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Dear Ben

Vector submission on EDB expenditure forecasting

1. This is Vector's feedback on the Commerce Commission's (Commission) request for feedback – Expenditure forecasting by electricity distribution businesses (EDB) and areas of focus for the 2025 default price-quality path (DPP) reset. None of this submission is confidential.

2. The Commission has indicated that at a high-level there are two options for expenditure forecasting for DPP4:

    - Rely on an EDB's own forecasts because we (the Commission) have sufficient confidence in them, and the supporting evidence in the Asset Management Plans (AMP) and from stakeholder engagement, potentially supplemented with additional information; or
    - Come up with our (Commission's) own forecasting methodology. For a DPP this is likely to involve generic, regional, and business-specific inputs.

3. Additionally, the Commission has explained that they may use different approaches for different EDBs, and different approaches for different categories of spend for the same EDB.

4. Vector has confidence in the robustness of our forecasts and believes that the Commission should use Vector's forecasts for the DPP reset. No other party is better placed to derive future network planning needs than our own internal teams.

5. Similarly, Vector is best placed to understand our customers wants and needs. We have continuous engagement with our customers through our customer excellence teams including direct access to larger stakeholders through our key account managers. Some of our customers contact us confidentially too. For all these reasons we do not believe the Commission can make forecasting assumptions on our behalf.

6. Vector's EV Smart Charging Trial is an example of how we are acting now to understand what customers will need in the future so we can start delivering solutions that are right for them, for us and for our stakeholders.

7. Our AMPs have historically contained detailed information on how we derive our forecasts, for the most uncertain areas of expenditure such as system growth and consumer connections. In this submission we have attempted to summarise some of those processes to illustrate to the quality, efficiency, and effectiveness of our planning and forecasting processes.

8. We will be revisiting the forecasting scenarios which led us to adopting our Symphony strategy developed in our 2018 AMP for our 2023 AMP. By reviewing these scenarios, we want to highlight how our chosen path leads us to a new energy future that best benefits consumers.

9. Separately, through the Input Methodologies (IM) review consultation processes we have highlighted the significant limitations with the Commission's current approach of setting future expenditure allowances based on historic expenditure.

10. The DPP3 reset decision capped aggregate capex forecasts for each distributor at 120% of its historical average expenditure. This overall cap is intended to reflect the point at which the Commission considers that the cost impact on consumers justifies further scrutiny of expenditure. As we stated back in 2019, at the time of the decision, the cap is arbitrary and unsupported by any analysis.

11. For this reason, we believe the separate discussion on re-openers is of utmost importance if the cap remains in place. For further details on this point, please refer to Vector's feedback to the Commission's 'In Period Adjustment workshop' held on 29 November.

12. Vector has collaborated with the other five largest EDBs in New Zealand to commission a Frontier Economics (Frontier) report on the barriers ahead for EDBs as they enable decarbonisation. This report has been submitted separately to the six large EDB individual feedback on the workshop.

13. Frontier outlines how the Commission has accounted for step changes historically and describes the limitations in adopting the same method going forward. They suggest that DPP over CPP regulation should be the norm, that the regime should better account for step changes, that the current reopeners at EDBs disposal are limited, and that the sector could benefit from better innovation incentives.

14. In section 7 of the report, Frontier has proposed three packages of changes to the IMs or DPP which will assist EDBs to invest efficiently to enable decarbonisation. The first is a list of changes which do not require IM amendments, the second is a list of changes which do.

15. We believe this list should be considered in the IM and DPP process going forward as they could provide some tangible solutions to some of the uncertainty challenges the sector is facing.

16. In addition to Frontier's report Vector has been searching for other solutions which could assist with forecasting and managing uncertainty. We highlight Ofgem's Business Plan Incentive

(BPI) adopted under the RIIO-ED2 framework and recommend the Commission should consider how a light touch version could be introduced to reward ambitious and efficient AMPs.

