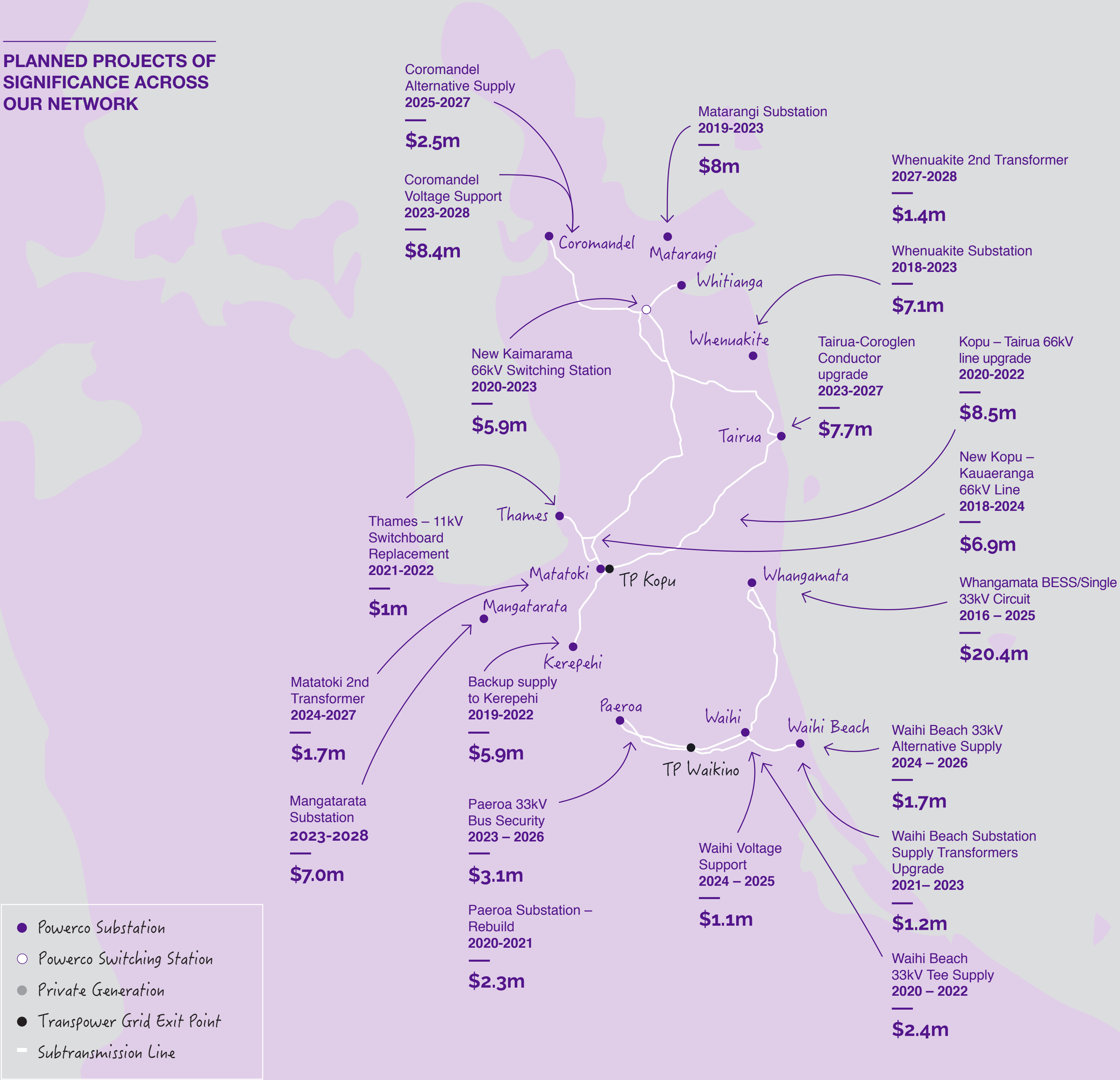
Stretch targets for Opex savings represent an additional challenge to deliver savings for our customers

These target savings are over and above the expected efficiencies from stabilised asset health, improved asset management capability, and process improvements already accounted for in the Opex forecast. Significant analysis and improvements implementation are required to achieve these stretch targets and given the high level of uncertainty, the stretch targets have not been included in our Opex forecast.

