electricity asset management plan update

Information disclosure 2020

contents

section 01 introduction

1 – introduction

This Asset Management Plan (AMP) update sets out the material changes that have occurred in our Asset Management practices and investment since 31 March 2019, when the last electricity AMP (2019-2029) was published.[1] Where relevant we have also included context and updates on our operating environment and strategic planning; taking into account our updated assessment of the potential for rapid shifts in demand trends driven by uptake and impact of new technology, climate change, changing customer preferences and expectations, and in Auckland particularly, continued and rapid growth, development and urbanisation of the rural fringes.

Throughout this AMP we comment on Vector's Strategic Reliability Management Plan (SRMP) covering the accelerated programmes of work that reflect our commitment to quality compliance. There has been a concerted effort to improve data quality and analyse the root cause of outages and this has confirmed that the big challenge for the business to achieve its quality targets is outage duration.

We have updated the 10-year capital and maintenance programmes to reflect ongoing investment in the existing network assets to ensure a safe and reliable network; ongoing evolution of work practices to ensure worker and public safety; and the network development required for the long-term interests of Auckland's energy consumers.

As documented in this AMP update, our asset management and replacement strategies, SRMP initiatives and Health and Safety practices are designed to achieve strengthened network resilience.

We have made a number of deviations from our previously published 2019 AMP to bring forward planned reliability improvements that reflects our commitment to achieving regulatory compliance requirements. This focus on regulatory compliance and reliability is further expanded below.

For further context, we have also set out Vector's Symphony group strategy, and how this is applied within the regulated electricity network.

During the second part of March 2020, the New Zealand government declared a range of measures in response to the COVID-19 pandemic. We had already begun planning for what the impacts could be by establishing an incident management team (IMT) to oversee our response to the outbreak, in line with the Vector group's Crisis Management Framework. Our focus is on the wellbeing of staff and ensuring the electricity network continues to be available for all our customers. The uncertainty and fluidity of the situation means that the impact of this crisis could not be factored into this update.

1.1 Regulatory compliance and reliability

In the context of performance against regulatory quality measures, underlying duration of outages persists as a challenge.

Our outage duration performance continues to be impacted by ongoing changes in the operating environment. Further to additional time driven by safety improvements following Health and Safety legislation introduced during the last regulatory period (DPP2), ongoing changes have included customer growth in previously rural areas; congestion caused by infrastructure projects; increases in new connections; substantial increases in the number of vehicles on the roads; reduced road space due to new bus and cycle lanes; and more activity on our network due to increasing expenditure on system growth and relocation works resulting from those large-scale infrastructure projects.

Major fault causes such as third-party interference (for example car v pole), vegetation, and overhead and underground faults have been compounded by these changes to Auckland's operating environment. We have also seen more weather-related major event days (MEDs), which carry an impact on regulatory performance due to the clean-up occurring outside the required event boundaries, and a greater number of high wind days that sit below the MED trigger.

Within this context, the activity driven by the RY20 SRMP as part of our ongoing reliability programme was designed to deliver a specific set of initiatives within a twelve-month time frame to provide lasting outage duration reduction.

The RY20 SRMP is a further development of our existing reliability programmes undertaken since RY2015-16 and meaningfully accelerates reliability focussed initiatives as part of a progressive work programme that has expanded as we have validated sustained adverse trends.

In designing and executing the SRMP for RY20, we took considerable care to ensure each initiative would deliver an enduring reliability benefit in an economically responsible manner, proportionate to the need and with explicit regard to the long-term expectations of our customers.

Expenditures originally forecast in later periods of the 2019 AMP have been brought forward to deliver the reliability benefit earlier. Early indications are that the technology being adopted for some of these programmes of work will deliver not only the forecast improvement in unplanned outages, but also a positive impact on planned activities for customers.

Importantly, as the SRMP involved bringing forward work programmes and expenditure already discussed in our 2019 AMP, there is no additional long-term cost to consumers other than the time value of money. The accelerated programmes include the rollout of network automation.

It is also important to note that the reliability objectives and reliability strategies within the SRMP are a subset of Vector's broader set of asset management objectives as specified in the 2019 AMP and reiterated again where necessary in this 2020 AMP update. In some limited instances, work in our 2019 AMP was deferred by a short period to enable work under the SRMP

1 A copy of this AMP is available on the Vector website at https://www.vector.co.nz/disclosures/electricity/amp

to be expedited. For example, some preventive ring main unit replacements have been deferred between six and twelve months to enable automation projects to proceed earlier. In all cases where such a decision was taken, the impact of the deferral on SAIDI (system average interruption duration index) and safety risk was assessed as low.

Initiatives within the SRMP related to asset portfolio and asset management capability improvement have been integrated into this 2020 AMP update.

EVOLUTION OF WORK PRACTICES

Following the significant changes to Health and Safety legislation through the Health and Safety at Work Act 2015, Vector introduced operational practices of working deenergised except in specific limited circumstances. Since that time, and in accordance with a prudent approach to reassessment of hazards and risks associated with our activities, we have developed a greater understanding of the holistic work task risks, as well as the implications for our health and safety and asset management systems. New technologies and more advanced operating practices both in New Zealand and internationally are also available.

In RY19, in collaboration with our field service providers (FSPs), we commenced a comprehensive review of all work tasks previously performed live, considering both the risk and the complexity of the task. We also considered the risk and complexity of the alternative to performing the work live along with new technologies and innovative practices. As a result of that review we identified and have implemented some changes to work practices that enable holistic safety risks to be appropriately managed while also managing down the outage time for customers.

These changes have included some specific work tasks which are appropriate to perform live to manage down the impact on customers (either because the tasks have an acceptable level of risk and complexity, or because alternative techniques requiring customer outages would carry a similar quantum of risk); and utilising technologies and practices that can provide 'indirect live line' capability, with work being performed on energised assets thereby minimising disruption to customers.

The use of new equipment such as bypass cables, increased use of temporary pole supports and more robust application of defect classifications can enable remedial work to be carried out under planned conditions making the customer experience better since the work can be more efficiently planned, then completed at a prior advised time, rather than under unplanned emergency conditions.

Our FSPs remain empowered to assess the risk of the work task on the day, applying controls up to, and including, vetoing work when it is unsafe to do so.

We have also conducted protection reviews and risk assessments on recloser operations to improve the customer experience from transient fault protocols with the aim to align these with international best practice.

SINGLE POINT ACCOUNTABILITY

Reflecting the advice of the Commerce Commission, we have implemented organisational realignment to provide single points of accountability within the regulated electricity network business for regulatory quality standards, and to separate out accountability for the regulated gas network. Please refer to section 3, Asset Management System for more information.

REGULATORY SETTINGS CONFIRMED

As we noted in our FY20 half year report, the Commerce Commission has confirmed the regulatory settings for the DPP3 period, commencing 1 April 2020. Those settings have restricted the capital expenditure available to us over the next five years at a time when the need to maintain and upgrade Auckland's electricity network is at an all-time high. The level of both capital and operating expenditure is less than was published in the 2019 AMP and we have throughout this AMP update considered the impacts of the settings for revenue, expenditure and quality in the investment decisions made.

Our investment prioritisation will continue to be health and safety outcomes, asset renewal, reliability and resilience of our existing network. Expenditure in these areas of investment will remain within the DPP3 allowances – any shortfall in the DPP3 CAPEX allowance is likely to impact our investment in the area of capital growth which will require regular reviews of options to fund that growth investment.

While our focus for OPEX is increased expenditure in maintenance categories, there are operating expenditure areas that are outside the DPP3 framework that are fundamental to the safe, reliable future of our electricity network. These include cyber security, LV metering data, costs for new systems to support new technologies, as well as the costs of implementing the changes in DPP3 requirements.

1.2 Our Symphony Strategy

It is a time of challenges and opportunities for the energy sector in New Zealand. The Electricity Price Review (EPR) has highlighted the need for a coordinated and proactive step-change to ensure that key customer issues – such as energy affordability, are at the centre of the sector's decision making. This is particularly relevant as we transition to a low emissions future – as former Interim Climate Change Committee (ICCC) Chair David Prentice put it, "accelerated electrification will not happen if electricity is too expensive". We maintain our belief that in order to enable a transition to low emissions energy at an affordable price, technology and innovation must play a leading role.

It follows that the long-term interests of Auckland's energy consumers cannot be served by a traditional view of what a network is and needs to deliver. Our traditional network assets will continue to play a key role, while becoming increasingly integrated with digital and consumer assets. This convergence allows us to more efficiently manage loads and smooth out demand curves, and adapt more quickly to changing network dynamics. This is a key part of efficiently responding to uncertain and rapidly changing demand patterns.

Accordingly, we will continue to target investments as efficiently as we can by supporting traditional network assets with digital and new energy solutions for the long-term benefit of energy consumers. New energy solutions, such as smart demand response and demand management technologies (such as smart EV chargers), can respond to customers and flatten peak demand, optimising network assets whilst meeting customer needs. These technologies deliver the most benefit when they are coordinated through a digital platform – such as our Distributed Energy Resource Management System (DERMS).

"Enabling the different drivers of a new energy future – such as demand response, EVs, and renewable DER – to coordinate seamlessly around customers enables a system which is greater than the sum of its parts, delivering greater return on investment."

SYMPHONY IS CREATING A NEW ENERGY FUTURE FOR OUR CUSTOMERS

Whilst energy supply chains have traditionally focused on connecting generation to customers, Symphony is creating a New Energy Future which starts with the customer and ensures our energy systems respond seamlessly and efficiently to their needs. With Vector being majority owned by Entrust on behalf of customer beneficiaries, our interests are our communities' interests.

Every customer is different, but every business and residential customer is facing significant change in the way that they consume electricity and get around. At the same time, customer service expectations are increasing as a result of new technologies and business models that have invested in digital services, rather than physical infrastructure. This approach enables businesses to be agile and responsive to changing customer needs and delivers intuitive, relevant services that meet the needs of each individual customer.

Understanding customer behaviours is key to delivering network optimisation with the needs of the customer at the centre. Vector is working with partners across the sector to develop behavioural based insights to understand, for instance, the role of price incentives to manage demand efficiently, equitably and in line with customer needs and preferences. Vector is working with Mercury on the Power Down Trial to test the impact of financial incentives to reduce electricity consumption during peak times. Whilst the findings are still in the early stages, this study will be a step toward understanding the role of incentive-based price levers to manage demand.

We have used behavioural insights to deepen our understanding of the demand impact of new energy solutions including energy efficient appliances, solar PV, or switching to/from gas. These insights inform our network management and strategy and have implications for customer cost and experience as well as New Zealand's wider transition to a low emissions energy future. These insights shed light on the value of implementing customer facing energy efficiency measures to achieve New Zealand's wider energy goals. Understanding the behaviour of our own customers is key also to understanding how transferable overseas policy interventions could be to the New Zealand context.

Symphony creates a new energy future for our customers through the integration of data analytics and digital platforms which support distributed energy resources (DER) – such as solar PV and batteries, and smart demand management technology. This enables us to understand customers and to create a system which responds seamlessly to their needs. In turn, this supports the transformation of our wider energy system – to start with the customer, not the power-plant.

SYMPHONY IS A WHOLE GROUP STRATEGY

Symphony provides a blueprint for the Vector group to lead the creation of intelligent and affordable energy systems that empower our customers and communities well into the future. At its core, Symphony leverages new energy solutions to deliver optimal outcomes for customers, society, and the environment in the context of disruptive change.

Because new energy solutions are designed around customer needs – rather than old regulatory or market silos – Symphony is not confined to the networks part of the Vector group. It takes a whole-of-systems approach that requires seamless coordination – between our network and customers; within the Vector group; across the energy supply chains; and between Government and industry.

Our drive to re-organise ourselves around the customer is reflected in the recent move to reengineer our organisational model, to further enable the Symphony strategy. This will see the Vector group transition to a collaborative working model, reflecting the groups' priority to leverage constructive interdependencies – both internally and externally (see section 3 for the latest organisation diagram).

Across the Vector group the Symphony strategy is shaping our approach to creating a New Energy Future. For example, reducing emissions from transport is a complex challenge which draws on the efforts of many. Vector OnGas, which has a fleet of 80 trucks, is investigating a trial of electric trucks as a first step in understanding the infrastructure costs and changes associated with the electrification of the heavy vehicle fleet – a transition which will have direct implications for Vector's distribution network and the national transmission grid. Vector PowerSmart is concurrently working with Auckland Transport to understand the network impacts of the electrification of buses.

These efforts are alongside our continued engagement with the Ministry of Transport to support the Green Freight Project, which seeks to understand how to reduce greenhouse gas emissions from New Zealand's heavy vehicle fleet. As transport accounts for 20 percent of New Zealand's overall emissions, this strategy is a key first step in New Zealand's decarbonisation efforts and will require a coordinated approach.

"The best way to predict the future is to create it." Peter Drucker

SYMPHONY FOR OUR ELECTRICITY DISTRIBUTION NETWORK

Symphony emerged from a scenario planning exercise in 2018 that identified alternative future scenarios for the next ten years. These were labelled Pop, Rock, and Symphony and modelled variations of two key inputs – the uptake of new customer technologies and the network response. Under the Pop scenario, a 22% increase in network demand was predicted by 2028. This was based on a steady energy efficiency uptake; steady electric vehicle (EV), solar and battery uptake, and intelligent but passive management of the network. The Rock scenario showed that with faster EV, solar and battery uptake network demand could increase by 38%. The Symphony scenario showed that with investment in network intelligence and digital platforms, innovative pricing signals, and integration of distributed energy resources, Vector could limit demand increases to 7%.

