

NZ EDB 2023 AMP REVIEW

Resilience Assessment Report

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NZ EDB 2023 AMP RESILIENCE ASSESSMENT REPORT

CONTACT PERSON

Ranjan Vaidya

Director, IAEngg



✉ Ranjan.vaidya@iaengg.com

IAENGG PTY LIMITED

ABN 66 641 886 204, Level 19, 15 William St,
Melbourne, VIC 3000

 www.iaengg.com

EXECUTIVE SUMMARY

Background

<h1 style="font-size: 48px; margin: 0;">29</h1> <p style="font-size: 24px; margin: 0;">EDBs</p> <h2 style="font-size: 24px; margin: 0;">ELECTRICITY DISTRIBUTION BUSINESSES</h2>	<p>IAEngg was engaged by the NZ Commerce Commission (ComCom) in July 2023 to undertake a review of the 2023 Asset Management Plans (AMPs) of the 29 Electricity Distribution Businesses (EDBs).</p> <p>This report is the deliverable on resilience planning in stage 2 of the project, and covers IAEngg’s assessment on the resilience planning of the EDBs.</p>
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Specific deliverables for resilience planning assessment include:

- EDB’s understanding of environmental risks and planning for High Impact Low Probability (**HILP**) events;
- The level of assessment that has been undertaken by EDBs to determine the resilience initiatives; and
- Provide independent opinion on:
 - » Initiatives raised to improve resilience;
 - » Assessment of natural disaster risk to networks;
 - » Resilience assessment and evaluation;
 - » Analysis of expenditure on resilience, and
 - » Identification of good electricity industry practice.

Complexity

The review task was complex due to a number of factors:

- The AMPs are lengthy documents and the timeframe for this high-level review did not allow a comprehensive detailed review of each of the 29 AMPs. IAEngg needed to target areas of the AMP to extract the required information for analysis;
- IAEngg’s scope of resilience assessment includes the analysis of expenditure in resilience. However, the majority of EDBs do not itemise the expenditure they define as resilience related, but the expenditure has been grouped into the various capex and opex regulatory categories. For the minority of EDBs who have stated the value of the resilience expenditure, the details have been summarised in this report.
- IAEngg has found that there are differences in how EDBs classify resilience expenditure. Some EDBs have included reliability improvement expenditure under resilience. We are of the opinion that reliability improvement expenditure should not be included under the resilience theme as their benefits apply to both normal supply interruption as well as HILP events.

Review approach

IAEngg’s review focuses on the following:

Level of assessment that has been undertaken by EDB for naturally occurring HILP events	
Initiatives raised to improve resilience	Proposed expenditure on resilience in 2026-2030 period
Justification for the proposed expenditure	Identification of good industry practice

Many naturally occurring and man-made events can impact the grid’s ability to supply electricity. Most of these events occur relatively frequently but with least serious damage. There are also those that rarely occur but with much serious damages, commonly referred to as “High Impact Low Probability” (HILP) events.

Grid resilience as discussed in this report (and aligned with the scope of ComCom’s engagement) refers to the grid’s ability to absorb the impact of HILP events so electricity

supply can either be maintained or be restored promptly after an interruption.

For the resilience assessment covered in this report, we have focussed on EDB approach to deal with naturally occurring HILP events that are either climate related (storms, floods, bushfires etc.) or geographically related (earthquakes, volcanoes etc.). Man-made events, such as cyber-attacks, are considered outside the scope of the review.

The primary source of information for the review came from the AMPs.



High level findings across EDBs

Capex and opex summary

The initiatives are those identified in the AMPs:

Initiatives to improve supply reliability such as network sectionalisation, installation of reclosers, new Advanced Distribution Management Systems to increase situation awareness and automatic switching order generation.

Initiatives to rapidly respond and recover after large-scale supply disruptions, mostly to do with ready access to mobile generators, mobile substations & network asset spares, regular emergency exercises and mutual aid arrangements.

Design resilience in new assets and network configuration, making use of the opportunities presented by load growth augmentation, new customer projects and asset renewals.

Modify existing assets to increase their resilience against floods, earthquakes and strong wind.

As the majority of EDBs do not separately itemise the expenditure they define as resilience related, IAEngg has not been able to extract the resilience expenditure from the AMPs.

Resilience Framework

All EDBs have considered planning for HILP events as part of their risk management, business continuity and broader asset management function.

EDBs generally have a framework that they use for resilience assessment. A common framework quoted is Electricity Engineers Association’s Resilience Guide.

Resilience Standards

A few resilience standards have been mentioned: NZ Society of Earthquake Engineering for seismic strengthening, 1-in-100-year or 1-in-500-year flood standards and recent experiences of extreme climatic events. There are, however, no justification in the AMPs for the adoption of these standards.

Option and Cost-Benefit Analysis

Good industry practice for investment planning in a capital constrained industry would require

methods to prioritise the expenditure to ensure the appropriate areas are targeted. Little details can be found in the AMPs to justify the areas targeted for resilience expenditure, cost/benefit assessments for capital rationing, and modelling to support an increase probability/frequency of occurrence of the HILP events (if required for justification). This is not to say that the background work has not been undertaken, but this work is not presented in the AMPs.

Conclusions

In conclusion, IAEngg supports the notion of investing to “harden” the EDB networks against HILP events. Standardisation of the assessment framework, the resilience standards to be used, and approach for cost/benefit assessments will be essential. Last but not least, customers should be consulted on the level of resilience they are prepared to pay.