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK

COROMANDEL / WAIKINO

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK



Note: Dollar amounts are round-up figures.

TAURANGA

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK

Aongatete – 11kV Switchboard Replacement
2022 – 2023
—
$0.7m

Katikati Second Transformer
2018 – 2019
—
$1.2m

Katikati Substation Second Subtransmission Circuit
2019 – 2020
—
$1.5m

Bethlehem 2nd Transformer
2027 – 2028
—
$1.0m

Matua 2nd Transformer
2025 – 2027
—
$1.4m

Te Matai Substation Voltage Support
2023 – 2025
—
$5.9m

Triton Substation Rebuild
2020 – 2022
—
$7.8m

Atuaroa Substation Upgrade
2026 – 2028
—
$4.6m

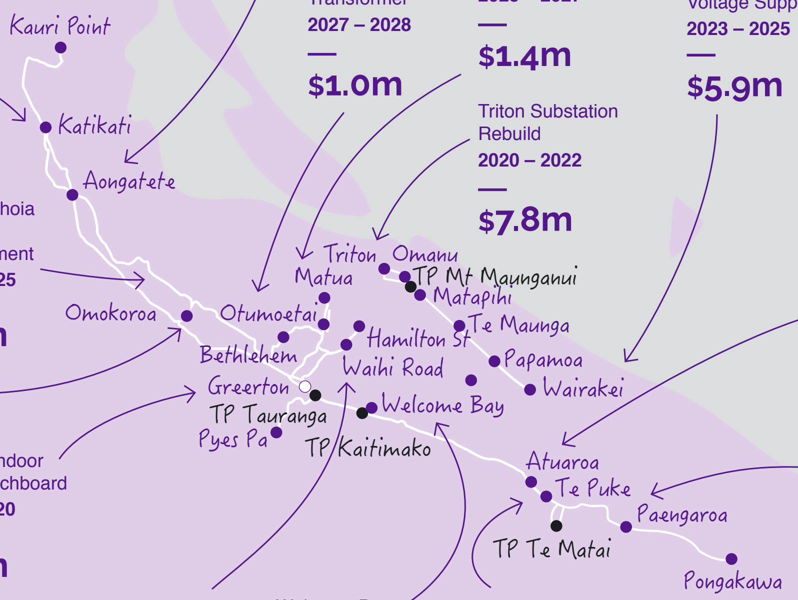
Apata / Pahoia Capacity Reinforcement
2023 – 2025
—
$5.3m

Atuaroa Subtransmission Upgrade
2026 – 2028
—
$2.2m

Northern Tauranga Reinforcement (Omokoroa Additional 33kV Circuits)
2021 – 2024
—
$11.4m

Greerton Indoor 33 kV Switchboard
2019 – 2020
—
$2.9m

Rangiuru Business Park
2023 – 2026
—
$6.6m



Gate Pa / Hospital Sub
2024 – 2028
—
$8.9m

Waihi Rd Bus Security Project
2019 – 2022
—
$4.6m

Welcome Bay 2nd Substation
2025 – 2028
—
$9.1m

Te Puke 33kV Bus Security Upgrade
2025 – 2027
—
$2m

Welcome Bay Reinforcement
2025 – 2027
—
$5.5m

- Powerco Substation
- Powerco Switching Station
- Private Generation
- Transpower Grid Exit Point
- Subtransmission Line

Note: Dollar amounts are round-up figures.

EGMONT / TARANAKI

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK

Moturoa Subtransmission
2018 – 2020
—
$9.4m

Moturoa Substation Building, Transformer, 11 kV and 33 kV Switchgear Replacement
2017 – 2020
—
$5.0m