As stated in our previous AMP, “The two greatest uncertainties around future demand growth are the speed of the uptake of new customer side technologies and the network response to such technologies”. By using a consistent rate of customer growth and testing the impact of different variables relating to those core uncertainties, a scenario emerged where our network could mould to the demand curves of the future. By adopting Symphony as our preferred scenario to manage future demand growth, in 2019 we forecast a reduction in $78m in system growth expenditures for the period of 2019-2028. Such savings are passed on to our customers. This showed that by forecasting and planning for a demand future we were also shaping it.

We have consequently continued to embed Symphony as a proactive strategy in our network asset management and planning, ensuring that decisions and investments are made around the customer. Symphony seeks to manage uncertainty by both responding to, and leading, change for customers and goes beyond traditional poles and wires solutions in analysing options for network investments. In adopting this approach, Symphony minimises the risk of ‘stranded assets’ by deferring, or avoiding, costly investments in traditional network infrastructure which may not have a role in the future. As an investment approach, Symphony avoids unnecessary investments in physical network assets to ensure long-term efficiency for customers in the context of future demand which is subject to rapid change.

In addition to the development and adoption of new technology, Symphony also considers the impact of global and domestic policies and climate impacts, as well as unquantifiable ‘unknown unknowns’. To ensure an efficient and agile response to this uncertainty, Symphony leverages smart demand management technology, optimised by smart digital platforms which can support increasing penetration of DERs, and integrating network-level data analytics and customer behavioural insights to ensure that where physical network investments are required, this reinforcement and design is targeted towards consumption.

For example, our DERMS makes use of predictive modelling algorithms to assess and predict utility loads, customer demand, capacity, and market dynamics in real time and it can automatically issue commands in response to these predictions. This facilitates the coordination of DERs and demand management technology to provide visibility and flexibility at a network level. The result is a symphony where customers, the network, and wider energy services work together seamlessly.

section 02

customers, stakeholders and service levels

2 – customers, stakeholders and service levels

Our customers continue to tell us that they want safe, reliable and affordable energy systems that empower them with choice and control. This means we have a responsibility to ensure our energy systems remain stable and robust, yet flexible enough to evolve in concert with changing customer behaviours. Keeping our broad range of stakeholders at the heart of what we do is key to achieving this.

As part of the COVID-19 pandemic response, we continue to prioritise proactive communication with stakeholders through a proactive communications plan and are prioritising in particular the provision of information to customers. We are also co-ordinating and communicating with our industry partners and other external stakeholders specifically on this topic.

2.1 Customer engagement

Understanding customer needs and behaviours is core to delivering optimal network services with the customer at the centre.

By leveraging behavioural and customer insights Symphony optimises the way that Vector delivers operational services to customers. Qualitative and quantitative data from multiple channels builds our understanding of customer needs and behaviours, which then can inform the scheduling and management of planned outages to minimise disruption to customers, as well as our communications and digital strategies. One example of this from the last twelve months is how customer insights have informed the development of our recently-released, web-based outage map to show the location and the status of the outage to minimise customer impact. This is additional to the outage centre where customers are able to check if there is an outage in their area or report one themselves.

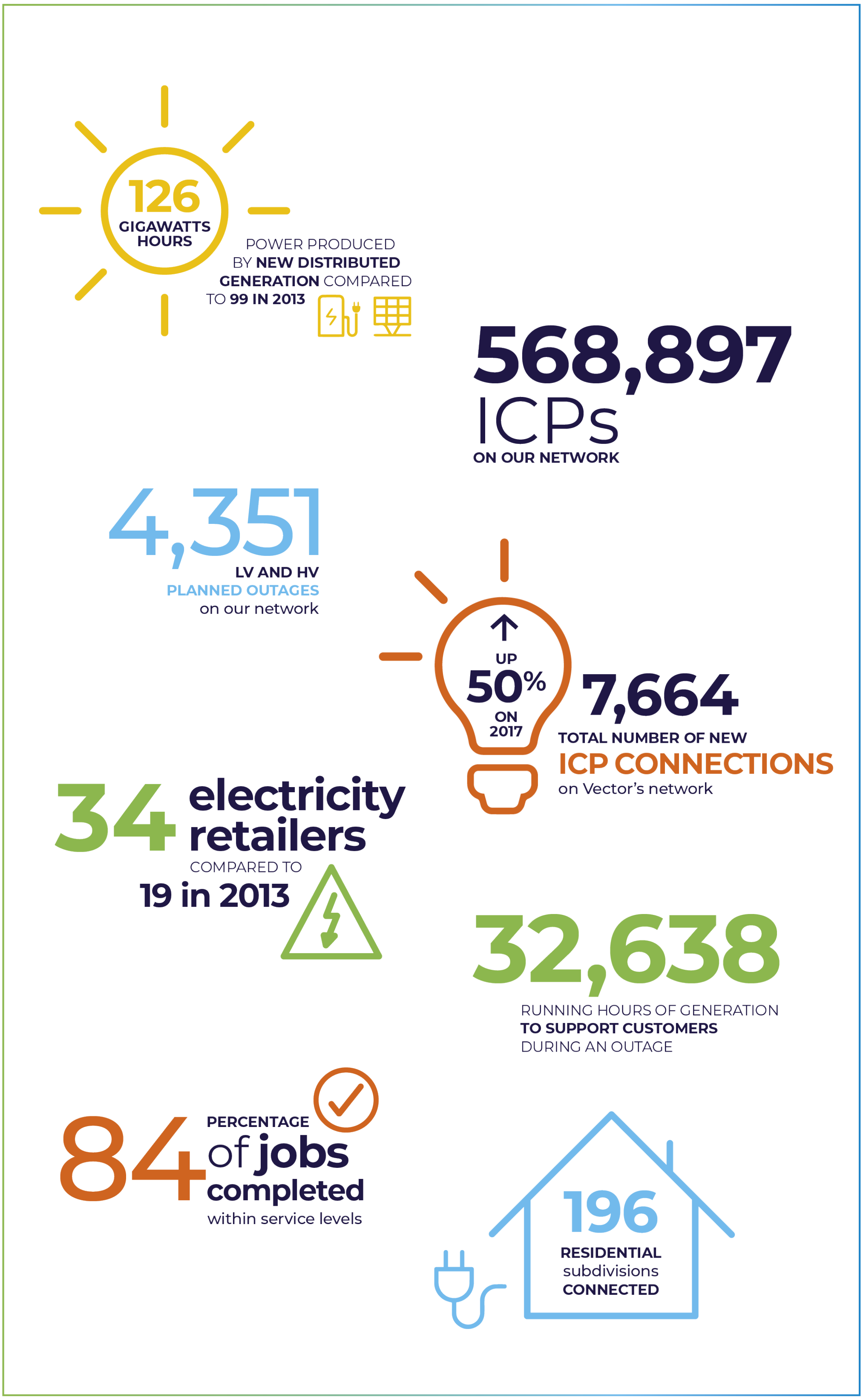
Furthermore, based on their preferences, customers can also choose how they are notified when there is a planned outage. The application of behavioural insights is a dynamic and ongoing focus for Vector as we continue to explore opportunities for innovation and better solutions which put the customer at the centre.

We continue to deepen community and customer engagement regarding planning and impact of operations to ensure optimal solutions and minimal disruptions for our consumers. One element of this is our Customer Advisory Board (CAB) – it provides a forum to engage with a range of customers directly and exchange information about the electricity network. Having greater access to our customers' smart meter data, as discussed in the 2019 AMP is also an important element. We support the recommendation of the EPR for the Electricity Authority (EA) to expedite work to make it easier for networks and customers to access smart meter data. While we continue to work with metering businesses independently to have greater access to smart meter data, we look forward to the EA progressing this important work.

We also support the EPR's focus on strengthening the voice of customers, and the EPR's recommendation to establish a Customer Advocacy Council to help ensure that the interests of customers remain at the centre of regulatory and industry decision making. We believe that the composition of this Council will be key to its success in providing a genuine voice for the customer, and we support fresh thinking which is informed by customer data analytics.

CUSTOMER PERFORMANCE

Our Customer Performance snapshot details the latest key customer engagement metrics.



FY19 CUSTOMER PERFORMANCE SNAPSHOT

COMMUNITY ENGAGEMENT WITH ASSET BEAUTIFICATION

Vector's electricity assets are spread throughout Auckland and form part of the built environment of each community's local neighbourhood. That's why we're happy to work with local artists and other organisations who want to take ownership of their spaces and make them look great. In May 2019 we published guidelines that set out our approach to facilitating requests for public art on Vector's network assets.

One recent example of this process in action was a request we received from the Onehunga Business Association to facilitate public art on the Onehunga substation.

ONEHUNGA SUBSTATION – THE ART PIECE IS CALLED 'THE PEOPLE WEAVER' AND IS PART OF NGA ATUA HOU, A SERIES OF MURAL PROJECTS TO REVITALISE SPACES ACROSS THE CITY

2.2 Service levels

The Service Levels measurements from AMP19 are updated for the RY19 measurements in the table below:

DESCRIPTION	RY15	RY16	RY17	RY18	RY19
Customer Effort Means Score	-	-	6.9	6.7	7.0
Speed of quotes for new connections – (<5 lots)	-	-	-	84%	87%
Advance notification of planned outages	-	-	-	-	95.45%
Average Grade of Service (GOS)	86%	87%	81%	75%	79%
Total recordable injury frequency rate (TRIFR)	6.89	7.17	5.28	14.07	5.01
Asset safety incident	0	2	1	7	5
SAIFI (system average interruption frequency index)	1.41	1.11	1.85	2.14	1.76
Customer interruptions performance	99.3%	97.8%	96.6%	92.6%	97.1%
SAIDI (system average interruption duration index)	128.5	117.0	173.6	226.2	198.2

SERVICE LEVEL MEASUREMENTS

We are pleased that all the service levels show improvement over the course of RY19. Per our previous AMP, no measures are included for our Cyber Security and Privacy service levels due to commercial sensitivities and for security reasons.

SECURITY OF SUPPLY STANDARDS

The Security of Supply Standards (SoSS) are being reviewed in line with the expansion of the Symphony strategy across the network planning function and the RY20 SRMP activities. The previous SOSS did not reflect these improvements and the amendments will also more clearly articulate the Auckland CBD security of supply and includes cost/benefit principles.

2.3 Supporting Auckland's growth

Auckland's relentless growth continues, with a population that has now grown since 2013 by the size of Tauranga and Whangarei combined. In that time, we have spent nearly $1.3 billion to strengthen network integrity and support Auckland's growth, and have added 59,222 new customers to the network. This growth is not stopping. In the next 10 years Auckland will see around 300,000 more people in the region for a total population of 2 million; up to 250,000 more vehicles on our roads (assuming current ownership rates continue); and 117,000 new energy network connections required to support this growth.

Development projects in new areas, or greenfield developments, have started slowing down but the Auckland Unitary Plan triggered a significant amount of small infill subdivisions over the past several years, where property owners of single lots were redeveloping these to high density developments. Re-development projects, or brown field developments, are more complex and more expensive for Vector, because existing assets often need to be removed, relocated, or upgraded. There is also typically less space to work in as a result of the existing buildings, and as work is done in existing roads, traffic management and access are more complex.

Enabling this growth through the provision of necessary electricity connections and upgrades requires appropriate investment, whether that be constructing new assets, adding intelligence to our network and systems, or developing digital solutions that put customers' needs at the centre. Significant investment is required across all infrastructure in Auckland to cater for growth and electricity network reinforcement is no exception – ensuring this growth results in the greatest economic benefit for Auckland requires a partnership approach to capital and infrastructure needs by local and central Government. We support the Government's focus on infrastructure investment and agree that now is the time to be investing for future growth.

Traditional network assets will continue to form the backbone of our network. However, our Symphony strategy will integrate new technologies and digital solutions into the broader system in order to maximise customer outcomes within allowable spend, and to better manage energy flows as demand grows and changes.

An important factor in how we support Auckland growth is the availability of suitable resource to undertake project works. We will not compromise on safety, quality of materials or technician expertise when considering investments to deliver a resilient, reliable electricity network that meets the current and future needs of Auckland families and businesses. Resource constraints are a factor in our capability to support Auckland's growth in a timely fashion.

FUNDING APPROPRIATE INVESTMENT

The growth in Auckland's population over the past five years has caused a significant volume of growth-related investment for new connections and for reinforcement works to meet the increased demand on the network. At the same time, we have increased capital spend year-on-year since RY16 to address the integrity needs of our assets with a focus on addressing the long-term requirements in an economically prudent manner.

With no sign of Auckland growth conditions easing, we will need to continue to invest significant capital expenditure in our network to support infrastructure growth for Auckland.

This continued investment ensures that the electricity network can play its part building Auckland's future which includes affordability and choice, making it a great city to live in for those who call Auckland home today.

The investment to support new housing connections is significant and we anticipate greater investment will be needed to support residential intensification objectives – consents for dwellings in Auckland are forecast to hit 17,200 in 2023.

Affordability of electricity is an important issue – particularly as EV uptake will increase demand for electricity. Pushing value for money and continuing to deliver quality services in the long run requires new efficiencies and technology. Our work to put in place new technology options that will flatten peak demand has the direct outcome of being able to defer infrastructure investment that would otherwise be needed, thereby keeping costs for consumers down. Vector's investment in innovation is also important to find new efficiencies and resilience in the future.

Some of the future investment required flows directly from other infrastructure decisions made either by central or local government. The proposal to build a light rail line (Auckland Light Rail or ALR) from the city to the airport is a good example – depending on the route finally chosen, we anticipate a capital cost in the vicinity of $85m to move the electricity assets.

ENABLING ELECTRIFICATION OF TRANSPORT

We support the work of the former ICCC, which recommended in their report, *Accelerated Electrification*[2], that the electrification of transport be prioritised to reduce emissions. This reflects New Zealand's unique energy emissions profile – whereby emissions from transport are around four times greater than the emissions from electricity generation (with transport accounting for around 20 percent of New Zealand's total emissions). The scenario favoured by the ICCC to reduce emissions included replacing around two million vehicles with EVs in New Zealand over the next 15 years. Already more than 40% of EVs are on Auckland roads, and international trends suggest that EV uptake tends to be concentrated in larger urban centres. This 'clustering' would further concentrate load on the network.