17. In a world where one of our biggest source of uncertainty comes from large customer connections such as data centres and infrastructure projects, we would also like to table consideration of the introduction of an EDB contractual arrangement similar to Transpower's 'new investment contract' which is part of Transpower's Capex IM.

18. In the rest of our feedback we answer the specific questions raised by the Commission in response to the workshop.

Question 1: How are EDBs obtaining confidence in establishing the requirements they are forecasting to meet, including but not limited to demand, resilience, and reliability?

Demand

19. To meet increased network demands and meet our security of supply standards (SoSS), we typically have looked solely at projects that increase the capacity of existing assets or that add new assets such as zone substations and distribution feeder circuits. With the change in customers behaviours' and needs, the current and future advancement of technologies and the attention to carbon emissions, we are now focused on being more diverse in our approach to network planning. Our new approach promotes a lower cost, smarter, more decentralised but more connected network, rather than potentially overcapitalising in projects that could result in or creating stranded assets. When planning for network development, we consider:

    - The long-term (life cycle) costs of investments in the long-term interest of consumers;
    - The use of probability based incremental planning methods and risk-based scenario models;
    - The agility and flexibility of solutions to be able to adapt to emerging technologies and urban development trends;
    - The use of non-network solutions such as digital platforms to enable distributed energy resource optimisation;
    - Use of data analytics and advanced operational practices;
    - Customer and stakeholder engagement;
    - Non-network solutions such as demand side management strategies to reduce peak; and
    - Network reconfiguration to improve the utilisation of existing assets and reduce losses.

20. To face the challenges of rapid customer transformation and heightened uncertainty, Vector has defined its integrated Symphony planning approach. Symphony planning starts with the customer and builds its understanding about the future electricity network bottom-up. The advantage is that locational differences are reflected and can inform options analysis.

21. Also, new customer behaviour and technology adoption is observed, analysed, and considered in the planning process before exponential uptake makes them rapidly mass market, therefore, allowing for more foresight and preparedness in the planning process, as well as more active customer engagement.

22. Finally, our options analysis is expanding to consider not only wires solutions (e.g. cables, lines, transformers) which continue to serve us well, but also innovative non-wires solutions (e.g. smart hot water control, batteries, smart EV charging).

23. Our planning and delivery processes are agile with:

    - annual revision of our plans reflects the latest reality and identify opportunities for synergy (e.g., think twice, do once, for example when an asset fails, should the replacement cater for load growth);
    - most of our projects only have timeframes of 2-3 years before the constraint bites; and
    - continuous engagement with other utility and infrastructure providers, property developers, and customers.

24. The planning process is informed by an annual assessment of the peak loading on all distribution feeders and zone substations. This reassesses the summer and winter loading and security levels. The distribution network loading and security assessment includes thermal limits and voltage modelling. We have provided details of the seven process steps in Appendix 1.

Reliability

25. In 2020 Vector formalised the Strategic Reliability Management Plan (SRMP) which underpins our commitment to compliance with the Default Price-Quality Path (DPP) quality standards. Vector undertook a significant programme of work to improve network outage data and asset data quality to improve our analysis of the root causes of SAIDI and SAIFI performance.

26. The SMRP now informs the way we forecast reliability expenditure in the AMP and includes the following features:

    - Prioritising health and safety;
    - Ongoing review of our generation strategy;
    - Risk based vegetation management;
    - Deployment of network automation;
    - Corrective maintenance strategy and improved inspection techniques; and
    - Proactive risk management of asset portfolios.

Resilience

27. As climate change increases weather volatility, we continue to develop our understanding of the consensus view of what the impacts of climate change will mean for Auckland. In response we are evolving our approach to asset management to ensure the ability of the electricity network to anticipate, absorb, accommodate, and recover from the effects of potentially hazardous events related to climate change.

