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Strengthening the resilience of Aotearoa New Zealand’s critical infrastructure system

Introduction

1. Orion New Zealand Limited (**Orion**) welcomes the opportunity to make a submission on the Discussion Document *Strengthening the resilience of Aotearoa’s critical infrastructure system*.
2. We have a unique perspective given our experience in the 2010-2011 Canterbury earthquake sequence. However, we are very conscious that we face a rapidly changing and massively different energy environment in the decades ahead. The changing landscape facing Orion is primarily driven by three factors – climate change, new technology and increasing demand for electricity.

About us

3. We own and operate the electricity distribution infrastructure in Central Canterbury, including Ōtautahi Christchurch. Our network is both rural and urban and extends over 8,000 square kilometres from the Waimakariri River in the north to the Rakaia River in the south; from the Canterbury coast to Arthur’s Pass. We deliver electricity to more than 220,000 homes and businesses and are New Zealand’s third largest Electricity Distribution Business (EDB).

4. Our principal subsidiary is Connetics and their core business is the design, construction and maintenance of overhead and underground power lines and associated equipment. Specialists in electrical distribution, Connetics supports Orion with the design and build expertise to maintain and develop our network and provides these services to other electricity distribution businesses around New Zealand. Together Orion and Connetics make up the Orion Group.
5. Central Canterbury is a place of rapid growth and transformation, embracing change and innovation, with Ōtautahi Christchurch at the heart of this diverse and vibrant region. Electricity distribution has always been an essential service that underpins regional, community and economic wellbeing. Our service is vital to the wellbeing and livelihood of the people and businesses who live and operate here.
6. At Orion, our purpose is powering a cleaner and brighter future with our community. We want to drive prosperity for our region through balancing energy affordability, energy security and sustainability. We have five focus areas for achieving our purpose including
 - facilitating decarbonisation and hosting capacity at lowest cost while giving our customers choice on how they access our network, and
 - being a force for good in the community we serve, enabling the net zero transition.
7. Standing still in a changing world is not an option for us. We welcome the chance to innovate and seek out ways to support Central Canterbury's rapid growth, deliver on our commitment to confronting the climate emergency and respond to our customers' increasing desire for control over their energy choices.
8. Turning to the specific questions raised, we set out our comments below.

Prelude: Objectives for and principles underpinning this work programme

Does more need to be done to improve the resilience of New Zealand's critical infrastructure system?

9. There is always more that can be done to improve the resilience of New Zealand's critical infrastructure system, and in particular the resilience of power infrastructure.

10. Being a lifeline utility, our community depends on electricity and our services especially during and after High Impact Low Probability (HILP) events such as major earthquakes or storms. However, just as this Discussion Document encourages the sector to think more broadly about the risks facing critical infrastructure, we also need to think more broadly about the electricity sector as a whole and the role of distributed energy resources which will potentially increase the energy resilience of New Zealand communities.

Have you had direct experience of critical infrastructure failures, and if so, how has this affected you?

11. Yes. Please see the Appendix. This is an extract from the Electricity Engineers Association of New Zealand *Resilience Guide* which details Orion's lessons from the Canterbury earthquakes recovery, and has been reproduced with the permission of the Association.

How would you expect a resilient critical infrastructure system to perform during adverse events?

12. Ideally, we expect a resilient critical infrastructure **system** to perform seamlessly during an adverse event (of whatever type). The safety and well-being of our people and the community remains at the heart of the response.

13. People must be properly enabled and empowered to make the right decisions with their communities. People and organisations (including official agencies and organisations) will have a clear view of their role and how it fits into the overall "whole". Decision-making will be informed, timely and consistent.

14. Critical infrastructure must be able to function during adverse conditions (including security events), and quickly recover to acceptable levels of service after an event.¹ As the National Disaster Resilience Strategy points out, this is fundamental to the wellbeing of communities.

Would you be willing to pay higher prices for a more resilient and reliable critical infrastructure system?

15. The question is not so much whether we are willing to pay higher prices for a more resilient and reliable critical infrastructure system but whether our customers would want this and whether we are

¹ By way of example, Orion invested in new 66,000 volt "Northern Loop" underground cables as part of our resilience programme after the Canterbury earthquakes. The cables were commissioned in June 2016 and were an investment of \$60m. The cables enable us to re-route power around and across the city when required and in case of emergency. When we lost power to almost 90,000 customers during the Port Hills fires, it was the Northern Loop that enabled power to be fully restored in under 30 minutes, including to the pumps feeding water for firefighting.

permitted to recover the cost of such a system as a regulated entity under the Commerce Act 1986.

16. We discuss this further in this submission.

The work programme's objective is to enhance the resilience of New Zealand's critical infrastructure system to all hazards and threats, with the intent of protecting New Zealand's wellbeing, and supporting sustainable and inclusive economic growth. Do you agree with these objectives? If not, what changes would you propose?

17. Yes, we agree with these objectives.

Do you agree with the proposed criteria for assessing reform options? If not, what changes you would propose?

18. Yes, we agree with the proposed criteria but we submit that criterion A needs to be further clarified.

Currently, the criterion is "*how well does the option enhance infrastructure resilience*", and the commentary states that "*this question considers how effectively an option enhances resilience across all critical infrastructure sectors*".

19. We want to make sure that this criterion takes into account the interconnectedness of our critical infrastructure with other critical infrastructure.

20. Specifically for the electricity distribution sector, this criteria should also take into account -

- the ability to enable resilience through alternative methods of supply e.g. alternate feeds through a meshed distribution system or through the use of local distributed energy resources or from a community perspective through the leverage of micro grids, and
- designing systems to appropriate levels consistent with plausible scenarios of adverse events.