EVs require charging and a 22kW fast charger can add the equivalent average demand of 9 houses to the existing network. Clearly, growth in EV uptake puts pressure on network infrastructure. Even with the uptake of 7kW 'slow' chargers, our modelling has found that existing network capacity would be exceeded at just 20 percent EV penetration. New solutions, such as vehicle-to-home technology and smart EV chargers (coordinated through a smart digital platform, like a DERMs), supported by the right pricing signals, can help shift load, manage network peak and keep electricity affordable in the long term.

2 https://www.iccc.mfe.govt.nz/assets/PDF_Library/daed426432/FINAL-ICCC-Electricity-report.pdf

In addition to passenger vehicles, Auckland Transport's Low Emission Bus Roadmap targets an entirely low-emissions bus fleet by 2040. Trials have already begun with 11 electric buses expected on the road by the end of 2020. Vector and AT will carry out a feasibility study to assess the impact of a fully electric bus fleet on the Auckland electricity network, and to identify opportunities where innovative energy technologies could be deployed to facilitate the transition and help avoid large network upgrade costs.

2.4 Better outcomes through regulatory and policy alignment

Here we present Vector's position on regulatory and policy related matters that have significant potential to improve network reliability, security and resilience. Vector continues to engage with stakeholders on all these issues in a proactive and committed manner. We believe that some regulatory settings are inconsistent with other policy and regulatory goals – including to enable Auckland growth, as well as to ensure long term reliability is delivered affordably and in partnership with communities and stakeholders. Some of the regulatory issues below – such as the current vegetation management regulation, are significantly misaligned with the efficient delivery of reliability.

VEGETATION MANAGEMENT

Vegetation management regulations are currently under review by the Ministry of Business Innovation and Employment (MBIE) – and we support this initiative and its continued urgent progression. Current regulations present significant issues. For example, in some cases the narrow growth limit zone prescribed does not align with minimum approach distances (MAD) prescribed by health and safety legislation. Accountabilities are not appropriately balanced within the current regulatory framework and do not align with parties' abilities to manage risk. We support regulations that respond to the drivers of risk, that allow a preventative approach, and which align incentives with good health and safety practices and reliability outcomes.

As we expect an increase in extreme weather events linked to climate change, and as we rely on electricity more through the electrification of transport and industrial process heat, it is critical that vegetation management regulations respond to the key drivers of risk. As stated in the 2014 Opus report, a review of the effectiveness of the Electricity (Hazards from Trees) Regulation 2003[3], "of all reported tree related incidents, fall zone and overhanging trees have the most significant impact on electricity network reliability, although these trees are not covered under the current regulations". We therefore support an approach which accounts for the factors that contribute to the risk posed by a tree – including, critically, the fall zone. A risk-based approach could support a more efficient response by targeting resource towards trees that most require a response, whilst allowing trees to grow which do not pose a risk.

By only prescribing a narrow distance that trees' branches must be from lines, the current framework limits the scope for prevention and efficiency. There is an opportunity for regulation to better protect security of supply and health and safety, to gain efficiency, to create a better experience for customers. We also believe there is an opportunity to support these outcomes through preventive planting guidelines – to prevent trees from being planted where they will inevitably grow into lines in the future.

Lastly, cost recovery for electricity distribution businesses (EDBs) is determined by whether the cut is the first or a subsequent cut. This approach creates administrative burden and does not clearly reflect considerations which we believe should be central in determining cost recovery – such as affordability and health and safety.

OUTAGE RESPONSE

We support the proposed, *"Land Transport (Vehicles Responding to Electrical Emergency) Amendment Bill"*[4] allowing lines companies' response vehicles to use flashing lights to move through traffic and swiftly respond to electrical emergencies.

Under current land transport rules, emergency response vehicles such as the ambulance or fire brigade can use their lights to respond quickly to an accident. However, when that accident involves downed electrical lines from a vehicle striking a power pole, the emergency response crews must wait for our lines crews, who are often stuck in traffic, to arrive and turn off the power flowing through the downed lines before they can safely perform their life-saving work. Similarly, in the case of customers who are medically dependent on electrical machines, the response time for getting the power back on in a power outage is critical.

The proposed bill addresses the use of vehicle lights to respond to those electrical emergencies with an associated health and safety issue. However, following the proposed pathways to decarbonising New Zealand's economy will make consumers lives and businesses more dependent on an uninterrupted supply of electricity. If response crews had access to flashing lights in every power outage situation where congestion is a problem, we could reduce response times and speed up power restoration considerably.

CUSTOMER SERVICE LINES

We support the Ministry of Business, Innovation and Employment's (MBIE's) review of the regulations around customer service lines, including discussions about the treatment of right of way poles. The legislative treatment of customer service lines has changed over time, contributing to inconsistency in how assets are treated by different EDBs and a lack of clarity around responsibilities in some cases.

In this context, it is our experience that customers often do not know they own these assets or what their responsibilities are (and often dispute responsibility when this is raised). This is concerning as the assets age and require maintenance. Limitations around property access rights and cost recovery restricts an EDB's ability to undertake proactive maintenance of customer service lines.

3 https://www.ena.org.nz/assets/Uploads/Opus-Tree-Regs-Report-May-2014-Final.pdf

4 https://www.parliament.nz/en/pb/bills-and-laws/proposed-members-bills/document/52HOH_MEMBILL157_1/land-transport-vehicles-responding-to-electrical-emergency

Ambiguity around the treatment of customer service lines does not provide clarity as customers explore distributed energy resources, electric vehicles, and other electrification options which may require upgrades to their customer service lines. The review is an opportunity to create regulations that give clarity to market participants about ownership and responsibility, while supporting New Zealand's policy objectives around decarbonisation alongside reliable and resilient electricity supply.

CASE STUDY: GETTING AHEAD OF INCREASING NUMBERS OF END-OF-LIFE BATTERIES

In December 2019 Vector announced the launch of the Battery Industry Group (B.I.G.), a cross-industry collaboration that will design reuse and recycling solutions for large batteries, commonly found in electric vehicles or in stationary energy storage.

The vision and context for the group is provided by Vector's New Energy Futures Paper: *Batteries and the Circular Economy* and a Technical Addendum, in which Vector transparently shares all research and data gathered to date.

B.I.G. is a significant move for the business community, being described by internationally prominent sustainability charity, Forum for the Future, as a 'lightning rod' for the public and private sector in New Zealand.

The group aims to propose a 'circular' product stewardship scheme for end-of-use and end-of-life battery management to the Ministry for the Environment within the next 12 months. This will include recommendations on consistent safety guidance for the handling, storage and shipping of used large batteries.

The group has a core delivery team of Vector, Eunomia Research & Consulting and WasteMINZ, with funding from Vector, EECA and the Motor Industry Association of New Zealand.

The move acknowledges the important role businesses can play in not only front-footing the e-waste challenge, but also acting as a catalyst to accelerate our transition to a low-emission circular economy.

"Vector recognises that electrification of transport presents a significant opportunity to help New Zealand achieve a zero-carbon future," said Vector Group CEO, Simon Mackenzie.

"The research in the New Energy Futures Paper tells us that there will be between 500 and 1,000 EV batteries coming to the end of their lives by 2020, potentially rising to 17,000 by 2025 and a staggering 84,000 by 2030.

"While batteries are key to powering our new energy future, they contain valuable materials that come at an environmental and social cost. It's clear that we must work collaboratively with others to ensure we have a proactive, robust plan in place to make the most of battery capacity, as well as mitigating any risks from their disposal. This initiative will produce the circular blueprint we need to achieve this."

The New Energy Futures Paper is the culmination of research commissioned by Vector from Eunomia with the Batteries Leaders Group in 2018. That group now forms the basis of the wider B.I.G. and its three working groups: the Safety & Logistics Group, the Battery Innovation Hub, and the Battery User Group.

section 03

assest management system

3 – asset management system

As noted in the 2019 AMP, the continuous improvement of the Asset Management systems, practices and policies is a fundamental part of our Asset Management Strategy. Since the publication of that AMP, we have continued the development and formalisation of the proposed framework, supported by the completion of an external review of the asset management systems and processes, the outcomes of which are being adopted into the required activities. It remains our strategic objective to seek accord with the principles of ISO 55000 as we improve our asset management system to deliver a forward-looking proactive approach to asset management. Dedicated resource has been assigned to ensure focus on these activities is maintained.

Our Asset Management policy is being refreshed and as noted below, the planned expansion of the use of SAP PM is progressing well, becoming operational during FY21, creating a single source of truth for asset information in the system of record (SAP). This streamlines and automates the proactive and planned network maintenance processes, and this improved view of the condition of our assets will enable even better asset management decisions and customer outcomes. In the last 12 months, we have also formally published to our internal document register Asset Class Strategies for six of our nine header classes, focusing on the large population distribution and critical subtransmission classes first, as well as completing the seventh condition-based asset risk management (CBARM) model. Four more models are proposed for completion in FY21, including the first two relating to low voltage (LV) assets.

3.1 Enabling technologies

As part of the continuous improvement path for asset management, we are continuing the investment in key systems that will enhance our capabilities.

SAP PM

In the 2019 AMP we included planned investment in the plant maintenance module of SAP (SAP-PM) to enhance our asset replacement, planning and maintenance capabilities by centralising operational history, providing additional condition data and auditing capability for planned and corrective maintenance activities and incorporating financial transactions. This provides a standard method for FSPs to access maintenance standards and inform Vector of work completed.

Throughout FY20, this project has been extended to include further functionality than what was initially envisaged with the new design reflecting an updated field operating model as well. While it will largely be complete in FY20 as planned, some activity will continue into FY21.

Strategic partnerships are being leveraged in this area and investment has been allowed for in order to optimise dispatch and work allocation in a way that will minimise outages and maximise use of the outage window.

ADVANCED DISTRIBUTION MANAGEMENT SYSTEM

Over the course of FY20, we have further explored the benefits of Advanced Distribution Management Systems (ADMS) capabilities and have approved a business case for the implementation of such a system. We have expanded the functionality and reduced the timeframe for delivery in order to provide benefits to our customers as early as possible and earlier than initially planned.

We will be utilising the Electronic Switching Module to reduce manual and paper-based processes and the Outage Management System (OMS) component supports better and faster response time to faults. Due to the acceleration of the feeder automation programme (see section 4.1), we will also include Fault Location, Isolation and Service Restoration (FLISR) in an earlier timeframe than initially expected to fully utilise the capability of remote switching. With FLISR, the system will automatically choose the best devices to operate to reconfigure the network and reduce the impact of an outage to the minimum number of customers.

Including these capabilities supports DPP3 requirements and provides better outcomes for our customers.

SYMPHONY NETWORK MODELLING TOOLS

As noted in section 1.2, under the Symphony strategy, our network planning approach needs to go beyond traditional solutions to building solutions that are able to adapt and respond as time progresses.

While some models exist already, new methodologies are required to enable integration into the planning processes. Therefore, we have added a new project for this AMP period where the necessary tools can be developed over FY21 and FY22. The roadmap for this Symphony Planning project is being finalised and formalises use of granular bottom-up modelling from customer level, further system dynamics modelling and a greater level of power flow analysis to allow risk-based options analysis to be applied when determining the most appropriate solution to a network need.

Other tools will provide greater visibility, observability and controllability for the operations and ongoing asset management of the solutions.

Part of our approach is to leverage expertise through investment in strategic partnerships that will be focused on modelling and simulation to aid in planning. The form and detail of these investments are still being determined.

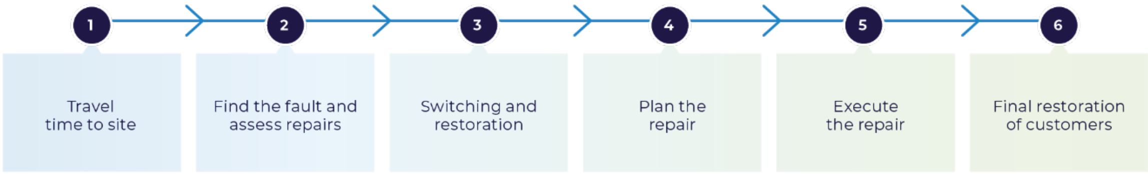
3.2 Maintenance Models

Duration from outages captures all the effort and tasks involved with identifying and reaching the fault location, making safe and isolating the faulted area, partially restoring service (i.e. switching to reduce the outage area) and the steps involved with repairing the fault. This undertaking is a key asset management process for managing both inherent and environmental causes.

To support the SRMP, our operating models for each maintenance type have been reviewed and updated where required.

REACTIVE MAINTENANCE

In order to bring more focus to repair and restoration time we have put effort into breaking down the Reactive Maintenance time-line of activities.



The resulting six steps have then been assessed for options to improve the time taken for each step. Using data analysis completed both internally and by the FSPs, solutions were prioritised by understanding which would have the greater impact on reducing CAIDI. In both regions of our network, different solutions are needed based on each network's topology and characteristics.

Solution options include resourcing levels and structure, vehicle type and fit-out, and physical location of crews. Increased funding for reactive maintenance has been approved to implement the determined solutions.

Additionally, a performance framework focused on the FSPs achieved duration time has been introduced. The intent of the performance framework is to drive focus onto CAIDI to achieve the fastest possible restoration for the customers.

VEGETATION MAINTENANCE

As discussed in the 2019 AMP, we have approached management of vegetation with a lens of reliability, resilience and safety. In RY20 Vector has implemented improved risk-based planning, technology enablement, increased resourcing for the delivery of cutting programmes, and processes to monitor and audit the performance of vegetation service providers (VSPs).