28. Robustness refers to the ability of the network to withstand the gradual long-term changes in climate patterns to continue operations and deliver on customer expectations. Vector has implemented the following initiatives to improve the robustness of the network:

    - Pioneering a risk-based approach to vegetation management, supplemented by LiDAR based inspections, independent scoping of high-risk vegetation sections and collaboration with the Auckland Council to improve the management of council trees in the proximity of powerlines.

    - Hardening the network by selective replacement of bare overhead conductor with aerial bundled and covered conductor to improve the susceptibility of the lines to vegetation during high wind conditions, converting radial networks to a meshed configuration and using composite crossarms where economic.

    - Mitigating the risk of accidental fire starts on extreme fire risk days by utilising data from Fire Services and the National Institute of Water and Atmospheric Research (NIWA) to identify areas at risk; and remotely disabling automatic fault restoring devices on overhead lines to these areas.

    - Implementing additional processes for managing equipment ratings during periods of warm and dry weather conditions, using soil moisture levels, published by NIWA, to revise the capacity ratings of underground cables. The revised ratings are then used to update the alarms in supervisory and control systems to match it to the loading on the network to avoid an inadvertent overload, which could result in power outages to the community.

    - Relocating assets and performing site-specific civil works to manage rising sea, flood, and storm surge levels.

    - Deploying microgrids to support local communities during weather related outages.

    - Partnering with global companies like IBM to develop weather and outage modelling tools to enhance operational response using advanced and predictive analysis.

    - Investing in a distributed energy management system (DERMS).

29. Cyber resilience has also become an integral part of Vector's strategy. Digital platforms that reduce the cost and improve the efficiency and effectiveness of our core network operations are becoming increasingly important. Consequently, it is becoming even more critical to ensure safe and secure connectivity. At the same time, there is a rapidly escalating threat to cyber security. Vector has invested in improving our cyber security capabilities and maturity and we will continue to do so. It is our view that allowance should be made for distribution businesses to invest in this capability, to ensure that, as the sector transforms, it does so safely and securely.

i. ***Are EDBs intending to change the inputs used in forecasting expenditure given key drivers of forecasts may have changed – particularly in the following areas:***
• Connection growth (e.g., new connections from development, green fields and brown fields)
• Large capacity growth, (e.g., decarbonisation, industrial growth)
• Incremental demand growth (e.g., EVs, residential technology)
• Legislative change

30. Vector has been scenario modelling since its 2018 AMP disclosure, so this activity is not new to us. We review our forecasting methodologies as new data, inputs and tools become available. We are mindful that forecasting is not an exact science, so we constantly strive for continuous improvement. Most importantly, our scenario modelling and forecasting is done bottom-up. By flipping our planning process to start with the customer, we have set up a process which is future proof as it enables us to add new learnings and data points with ease.

ii. ***With a potentially increased need for resilience-related investment, what are the key inputs for EDB resilience forecasting?***

31. See above section on Resilience.

iii. ***What forms of assurance will EDBs use (e.g., external verification) to provide confidence in forecasts, particularly where new forecasting inputs are used?***

32. At Vector we believe external verification is a useful tool to provide confidence in forecasts and we understand the value in the Commission having independent audits included in information disclosure requirements.

33. However, there is both a cost and resource uplift involved in obtaining that additional level of scrutiny from an external advisor so we would caution against it, unless the overall benefit to consumers could be demonstrated and the assurance itself be low touch. If the Commission chooses this approach, then recognition of these costs needs to be considered when setting allowances for the next DPP.

34. Forecast modelling can be complex and involve specialist skills, advanced software, and inputs from a range of data sources. At Vector we have a dedicated team of data scientists who specialise in energy systems analytics which is separate to the future network planning team.

35. That said, Vector's major shareholder Entrust requires Vector to provide an independent review of the electricity network every two years which is published on their website[1]. The Network Security report focuses on the effectiveness of Vector's processes that support Operational Risk Management for its electricity network. The following specific areas were targeted for the review in 2022: maintenance practices, network growth, capacity to meet forecast demand, risks to security of the network, Vector's response to managing customer behaviour and the uptake of distributed energy resources.