Section 1: Background and context

The paper discussed four megatrends: i) climate change, ii) a more complex geopolitical and national security environment, iii) economic fragmentation, and iv) the advent and rapid uptake of new technologies. Do you think these pose significant threats to infrastructure resilience?

21. Yes. We see these megatrends affecting our business and posing significant threats to our infrastructure as follows:

- **Climate change**

Climate change is presenting the electricity sector with a number of opportunities and challenges. Electrification will support decarbonisation, improve household energy bills, and increase the resilience of New Zealand's energy system. It is estimated that it will remove 18.4 tonnes CO₂-e per year by 2050. It is forecast to substantially reduce average (mean) household energy bills by about 10% in 2030 and 45% in 2050. It will also improve New Zealand's energy independence, increasing energy supplied from domestic production from 55% today to 85–90% in 2050.²

However, extreme weather events caused by climate change mean Orion's infrastructure must become more resilient and provide alternative solutions for customer and community energy resilience.³ In 2020 we produced a report that outlines Orion's Climate Change Opportunities and Risk⁴. This provides our community with an understanding of how climate change might impact our business, and what we are doing to prepare for the future. The initial impacts of climate change are that our network will experience more frequent and more intense windstorms and drier conditions increasing the risk of fire.

To prepare for the increased climate change such as wind and fire risks associated with a 1.5°C temperature rise – consistent with the Government's emissions targets – we have recognised that we need to improve the resilience of our overhead network. To do this we are planning to

- replace end-of-life poles with more resilient designs that are fit for the future,
- upgrade the resiliency of poles that have been identified as at high risk of wind/fire damage, but which aren't at the end of their life, in the lowest cost manner,

² See Boston Consulting Group Report: *The Future is Electric A Decarbonisation Roadmap for New Zealand's Electricity Sector 2022*, page 11. The Report estimates that there are plans to invest \$22 billion in the 2020s in distribution infrastructure to support electrification and distributed energy resources.

This is a ~30% increase in spend in 2026–2030 relative to 2021–2025 and is sufficient for increased electrification provided it is supported by regulatory allowances.

³ By way of example, see the discussion in Vector's submission to the Commerce Commission dated 1 July 2023. Vector notes that it has faced two network-threatening events since January. "*Cyclone Gabrielle and the Auckland floods both did widespread damage and gave a stark reminder of the challenges posed by changing weather patterns*". [Vector-Submission-on-IM-Review-2023-Draft-Decisions-19-July-2023.pdf \(comcom.govt.nz\)](https://www.comcom.govt.nz/Vector-Submission-on-IM-Review-2023-Draft-Decisions-19-July-2023.pdf)

⁴ See <https://www.oriongroup.co.nz/assets/Company/Corporate-publications/2020-Orion-Climate-Change-Report.pdf>

- increase our vegetation management programme to reduce the incidence of trees damaging our network, particularly in windstorms, and
- replace more of our higher altitude poles.

We have also introduced a system to automate recloser management during a high fire season. A recloser is an automatic, high-voltage electric switch. Like a circuit breaker on household electric lines, it shuts off electric power when trouble occurs, such as a short circuit. In this case, Orion have automated a feed from the NIWA fireweather site⁵, and we use automation to disable and enable the auto-reclose functionality on high fire risk days in specific network zones to reduce the risk of fire ignition after a fault. This is a New Zealand first.

In the longer-term, with much of our customer base living near the coast, sea-level rise will affect the planning, maintenance and replacement of our assets. Higher temperatures will also impact the performance of some of our equipment.

- **More complex geopolitical and national security environment**

As the Discussion Document points out, New Zealand faces a substantially more challenging and complex strategic environment than it has for decades.

As noted in the Boston Consulting Group Report *The Future is Electric A Decarbonisation Roadmap for New Zealand's Electricity Sector 2022*, Russia's invasion of Ukraine threw energy markets around the world into turmoil, highlighting the geopolitical risks associated with global energy security.⁶

"Sanctions on Russia – a major exporter of natural gas, oil, and coal – have constrained upstream energy supply chains, impacting the availability and cost of energy for consumers and industries such as steel, chemicals, and transportation. The price hikes that have evolved from these supply and liquidity pressures have had second order effects, eroding margins in energy-intensive industries, and contributing to inflationary pressures."

As with other critical infrastructure organisations, Orion is now potentially susceptible to cyberattacks from any part of the globe. To prevent and reduce the potential impacts of attacks by malicious third parties, Orion uses layers of cyber security at server, network and device levels and

⁵ See <https://fireweather.niwa.co.nz/>

⁶ See Boston Consulting Group Report: *The Future is Electric A Decarbonisation Roadmap for New Zealand's Electricity Sector 2022*, page 41

subject them to penetration testing – a simulated cyber attack. We aim to employ fit-for-purpose and up-to-date security systems that track and respond to suspicious patterns of behaviour, known digital signatures and explicit security breaches. We also use the knowledge and experience of others by consulting with our peers in the industry, Government agencies and independent experts. The latter group helps us to build our capacity and also audit our systems and practices so that we continuously improve our resilience to cyber threats.

We note that the Discussion Document refers to espionage, sabotage, coercion and foreign actors accessing critical infrastructure organisations. We are aware of these risks and we would ask the Government to provide more information and resources in order to be able to respond to these potential threats.

- **Economic fragmentation**

The Discussion Document refers to the operation of global supply changes as exemplifying economic fragmentation.

By way of example, the impacts of the COVID-19 pandemic continue to create supply chain issues for us and while these are declining in severity, there remains a long tail as the pandemic recedes in severity.