The implementation of a Quantitative Tree Risk Assessment (QTRA) model assesses the likelihood of failure of any tree. Consequence of failure is expressed in terms of the impacted feeder span and predicted SAIDI determined using our SAIDI criticality model.

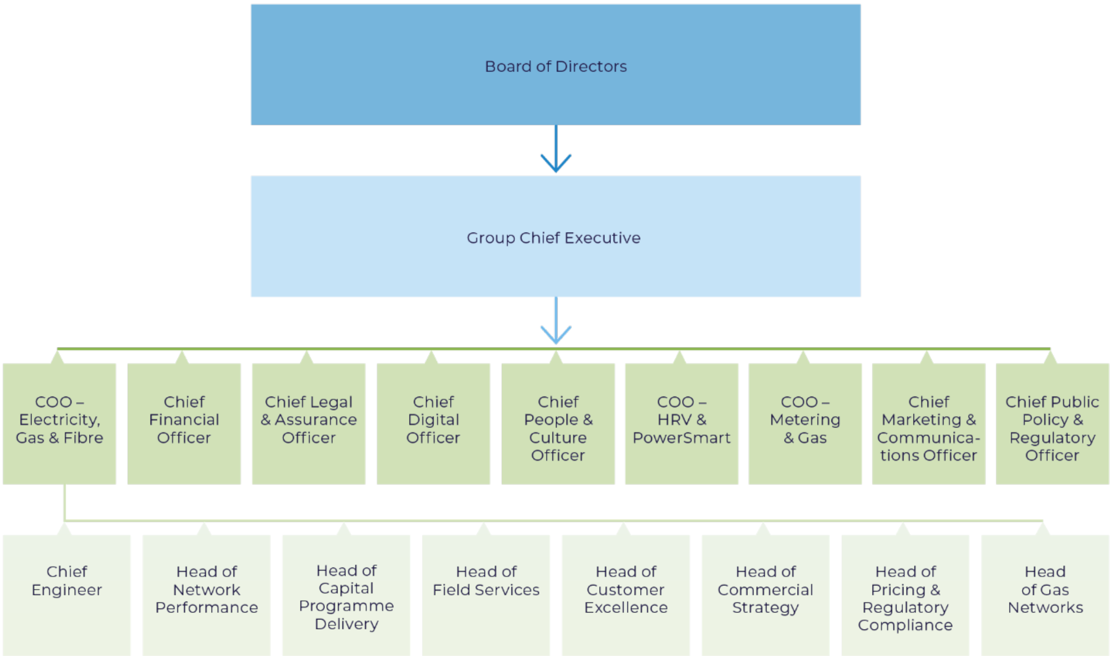
Increased investment for RY20 and an expanded group of service providers, including a separate resource for initial survey and subsequent audit activity, have enabled an acceleration of activity to address the highest risk vegetation. The use of cloud-based management software allows all parties to have access to the same data, ensuring the most effective use of resources. The use of this new model will be formalised to include the information available from the LiDAR survey completed in RY20 and our ongoing strategy.

3.3 Operating model

As part of creating the New Energy Future, Vector is currently undertaking a review of some of its assets and business activities within the Vector group in order to deliver its Symphony strategy. The rationale for such a review is to optimise value from assets that are currently undervalued relative to market value and provide a new platform for Vector to provide services to third parties distinct from its electricity business. Should these intra-group transactions materially change the CAPEX and OPEX profile for the electricity business, this will be identified Vector's 2021 Asset Management Plan.

ORGANISATION AND GOVERNANCE

Reflecting the advice of the Commerce Commission, we have restructured the networks business to improve lines of accountability for the regulatory quality standards and strengthen management focus. The electricity distribution business reports to the Chief Operating Officer Electricity, Gas and Fibre and this change in organisational design better supports the roles and governance responsibilities of the Board of Directors and Group Chief Executive – please see the structure illustrated below:



ASSET MANAGEMENT GOVERNANCE STRUCTURE

The **Head of Field Services** is a new role separated from the rest of the Service Delivery function. This role has specific accountability for the programmes of FSP work for corrective maintenance, preventative maintenance and reactive response. This role also has delegated responsibility for Networks OPEX. For quality compliance, this role has specific accountability for duration.

A new **Outage Manager** role has also been established under the Head of Field Services to assist with optimising the outage experience for customers. This role has a key function of ensuring efficient customer switching occurs for the management of planned outage events and includes assistance with optimising fault locations for field technicians and managing the deployment of network hardening strategies such as fixed generation or mobile generation deployment.

The role of **Head of Network Performance** is responsible for managing the network asset strategy. The key performance indicator for this function is SAIFI – as the measure of asset performance. This function maintains Vector's design and maintenance standards and sets the asset investment prioritisation for the upcoming period.

Under the new structure, the Service Delivery function is now dedicated to the delivery of the annual capital programme. Under the new design this function is managed by the **Head of Capital Programme Delivery** and includes projects for new technologies.

Under the new alignment of accountabilities, the Head of Pricing and Regulatory Compliance is responsible for managing compliance to the Quality Standard. This role has primary responsibility within Vector for raising concern if there is a change to the company's risk of complying with the DPP Quality Standard. To provide a specific focus on reliability, the Head of Pricing and Regulatory Compliance chairs a weekly review of outage performance and interrogates the Heads of Field Services and Network Performance on the week's performance.

USING ANALYSIS TO INFORM THE NEED

Sound electricity industry practice demands that EDBs support their reliability-driven expenditure with robust evidence and analysis. Part of Vector's journey over the course of DPP2 has been to invest significantly in data analytics and associated solutions to increase understanding of the drivers of our underlying network reliability.

Given the volatility within metrics and the performance of the system on a year-on-year basis we are cautious to execute significant asset investment interventions in response to apparent trends which may in fact be the result of a momentary change as opposed to a sustained failure mode in a supply element. The risks of misdiagnosis and ill-defined intervention are significant, and we rely on evidence and observation of system performance to identify trends requiring a specific focus. Any changes to performance must be validated before significant asset management strategies are put in train.

We are also acutely aware of the need for our response and solution to be efficient and proportionate to the problem. Determining the right intervention is especially important in today's environment as the sector manages the transition to new technology solutions such as more affordable distributed generation (DG). In recognition of this uncertainty, our interventions and strategic plans are calculated to ensure we do not overcompensate the system into a deterministic high-redundancy network where reliability will improve but comes at an unnecessary excessive sustained price to consumers.

This approach means we are confident of developing efficient rather than "knee jerk" responses for interventions that are clearly in the interests of consumers, both in terms of costs and operational impacts.

RISK MANAGEMENT

As part of our continuous improvement, adoption of the New Zealand Coordinated Incident Management System (CIMS) is currently underway for incident management at Vector. The CIMS model will ensure a consistent and scalable process across all incidents, regardless of size, complexity or criticality, and is already employed by Civil Defence, emergency services and a number of energy sector players.

The transition to a CIMS model is commencing with externally-facilitated training for key members of staff likely to be actively involved in responding to a serious incident, with full implementation of the new approach expected to occur in the first half of 2020 (once training is complete). Until this time, all existing processes and documentation remain in force.

Following the Commerce Commission's review of EDB's risk preparedness[5] we are reviewing our HILP and other risk management documentation in light of the recommendations made in that report.

The Pandemic Response plan as part of the Vector group's Crisis Management Framework is being utilised for planning of activities, resources and facilities as regards our COVID-19 pandemic response.

[5] https://comcom.govt.nz/__data/assets/pdf_file/0028/153883/Partna-Consulting-Group-Expert-report-AMP-review-of-EDB-risk-preparedness-20-May-2019.PDF

section 04

delivering our plan

4 – delivering our plan

As in Section 6 of the 2019 AMP, this section outlines how we have developed an optimal portfolio of works so as to improve service levels and deliver on our strategic outcomes. The expenditure plans from AMP19 have been reviewed with consideration to internal operating changes, new and amended customer needs, and external influencing factors such as DPP3 and other regulatory and policy change.

Please note that at the time of publishing this AMP update, there is great uncertainty around the likely impact of the COVID-19 pandemic on our delivery of these plans. Should material changes to the CAPEX and OPEX profiles of the electricity business occur as a result of the pandemic, this will be identified in Vector's 2021 Asset Management Plan.

4.1 Drivers for change

As we have prepared the expenditure plans for this AMP update, we have considered the material changes from the previous AMP and the influencing factors behind that change.

CUSTOMER CONNECTIONS

Distribution prices are designed in line with Pricing Principles published by the Electricity Authority to efficiently recover the cost of the existing electricity distribution network and send price signals to users when new investments are required.

We have reviewed our policy on Capital contributions and updated it effective from 1 February 2020. The policy published on our website[6] meets the requirements of clause 2.4.6 of the Electricity Distribution Information Disclosure Determination 2012.

Consumers requiring new or enhanced connections or sole use assets, are required to fund their connection and sole use assets directly via capital contributions. These capital contributions take the form of an upfront one-off payment and will be netted off the value of new assets added to the Regulatory Asset Base (RAB) per the Input Methodologies[7]. The new policy anticipates 100% contribution for all new consumer connection activity.

A SYMPHONY APPROACH: IMPACT OF SOLAR/PV ON THE NETWORK

As part of our Symphony strategy, Vector supports the uptake of solar connections to the network. However, where there are clusters of high solar uptake this can lead to increased local voltage levels that exceed the statutory maximum limits.

A solution to mitigating this adverse effect is utilising the smart voltage influence technology available within the inverters of new solar connections (the AS/NZS4777 standard device used to interface new solar the network). The cause of a problem now becomes part of the solution allowing increased solar to be connected to the network with reduced adverse impact.

We anticipate a large portion on solar connections going forward will have associated battery storage, thereby reducing the solar input to the network during light network load.

These customer-centric solutions mean we can revisit the network upgrades planned to relieve voltage and capacity constraints. We will continue our modelling to more granular levels with smart meter data to ensure the most appropriate solution is implemented to achieve the best outcomes for our customers.

A SYMPHONY APPROACH: INCREASED PROVISION FOR LV NETWORK TRANSFORMER UPGRADES DUE TO EVS

Another key component of Symphony is allowing for the increased uptake of EVs. While little network impact caused by the uptake rate is anticipated within the next 5 years, later year planned spend has been increased to match the expected increased rates of uptake. The desired outcome is for most EV charging to occur outside local network peak times, however, even a modest 20% of EV total potential maximum charging demand coinciding with the local peak will have a significant adverse impact on the existing network capacity.

In a similar vein to the modelling noted for solar uptake, further detailed modelling is required to better quantify the impacts and required solutions and for this access to smart metering data is required. Future AMPs will include the outcomes of this modelling.

ALLOWING FOR GREATER AUCKLAND'S CONTINUED GROWTH

The Warkworth area is forecast to grow and in order to ensure the necessary supply is available and supported, the subtransmission programme of activities included in the 2019 AMP has been reviewed and amended to ensure this is achieved as well as aligning with planned NZTA and Auckland Transport (AT) activities for new and existing roadways.

ADDRESSING THE CUSTOMER NEED

The replacement of the existing 33kV outdoor switchgear at Wellsford zone substation will be completed in conjunction with Transpower and Vector is dependent on Transpower's project timing. The project was pushed out by one year to suit

6 https://blob-static.vector.co.nz/blob/vector/media/vector-regulatory-disclosures/200201-policy-for-determining-capital-contributions-electricity-distribution.pdf

7 https://comcom.govt.nz/__data/assets/pdf_file/0017/60542/Electricity-distribution-services-input-methodologies-determination-2012-consolidated-29-January-2020.pdf

Transpower's programme of works. Similarly, the Mangere zone substation project to convert Transpower outdoor oil filled 33kV circuit breakers to indoor fixed pattern switchgear was forecast for completion in FY20 in AMP 2019. However, this project will rollover into FY21 due to Transpower' programme timing.

For the SH16 Safe Roads Project, the unanticipated high costs have caused NZTA to pull back on this project and look at a redesign. It is expected that with recent announcements on Government funding this project and others may come back onto the horizon.

REVISION OF LOAD FORECAST

The continued downward trend for electricity demand per existing customer has the effect of tempering the forward total load forecasts and has allowed in some instances new infill housing and redevelopment housing demand to effectively take up the existing network capacity and thereby defer otherwise required network reinforcement.

Overall future forecasted spend for distribution reinforcement has been reviewed with several projects amended to reflect the preferred activity pattern including HV and LV reinforcement, and 11 kV feeder meshing in the Northern network.

IMPACT OF SRMP INITIATIVES

As noted earlier, the SRMP brought forward some planned expenditure from later years in the AMP to deliver the reliability benefit earlier. One of those accelerated programmes was the feeder automation plan where an eight-year programme was brought forward to a one-year programme to be completed this financial year. There have been cost increases in this condensed programme due to resource constraints and while spend in this area has been limited in the remainder of the DPP period due to this concentrated effort, plans for future spend are included in later years of the AMP period, increasing the overall spend for automation over what was included in the 2019 AMP.

Another activity as part of the SRMP was to bring forward the new zone substation at Kaukapakapa from its planned period in FY29 to be completed in FY20. The primary driver in bringing forward this project is that it addresses the capacity security risk at Helensville zone substation thereby allowing the transformers to be changed out now at a low risk. It is estimated that the SAIDI improvement the zone substation will deliver is 1.6 minutes.

Following on from the RY20 SRMP initiatives, some future resilience projects have been more specifically identified and added to this AMP update. The reactive management model changes under the SRMP will continue and increased spend has been allowed for that purpose both in CAPEX and OPEX.

RISK AND PRIORITY

It is an ongoing part of asset lifecycle management to reassess risk and priorities of the activities required to maintain the existing network. Information from fault history, condition testing and tools such as our CBARM models all play a part in establishing the required activity and timing in our network programmes of work.