[1] https://www.entrustnz.co.nz/resource-library/network-security-reports/

36. Finally, Vector's company structure with majority consumer trust ownership and listed on the NZX) means that our internal governance is robust and transparent.

Question 2: Are there specific events or metrics that can be forecast and then observed that indicate that a step change in expenditure is required or an alternate scenario is playing out?

i. What forms of information do EDBs use to build scenarios on the different forecast areas?

37. Vector uses an array of inputs to inform our forecasting scenarios including but not limited to:

- Individual customer historical energy (electricity and gas) and peak demand usage from billing and half-hourly metering;
- customer attributes from internal systems and NZ registry for e.g. industry types;
- distributed generation connections;
- individual customer geospatial locations and connection points to network;
- socio-economic information from census and surveys;
- building attributes from Auckland Council valuation role;
- Auckland building consents;
- Stats NZ household and employment forecasts;
- Ministry of Transport EV uptake database;
- Auckland Unitary Plan zoning (including new amendments such as NPS-UD and MDRS);
- customer consultation and cooperation for e.g. major developers, data centre owners, Council transport electrification projects;
- international trends, research, and forecasts e.g. International Energy Agency (IEA), National Renewable Energy Laboratory (NREL);
- local technology trials e.g. EV charger and hot water control; and
- NZ scenarios and targets such as Climate Change Commission, Government climate targets, Auckland Council Transport Emissions Reduction Pathway, NZ Gas Transition Plan 2023

ii. What are the underlying drivers where EDBs are forecasting a potential significant step change in expenditure requirements compared to previous levels?

38. In order of priority we suggest that the following are drivers of potential significant step changes in expenditure requirements:

- EV uptake;
- point loads such as datacentres;
- rail development (e.g. City Rail Link in Auckland), bus and ferry charging stations;
- industrial gas fuel conversion;
- continued customer growth with changing behaviours;

- Major roading and other infrastructure projects that require relocations or provide opportunities for futureproofing;
- Economic stimulus, such as funding boost as part of economic recovery;
- Local and central government policy changes; and
- Housing planning policy and rules such as Auckland unitary plan, National Policy Statement on Urban Development (NPS-UD) and Medium Density Residential Standards (MDRS).

iii. Are there trigger points where increased certainty on level of spend required may be obtained?

39. Through continuous monitoring of our assumptions we will gain increased certainty on the level of spend required: notably through ongoing review of the network load on our assets and the uptake of EVs compared to those we have forecast.

40. An increasingly important requirement of asset management is to make decisions under uncertainty. Given that the current regulatory periods lock us in for five-years, we reiterate the importance of uncertainty mechanisms.

41. Through reviewing our assumptions, we will look for trigger points to make least regrets decisions. An example of would be our endeavours to gain more certainty around data centres connecting to our network and when these types of loads or other large loads could materialise.

iv. What are the key dependencies or risks EDBs have identified which may impact forecast scenarios?

42. We have covered this question in more detail under Question 3 – ii.

v. Do EDBs consider that the expenditure required to address different scenarios may usefully follow proxies or will these be disjointed and network characteristic and network design specific increases?

43. We do not understand this question but would be happy to pick this up separately after we gain more clarity.

vi. What is the sensitivity of the expenditure plan to out-turn differences in requirements like incremental demand growth, resilience, decarbonisation, and connection growth?

44. There is sensitivity in the plan to out-turn differences in demand growth, resilience, decarbonisation, and connection growth. For that reason, we make it standard practice to review our forecasts and adapt them accordingly.

Question 3: How are EDBs obtaining confidence that their proposed expenditure plan is the most effective and efficient solution for the forecast level of demand, resilience requirements, and reliability levels?

i. In which categories of expenditure do EDBs have greater levels of confidence than others?

45. The expenditure categories which are more certain are Asset Replacement & Renewal and Reliability.

- Asset Replacement and Renewal

46. Vector applies a risk-based approach to forecasting asset condition, and therefore the expected asset volumes and expenditure required for asset replacement. The value and criticality of the asset type determines the complexity of the modelling implemented so that the effort is appropriate for the risk posed to the network.