We have experienced extended supply chain delays as equipment providers have been unable to supply equipment in a timely manner. An example of this is the delivery time for switchgear which was previously delivered within six months and has now increased to 15 months. Delays in the supply of equipment have also been due to sickness in overseas manufacturing staff causing a backlog of supplier equipment requests. This has been exacerbated by a shipping freight backlog which has caused uncertainty with delivery dates.

Globally, the energy transition has also led to an international surge in demand for renewables and storage capacity across the world. This step-change in international demand is placing pressure on green energy supply chains across the world. Bottlenecks are emerging in low-carbon infrastructure development, and shortages of critical energy resources are driving technology costs higher.⁷ New Zealand being a small and isolated country can face difficulty in sourcing some energy related equipment as other larger countries take priority.

⁷ See Boston Consulting Group Report: *The Future is Electric A Decarbonisation Roadmap for New Zealand's Electricity Sector 2022*, page 43

- **The advent and rapid uptake of new technologies**

We agree that the adoption of new technologies will facilitate (amongst other things) greater automation, better remote monitoring and management/optimisation, and greater connectivity. This is particularly true in the electricity sector, where the advent and rapid uptake of new technology will be critical in our journey to decarbonisation.

For example, new smart technologies like automation, AI, Internet of Things (IoT), real-time communication, and network visibility by household will revolutionise the way electricity systems are operated. As technology improves and the cost of IoT sensors decline, it is likely that millions of distributed energy resources will be able to interact in real-time with the electricity system. This provides a significant opportunity to increase consumer participation in markets and allow consumers to make choices that better suit their needs.

However, we agree that it will introduce new vulnerabilities as the Discussion Document identifies on page 21.

Are there additional megatrends that are also important that we haven't mentioned? If so, please provide details.

22. We note that in 2022, the Boston Consulting Group identified that population shifts (including an ageing population) is another megatrend that New Zealand will need to face into.⁸ The Group notes that New Zealand, like most OECD countries, has an aging population – where Kiwis over 65 are predicted to outnumber those under 15 by 2025.

23. An ageing population with more people retiring presents additional challenges for New Zealand. As noted in the Boston Consulting Group report, according to Infometrics, a quarter of the electricity sector workforce is aged 55+ years, which represents a large number relative to the rest of the New Zealand economy.⁹

⁸ See [Megatrends in New Zealand | Navigating Uncertainty | BCG](#). Also see the article in the New York Times on 16 July 2023 where the Times detailed how a vast demographic shift will reshape the world in years to come. See [How a Vast Demographic Shift Will Reshape the World - The New York Times \(nytimes.com\)](#)

⁹ See Boston Consulting Group Report: *The Future is Electric A Decarbonisation Roadmap for New Zealand's Electricity Sector 2022*, page 197.

24. Furthermore, there is a lack of skilled workers available to undertake the work currently scheduled. In addition, the large increase in electricity projects that need to occur in coming years creates concern that not enough skilled workers will be available to deliver the initiatives needed to occur to decarbonise the economy.¹⁰ The International Energy Agency recently released its report *New Zealand 2023 Energy Policy Review*, and it noted that

“To advance energy efficiency strategies, the government should ensure sufficient capacity and skills to deliver on projects. As in other countries, the scale of upcoming energy efficiency upgrades to meet decarbonisation plans will require a significant expansion of skilled workers across the sector. As the government pursues a new NZECS¹¹ and decides on budgetary outlays, specialty skills training in the energy efficiency space should be given due consideration.”²

25. We are not sure whether the rise and spread of disinformation and misinformation come under one of the four mega trends identified in the Discussion Document, but we submit these should be factored into the current discussion.

Do you think we have described the financial implications of enhancing resilience accurately? If not, what have we missed?

26. Our submission is that this part of the proposed reform requires more investigation and analysis in relation to the electricity sector and electricity distribution businesses (EDBs). We do not think it is quite as simple as your analysis in paragraphs 64 to 68 of the Discussion Document.

27. As you will be aware EDBs are subject to regulation under the Commerce Act 1986 because they are natural monopolies. As the Commerce Commission notes, *“the aim of this regulation is to mimic the effects seen in competitive markets so regulated companies are limited in their ability to earn excessive profits, as well as having incentives to innovate, invest, and provide services at a quality consumers expect.”¹²*

28. The Commerce Commission sets revenue and price quality controls for EDBs. These measures involve capping the total revenue the companies can earn from their consumers and requiring them to

¹⁰ The Energy Academy is an initiative of the Orion Group with the purpose of galvanising the industry to work on common challenges, such as redefining the roles of industry in tertiary training. See <https://www.energyacademy.co.nz/>

¹¹ New Zealand Energy Efficiency and Conservation Strategy

¹² See https://comcom.govt.nz/_data/assets/pdf_file/0029/96770/Regulation-for-electricity-lines-companies.pdf

maintain their average quality to certain levels.

29. There are two types of price quality paths – default and customised. Orion is following the default price-quality path. The current default price quality path for electricity distribution businesses (DPP3) is due to expire on 31 March 2025 and the Commerce Commission must make a decision on the next default price-quality path to apply (DPP4) by 30 November 2024.

30. In addition, the Commerce Commission sets the input methodologies (“IMs”) that apply to regulated industries. As the Commission notes

“The IMs are the rules and processes that we set upfront to help provide certainty about how we will regulate specific services under Part 4 of the Commerce Act (Part 4). The IMs apply to key components of the regulatory regime such as how we value assets, allocate costs, share risk between businesses and consumers, and determine how businesses are compensated for their investments. We must apply the IMs when setting price-quality paths and determining information disclosure (ID) requirements.”¹³

31. The Commerce Commission is currently reviewing the IMs and is proposing to complete the review by December 2023. The review of the IMs runs on a 7-year cycle.