Whalers Gate New 33/11Kv Substation
2028 – 2029
—
$7.9m

Pungarehu – 13E Power Transformer Replacement
2024
—
$0.7m

Kapuni & Manaia Subs 3rd 33kV Line (13km)
2024 – 2028
—
$3.0m

Kapuni – 11kV Switchboard Replacement
2022-2023
—
$0.7m

City Sustation Transformers' Upgrade (2 x 16/24Mva)
2028 – 2029
—
$2.4m

City – 11kV Switchboard Replacement
2021-2022
—
$1.0m

Oakura Sub 2nd Circuit & 2nd Transformer
2024 – 2027
—
$5.9m

Egmont Village New Zone Substation Project
2025 – 2027
—
$5.9m

Kaponga, Transformers and 11 kV Switchgear Replacement
2022-2022
—
$1.2m

Kaponga – Outdoor to Indoor 11kV Switchgear Conversion
2023-2024
—
$2.0m

Bell Block Substation 11kV Offload
2023 – 2025
—
$1.5m

Manaia Substation 2nd Transformer
2023 – 2025
—
$1.1m

Manaia Subtransmission
2022-2023
—
$3.2m

Cambria Sub two Transformer & two 3km 33kV cable Upgrade
2026 – 2028
—
$4.3m

Waitara to Mckee 33kV Line
2020
—
$1.9m

Cardiff – 4700T Power Transformer Replacement
2024
—
$0.5m

Livingstone substation 33 kV switchyard rebuild
2020
—
$0.6m

Livingstone – T1 and T2 Power Transformer Replacement
2022-2023
—
$1.6m

Inglewood 6.6kV to 11kV Conversion
2019 – 2022
—
$5.9m

Inglewood Substation Transformers' Upgrade (2 x 7.5/10Mva)
2025 – 2027
—
$2.0m

Motukawa – Outdoor to Indoor 11kV Switchgear Conversion
2023 – 2024
—
$1.4m

Motukawa Sub 6.6kV to 11kV Conversion
2023 – 2026
—
$2.6m

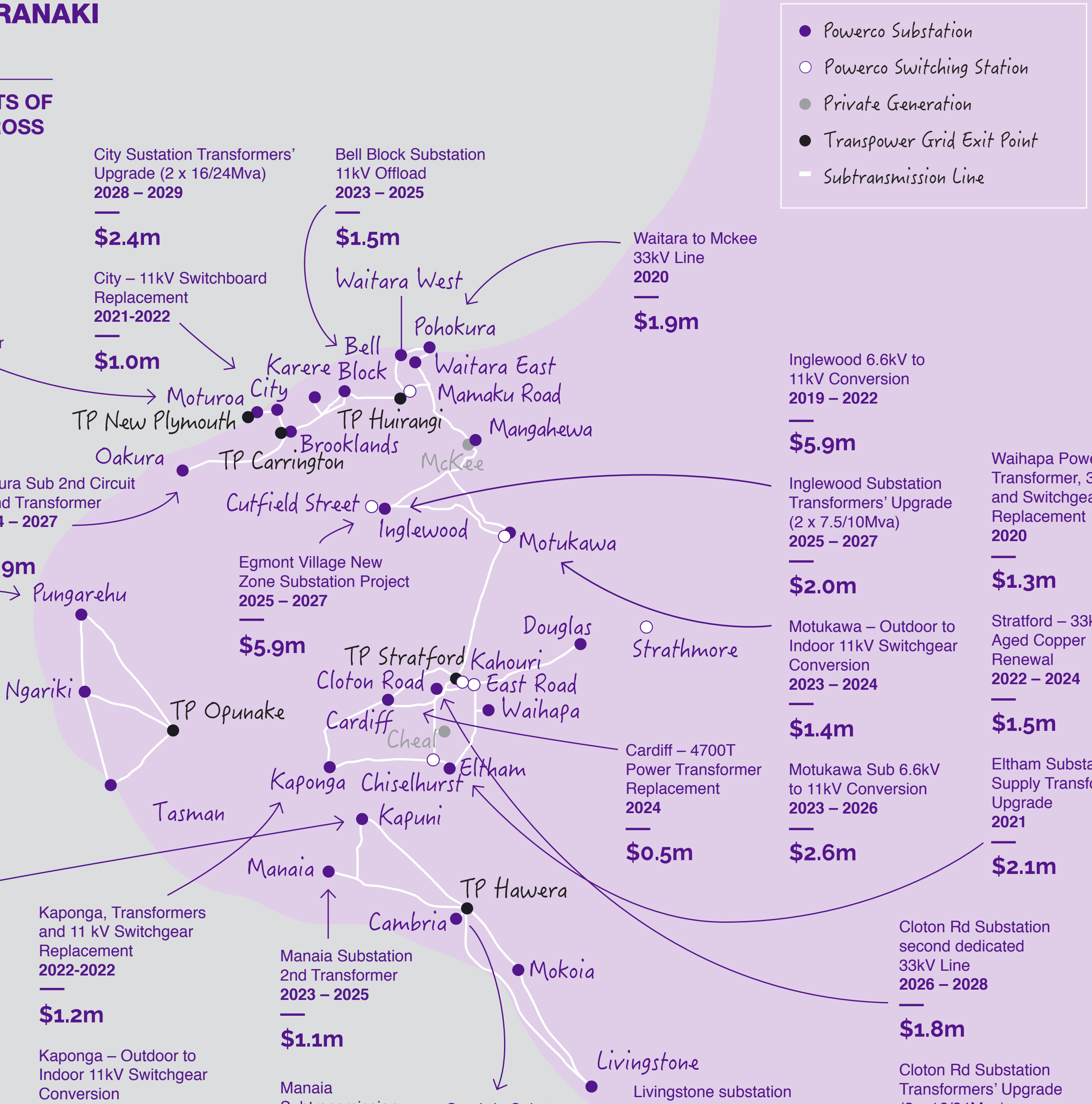
Cloton Rd Substation second dedicated 33kV Line
2026 – 2028
—
$1.8m