47. Asset obsolescence, vendor support and/or availability of spare parts are included in the condition assessment of asset types. For example, high value assets such as switchboards are forecasted using condition-based risk models, whereas low value and low criticality assets such as LV distribution equipment, are forecast using historical trend models.

48. Condition Based Asset Risk Management (CBARM) models have been developed for all distribution assets. Data from SAP Plant Maintenance, which includes maintenance planning, scheduling, planned maintenance inspection and asset observations supports and underpins these models, which in turn inform our asset health knowledge and support the development of our asset strategy, renewal and replacement programme, and the AMP.

49. Vector's CBARM models are at different stages of maturity in their development cycle. The level of maturity of each CBARM model is largely dependent on the quality and accuracy of asset information used in the model. As such, Vector's focus on improving its asset health information is complementary to the continued improvement in the accuracy of its CBARM models.

- Reliability – see our comments under Question 1 on how we manage greater certainty in the area.

50. The expenditure categories which are more uncertain are Demand (System Growth and Consumer Connections) and Resilience. Please see our responses under Question 1 on how we manage the uncertainty for these areas.

51. For an overview of our investment profile, please refer to Figure 1 below which shows that for every $100 of total capex expenditure that Vector spends half is externally driven mostly drive by customer connection requests, but also relocating assets or more generic load growth.

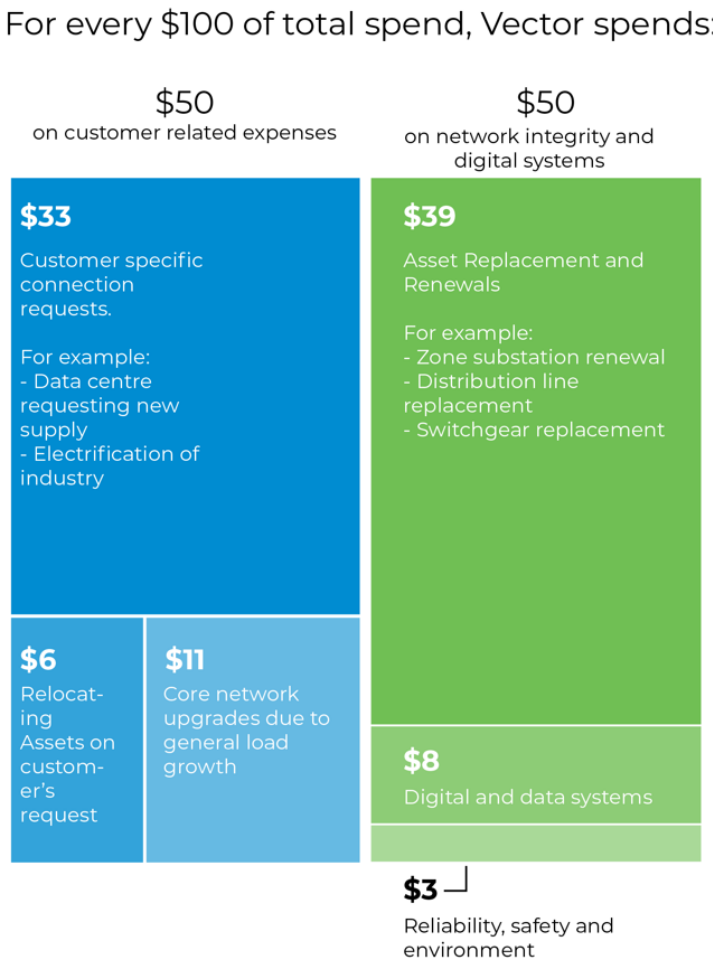


Figure 1: Vector's capex breakdown by $100 spent derived from 2022 AMP

ii. Where new sources of uncertainty exist related to potential increases in expenditure requirements, is there a particular driver of the uncertainty?