Risk and priority have also been considered for projects in the System Growth expenditure category in order to accommodate what we can of growth projects within our capacity

Based on the risk profile or alternate solutions being available under Symphony, projects have been reprioritised, amended from the original intended solution or phased differently across the AMP period. All projects will continue to be re-evaluated annually or as the risk or drivers change.

INCREASING CONSTRUCTION COSTS

The project for installation of cable ducts coinciding with NZTA's safety improvement programme along SH1 from Warkworth to Wellsford has incurred much greater civil costs than initially anticipated and is now expected to be complete in FY22 rather than FY21.

Increased construction costs along with an increase in tendered pricing for switchgear has required a lift in the project value for the Liverpool 110kV SWBD extension and bus zone protection project.

Costs for the City Rail Line (CRL) in the CBD completion have also increased, in part due to the extended timeframe and in part due to increased construction and civil costs.

4.2 Resource requirements and constraints

During the RY2017-19 period of exceptional growth, living and working in the Auckland region tested affordability for many workers. This problem also manifested for businesses and tested their ability to retain and attract the right skilled workforce to meet their operating requirements. These challenges are acute for us and our FSPs, as we must attract and retain highly specialised skilled workers that are constantly presented with opportunities to work in similar roles in more affordable parts of the country.

4.3 CAPEX forecast

The forecast CAPEX during the next 10-year planning period (prior to contributions), broken down into the asset categories defined in the Commerce Commission's Electricity Distribution Information Disclosure Amendments Determination 2012 is shown below.

FINANCIAL YEAR ($000)

AMP20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Customer connection	71,619	76,105	65,328	59,411	62,971	61,931	58,891	58,891	59,038	59,038	633,224
System growth	50,266	43,076	31,518	16,334	13,946	45,562	48,206	41,735	29,985	37,330	357,956
Asset replacement and renewal	114,930	102,243	104,294	103,349	91,209	100,717	101,448	93,472	91,142	93,090	995,895
Asset relocations (excl ALR)	34,709	34,767	21,848	22,941	20,808	23,929	23,929	23,929	23,929	23,929	254,718
Reliability, safety and environment:	22,471	24,410	30,325	29,329	30,068	36,310	35,847	35,847	38,620	36,367	319,591
Quality of supply											0
Legislative and regulatory											0
Other reliability, safety and environment	22,471	24,410	30,325	29,329	30,068	36,310	35,847	35,847	38,620	36,367	319,591
Non-network asset	47,682	35,311	29,676	20,284	18,960	17,304	14,551	15,289	20,264	14,950	234,271
Total CAPEX (excl ALR)	341,675	315,911	282,989	251,648	237,962	285,753	282,872	269,163	262,978	264,705	2,795,658
Auckland Light Rail	0	0	12,485	21,848	21,848	21,848	8,323	0	0	0	86,353
Total CAPEX (incl ALR)	**341,675**	**315,911**	**295,474**	**273,496**	**259,810**	**307,601**	**291,195**	**269,163**	**262,978**	**264,705**	**2,882,010**

2020 FORECAST CAPEX

FINANCIAL YEAR ($000)

AMP20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	TOTAL
Customer connection	(2,490)	13,250	4,976	2,520	7,883	6,843	5,692	8,779	8,926	56,378
System growth	6,752	11,304	(5,534)	(18,914)	(15,513)	5,115	12,952	3,743	(4,111)	(4,206)
Asset replacement and renewal	13,477	(1,261)	3,080	7,304	25	8,249	2,395	(572)	(5,065)	27,632
Asset relocations (excl ALR)	2,919	3,815	(2)	2,081	0	0	0	0	0	6,734
Reliability, safety and environment:	(3,186)	(5,294)	(4,165)	(4,059)	(4,110)	(1,509)	(1,451)	(1,451)	(1,451)	(26,675)
Quality of supply										0
Legislative and regulatory										0
Other reliability, safety and environment	(3,186)	(5,294)	(4,165)	(4,059)	(4,110)	(1,509)	(1,451)	(1,451)	(1,451)	(26,675)
Non-network asset	19,906	10,512	9,495	2,664	463	(16,364)	(1,229)	308	4,696	30,452
Total CAPEX (excl ALR)	37,378	32,326	5,772	(8,403)	(11,251)	2,334	18,358	10,808	2,995	90,314
Auckland Light Rail	(12,485)	(21,848)	(9,364)	0	13,525	21,848	8,323	0	0	0
Total CAPEX (incl ALR)	**24,893**	**10,478**	**(3,592)**	**(8,403)**	**2,274**	**24,182**	**26,681**	**10,808**	**2,995**	**90,314**

2019/2020 CAPEX VARIANCE

EXPLANATION OF MAJOR CAPEX VARIANCES

- Customer connection is $56m higher due to higher number of large-customer connections and forecast increase in greenfield subdivision volume and cost
- System growth is $4m lower largely due to a lower load forecast, and adopting alternative, lower cost options to meet capacity requirement. This is partially offset by an increase in Wellsford-Warkworth 110kV project cost
- Asset replacement is $28m higher driven by additional resource allocated to reactive maintenance to improve response times to asset failures when they occur, and thus reducing network outage period
- Asset relocation is $7m higher due to deferral/delay of Transpower 33kV switchgear outdoor to indoor projects and CRL project from FY20 into the AMP20 planning period
- Due to the acceleration of work programmes for network automation and fault passage indicators (FPIs) into the FY20 period as part of the RY20 SRMP, Reliability expenditure is included in this AMP update at a reduced level
- In the 2019 AMP, allowance was made for increased property CAPEX pertaining to refurbishment costs and lease amendment. Much of that spend was expected in FY20 but the refurbishment is now likely to occur across FY21 and FY22. Leasing arrangements have also been amended causing re-phasing of spend across the AMP years
- Additional investment has been included in for strategic technology partnerships

4.4 OPEX forecast

The OPEX forecast for the electricity distribution network assets for the next 10-year planning period, broken down into the asset categories defined in the Electricity Distribution Information Disclosure Amendments Determination 2012, is shown below.

FINANCIAL YEAR ($000)

AMP20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Service interruptions and emergencies	15,399	15,516	15,641	15,800	15,915	15,975	16,089	16,208	16,327	16,448	159,318
Vegetation management	10,383	8,612	8,717	8,823	8,931	7,404	7,495	7,586	7,679	7,773	83,403
Routine and corrective maintenance and inspection	18,456	18,679	19,875	24,252	24,386	19,370	19,379	19,402	19,504	19,627	202,930
Asset replacement and renewal	13,999	14,455	14,599	14,744	14,868	14,834	14,649	14,795	14,942	15,092	146,977
System operations and network support	36,745	40,939	41,419	41,822	42,344	42,607	42,533	42,416	42,295	42,030	415,150
Business support	37,677	37,677	37,677	37,677	37,677	37,677	37,677	37,677	37,677	37,677	376,770
Total OPEX	**132,659**	**135,878**	**137,928**	**143,118**	**144,121**	**137,867**	**137,822**	**138,084**	**138,424**	**138,647**	**1,384,548**

2020 FORECAST OPEX

FINANCIAL YEAR ($000)

AMP20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	TOTAL
Service interruptions and emergencies	1,118	1,104	1,095	1,119	1,100	1,024	1,006	983	970	9,519
Vegetation management	1,772	(105)	(106)	(108)	(109)	(91)	(92)	(93)	(94)	974
Routine and corrective maintenance and inspection	229	223	266	262	200	300	358	290	252	2,380
Asset replacement and renewal	(168)	144	142	141	310	442	110	109	107	1,337
System operations and network support	(5,915)	(2,440)	(2,480)	(2,793)	(2,709)	(2,480)	(2,565)	(2,690)	(2,670)	(26,742)
Business support	(598)	(598)	(598)	(598)	(598)	(598)	(598)	(598)	(598)	(5,382)
Total OPEX	**(3,563)**	**(1,672)**	**(1,681)**	**(1,976)**	**(1,806)**	**(1,402)**	**(1,780)**	**(1,999)**	**(2,033)**	**(17,912)**

2019/2020 OPEX VARIANCE

EXPLANATION OF MAJOR OPEX VARIANCES

- Service interruptions and emergencies is $9m higher due to an increase in fault response actions contracted to reduce fault duration
- Vegetation management has the balance of the acceleration project from the RY20 SRMP that will complete in FY21
- Changes made to the operating model for reactive maintenance under the SRMP will continue. This causes an increase of $2m in Routine and corrective maintenance and inspection costs
- Asset replacement and renewal spend has been re-baselined against the increased corrective maintenance spend in FY20
- There is a $27m decrease in System Operations costs due to 1) a targeted reduction in third party services activity, 2) a reduction in communication costs due to a change in accounting treatment, 3) lower call centre fees due to the renegotiated Telnet contract and new outage manager service, 4) lower indirect costs driven by cost savings initiatives and 5) an increase in capital activity resulting in higher recoveries
- Business support costs have decreased by $5m overall due to cost savings initiatives

section 05 appendices

5.1 Appendix A – Schedule 11a Forecast Capital Expenditure

Company Name	**Vector Electricity**
AMP Planning Period	**1 April 2020 – 31 March 2030**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref													
7			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
9		**11a(i): Expenditure on Assets Forecast**	**$000 (in nominal dollars)**										
10		Consumer connection	65,876	67,133	75,330	69,703	63,644	66,185	67,627	66,163	66,626	68,087	69,491
11		System growth	41,852	46,551	44,235	34,596	20,645	15,213	40,183	51,747	48,128	37,280	40,995
12		Asset replacement and renewal	120,026	111,988	106,441	106,888	108,820	100,986	107,483	112,894	108,558	106,390	109,556
13		Asset relocations	26,647	32,778	34,841	35,219	43,991	45,950	48,830	39,442	29,366	27,556	28,108
14		Reliability, safety and environment:											
15		Quality of supply	5	-	-	-	-	-	-	-	-	-	-
16		Legislative and regulatory	731	-	-	-	-	-	-	-	-	-	-
17		Other reliability, safety and environment	39,649	27,141	23,607	29,031	30,363	31,290	37,114	39,177	39,832	42,986	42,694
18		**Total reliability, safety and environment**	40,385	27,141	23,607	29,031	30,363	31,290	37,114	39,177	39,832	42,986	42,694
19		**Expenditure on network assets**	294,786	285,591	284,454	275,437	267,463	259,624	301,237	309,423	292,510	282,299	290,844
20		Expenditure on non-network assets	35,751	43,790	38,666	31,923	23,707	20,612	19,309	16,941	17,127	21,998	19,203
21		**Expenditure on assets**	330,537	329,381	323,120	307,360	291,170	280,236	320,546	326,364	309,637	304,297	310,047
22													
23	*plus*	Cost of financing	5,971	5,842	5,680	5,365	4,898	4,694	5,879	6,188	5,874	5,637	5,782
24	*less*	Value of capital contributions	81,090	87,603	97,374	82,896	74,734	76,102	78,844	78,132	78,821	80,527	82,182
25	*plus*	Value of vested assets											
26													
27		**Capital expenditure forecast**	255,418	247,620	231,426	229,829	221,334	208,828	247,581	254,420	236,690	229,407	233,647
28													
29		Assets commissioned	239,211	249,025	232,118	231,243	222,066	208,582	241,299	242,722	253,821	232,507	236,840
30			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
31		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**	**31 Mar 26**	**31 Mar 27**	**31 Mar 28**	**31 Mar 29**	**31 Mar 30**
32			**$000 (in constant prices)**										
33		Consumer connection	65,876	65,817	72,405	65,683	58,797	59,946	60,051	57,599	56,865	56,972	57,007
34		System growth	41,852	45,638	42,517	32,601	19,073	13,779	35,681	45,049	41,077	31,194	33,630
35		Asset replacement and renewal	120,026	109,792	102,308	100,723	100,533	91,466	95,442	98,281	92,653	89,022	89,874
36		Asset relocations	26,647	32,135	33,488	33,188	40,641	41,618	43,360	34,337	25,064	23,058	23,058
37		Reliability, safety and environment:											
38		Quality of supply	5	-	-	-	-	-	-	-	-	-	-
39		Legislative and regulatory	731	-	-	-	-	-	-	-	-	-	-
40		Other reliability, safety and environment	39,649	26,609	22,690	27,357	28,051	28,340	32,956	34,106	33,996	35,969	35,024
41		**Total reliability, safety and environment**	40,385	26,609	22,690	27,357	28,051	28,340	32,956	34,106	33,996	35,969	35,024
42		**Expenditure on network assets**	294,786	279,991	273,408	259,552	247,095	235,149	267,490	269,372	249,655	236,215	238,593
43		Expenditure on non-network assets	35,751	42,931	37,165	30,082	21,902	18,669	17,146	14,748	14,618	18,407	15,753
44		**Expenditure on assets**	330,537	322,922	310,573	289,634	268,997	253,818	284,636	284,120	264,273	254,622	254,346
45													
46		**Subcomponents of expenditure on assets (where known)**											
47		Energy efficiency and demand side management, reduction of energy losses											
48		Overhead to underground conversion	7,932	7,895	10,527	10,527	10,527	10,527	10,527	10,527	10,527	10,527	10,527
49		Research and development											

Row			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
50													
52		for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28	31 Mar 29	31 Mar 30
53	**Difference between nominal and constant price forecasts**		$000										
54	Consumer connection		-	1,316	2,925	4,020	4,847	6,239	7,576	8,564	9,761	11,115	12,484
55	System growth		-	913	1,718	1,995	1,572	1,434	4,502	6,698	7,051	6,086	7,365
56	Asset replacement and renewal		-	2,196	4,133	6,165	8,287	9,520	12,041	14,613	15,905	17,368	19,682
57	Asset relocations		-	643	1,353	2,031	3,350	4,332	5,470	5,105	4,302	4,498	5,050
58	Reliability, safety and environment:												
59	Quality of supply		-	-	-	-	-	-	-	-	-	-	-
60	Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
61	Other reliability, safety and environment		-	532	917	1,674	2,312	2,950	4,158	5,071	5,836	7,017	7,670
62	**Total reliability, safety and environment**		-	532	917	1,674	2,312	2,950	4,158	5,071	5,836	7,017	7,670
63	**Expenditure on network assets**		-	5,600	11,046	15,885	20,368	24,475	33,747	40,051	42,855	46,084	52,251
64	Expenditure on non-network assets		-	859	1,501	1,841	1,805	1,943	2,163	2,193	2,509	3,591	3,450
65	**Expenditure on assets**		-	6,459	12,547	17,726	22,173	26,418	35,910	42,244	45,364	49,675	55,701
66													