32. The Commission released its draft decision on the IMs review on 14 June 2023. The Commission is proposing a reduction in the weighted average cost of capital (WACC)¹⁴. The WACC is a key input in price quality regulation and is the ex-ante allowed rate of return on regulated assets.

33. The Commission has stated that

4.13 Our draft decision to use the 65th percentile for EDBs and Transpower reflects an updated assessment of the evidence, including consideration of regulatory changes that have reduced the risks of underinvestment.”

34. Orion’s position is that the reduction in the WACC is concerning given the volatility of expenditure (traffic management compliance, supply chain issues, sourcing equipment, etc) during DPP3 (2020-2025) and high inflation. Reducing the WACC from the 67th percentile to 65th percentile leaves EDBs undercompensated for the challenges of increased expenditure incurred during DPP3 going forward.¹⁵

¹³ See <https://comcom.govt.nz/regulated-industries/input-methodologies/input-methodologies-for-electricity-gas-and-airports/input-methodologies-projects/2023-input-methodologies-review>

¹⁴ See https://comcom.govt.nz/_data/assets/pdf_file/0030/318666/Part-4-IM-Review-2023-Draft-decision-Summary-and-context-paper-14-June-2023.pdf

¹⁵ Over DPP resets we have seen a downward trend from 75th, to 67th and now the proposed 65th percentile in a period where we expect even higher uncertainty than before. In Orion’s case, we expect the reduction to equate to

35. As a part of this review, the Commerce Commission has also been looking at “expenditure reopener events and scenarios” where a regulated business can apply to seek reconsideration of a price quality path. This is because pre-emptive expenditure in relation to natural disaster readiness, climate change adaptation or cyber security preparedness is not covered by the current DPP reopeners.
36. It is proposing in relation to resilience to extend the drivers in the proposed EDB Foreseeable and Unforeseeable large project DPP to include targeted resilience-related expenditure.¹⁶
37. In the draft decision, the Commission notes that
- 6.71 In general, most resilience type expenditure should occur as part of a regulated supplier’s ordinary asset replacement and renewal programme of work. Accordingly, the proposed driver is designed to cover a step change in proactive capex beyond the intended programme (at an EDB, GDB and GTB DPP reset) of asset replacement. It does not include asset replacement and renewal capex that is consistent with appropriate lifecycle and asset management planning, or expenditure for cybersecurity.*
- 6.72 Resilience expenditure will be limited to a capex project or programme and any opex that is directly associated with the implementation of a capex solution, providing the expenditure would not have been incurred but for that particular project or programme.*
- 6.73 Extending the DPP reopeners for EDBs ... to provide for resilience expenditure and asset relocation will better promote the Part 4 purpose in s 52A of the Act, as it will provide incentives for innovation and investment and provide services at a quality that reflects consumer demand, promoting the long-term benefit of consumers.*
38. We support this reopener provision. However, we note that for the most part, the Commission sees most resilience type expenditure as part of a regulated supplier’s ordinary asset replacement and renewal programme of work.
39. We are concerned that any added expenditure in terms of resilience identified in this Discussion Document will also need to be funded as “business as usual” expenditure which the Commission grounds its decisions in historical expenditure rather than with a forward-looking view, and we are

about \$25m in lost revenue during DPP4, all other things being equal. The environment during DPP3 due to Covid impacts has meant increased costs to do the same work, for example reprioritisation and potential deferral may have occurred and EDBs will be looking to play “catch-up” for works which may have moved into DPP4 to mitigate the potential for underinvestment if not addressed.

¹⁶ See CPP and in-period adjustment mechanisms topic paper [Part-4-IM-Review-2023-Draft-decision-CPPs-and-In-period-adjustments-topic-paper-14-June-2023.pdf \(comcom.govt.nz\)](#)

concerned that this is unsustainable.

Section 2: Potential barriers to infrastructure resilience

Building a shared understanding of issues fundamental to system resilience

How important do you think it is for the resilience of New Zealand's infrastructure system to have a greater shared understanding of hazards and threats?

40. Organisations will benefit from an information exchange process with other critical infrastructure providers and agencies. Sharing information will allow for increased synergies between infrastructure providers and agencies. This could result in more efficiencies in spend on resilient infrastructure. However, this will need to be a "two-way sharing" process.
41. To some degree this already occurs within the national and regional lifeline utility groups where information is shared between local authorities and other lifeline utilities. Another example is the CSSIE (Control Systems Security Information Exchange) where utilities and generators talk about threats and developments in the security space. However, utilities generally would certainly benefit from a more co-ordinated approach.

If you are a critical infrastructure owner or operator, what additional information do you think would best support you to improve your resilience?

42. Further information and training about geopolitical risks and national security risks will better enable Orion to prepare for cyber-attacks, espionage sabotage, and coercion.
43. Applying a local lens, information from the Police and local authorities about security risks at particular properties will also be of help. For the protection of our staff we do need to know where we shouldn't send our operators or contractors.

What do you think the government should do to enable greater information sharing with and between critical infrastructure owners and operators?