52. We have outlined below our latest view on sources of uncertainty related to potential increases in expenditure.

- Decarbonisation - We are facing uncertainty at unprecedented levels around future electricity demand, and associated policy response to meet Aotearoa New Zealand's net zero targets which will include the government's Emissions Reduction Plan (ERP) and Gas Transition Plan (GTP).

- Climate change - Adapting to the extreme weather caused by climate change means our infrastructure must seek to become more resilient. In addition to reinforcing existing network assets and designs, decentralised designs must be considered as a complementary solution to reduce reliance on a central point of failure.

- Supply chain and inflation - The last year and a half has seen an increase in cost pressure aligned to the global cost of raw materials, supply chain disruption and local labour resource issues impacting inflation globally.

- Changing customer behaviours - Evolving customer needs and expectations, centred around the use of new technology and digitalisation, is resulting in massive shifts in service industries across the world.

- Auckland growth - Auckland's growth continues at pace requiring us to spend significantly on network integrity and reinforcement. Immigration, cost of living (including housing and international competitiveness.

- Relocation of assets – We face a lot of uncertainty in this investment category given that we are at the mercy of third parties. It is also an area which faces delays with consents often halting the process.

- Covid-19 pandemic - Vector continues to work hard to minimise the ongoing uncertainty and disruption related to the Covid-19 pandemic (including hybrid working).

- Urban planning rules (see above).

iii. How are EDBs accounting for the uncertainty of timing of when non-network solutions may become available or viable (due to technological developments or scale) and able to defer network investment requirements?

53. EDBs will play a role in unlocking this new value and should be supported by appropriate investment returns and incentives to make a broader mix of investments, and to leverage a wider range of solutions. For Vector, these include data analytics, distributed energy solutions, and the digitalisation of the network. Through making these investments now, we believe we can manage peak demand and avoid unnecessary investments in traditional pole and wire solutions which will burden future generations with long-term cost recoveries.

54. In the context of heightened uncertainty, non-wire solutions offer additional benefits: 1)they are less intrusive in road corridors 2) reduce heavy engineering works (i.e. a smaller public works footprint and more agile to deploy); 3) are also more modular (i.e. can start at a small scale and grow incrementally) reducing the risk of stranded assets. However non wire alternatives need robust assessment against alternative more traditional solutions to ensure that their investment is in the long-term interests of consumers.

iv. What forms of assurance do EDBs use, including external verification / challenge to provide confidence in the appropriateness of expenditure plans?

55. We see value in independent verification from an expert to help the Commission gain confidence in expenditure plans. Though we reiterate that there would be a cost involved for EDBs.

56. That said Vector already conducts ongoing consultation with customers and stakeholders to ensure our plans are fit for purpose. We also have significant interactions with customers through enquiries that we receive every year. This includes large customers asking specific questions on our AMP. This reactive engagement along with our proactive engagement channels enables us to understand our customers' needs more effectively. Insights from our key account and relationship managers as well as our field service providers (FSP) also contributes to our understand of customers as these parties are our 'eyes and ears' on the ground with our customers.

57. Vector continues to use data driven insights to inform our AMP, but there have been regulatory barriers along the way. For example, access to smart meter data has only been enabled after years of pushing for it and having the funding for the data to enhance low voltage (LV) monitoring disallowed by the Commission in our reset for DPP3.

58. We believe there is merit in adopting a wider stakeholder engagement programme with local boards, consumer panels and other key parties, to help review and input into our plans. If the Commission is considering this type of external verification it must ensure EDBs are funded adequately to do so under the next reset.

59. Vector is primarily an urban network, which means that a large share of our network infrastructure is interconnected and shared across many customers, so for many system growth projects we are able to make efficient modifications to the network such as strengthening individual sections or adding additional interconnections between different network assets. Over 85% of system growth projects from the past five years (by number) have been delivered for less than $500,000, as can be seen in Figure 2 below.