Row			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
67		for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25
68	**11a(ii): Consumer Connection**							
69	*Consumer types defined by EDB**		$000 (in constant prices)					
70	Service Connection		14,781	15,670	14,754	14,489	14,489	14,489
	Customer Substations		18,028	16,057	22,480	16,596	9,645	10,773
	Business subdivisions		1,637	1,166	1,135	1,135	1,135	1,135
	Residential Subdivisions		23,967	25,759	28,154	27,581	27,646	27,667
71	Capacity Changes		6,201	5,534	4,958	4,958	4,958	4,958
72	Street Lighting		1,262	1,631	924	924	924	924
73	Relocations		-	-	-	-	-	-
74	Easements		-	-	-	-	-	-
75	**include additional rows if needed*							
76	**Consumer connection expenditure**		65,876	65,817	72,405	65,683	58,797	59,946
77	*less* Capital contributions funding consumer connection		66,886	66,824	73,513	66,689	59,697	60,864
78	**Consumer connection less capital contributions**		(1,010)	(1,007)	(1,108)	(1,006)	(900)	(918)
79	**11a(iii): System Growth**							
80	Subtransmission		12,100	12,967	13,319	6,864	1,816	353
81	Zone substations		16,821	17,698	14,126	9,586	4,196	2,364
82	Distribution and LV lines		3,296	1,586	2,047	2,336	2,560	2,975
83	Distribution and LV cables		5,367	11,604	10,437	11,979	8,689	6,154
84	Distribution substations and transformers		862	-	-	-	-	-
85	Distribution switchgear		1,862	-	-	-	-	-
86	Other network assets		1,544	1,783	2,588	1,836	1,812	1,933
87	**System growth expenditure**		41,852	45,638	42,517	32,601	19,073	13,779
88	*less* Capital contributions funding system growth							
89	**System growth less capital contributions**		41,852	45,638	42,517	32,601	19,073	13,779
90								

11a(iv): Asset Replacement and Renewal

for year ended	Current Year CY 31 Mar 20	CY+1 31 Mar 21	CY+2 31 Mar 22	CY+3 31 Mar 23	CY+4 31 Mar 24	CY+5 31 Mar 25
	$000 (in constant prices)					
Subtransmission	6,087	7,097	2,243	154	6,740	4,024
Zone substations	27,707	32,341	25,842	26,542	21,107	15,607
Distribution and LV lines	30,957	15,273	12,708	12,731	11,888	11,322
Distribution and LV cables	26,818	29,462	31,891	32,280	32,356	32,165
Distribution substations and transformers	5,847	4,797	5,729	5,744	5,683	5,660
Distribution switchgear	16,707	16,728	18,972	19,113	19,060	19,038
Other network assets	5,903	4,094	4,923	4,159	3,699	3,650
Asset replacement and renewal expenditure	120,026	109,792	102,308	100,723	100,533	91,466
less Capital contributions funding asset replacement and renewal						
Asset replacement and renewal less capital contributions	120,026	109,792	102,308	100,723	100,533	91,466

11a(v): Asset Relocations

for year ended	Current Year CY 31 Mar 20	CY+1 31 Mar 21	CY+2 31 Mar 22	CY+3 31 Mar 23	CY+4 31 Mar 24	CY+5 31 Mar 25
*Project or programme**	$000 (in constant prices)					
Overhead to Underground conversions	7,932	7,895	10,527	10,527	10,527	10,527
**include additional rows if needed*						
All other project or programmes- asset relocations	18,715	24,240	22,961	22,661	30,114	31,091
Asset relocations expenditure	26,647	32,135	33,488	33,188	40,641	41,618
less Capital contributions funding asset relocations	14,204	19,061	20,080	11,426	9,346	8,064
Asset relocations less capital contributions	12,443	13,074	13,408	21,762	31,295	33,554

11a(vi): Quality of Supply

for year ended	Current Year CY 31 Mar 20	CY+1 31 Mar 21	CY+2 31 Mar 22	CY+3 31 Mar 23	CY+4 31 Mar 24	CY+5 31 Mar 25
*Project or programme**	$000 (in constant prices)					
**include additional rows if needed*						
All other projects or programmes- quality of supply	5	-	-	-	-	-
Quality of supply expenditure	5	-	-	-	-	-
less Capital contributions funding quality of supply						
Quality of supply less capital contributions	5	-	-	-	-	-

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25

11a(vii): Legislative and Regulatory

*Project or programme**	$000 (in constant prices)					
**include additional rows if needed*						
All other projects or programmes - legislative and regulatory	731	-	-	-	-	-
Legislative and regulatory expenditure	731	-	-	-	-	-
less Capital contributions funding legislative and regulatory						
Legislative and regulatory less capital contributions	731	-	-	-	-	-

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25

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

*Project or programme**	$000 (in constant prices)					
**include additional rows if needed*						
All other projects or programmes - other reliability, safety and environment	39,649	26,609	22,690	27,357	28,051	28,340
Other reliability, safety and environment expenditure	39,649	26,609	22,690	27,357	28,051	28,340
less Capital contributions funding other reliability, safety and environment						
Other reliability, safety and environment less capital contributions	39,649	26,609	22,690	27,357	28,051	28,340

	Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25

11a(ix): Non-Network Assets

Routine expenditure						
*Project or programme**	$000 (in constant prices)					
**include additional rows if needed*						
All other projects or programmes - routine expenditure	21,594	9,964	13,731	15,405	14,061	14,652
Routine expenditure	21,594	9,964	13,731	15,405	14,061	14,652
Atypical expenditure						
*Project or programme**						
**include additional rows if needed*						
All other projects or programmes - atypical expenditure	14,157	32,967	23,434	14,677	7,841	4,017
Atypical expenditure	14,157	32,967	23,434	14,677	7,841	4,017
Expenditure on non-network assets	35,751	42,931	37,165	30,082	21,902	18,669

5.2 Appendix B – Schedule 11b Forecast Operational Expenditure

Company Name: **Vector Electricity**

AMP Planning Period: **1 April 2020 31 March 2030**

SCHEDULE11b:REPORTON FORECASTOPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8	for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28	31 Mar 29	31 Mar 30
9	**Operational Expenditure Forecast**	**$000(in nominal dollars)**										
10	Service interruptions and emergencies	10,821	14,173	15,766	16,259	16,777	17,276	17,720	18,202	18,717	19,247	19,793
11	Vegetation management	10,313	10,217	9,210	9,052	9,365	9,683	8,638	8,469	8,750	9,042	9,343
12	Routine and corrective maintenance and inspection	17,157	18,458	18,959	20,395	24,670	26,482	22,876	21,960	22,440	23,004	23,624
13	Asset replacement and renewal	13,433	13,836	14,601	15,169	15,657	16,135	16,478	16,653	17,074	17,603	18,149
14	**Network Opex**	51,724	56,684	58,536	60,875	66,469	69,576	65,712	65,284	66,981	68,896	70,909
15	System operations and network support	39,064	37,365	40,627	43,017	44,413	45,906	47,232	48,224	49,104	49,983	50,746
16	Business support	36,346	37,441	38,356	39,243	40,107	40,971	41,830	42,700	43,588	44,495	45,420
17	**Non-network opex**	75,410	74,806	78,983	82,260	84,520	86,877	89,062	90,924	92,692	94,478	96,166
18	**Operational expenditure**	127,134	131,490	137,519	143,135	150,989	156,453	154,774	156,208	159,673	163,374	167,075

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
20	for year ended	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24	31 Mar 25	31 Mar 26	31 Mar 27	31 Mar 28	31 Mar 29	31 Mar 30
21		$000(in constant prices)										
22	Service interruptions and emergencies	10,821	13,884	15,098	15,218	15,365	15,488	15,560	15,658	15,772	15,889	16,006
23	Vegetation management	10,313	10,021	8,828	8,473	8,576	8,681	7,591	7,285	7,374	7,464	7,555
24	Routine and corrective maintenance and inspection	17,157	18,111	18,156	19,085	22,577	23,741	20,106	18,891	18,910	18,990	19,105
25	Asset replacement and renewal	13,433	13,573	13,981	14,198	14,339	14,465	14,470	14,326	14,388	14,532	14,677
26	**Network Opex**	51,724	55,589	56,063	56,974	60,857	62,375	57,727	56,160	56,444	56,875	57,343
27	System operations and network support	39,064	36,674	38,890	40,263	40,675	41,155	41,475	41,484	41,381	41,263	41,040
28	Business support	36,346	36,732	36,732	36,732	36,732	36,732	36,732	36,732	36,732	36,732	36,732
29	**Non-network opex**	75,410	73,406	75,622	76,995	77,407	77,887	78,207	78,216	78,113	77,995	77,772
30	**Operational expenditure**	127,134	128,995	131,685	133,969	138,264	140,262	135,934	134,376	134,557	134,870	135,115
31	**Subcomponents of operational expenditure (where known)**											
32–33	Energy efficiency and demand side management, reduction of energy losses											
34	Direct billing*											
35	Research and Development	-	-	-	-	-	-	-	-	-	-	-
36	Insurance	3,170	3,252	3,330	3,406	3,480	3,555	3,629	3,704	3,781	3,860	3,940

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

39		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
40												
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	289	668	1,041	1,412	1,788	2,160	2,544	2,945	3,358	3,787
43	Vegetation management	-	196	382	579	789	1,002	1,047	1,184	1,376	1,578	1,788
44	Routine and corrective maintenance and inspection	-	347	803	1,310	2,093	2,741	2,770	3,069	3,530	4,014	4,519
45	Asset replacement and renewal	-	263	620	971	1,318	1,670	2,008	2,327	2,686	3,071	3,472
46	**Network Opex**	-	1,095	2,473	3,901	5,612	7,201	7,985	9,124	10,537	12,021	13,566
47	System operations and network support	-	691	1,737	2,754	3,738	4,751	5,757	6,740	7,723	8,720	9,706
48	Business support	-	709	1,624	2,511	3,375	4,239	5,098	5,968	6,856	7,763	8,688
49	**Non-network opex**	-	1,400	3,361	5,265	7,113	8,990	10,855	12,708	14,579	16,483	18,394
50	**Operational expenditure**	-	2,495	5,834	9,166	12,725	16,191	18,840	21,832	25,116	28,504	31,960

5.3 Appendix C – Schedule 12a Asset Condition

Company Name	**Vector Electricity**
AMP Planning Period	**1 April 2020 – 31 March 2030**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a. All units relating to cable and line assets, that are expressed in km, refer to circuit lengths.

sch ref

					Asset condition at start of planning period (percentage of units by grade)							
7												
8												
9	**Voltage**	**Asset category**	**Asset class**	**Units**	**H1**	**H2**	**H3**	**H4**	**H5**	**Grade unknown**	**Data accuracy (1–4)**	**% of asset forecast to be replaced in next 5 years**
10	All	Overhead Line	Concrete poles / steel structure	No.	0.01%	0.13%	21.25%	38.28%	40.33%		4	6.33%
11	All	Overhead Line	Wood poles	No.	0.05%	1.11%	82.44%	12.72%	3.69%		4	33.28%
12	All	Overhead Line	Other pole types	No.	-	-	-	-	100.00%		4	-
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km	-	-	90.16%	2.56%	7.28%		3	-
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km	-	-	72.35%	-	27.65%		3	-
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km	-	0.89%	5.57%	34.64%	58.89%		2	0.89%
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km	-	-	-	96.02%	3.98%		2	-
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km	-	100.00%	-	-	-		2	100.00%
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km	-	64.06%	25.17%	8.46%	2.31%		2	82.86%
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km	-	-	-	27.96%	72.04%		2	-
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km	-	-	-	93.87%	6.13%		2	-
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km							N/A	
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km							N/A	
23	HV	Subtransmission Cable	Subtransmission submarine cable	km	-	-	4.96%	95.04%	-		2	-
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.	-	-	1.75%	79.82%	18.42%		4	3.00%
25	HV	Zone substation Buildings	Zone substations 110kV+	No.	-	-	-	100.00%	-		4	-
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	-	3.60%	3.60%	15.60%	77.20%		3	3.60%
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.	-	21.31%	39.34%	9.84%	29.51%		3	30.33%
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.							N/A	
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.	-	23.37%	69.57%	4.35%	2.72%		3	23.91%
30	HV	Zone substation switchgear	33kV RMU	No.	-	-	-	100.00%	-		3	-
31	HV	Zone substation switchgear	50/66/110kV CB (Indoor)	No.	-	-	-	45.00%	55.00%		3	-
32	HV	Zone substation switchgear	50/66/110kV CB (Outdoor)	No.	-	-	100.00%	-	-		3	-
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	-	10.68%	20.18%	20.92%	48.22%		3	14.84%
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.							N/A	
35												