44. There will need to be robust rules around the sharing and use of the information. By rules, we envisage there will need to be statutory provisions providing for this.
45. Information provided by critical infrastructure owners may be commercial in confidence or sensitive information relating to specific security procedures or systems used by the asset owner. Potentially it could also include personal information.
46. There will need to be guarantees that the information is held securely and not shared beyond the authorised members of a sharing group. There will also need to be clear statutory provisions about the use of the information. These provisions will need to be backed up by statutory enforcement provisions. For example, in Australia, under the Security of Critical Infrastructure Act 2018, unauthorised use or disclosure of protected information attracts an offence that is punishable by imprisonment for 2 years or 120 penalty units, or both.¹⁷
47. However, information shared for resilience purposes should not be used by regulatory agencies for compliance or enforcement action.
48. The new Emergency Management Bill contains a new clause providing that a critical infrastructure entity must
 - proactively share information with the specified bodies to which the information is relevant for the purposes of planning and monitoring in relation to emergencies, including sharing information before, during, and after an emergency, and
 - if requested in writing to do so, provide information for the purpose of planning for emergencies to the Director, a relevant chief executive, or a representative of an Emergency Management Committee.
49. This clause is targeted at emergencies as opposed to the resilience of critical infrastructure. However, there are no provisions which provide specific legal protections for information sharing, and we will be making a submission to the select committee on this aspect. (This would not be covered by clause 122 of the Bill (and there is a question as to whether it applies to Orion in any case.)

¹⁷ Penalty units serve as the basis for calculating monetary fines for various law violations. The amount payable as a fine is determined by multiplying the value of the penalty unit by the number of penalty units assigned to the offense

50. We also believe there is a case for government funding for local councils to facilitate the connection and collaboration of critical infrastructure/essential service entities. We think this will further enable critical information sharing, reduction and readiness for events.

Setting proportionate resilience requirements

Would you support the government being able to set, and enforce, minimum resilience standards across the entire infrastructure system? If so:

51. There are advantages in going beyond a silo-based approach and targeting critical infrastructure sectors together. As the OECD note,

*“While operators tend to be well aware of their own dependencies upon critical sectors, they may not be as conscious of the dependencies others have upon their own services.”*¹⁸

52. If the Government introduced minimum infrastructure standards, we are concerned that the costs of this will need to become absorbed by each EDB (and in turn its customers) as part of a regulated supplier’s ordinary asset replacement and renewal programme of work. (We refer to our comments above at paragraphs 26 to 39.)

53. With the above comments in mind, we can support the Government being able to set, and enforce, minimum resilience standards across the entire infrastructure system if there is a very clear and enforceable direction to the Commerce Commission that a financial uplift in revenue would be permitted for EDBs to meet the costs of meeting these standards. It should also be recognised that resilience enhancements and changes generally require work programmes that cover a number of years. Often they are not a quick fix, and short time frames for meeting such standards will not be appropriate.

54. That said, the electricity distribution sector is heavily regulated, and we do not see any particular advantages in doubling up on resilience standards on physical assets with which we must comply under the Electricity Industry Participation Code or regulation under the Commerce Act 1986.

¹⁸ See the OECD *Policy Toolkit on Governance of Critical Infrastructure*.

- **what type of standard would you support (eg. requirement to adhere to a specific process or satisfy a set of principles)?**

55. We would prefer a risk management approach, such as that outlined in the Australian legislation¹⁹ where, the risk management programme must provide for

- the identification of hazards where there is a material risk that the occurrence of the hazard could have a relevant impact on the asset;
- so far as it is reasonably practicable to do so—minimise or eliminate any material risk of such a hazard occurring; and
- so far as it is reasonably practicable to do so—mitigate the relevant impact of such a hazard on the asset.²⁰

- **do you have a view on how potential minimum resilience standards could best complement existing approaches to risk management?**

56. No comment.

Would you support the government investing in a model to assess what the significance of a critical infrastructure asset is, and using that as the basis for imposing more stringent resilience requirements? If so:

57. We would support the government investing in a model to assess the significance of critical infrastructure assets. This approach ensures a holistic perspective, acknowledging the vital interdependencies among various infrastructure elements while keeping the well-being of the community at its core.

- **what options would you like the government to consider for delivering on this objective?**

58. We suggest the government considers these matters:

- Data-driven analysis: utilise advanced data analytics and machine learning techniques to analyse historical data on infrastructure performance, vulnerability assessments, and potential cascading

¹⁹ See the Security of Critical Infrastructure Act 2018 at <https://www.legislation.gov.au/Details/C2022C00160>

²⁰ See above n19, section 30AA.

effects of asset failures. Leverage the geo-spatial data on assets, critical transit routes and natural hazard overlays including sea level rise,

- Scenario planning: conduct extensive risk assessments and scenario planning exercises to understand the potential consequences of disruptions to different assets. This process can help prioritise assets based on their impact on public safety and to inform the level of importance (criticality) of various infrastructure assets, and
- Broad consultation and engagement: involve the public and stakeholders in the decision-making process to ensure the model's transparency, buy-in, and gain broader perspectives on critical infrastructure's significance.

- **what criteria would you use to determine a critical infrastructure asset's importance?**

59. We suggest using the following criteria:

- Impact on public: assess the asset's role in ensuring the safety and security of communities,
- Dependency of systems: identify assets that are highly interconnected and have dependencies on other critical infrastructure e.g., a failure in one asset might cascade into disruptions in others,
- Geographic factors: account for the asset's location and its significance concerning the population it serves. Assets serving densely populated areas or critical facilities (hospitals etc.) should be given special attention, and
- Economic consequences: consider the asset's impact on the regional and national economy. Assets crucial for maintaining essential services, supporting industries, and ensuring a stable supply chain should be considered critical.

What criteria would you use to determine a critical infrastructure asset's importance? Investing in a model to assess a critical infrastructure asset's criticality, and using that as the basis for imposing resilience requirements that are more stringent on particularly sensitive assets?

60. See above.

If so:

- **what options would you like the government to consider for delivering on this objective?**

61. See above.

- **what features do you think provide the best proxies for criticality in the New Zealand context?**

62. We suggest these features:

- Geographic location: assets located in densely populated areas, key transportation hubs, or regions prone to natural disasters are likely to be more critical due to their direct impact on communities,
- Dependency on services: assets that support or provide services essential for daily life, such as healthcare facilities, emergency services, and communication networks, are vital to the public, and
- Economic significance: assets contributing significantly to the national economy and essential industries are crucial for sustained economic growth and stability.