Cloton Rd Substation Transformers' Upgrade (2 x 16/24Mva)
2028 – 2029
—
$2.4m

Waihapa Power Transformer, 33kV and Switchgear Replacement
2020
—
$1.3m

Stratford – 33kV Aged Copper Renewal
2022 – 2024
—
$1.5m

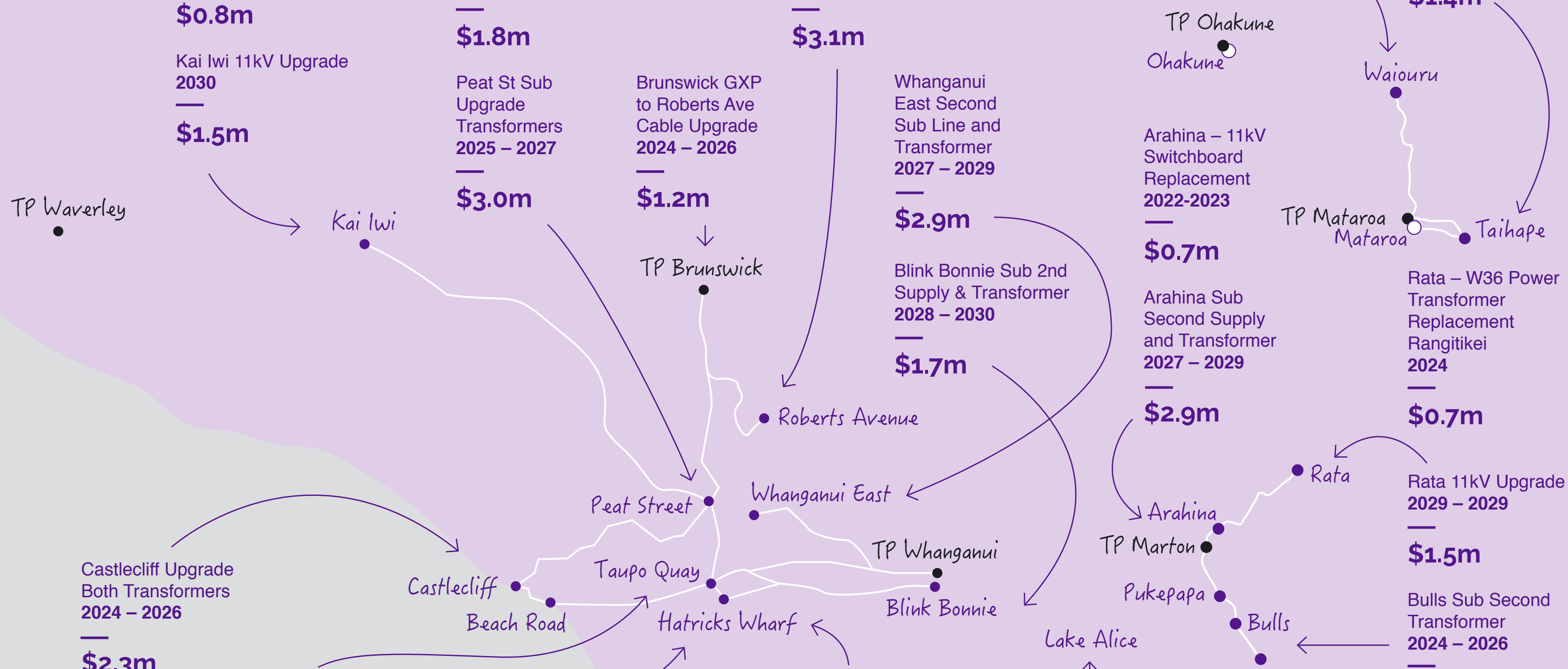
Eltham Substation Supply Transformer Upgrade
2021
—
$2.1m