36					Asset condition at start of planning period (percentage of units by grade)								
37													
38	Voltage	Asset category	Asset class	Units	H1	H2	H3	H4	H5	Grade unknown	Data accuracy (1–4)	% of asset forecast to be replaced in next 5 years
39	HV	Zone Substation Transformer	Zone Substation Transformers	No.	-	6.39%	45.66%	23.74%	24.20%		4	5.94%
40	HV	Distribution Line	Distribution OH Open Wire Conductor	km	-	-	82.32%	12.57%	5.11%		3	1.61%
41	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km							N/A	
42	HV	Distribution Line	SWER conductor	km							N/A	
43	HV	Distribution Cable	Distribution UG XLPE or PVC	km	0.47%	0.04%	1.66%	16.15%	81.69%		2	0.84%
44	HV	Distribution Cable	Distribution UG PILC	km	0.30%	1.21%	2.38%	72.91%	23.20%		2	1.51%
45	HV	Distribution Cable	Distribution Submarine Cable	km	-	-	86.11%	13.89%	-		2	-
46	HV	Distribution switchgear	3.3/6.6/11/22 kV CB (pole mounted)- reclosers and sectionalisers	No.	-	0.36%	9.09%	60.73%	29.82%		4	11.36%
47	HV	Distribution switchgear	3.3/6.6/11/22 kV CB (Indoor)	No.	-	-	15.33%	8.33%	76.33%		4	-
48	HV	Distribution switchgear	3.3/6.6/11/22 kV Switches and fuses (pole mounted)	No.	2.41%	1.78%	44.92%	18.32%	32.57%		4	9.13%
49	HV	Distribution switchgear	3.3/6.6/11/22 kV Switch (ground mounted)- except RMU	No.	2.49%	0.80%	76.05%	17.32%	3.35%		3	8.02%
50	HV	Distribution switchgear	3.3/6.6/11/22 kV RMU	No.	1.51%	1.29%	47.89%	18.51%	30.79%		3	3.93%
51	HV	Distribution Transformer	Pole Mounted Transformer	No.	1.49%	1.12%	47.30%	25.29%	24.79%		3	8.13%
52	HV	Distribution Transformer	Ground Mounted Transformer	No.	4.94%	1.35%	33.82%	27.65%	32.24%		3	6.29%
53	HV	Distribution Transformer	Voltage regulators	No.	-	-	-	33.33%	66.67%		4	-
54	HV	Distribution Substations	Ground Mounted Substation Housing	No.	2.55%	0.79%	75.30%	9.96%	11.41%		4	3.34%
55	LV	LV Line	LV OH Conductor	km	-	-	85.78%	8.09%	6.13%		3	0.23%
56	LV	LV Cable	LV UG Cable	km	0.50%	3.44%	21.01%	39.75%	35.29%		2	3.94%
57	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km						100.00%	1	0.08%
58	LV	Connections	OH/UG consumer service connections	No.						100.00%	1	-
59	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	1.81%	57.78%	22.06%	18.34%		3	1.81%
60	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot	-	5.31%	34.92%	33.80%	25.98%		4	5.31%
61	All	Capacitor Banks	Capacitors including controls	No.	-	-	77.63%	22.37%	-		3	-
62	All	Load Control	Centralised plant	Lot	-	-	100.00%	-	-		4	-
63	All	Load Control	Relays	No.							N/A	
64	All	Civils	Cable Tunnels	km	-	-	8.62%	-	91.38%		4	-

5.4 Appendix D – Schedule 12b Forecast Capacity

Company Name: **Vector Electricity**

AMP Planning Period: **1 April 2020 – 31 March 2030**

SCHEDULE 12b: REPORT ON FORECAST CAPACITY

This schedule requires a breakdown of current and forecast capacity and utilisat on for each zone substation and current distribution transformer capacity. The data provided should be consistent with the information provided in the AMP. Information provided in this table should relate to the operation of the network in its normal steady state configurat on.

sch ref

7 **12b(i): System Growth - Zone Substations**

sch ref	*Existing Zone Substations*	Current Peak Load (MVA)	Installed Firm Capacity (MVA)	Security of Supply Classificaton (type)	Transfer Capacity (MVA)	Utilisation of Installed Firm Capacity %	Installed Firm Capacity +5 years (MVA)	Utilisation of Installed Firm Capacity + 5yrs %	Installed Firm Capacity Constraint +5 years (cause)	Explanation
9	Atkinson Road	19.2	21	N-1	19.8	90%	21	86%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
10	Auckland Airport	18.0	25	N-1	10.0	72%	25	112%	No constraint within +5 years	Meets Vector security criteria
11	Avondale	25.6	24	N-1 switched	18.9	107%	24	117%	No constraint within +5 years	Meets Vector security criteria. New load connected to the 22kV network.
12	Bairds	23.2	24	N-1	21.4	97%	24	106%	No constraint within +5 years	Transfer load to Hobson 110/11kV to utilise the available spare capacity. New load connected to 22kV network
13	Balmain	8.7	-	N-1 switched	14.5	-	-		No constraint within +5 years	Constraint relieved by CBD (Quay 22kV) capacity upgrade project in progress
14	Balmoral	13.6	24	N-1	15.1	57%	24	56%	No constraint within +5 years	Constraint relieved by the installation of Hobsonville Point zone substation
15	Belmont	13.9	14	N-1	10.4	99%	14	96%	No constraint within +5 years	Commissioned in 2019 Meets Vector security criteria
16	Birkdale	22.9	24	N-1	16.2	95%	24	91%	No constraint within +5 years	Meets Vector security criteria
17	Brickworks	10.2	-	N-1 switched	13.5	-	-		No constraint within +5 years	Meets Vector security criteria
18	Browns Bay	16.6	16	N-1 switched	15.6	104%	18	89%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
19	Bush Road	25.0	24	N-1 switched	13.7	105%	24	103%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
20	Carbine	14.2	24	N-1	10.3	60%	24	59%	No constraint within +5 years	Meets Vector security criteria
21	Chevalier	18.4	19	N-1	15.4	97%	24	85%	No constraint within +5 years	Meets Vector and Customer's security criteria
22	Clendon	19.0	24	N-1	14.7	79%	24	83%	No constraint within +5 years	Meets Vector security criteria
23	Clevedon	2.5	-	N-1 switched	3.3	-	-		No constraint within +5 years	Meets Vector security criteria. Liverpool 22kV capacity upgrade project in progress
24	Coatesville	10.7	-	N	9.1	-	12	91%	No constraint within +5 years	Constraint relieved by the installation of the third transformer
25	Drive	21.6	24	N-1	23.2	90%	24	117%	No constraint within +5 years	Constraint relieved by load transfer to Mangere Central substation
26	East Coast Road	15.9	-	N-1 switched	16.3	-	-		No constraint within +5 years	Constraint relieved by load transfer to Mangere Central substation and planned new Mangere South substation
27	East Tamaki	14.8	24	N-1	6.9	62%	24	62%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
28	Flatbush	11.6	24	N-1	10.3	48%	24	73%	No constraint within +5 years	Meets Vector security criteria
29	Forrest Hill	16.8	20	N-1	15.8	84%	20	80%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
30	Freemans Bay	17.9	22	N-1	16.6	83%	22	99%	No constraint within +5 years	Meets Vector security criteria
31	Glen Innes	11.8	13	N-1	33.9	88%	24	47%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
32	Greenhithe	11.6	-	N	8.3	-	24	47%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
33	Greenmount	36.0	48	N-1	28.4	75%	48	78%	No constraint within +5 years	Meets Vector security criteria
34	Gulf Harbour	8.5	-	N	8.5	-	-		No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
35	Hans	23.5	24	N-1	14.9	99%	24	119%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
36	Hauraki	9.2	-	N-1 switched	10.0	-	-		No constraint within +5 years	Meets Vector security criteria
37	Helensville	14.7	9	N-1 switched	9.8	163%	18	82%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
38	Henderson Valley	17.3	15	N-1 switched	21.7	114%	15	117%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup, Planned Newmarket 11kV capacity upgrade
39	Highbrook	8.8	23	N-1	0.0	38%	23	46%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
40	Highbury	14.0	-	N-1 switched	14.7	-	24	59%	No constraint within +5 years	Constraint relieved by reinforcement and transformer upgrade at Belmont

41		Hillcrest	22.1	24	N-1	18.8	93%	24	105%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
42		Hillsborough	14.5	24	N-1	15.7	61%	24	76%	No constraint within +5 years	Constraint relieved by future subtransmission circuit replacement
43		Hobson 110/11kV	13.0	25	N-1	10.4	52%	25	73%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
44		Hobson 22/11kV	17.1	18	N-1	7.9	95%	18	83%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
45		Hobson 22kV	49.6	40	N-1 switched	34.7	124%	80	86%	No constraint within +5 years	Constraint relieved by 11kV switchgear replacement
46		Hobsonville	19.8	15	N-1 switched	17.9	130%	15	87%	No constraint within +5 years	Meets Vector security criteria
47		Hobsonville Point	0.0	24	N-1	7.8	-	24	51%		Meets Vector security criteria
48		Howick	34.0	48	N-1	16.0	71%	48	75%	No constraint within +5 years	Meets Vector security criteria
49		James Street	14.8	15	N-1	19.5	97%	15	-	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
50		Keeling Road	9.6	-	N-1 switched	17.0	-	-		No constraint within +5 years	Meets Vector security criteria
51		Kingsland	23.8	24	N-1	22.9	99%	24	106%	No constraint within +5 years	Constraint relieved by subtransmission circuit replacement in progress
52		Laingholm	8.6	9	N-1	10.7	96%	9	89%	No constraint within +5 years	Transfer load to 22kV distribution network
53		Lichfield	16.5	20	N-1	0.0	83%	20	88%	No constraint within +5 years	Meets Vector security criteria
54		Liverpool	28.1	48	N-1	18.1	59%	48	70%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
55		Liverpool 22kV	80.6	135	N-1	49.3	60%	150	69%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
56		Mangere Central	33.4	24	N-1 switched	15.8	139%	48	73%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
57		Mangere East	25.0	24	N-1 switched	23.4	104%	24	136%	No constraint within +5 years	Meets Vector security criteria
58		Mangere West	22.0	30	N-1	3.4	73%	30	111%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
59		Manly	19.2	14	N-1 switched	14.1	137%	14	132%	No constraint within +5 years	Meets Vector security criteria
60		Manukau	27.0	48	N-1	26.9	56%	48	61%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
61		Manurewa	45.0	48	N-1	33.3	94%	48	96%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
62		Maraetai	7.8	18	N-1	3.2	43%	18	49%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
63		McKinnon	19.3	24	N-1	18.1	81%	24	124%	No constraint within +5 years	Constraint relieved by the BESS and 11kV cable project
64		Mcleod Road	10.3	-	N-1 switched	11.1	-	-		No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
65		McNab	39.7	48	N-1	30.2	83%	48	84%	No constraint within +5 years	Constraint relieved by the installation of the second transformer
66		Milford	8.1	-	N-1 switched	8.3	-	-		No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
67		Mt Albert	6.4	-	N-1 switched	12.6	-	-		No constraint within +5 years	Meets Vector security criteria
68		Mt Wellington	16.3	24	N-1	17.1	68%	24	75%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
69		New Lynn	13.9	14	N-1	11.6	99%	14	107%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
70		Newmarket	37.4	48	N-1	31.6	78%	48	113%	No constraint within +5 years	Meets Vector security criteria
71		Newton	19.6	19	N-1 switched	19.7	104%	19	112%	No constraint within +5 years	Constraint relieved by transformer capacity upgrade
72		Ngataringa Bay	7.5	-	N	5.5	-	-		No constraint within +5 years	Constraint relieved by the installation of the second transformer
73		Northcote	6.6	-	N-1 switched	7.8	-	-		No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
74		Onehunga	14.3	15	N-1	12.3	97%	15	104%	No constraint within +5 years	Meets Vector security criteria
75		Orakei	20.0	22	N-1	16.0	93%	22	106%	No constraint within +5 years	Meets Vector security criteria
76		Oratia	5.3	-	N-1 switched	6.5	-	-		No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup. Transformer replacement upgrade
77		Orewa	18.1	15	N-1 switched	8.0	119%	24	104%	No constraint within +5 years	Meets Vector security criteria
78		Otara	29.9	36	N-1	27.4	83%	36	81%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
79		Pacific Steel	23.5	42	N-1	0.0	56%	42	53%	No constraint within +5 years	Meets Vector security criteria
80		Pakuranga	20.0	24	N-1	16.3	83%	24	86%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
81		Papakura	25.0	23	N-1 switched	9.1	107%	23	116%	No constraint within +5 years	Constraints relieved by options to enhance the existing network transfer capacity. Firm substation capacity established in the future by 2nd 33kV circuit.
82		Parnell	9.5	18	N-1	16.0	53%	18	68%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
83		Ponsonby	13.9	14	N-1	13.4	97%	18	86%	No constraint within +5 years	Constraint relieved by the Warkworth South BESS and the Omaha substation
84		Quay	20.6	24	N-1	17.3	86%	24	100%	No constraint within +5 years	Meets Vector security criteria