Managing significant national security risks to the critical infrastructure system

Do you think there is a need for the government to have greater powers to provide direction or intervene in the management of significant national security threats against a critical infrastructure?

63. In the event of a significant national security threat (**where that term is defined in a statute**), and as a **matter of last resort**, the Government could have some additional powers to intervene and provide direction to the entity responsible for the critical infrastructure. However, correspondingly, entities carrying out Ministerial directions in good faith must have protection from liability.

If so: – what type of powers should the government consider?

64. We note that the Australian legislation²¹ provides that the Minister may give a written direction requiring an entity to do, or refrain from doing, a specified act or thing within the period specified in the direction. This is a broad power and we submit that a more refined power may be appropriate in New Zealand.

- **what protections would you like to see around the use of such powers to ensure that they were only used as a last resort, where necessary?**

65. Under the Australian legislation²², the Minister must not give the direction unless:

²¹ See above n19, section 32(2).

²² See above n19, section 32(3).

- (a) the Minister is satisfied that requiring the entity to do, or to refrain from doing, the specified act or thing is reasonably necessary for purposes relating to eliminating or reducing the risk ...; and
 - (b) the Minister is satisfied that reasonable steps have been taken to negotiate in good faith with the entity to achieve an outcome of eliminating or reducing the risk without a direction being given under subsection (2); and
 - (c) an adverse security assessment in respect of the entity has been given to the Minister for the purposes of this section; and
 - (d) the Minister is satisfied that no existing regulatory system of the Commonwealth, a State or a Territory could instead be used to eliminate or reduce the risk mentioned in subsection (1).
66. The statute also lists the considerations that the Minister must have regard to before giving a direction²³. These include
- (a) the adverse security assessment;
 - (b) the costs that would be likely to be incurred by the entity in complying with the direction;
 - (c) the potential consequences that the direction may have on competition in the relevant critical infrastructure sector;
 - (d) the potential consequences that the direction may have on customers of, or services provided by, the entity; and
 - (e) any representations given by the entity or a consulted Minister
67. These are the types of considerations that would be appropriate, and would provide a basis for a judicial review proceeding to ensure that entities or other interested person have an avenue through the Courts to challenge the Minister's exercise of such a power.

Creating clear accountabilities and accountability mechanisms for critical infrastructure resilience

Do you think that there is a need for a government agency or agencies to have clear responsibility for the resilience of New Zealand's critical infrastructure system? If so: – do you consider that new regulatory functions should be the responsibility of separate agencies, or a single agency?

68. Yes, we do think it is appropriate for a government agency or agencies to have clear responsibility for the resilience of New Zealand's critical infrastructure system. There is currently expertise that sits

²³ See above n19, section 32(4).

across a number of agencies such as the Infrastructure Commission, the Commerce Commission, the National Cyber Security Centre and the Computer Emergency Response Team. We would prefer to have one or more of these organisations take on extra responsibilities with oversight from MBIE or DPMC, rather than create a new entity. We think this is a more cost-effective approach.

- **do you consider that an existing entity should assume these functions or that they should be vested in a new entity?**

69. As above, we think the responsibilities could sit across various existing agencies with departmental oversight.

- **how do you see the role of a potential system regulator relative to sectoral regulators?**

70. We would prefer for this role to sit with the Infrastructure Commission in terms of electricity distribution companies.

Do you think that there is a need for compliance and enforcement mechanisms (eg. mandatory reporting, penalties or offences) to ensure that critical infrastructure operators are meeting potential minimum standards? If so: – do you consider that legal obligations should be applied to the entity, to the entity's directors/executive leadership, or a mix of the two?

71. For electricity distribution businesses, we would prefer for any compliance and enforcement mechanisms to sit with MBIE.

Conclusion

72. Thank you for the opportunity to make a submission on this matter.

73. Please let us know if you have any questions about our submission. The contact person for this submission is Vivienne Wilson, Policy Lead.

Yours sincerely

Steve Macdonald

GM Electricity Network

APPENDIX

Orion - Earthquake Recovery Lessons

This case study is intended to illustrate the scale and impact of an actual major event on an *EDB* network and operational facilities and describes the likely issues and actions required to carry out a full recovery phase after a major event.

Earthquake Sequence

On Saturday 4th September 2010 at about 4:35am, a shallow depth magnitude 7.1 earthquake occurred on a previously unknown fault, now referred to as the Greendale Fault, about 40km from Christchurch City.

Although the earthquake was centred in a predominately rural area to the west of Christchurch, the shaking, and the incidence of severe liquefaction in areas of vulnerable soil type led to widespread damage throughout Christchurch and the surrounding area. *Civil Defence* emergencies were declared for Christchurch City, Selwyn District and Waimakariri District.

This earthquake later named the “Darfield Earthquake” affected much of Christchurch’s infrastructure including the electricity supply system. Orion immediately lost about 60% of supply to the city.

Supply restoration was rapid, requiring the resetting of tripped zone substation transformers (due largely to tap changer gas protection tripping) but also repairs to some damaged equipment. Thousands of aftershocks were experienced over the next four to five months, some as big as R5, with many centred much closer to urban areas of Christchurch.

On Tuesday 22nd February 2011 at 12:51 pm, a magnitude 6.3 earthquake ruptured a fault almost directly beneath Christchurch. This generated extreme ground shaking intensities with maximum intensities reaching MMIX and very high vertical accelerations up 2.2 G and horizontal acceleration of up to 1.7 G at Heathcote Valley and levels of 1 to 1.88 G in other areas of the city.