Note: Dollar amounts are round-up figures.

WHANGANUI / RANGITIKEI

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK



Roberts Ave – W23 Power Transformer Replacement
2022 – 2023
—
$1.1m

Roberts Avenue Sub Second Transformer
2027 – 2029
—
$2.0m

Roberts St to Peat St 33kV Circuit
2020 – 2021
—
$3.1m

Kai Iwi – W27 Power Transformer Replacement
2022 – 2023
—
$0.8m

Kai Iwi 11kV Upgrade
2030
—
$1.5m

Peat St to Castlecliff Cable and Conductor Upgrade
2024 – 2026
—
$1.8m

Peat St Sub Upgrade Transformers
2025 – 2027
—
$3.0m

Brunswick GXP to Roberts Ave Cable Upgrade
2024 – 2026
—
$1.2m

Whanganui East Second Sub Line and Transformer
2027 – 2029
—
$2.9m

Blink Bonnie Sub 2nd Supply & Transformer
2028 – 2030
—
$1.7m

Waiouru 11kV Upgrade
2028 – 2028
—
$1.5m

Taihape Second Transformer
2027 – 2029
—
$1.4m

Arahina – 11kV Switchboard Replacement
2022-2023
—
$0.7m

Arahina Sub Second Supply and Transformer
2027 – 2029
—
$2.9m

Rata – W36 Power Transformer Replacement Rangitikei
2024
—
$0.7m

Rata 11kV Upgrade
2029 – 2029
—
$1.5m

Bulls Sub Second Transformer
2024 – 2026
—
$1.4m

Castlecliff Upgrade Both Transformers
2024 – 2026
—
$2.3m

Whanganui Gxp to Taupo Quay Second 33kV circuit
2020 – 2021
—
$4,383

Taupo Quay to Hatricks Wharf Upgrade incl Hatricks Transformer
2023 – 2025
—
$2.6m

Hatricks Wharf to Beach Rd New Line
2028 – 2030
—
$2.1m

Hatricks Wharf to Peat St Cable and Conductor Upgrade
2023 – 2024
—
$1.2m

Whanganui GXP Bus A to Hatricks Wharf Cable and Conductor Upgrade
2023 – 2024
—
$1.2m

Whanganui GXP Bus B to Hatricks Wharf Cable and Conductor Upgrade
2023 – 2025
—
$1.2m