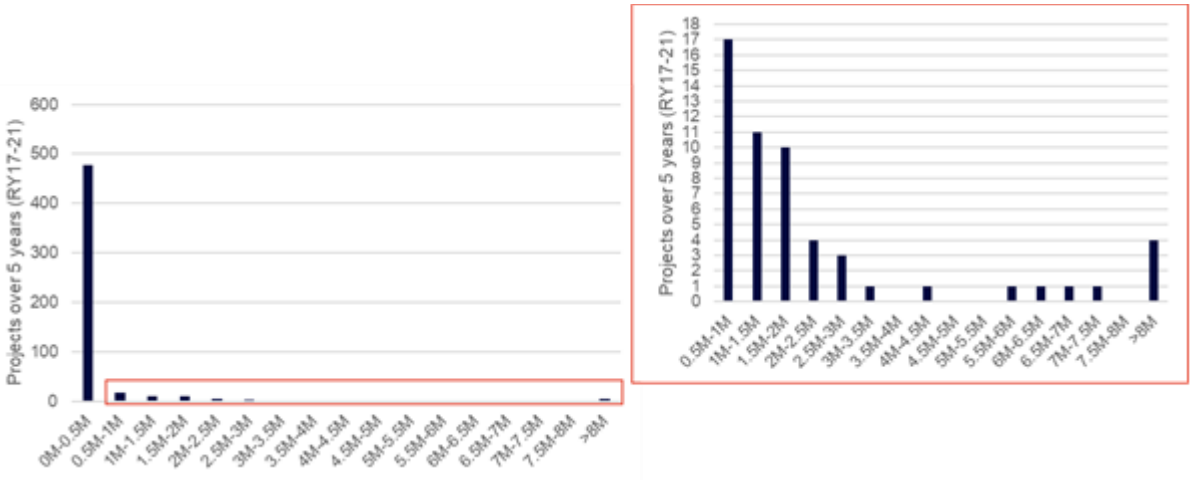


Figure 2 - System Growth projects from 2017 - 2021 by cost

60. Over the five regulatory years 2017-2021, seventeen system growth projects exceeded $2 million in costs. The projects mainly consisted of sub-transmission and zone substation projects, for which non-wires solutions are considered as part of the planning process. In many cases the rate of growth, which has been high in Auckland over the last decade, makes a network solution the most economic choice. In other cases, non-wires opportunities were

identified during the planning process, such as the Glen Innes battery storage system, which was the first of its kind in the Southern Hemisphere.

Question 4: How are EDBs getting confidence that their expenditure plans are deliverable, particularly if they involve a significant increase from historic levels?

i. How are EDB forecasts accounting for availability of materials and skilled staff to deliver programmes of work if there are significant increases in expenditure forecasted?

61. In our resource planning for skilled staff we will undertake more engagement with contractors to provide long term forecasts of work planned, noting that this can often rely on shifting priorities, such as surges in data centre builds which are not predicable.

62. We will also expand our contractor pool to extend resources while supporting overseas recruitment and training initiatives to bring additional resources into the industry.

63. On the supply chain we will extend our inventory buffer for certain equipment types such as distribution transformers, protection relays, and overhead switches. Where traditionally equipment has been sourced to a preferred vendor, we can extend the pool of approved vendors in various asset categories to allow a larger pool of equipment suppliers.

64. We will also increase the focus on supplier relationship management to maintain visibility of potential bottlenecks in production and take proactive action to address any risks.

ii. What are the trade-offs between asset renewal / replacement and significant new connection work that EDBs make in forecasting, particularly where a step change in expenditure is forecasted?

65. There are always trade-offs in managing network risk, particularly when a step change in expenditure is required. We always weigh up security versus reliability at a project level. Our teams provide internal friction which overlays a level of verification to the ongoing trade-offs.

66. We ensure that asset replacement as a function is never siloed from other activities and there is transparency in decision making across our asset management portfolio.

iii. How do EDBs assess achievability of delivery under different scenarios and forecasts?