85	Quay 22kV	34.4	60	N-1	31.8	57%	60	84%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
86	Ranui	12.9	-	N-1 switched	14.2	-	-		No constraint within +5 years	Meets Vector security criteria
87	Remuera	26.7	24	N-1 switched	24.1	111%	24	116%	No constraint within +5 years	Meets Vector security criteria due to sufficient 11kV backup
88	Riverhead	11.5	9	N-1 switched	12.5	128%	9	144%	No constraint within +5 years	Constraint relieved by new Wiri West substation
89	Rockfield	22.4	24	N-1	24.2	93%	24	91%	No constraint within +5 years	Meets Vector security criteria
90	Rosebank	21.6	22	N-1	10.4	100%	22	99%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
91	Rosedale	13.6	24	N-1	11.9	57%	24	68%	No constraint within +5 years	Constraint relieved by the installation of the second transformer
92	Sabulite Road	21.1	14	N-1 switched	17.1	151%	14	147%	No constraint within +5 years	Constraint relieved by transformer capacity upgrade
93	Sandringham	21.2	24	N-1	21.1	88%	24	97%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
94	Simpson Road	5.8	-	N-1 switched	6.3	-	-		No constraint within +5 years	Meets Vector security criteria
95	Snells Beach	7.1	-	N	6.3	-	-		No constraint within +5 years	Constraint relieved by the installation of a network battery
96	South Howick	25.0	24	N-1 switched	21.7	104%	24	110%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
97	Spur Road	11.8	-	N-1 switched	17.2	-	24	69%	No constraint within +5 years	Constraint relieved by the installation of the second transformer
98	St Heliers	19.2	21	N-1	19.3	91%	21	103%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
99	St Johns	17.7	24	N-1	33.7	74%	24	75%	No constraint within +5 years	Meets Vector security criteria
100	Sunset Road	15.9	14	N-1 switched	13.5	114%	14	110%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
101	Swanson	10.9	-	N-1 switched	11.0	-	-		No constraint within +5 years	Meets Vector security criteria
102	Sylvia Park	17.2	24	N-1	10.7	72%	24	79%	No constraint within +5 years	Meets Vector security criteria
103	Takanini	18.0	18	N-1	16.2	100%	18	108%	No constraint within +5 years	Constraint relieved by transformer capacity upgrade
104	Takapuna	9.5	-	N	9.5	-	24	49%	No constraint within +5 years	Constraint relieved by the installation of the second transformer
105	Te Atatu	21.9	14	N-1 switched	12.0	156%	14	154%	No constraint within +5 years	Constraint relieved by transformer capacity upgrade
106	Te Papapa	20.7	24	N-1	16.3	86%	24	98%	No constraint within +5 years	Meets Vector security criteria
107	Torbay	9.0	-	N	9.0	-	-		No constraint within +5 years	Meets Vector security criteria
108	Triangle Road	14.7	12	N-1 switched	14.8	123%	18	82%	No constraint within +5 years	Meets Vector security criteria
109	Victoria	20.2	22	N-1	16.1	92%	22	93%	No constraint within +5 years	Constraint relieved by load transfer to the CBD 22kV distribution network
110	Waiake	8.9	-	N-1 switched	9.8	-	-		No constraint within +5 years	Meets Vector security criteria
111	Waiheke	10.0	15	N-1	3.2	67%	15	69%	No constraint within +5 years	Meets Vector security criteria
112	Waikaukau	7.5	-	N-1 switched	7.7	-	-		No constraint within +5 years	Meets Vector security criteria
113	Waimauku	10.7	-	N	8.0	-	-		No constraint within +5 years	Constraint relieved by transformer upgrade +11kV cable project
114	Wairau Road	19.3	16	N-1 switched	19.9	121%	16	122%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
115	Warkworth	20.0	18	N-1 switched	18.7	111%	18	144%	No constraint within +5 years	Constraint relieved by the Omaha substatiob and the BESS at Snells Beach and Warkworth South
116	Wellsford	8.5	9	N-1	6.7	94%	9	92%	No constraint within +5 years	Meets Vector security criteria
117	Westfield	24.7	24	N-1 switched	21.0	103%	24	114%	No constraint within +5 years	Meets Vector security criteria when combined with 11kV backup
118	Westgate	4.4	24	N-1	1.5	18%	24	65%	No constraint within +5 years	Meets Vector security criteria
119	White Swan	27.2	32	N-1	17.1	84%	32	105%	No constraint within +5 years	Meets Vector security criteria
120	Wiri	42.0	48	N-1	20.2	88%	48	99%	No constraint within +5 years	Constraint relieved by new Wiri West substation
121	Woodford	9.1	-	N	9.1	-	-		No constraint within +5 years	Meets Vector security criteria

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

5.5 Appendix E – Schedule 12c Forecast Network Demand

Company Name **Vector Electricity**

AMP Planning Period **1 April 2020 – 31 March 2030**

SCHEDULE 12C: REPORT ON FORECAST NETWORK DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisat on forecasts in Schedule 12b.

sch ref								
7	**12c(i): Consumer Connections**							
8	*Number of ICPs connected in year by consumer type*				**Number of connections**			
9			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
10		for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
11	*Consumer types defined by EDB**							
12	Residential & Small Medium Enterprise (SME)		13,331	12,736	11,697	11,697	11,523	11,523
13	Industrial & Commercial		140	104	104	104	85	85
14								
15								
16								
17	**Connections total**		13,470	12,840	11,800	11,800	11,608	11,608
18	**include additional rows if needed*							
19	**Distributed generation**							
20	Number of connections		512	2,500	6,700	6,700	6,700	6,700
21	Capacity of distributed generation installed in year (MVA)		2	10	20	20	20	20
22	**12c(ii) System Demand**							
23			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
24	**Maximum coincident system demand (MW)**	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
25	GXP demand		1,731	1,876	1,923	1,961	1,987	2,009
26	*plus* Distributed generation output at HV and above		14	14	14	14	14	14
27	**Maximum coincident system demand**		1,745	1,890	1,937	1,975	2,001	2,023
28	*less* Net transfers to (from) other EDBs at HV and above		-	-	-	-	-	-
29	**Demand on system for supply to consumers' connection points**		1,745	1,890	1,937	1,975	2,001	2,023
30	**Electricity volumes carried (GWh)**							
31	Electricity supplied from GXPs		8,641	8,641	8,639	8,638	8,643	8,640
32	*less* Electricity exports to GXPs							
33	*plus* Electricity supplied from distributed generation		126	126	126	126	126	126
34	*less* Net electricity supplied to (from) other EDBs							
35	**Electricity entering system for supply to ICPs**		8,767	8,767	8,765	8,764	8,769	8,766
36	*less* Total energy delivered to ICPs		8,450	8,450	8,448	8,447	8,452	8,449
37	**Losses**		317	317	317	317	317	317
38								
39	**Load factor**		57%	53%	52%	51%	50%	49%
40	**Loss ratio**		3.6%	3.6%	3.6%	3.6%	3.6%	3.6%

5.6 Appendix F – Schedule 12d Forecast Interruptions and Duration

CompanyName	**Vector Electricity**
AMP Planning Period	**1 April 2020 – 31 March 2030**
Network / Sub-network Name	**Vector Limited**

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned and unplanned SAIFI and SAIDI on the expenditures forecast provided in Schedule 11a and Schedule 11b.

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
9	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	9.6	-	-	-	-	585.0
12	Class C (unplanned interruptions on the network)	86.4	104.8	104.8	104.8	104.8	104.8
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.06	-	-	-	-	3.00
15	Class C (unplanned interruptions on the network)	1.23	1.33	1.33	1.33	1.33	1.33

CompanyName	**Vector Electricity**
AMP Planning Period	**1 April 2020 – 31 March 2030**
Network / Sub-network Name	**Southern**

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
9	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	2.7	-	-	-	-	164.5
12	Class C (unplanned interruptions on the network)	34.9	42.4	42.4	42.4	42.4	42.4
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.02	-	-	-	-	164.5
15	Class C (unplanned interruptions on the network)	0.51	42.4	42.4	42.4	42.4	42.4

CompanyName	**Vector Electricity**
AMP Planning Period	**1 April 2020 – 31 March 2030**
Network / Sub-network Name	**Northern**

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned

sch ref		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
9	for year ended	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**	**31 Mar 25**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	6.9	-	-	-	-	420.5
12	Class C (unplanned interruptions on the network)	51.5	62.4	62.4	62.4	62.4	62.4
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.04	-	-	-	-	2.00
15	Class C (unplanned interruptions on the network)	0.73	0.79	0.79	0.79	0.79	0.79

5.7 Appendix G – Schedule 14a Mandatory Explanatory Notes on Forecast Information

1. This Schedule requires EDBs to provide explanatory notes to reports prepared in accordance with clause 2.6.6.
2. This Schedule is mandatory - EDBs must provide the explanatory comment specified below, in accordance with clause 2.7.2. This information is not part of the audited disclosure information, and so is not subject to the assurance requirements specified in Section 2.8.

   Commentary on difference between nominal and constant price capital expenditure forecasts (Schedule 11a)

3. In the box below, comment on the difference between nominal and constant price capital expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11a.

BOX 1: COMMENTARY ON DIFFERENCE BETWEEN NOMINAL AND CONSTANT PRICE CAPITAL EXPENDITURE FORECASTS

Vector has used a capital expenditure inflator based on the model used by the Commerce Commission in its DPP price reset on 1 April 2020. We have used an inflator which is a mix of Capital Goods Price Index (CGPI) and Labour Cost Index (LCI). The weighting between CGPI (50%) and LCI (50%) is based on the current Vector cost structure, i.e. the capital goods component and labour cost component in our CAPEX.

The CGPI forecast is 2%, which is based on a 10-year average to June 2019. The LCI forecast is 2%, which is based on a 10-year New Zealand average to June 2019.

The constant price capital expenditure forecast is inflated by the above-mentioned index to convert to a nominal price capital expenditure forecast.

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

4. In the box below, comment on the difference between nominal and constant price operational expenditure for the current disclosure year and 10-year planning period, as disclosed in Schedule 11b.

BOX 2: COMMENTARY ON DIFFERENCE BETWEEN NOMINAL AND CONSTANT PRICE OPERATIONAL EXPENDITURE FORECASTS

Vector has used an operational expenditure inflator based on the model used by the Commerce Commission in its DPP price reset on 1 April 2020. We have used an inflator which is a mix of Producer Price Index (PPI) and Labour Cost Index (LCI). The weighting between PPI (40%) and LCI (60%) is as per the Commission's model.

Vector has used the NZIER (New Zealand Institute of Economic Research) December 2019 PPI (Producer Price Index-outputs) forecast up to March 2024. Thereafter, we have assumed a long-term inflation rate of 2.20%.

The LCI forecast is 2%, which is based on a 10 year New Zealand average to June 2019.

The constant price operational expenditure forecast is inflated by the above-mentioned index to convert to a nominal price operational expenditure forecast.

5.8 Appendix H – Schedule 17 Certificate for Year Beginning Disclosures

Schedule 17 Certification for Year-beginning Disclosures

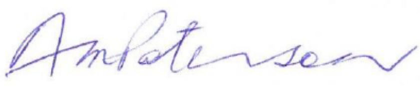
Clause 2.9.1

We, Dame Alison Paterson, and Jonathan Mason, being directors of Vector Limited certify that, having made all reasonable enquiry, to the best of our knowledge:

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

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

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



Director

Director

27 March 2020

Date

5.9 Appendix I – Glossary and terms

ADMS	Advanced Distribution Management System
ALR	Auckland Light Rail
AMP	Asset management plan
AT	Auckland Transport
B.I.G.	Battery Industry Group
CAB	Customer Advisory Board
CAIDI	Customer average interruption duration index
CAPEX	Capital expenditure
CBD	Central business district
CBARM	Condition based asset risk management
CIMS	Co-ordinated Incident Management System
CEO	Chief Executive Officer
COO	Chief Operating Officer Electricity, Gas, Fibre
CRL	City Rail Link
CTN	Cut or trim notice
DER	Distributed energy resource
DERMS	Distributed energy resource management system
DG	Distributed generation
DPP	Default price-quality price path
EA	Electricity Authority
EDB	Electricity distribution business
EECA	Energy Efficiency and Conservation Authority
EPR	Electricity Pricing Review
ERP	Enterprise resource planning
EV	Electric vehicle
FLISR	Fault location, isolation and service restoration
FPI	Fault Passage Indicator
FSP	Field service provider
FY	Vector financial year (year ending 30th June)
HILP	High impact low probability
HSE	Health, safety and environment
HSWA	Health and safety at work act
HV	High voltage: a nominal AC voltage of 1000 volts and more
ICCC	Interim Climate Change Committee
ISO55000	International standard for asset management
kV	Kilovolt
kW	Kilowatt
LiDAR	Light Detection and Ranging
LV	Low voltage – a nominal AC voltage of less than 1000 volts
MBIE	Ministry of Business, Innovation and Employment
MAD	Minimum approach distances
MED	Major Event Day (referring to a SAIDI or SAIFI event as defined in Electricity Distribution Services Default Price-Quality Path Determination 2020)
NZTA	New Zealand Transport Agency

OMS	Outage management system
OPEX	Operational expenditure
PV	Photovoltaic
QTRA	Quantitative tree risk assessment
RAB	Regulatory asset base
RY	Regulatory year (year ending 31st March)
SAIDI	System average interruption duration index
SAIFI	System average interruption frequency index
SAP	Enterprise Resource Planning (ERP) System (SAP)
SAP PM	Plant maintenance module of SAP
SH	State Highway
SoSS	Security of Supply Standard
SRMP	Strategic Reliability Management Plan
SWBD	Switchboard
VSP	Vegetation Service Provider

Bulk supply substation	A substation owned by Vector that directly connects the Vector network to the national grid. A bulk supply substation may contain more than one supply bus (of same or different voltages).
Distribution substation	A substation for transforming electricity from distribution voltage (22 kV or 11 kV) to 400V distribution voltage.
DPP2	The price-quality path set under Part 4 of the Commerce Act for the period 1 April 2015 to 31 March 2020
DPP3	The price-quality path set under Part 4 of the Commerce Act for the period 1 April 2020 to 31 March 2025
National grid (or grid)	The 110 kV and/or 220 kV AC network and the DC link between the North Island and the South Island owned by Transpower for connecting electricity generation stations to grid exit points.
N-x security	Subtransmission security class rating.
Reliability	The ability of the network to deliver electricity consistently when demanded.
Resilience	The ability of the network to recover quickly and effectively from an event.
Substation	A network facility containing a transformer for the purpose of transforming electricity from one voltage to another. A substation may contain switchboards for dispatch or marshalling purpose. A substation may also contain more than one building or structure on the same facility.
Switching station	A facility containing one or more switchboards (or switches) for the purpose of rearranging network configuration or marshalling the network through switching operation.
Zone substation	A substation for transforming electricity from subtransmission voltage (110 kV, 33 kV or 22 kV) to distribution voltage (22 kV or 11 kV).

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