Lake Alice Substation
2023 – 2026
—
$3m

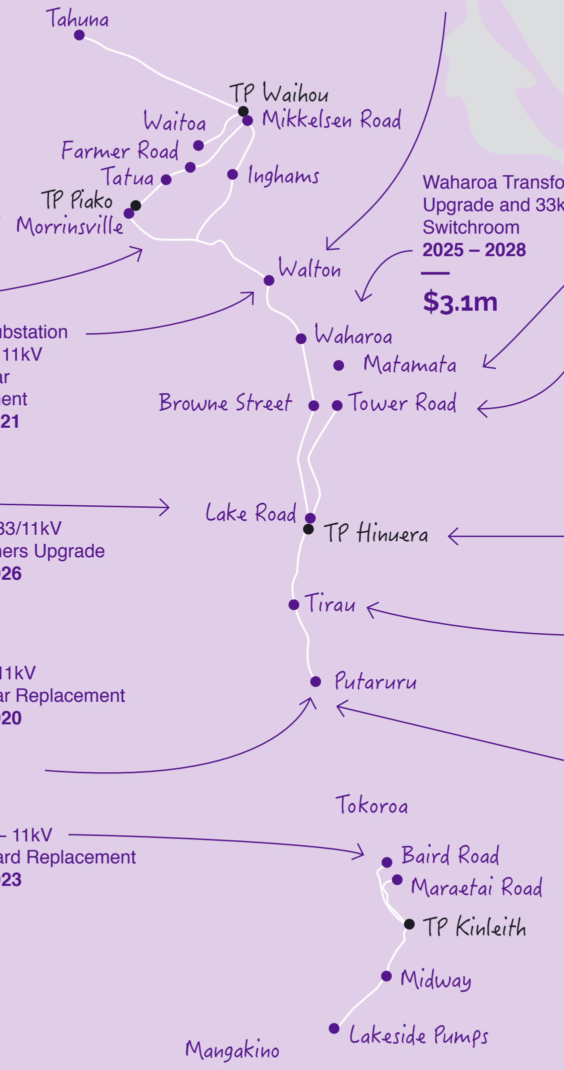
Pukepapa Second Transformer
2027 – 2029
—
$1.4m

Note: Dollar amounts are round-up figures.

KINLEITH / WAIKATO

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK

- ● Powerco Substation
- ○ Powerco Switching Station
- ● Private Generation
- ● Transpower Grid Exit Point
- ▬ Subtransmission Line



Morrinsville Second Circuit
2020 – 2023
$4.0m

Morrinsville Substation Upgrade
2024 – 2028
$7.8m

Piako Kiwitahi 11kV Feeder
2023
$1.7m

Lake Rd Substation Second Supply Transformer
2019
$2.4m

Walton Substation 33kV and 11kV Switchgear Replacement
2020 – 2021
$0.5m

Putaruru 33/11kV Transformers Upgrade
2023 – 2026
$2.4m

Putaruru 11kV Switchgear Replacement
2019 – 2020
$1.5m

Baird Rd – 11kV Switchboard Replacement
2022 – 2023
$0.7m

Kereone-Walton Upgrade
2020 – 2023
$6.4m

Waharoa Transformer Upgrade and 33kV Switchroom
2025 – 2028
$3.1m

Tower Rd Substation Second Supply Transformer
2019 – 2020
$4.1m

Hinuera Outdoor-Indoor (ODID) Conversion
2020 – 2021
$2.1m

Putaruru GXP
2019 – 2022
$25.4m

Putaruru-Tirau Upgrade
2019 – 2022
$6.7m

Matamata Subtransmission (Tower-Browne 33Kv Cable)
2019 – 2020
$2.1m

Matamata Subtransmission (Hinuera-Tower Rd 33Kv Line Upgrade)
2019 – 2020
$1.5m

Tirau 2nd Transformer & Upgrade Existing Transformer
2024 – 2027
$2.8m

Maungatautari Area Reinforcement
2025 – 2026
$2.5m

Note: Dollar amounts are round-up figures.