67. To assess achievability of delivery we look at a historic view of through put and always consider the efforts of our FSPs against targets.

68. When we assess the future outlook, we review market availability and capability of skills as well as materials including supply chain deliverability, and plant and equipment availability.

69. That said we also put in a lot of effort into risk management and contingency planning across our programmes of work.

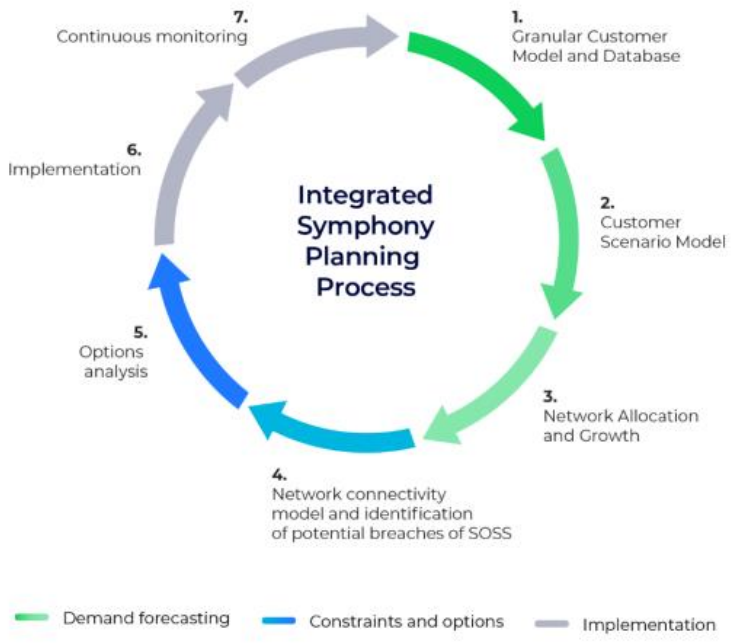
70. Finally, we would be delighted to host the Commission for a day at our offices ahead of the 2023 AMP disclosure. We could run the Commission through the processes we describe in this submission, to see first-hand how our teams function.

Yours sincerely,

Richard Sharp

GM Economic Regulation and Pricing

Appendix 1: The steps in our integrated Symphony planning process



Step 1: The Granular Customer Model and Database is the basis of the bottom-up modelling process and brings together all information of Vector's customer today. The granular customer model and database combines all of Vector customer and energy information and links it to a wider set of information such as building characteristics and socioeconomics. The resulting model operates at ICP level and provides a granular view on changing energy consumption patterns, customer profiling and new technology adoption

Step 2: The Customer Scenario Model draws from the detailed Customer Model and additional demographic data to model future changes in incremental electricity demand and consumption. The model considers future changes due to population growth, employment growth, energy efficiency, distributed solar PV and battery energy storage systems, electric vehicles, water heating load and gas-to-electricity conversion. Non-wire alternatives that can be managed via DERMS are also modelled. While the AMP covers a 10-year period, we run all our scenarios over a 30-year horizon to portray longer term impacts and derive short-term actions that prepare us for the future.

Step 3: Network Allocation and Growth allocates the results from the Customer Scenario results to the electricity network assets. The asset future loading for distribution feeders and zone substations is then computed by adding the allocated incremental customer scenario results based on network topology to the present asset loading of zone substations, taking diversity into account.

Step 4: The Network connectivity model uses the demand forecast to identify where and when capacity shortfalls, resulting in a breach of our SoSS, are expected over the next 10-year period for feeders and zone substations.

Step 5: Options Analysis - once the type, location and timing of a constraint is identified, is undertaken to identify and evaluate the best solution.

Step 6: Implementation involves, for both network and non-network solutions, finalising the detailed design, obtaining necessary approvals or permits required, construction and commissioning of the project.

Step 7: Continuous Monitoring - the review process ensures the investments are achieving the planned outcome and that Vector continually learns and improves.