Considerable damage was inflicted on buildings and infrastructure resulting in building collapses and extensive liquefaction, particularly in the Eastern suburbs.

A national *Civil Defence emergency* was declared. 185 lives were lost, and many thousands of people were injured. The CBD was evacuated and locked down requiring *Civil Defence*-issued passes to gain access. Orion's headquarters was located in this access-controlled zone which made things more difficult.

The earthquake sequence continued with a number of major aftershocks over the next 12 months, several being greater than R5.

The impact of the February earthquake is considered to be seven to ten times greater than the initial September quake when assessed in terms of power supply restoration times, direct repair costs and customer minutes lost.

Damage to the Orion network coincided closely to the areas where liquefaction was present and also where shaking effects were high, e.g., around areas of the Port Hills where cliff collapses and rock falls occurred.

Network Damage

During the response phase, which lasted approximately six months, Orion asset staff assessed the residual damage to network assets and began to formulate the necessary plans to reinstate the level of security back to at least pre-earthquake levels.

The legacy 66kV oil filled cable sub-transmission network was greatly impacted with 50% of it being damaged beyond economic repair due to multiple damage along each circuit route.

Approximately 10% of Orion's underground 11kV distribution network was damaged with many circuits suffering multiple fractures particularly in areas of liquefiable soils.

The condition of MV cables was assessed once the immediate repairs to faulty circuits was completed, by carrying out partial discharge testing in areas where there was evidence of ground movements.

Within the CBD, many building distribution substation sites were damaged and, along with the buildings, had to be bypassed and abandoned.

Brighton zone substation (40 MVA capacity) and an associated 66kV switching station nearby were extensively damaged by liquefaction and were written off. A replacement zone substation was constructed in a tight timeframe at the Rawhiti Domain on soils which demonstrated much less liquefaction effects.

Damage to network substation and switching centre buildings was minimised due to an extensive seismic strengthening programme carried out as a risk reduction strategy over a 15-year period prior to the earthquake events.

Orion's material damage insurance cover was limited to only substation and office buildings as, since 1992, extensive cover for other network assets such as lines and cable networks had become economically uninsurable on the global scene.

A significant shortfall in available finances was anticipated based on a significant repair bill to carry out a full recovery programme following completion of the initial response phase repairs. This led to Orion lodging a CPP application with the Commerce Commission to enable line charges to be increased to raise sufficient finance.

During this period Orion's line charge revenue was reduced due to the closure of the CBD and the red zone housing losses which caused the loss of customer connections through building demolitions and the population relocating their housing and businesses. This loss of revenue is estimated at \$50M over the first four years after the earthquakes.

The 'Recovery Phase' costs to fully restore the network to its pre-earthquake security level were estimated at an extra \$155M of CapEx above what was originally planned over a possible ten-year period.

In the meantime, there were many other costs to be met such as ongoing repair costs, new housing relocations from the red zone, and paying for uninsurable losses on various parts of the damaged network.

The five-year CPP did not commence until 1st April 2014, leaving Orion to finance all post-quake costs for a considerable period.²⁴ The approved CPP did not cover all the items requested by Orion.

In replacing the written-off oil-filled 66kV cables, Orion moved to solid insulation (XLPE) cables and decided not to use the previous radial transformer feeder configuration with both substation circuits laid alongside each other. This older architecture turned out to very vulnerable to common mode failure.

The long-term impact on staff and their families of this major event led to a period of relatively high staff turnover which also had to be managed, whilst carry out an ambitious recovery phase.

The main lessons learned were:

- a big event like an earthquake creates huge, extraordinary repair and recovery costs coupled with a potential drop in revenue
- under existing regulatory rules, lodging a CPP application with the Commerce Commission is likely to be necessary for the affected EDB to be able to fund these additional costs. It may take several years to get a CPP prepared and approved and may not lead to all requested work being funded
- material loss damage claims involving building demolitions and rebuilds can take several years to work through. Most of the damaged network assets were effectively self-insured
- the recovery plan should assess whether the replacement network should stay as like for like or be built in a more resilient manner the older weak mix concrete thermal backfill 66kV cable design

²⁴ See [Orion-CPP-Proposal-19-February-2013.PDF \(comcom.govt.nz\)](#) which is a copy of Orion's Customised Price Path proposal; to the Commerce Commission.

proved to be too rigid and replacement 66kV cable backfill designs introduce more freedom for the cable to move about during earthquake waves

- as a result, the Orion 66kV network in the eastern suburbs has been rebuilt using better and diverse routes, improved modern cables with the improved cable trench design. A northern 66kV cable ring system has been created by this process to provide interconnection diversity
- improvements have been made to the supply arrangements to key lifelines entities such as the as Christchurch Airport and Port of Lyttleton
- in this type of event there are likely to be relocations of customer loads requiring reinstated capacity but in a different location to the pre-event network
- where a built-up CBD is involved, which has sustained considerable damage, there are multiple work streams occurring, involving; working with demolition and rebuild work programmes
- liaison with relevant local body and central authorities requires sufficient resources to be deployed (the size of which should not be underestimated) to focus on safety and network rearrangements including the provision of completely new substations in new buildings and a high disconnection / connection rate
- cable networks in these areas are very likely going to have to be re-configured in some cases, opportunities arise to eliminate older legacy network assets rather than replace
- the impact on field resources having to carry out years of repair and recovery work can take a toll and it is important to look after these people some of whom were dealing with their own recovery issues
- it was important to communicate progress to stakeholders (customers, shareholders) as the recovery plan unfolded the location of an EDB headquarters and related contractor depots need to be considered to avoid suspect close neighbouring buildings or potentially suspect access areas.