MANAWATU / TARARUA

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK

Sanson – 11kV Switchboard Replacement
2021 – 2022
—
$0.8m

Sanson-Bulls 33kV
2020 – 2022
—
$6.0m

Sanson Transformer Replacement
2023
—
$1.9m

Palmerston North CBD (Ferguson Substation)
2016-2023
—
$27.4m

Fielding Transformer Upgrade
2020 – 2021
—
$2.7m

Fielding Outdoor to Indoor Conversion, 33kV Switchgear
2020 – 2022
—
$2.8m

New (Third) 33Kv Line Bunnythorpe – Feilding
2025 – 2026
—
$2.9m

Bunnythorpe – Load Control Plant Replacement
2022
—
$0.8m

Kimbolton – T1 Power Transformer Replacement
2022 – 2023
—
$1.2m

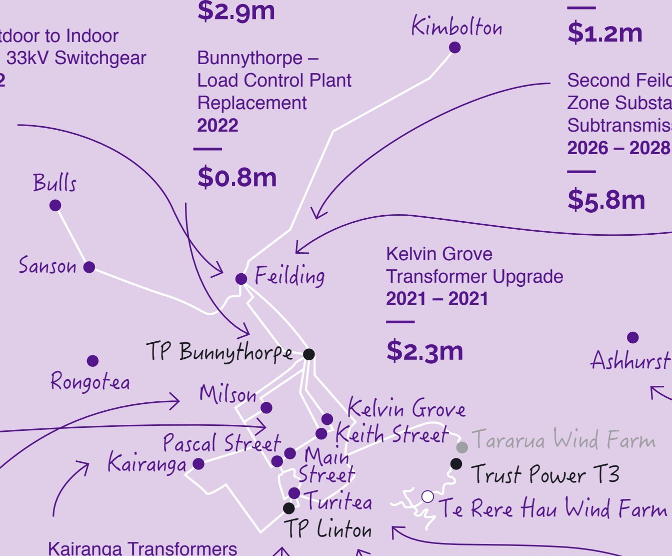
Feilding – 11kV Switchboard Replacement
2021 – 2022
—
$1.0m

Second Feilding Zone Substation and Subtransmission
2026 – 2028
—
$5.8m

Feilding-Sanson 33Kv Line Upgrade
2023 – 2025
—
$1.3m

Kelvin Grove Transformer Upgrade
2021 – 2021
—
$2.3m

New Ashhurst Zone Sub and Subtransmission
2027 – 2029
—
$6.0m



Milson-2 33kV Line Upgrade
2026 – 2027
—
$1.2m

Milson 11kV Switchgear Replacement
2020 – 2021
—
$0.9m

Milson – Outdoor to Indoor Conversion
2022 – 2023
—
$1.5m

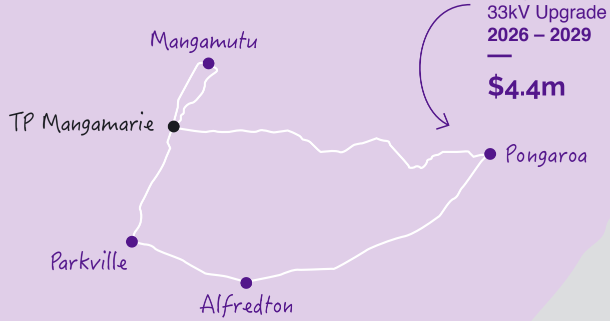
Kairanga Transformers Manawatu
2023
—
$2.2m