This resulted in a move to a resilient (IL4) and fit for purpose main office which includes the 24/7 network control centre

- Connetics, Orion's key network services provider, was also moved into a new resilient and fit for purpose base. Other site related improvements in resilience have been made, e.g. critical network component spares have been moved to diverse sites that are less susceptible to natural disaster risks
- a new disaster recovery site has been established if use of the normal administration office and control room is not possible after a major event and
- business priorities following a big event, can be quite different from business-as-usual resource deployment and part of being resilient is the ability to adapt to these new circumstances.

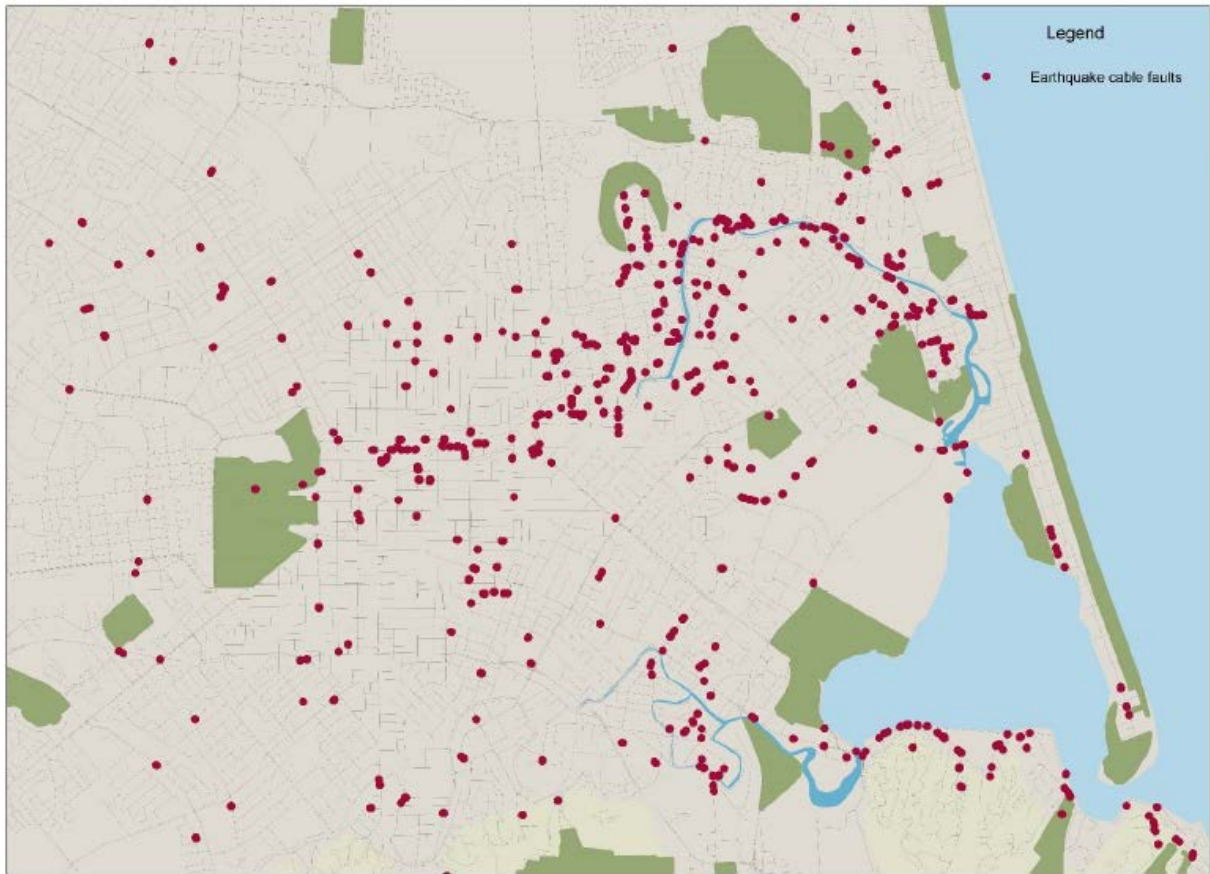




Figure 13: Urban Damage



Figure 14: 66kV Oil Filled Cable Damage – Armagh Street



Figure 15: 66kV Cable Damage



Figure 16: Low Voltage Line Damage



Figure 17: Liquefaction Impact on Major Substation





Figure 18: Liquefaction Inside Major Substation



Standard building substation strengthening

Quake damage – not strengthened

Figure 19: Substation Damage Comparison



Figure 20: Substation Damage from Bolder - Wakefield Avenue



Figure 21: Substation Rock Fall Damage

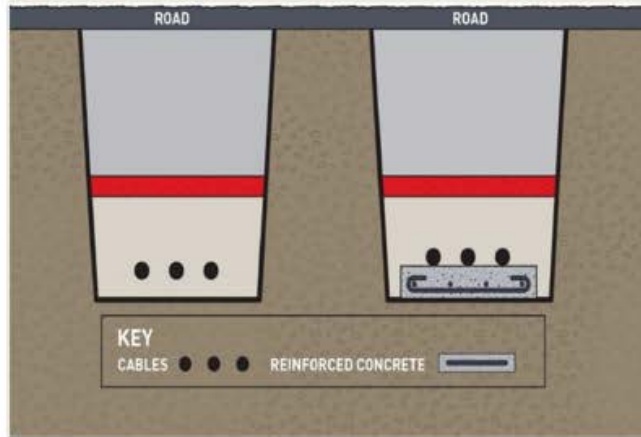


Figure 26: 66kV Replacement Trench Design: Liquefiable Soil



Figure 27: Substation Strengthening - Steel Framing



Figure 28: Replacement Zone Substation



Figure 29: Emergency 66kV Overhead Line