Main Street – T1 and T2 Power Transformer Replacement
2023 – 2024
—
$2.7m

Linton – Load Control Plant Replacement
2021
—
$0.7m

Turitea New 33kV Line Manawatu
2023 – 2025
—
$2.0m

TARARUA



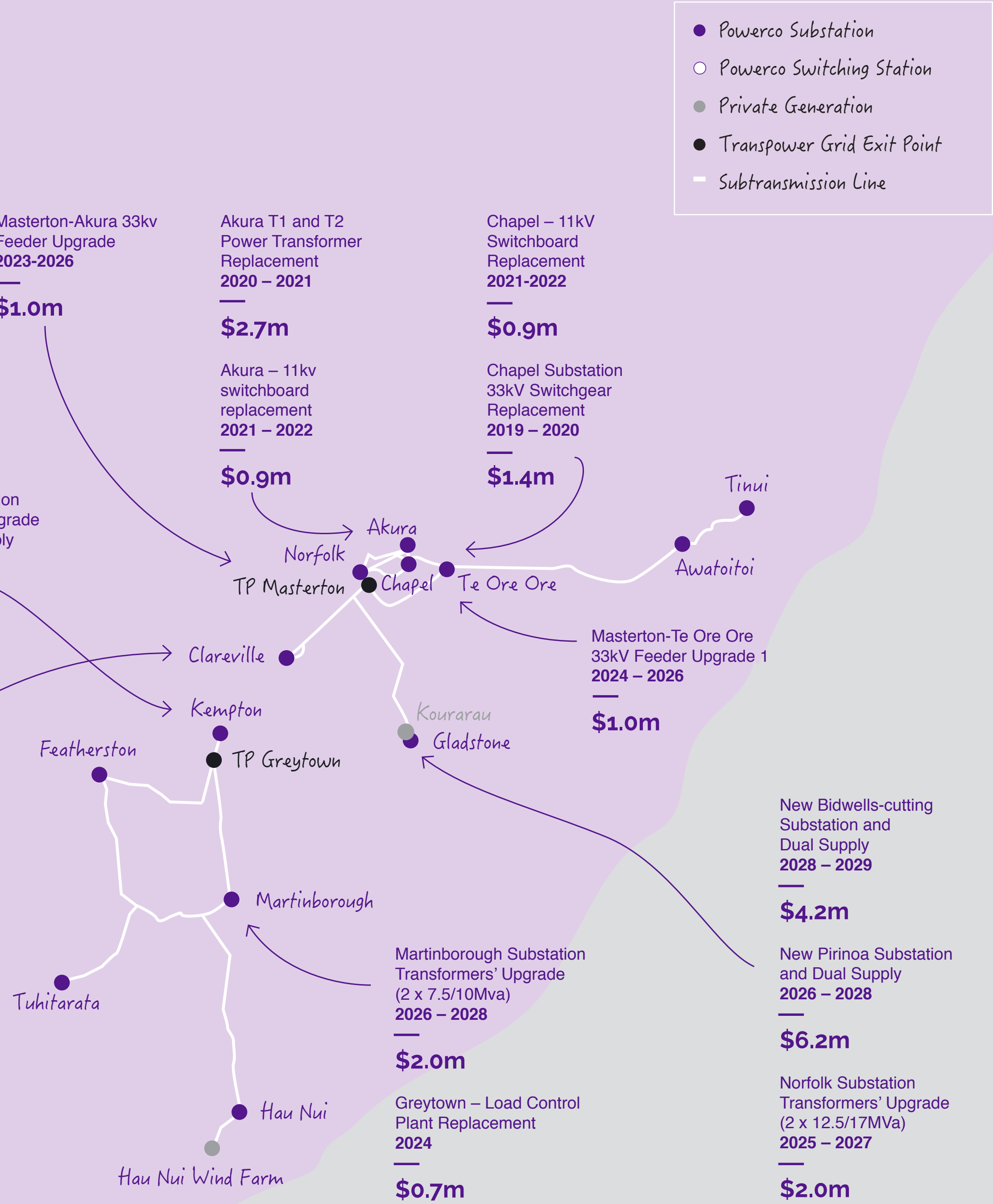
Pongaroa 33kV Upgrade
2026 – 2029
—
$4.4m

- Powerco Substation
- Powerco Switching Station
- Private Generation
- Transpower Grid Exit Point
- Subtransmission Line

Note: Dollar amounts are round-up figures.

WAIRARAPA

PLANNED PROJECTS OF SIGNIFICANCE ACROSS OUR NETWORK



Masterton-Akura 33kv Feeder Upgrade
2023-2026
—
$1.0m

Akura T1 and T2 Power Transformer Replacement
2020 – 2021
—
$2.7m

Akura – 11kv switchboard replacement
2021 – 2022
—
$0.9m

Chapel – 11kV Switchboard Replacement
2021-2022
—
$0.9m

Chapel Substation 33kV Switchgear Replacement
2019 – 2020
—
$1.4m

Kempton Substation Transformers' Upgrade and Second Supply (2 x 7.5/10Mva)
2026 – 2028
—
$2.7m

Clareville Substation Transformers' Upgrade (2 x 12.5/17Mva)
2024 – 2026
—
$2.0m

Clareville – 11kV Switchboard Replacement
2022 – 2023
—
$0.7m

Masterton – Clareville 33kV Re-tensioning
2025 – 2026
—
$1.0m

Masterton-Te Ore Ore 33kV Feeder Upgrade 1
2024 – 2026
—
$1.0m

New Bidwells-cutting Substation and Dual Supply
2028 – 2029
—
$4.2m

New Pirinoa Substation and Dual Supply
2026 – 2028
—
$6.2m

Norfolk Substation Transformers' Upgrade (2 x 12.5/17MVa)
2025 – 2027
—
$2.0m

Martinborough Substation Transformers' Upgrade (2 x 7.5/10Mva)
2026 – 2028
—
$2.0m

Greytown – Load Control Plant Replacement
2024
—
$0.7m

Note: Dollar amounts are round-up figures.


POWERCO