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1

INTRODUCTION



1 INTRODUCTION

IAEngg was engaged by the NZ Commerce Commission (ComCom) in July 2023 to undertake a review of the 2023 Asset Management Plans (AMPs) of the 29 Electricity Distribution Businesses (EDBs).

The review was conducted over two stages

STAGE 1	STAGE 2
Stage 1 included a desktop review and a detailed forecasting report.	Stage 2 covered the AMP disclosure requirements and resilience planning.

This report is the deliverable for Stage 2, and covers IAEngg’s assessment on the resilience planning of the EDBs. We have also included the resilience planning of Transpower as a comparison.

Specific deliverables for resilience planning assessment include:

- **EDB’s understanding of environmental risks and planning for High Impact Low Probability (HILP) events;**
- **the level of assessment that has been undertaken by EDBs to determine the resilience initiatives; and**
- **Provide independent opinion on:**
 - » initiatives raised to improve resilience;
 - » assessment of natural disaster risk to networks;
 - » resilience assessment and evaluation;
 - » analysis of expenditure on resilience, and
 - » identification of good electricity industry practice.



2

APPROACH



2 APPROACH

This section outlines the approach taken by IAEngg to assess the EDB’s resilience approach and initiatives contained in the AMPs.

2.1 Definition of Resilience

EDBs are in the business of supplying reliable electricity supply to its customers at a cost that is justified. Many naturally occurring and man-made events can impact the grid’s ability to supply electricity. Most of these events occur relatively frequently but do not result in serious damage to the grid. There are also those that rarely occur but result in serious

damage, commonly referred to as “High Impact Low Probability” (**HILP**) events. Grid resilience as discussed in this report (and aligned with the scope of ComCom’s engagement) refers to the grid’s ability to absorb the impact of HILP events so electricity supply can either be maintained or be restored promptly after an interruption.

For the resilience assessment covered in this report, we have focussed on EDB approach to deal with naturally occurring HILP events that are either climate related (storms, floods, bushfires etc.) or geographically related (earthquakes, volcanoes etc.).

Man-made events, such as cyber-attacks, are not considered for the following reasons:



There are separate regulations governing cyber security in NZ which are distinct from the resilience framework promulgated by the NZ National Emergency Management Agency;



ComCom’s focus of the review is on HILP events, and this had been driven by the extreme weather events that have occurred in NZ recently.



2.2 Approach

IAEngg’s review focuses on the following:

<p>Determining the level of assessment that has been undertaken by EDB for naturally occurring HILP events</p>	
<p>Initiatives raised to improve resilience</p>	<p>Proposed expenditure on resilience in 2026-2030 period</p>
<p>Justification for the proposed expenditure</p>	<p>Identification of good industry practice</p>

The key source of information for the review was the AMPs published by the EDBs. This was supplemented, for a limited number of EDBs, by meetings to clarify information provided in the AMP. The number of EDBs with which a meeting was held was limited due to the time and resources available to undertake the project.



2.3 Drivers for Resilience Planning

Drivers for proactive resilience investment

Electricity is an essential supply without which people’s quality of lives will be severely affected. It is important to point out that the energy Sector is uniquely critical because it

provides an “enabling function” across other critical infrastructure sectors such as water supply, wastewater management, telecommunication and transport.

The New Zealand integrated approach to civil defence emergency management can be described by the four areas of activity, known as the ‘4 Rs’ - Reduction, Readiness, Response and Recovery:

4 Rs			
Reduction	Readiness	Response	Recovery
Identifying and analysing long-term risks to human life and property from hazards; taking steps to eliminate these risks if practicable, and, if not, reducing the magnitude of their impact and the likelihood of their occurring.	Developing operational systems and capabilities before a civil defence emergency happens; including self-help and response programmes for the general public, and specific programmes for emergency services, lifeline utilities and other agencies. Actions taken immediately before, during or directly after a civil defence emergency to save lives and protect property, and to help communities recover.		The coordinated efforts and processes to bring about the immediate, medium-term and long-term holistic regeneration of a community following a civil defence emergency.

In New Zealand energy infrastructure is classified as “lifeline” utility. EDBs have existing duties as lifeline utilities under the Civil Defence Emergency Management Act 2002 to “function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency” (s. 60 (a)).

As such, risk assessment and contingency planning have traditionally been adopted by

EDBs as part of their corporate risk management process and operational planning for HILP events. The focus in the past has traditionally been on the last 3 ‘Rs’ – to be ready to respond swiftly to HILP events and restore electricity supply within the shortest timeframe. Proactive investments to reduce or eliminate the risks (“network hardening”) have generally not been considered economical due to the low probability nature of those events.

Recent severe weather events have heightened community awareness of the need to invest to protect critical infrastructure:



**CATASTROPHIC
FLOODS**

Beginning on Friday, 27 January 2023, regions across the upper North Island of New Zealand experienced widespread catastrophic floods caused by heavy rainfall, with Auckland being the most significantly affected.



**CYCLONE
GABRIELLE**

Shortly afterwards, in February 2023 Cyclone Gabrielle caused significant devastation in northern and eastern regions of North Island. A national state of emergency was announced for only the third time in New Zealand’s history. At the height of the cyclone’s impact, around 225,000 homes were without power, and thousands of people were displaced as flood waters rose. Cyclone Gabrielle was described as NZ’s costliest non-earthquake natural disaster.

For resilience to extreme climatic and seismic events, there is a general consensus that the frequency of extreme climatic events (such as storms and floodings) is increasing as a result of climate change. The review of the 2023AMP has revealed that some EDBs have forecasted increased expenditure to harden the network against extreme weather events. Some EDBs have also suggested that increased resilience expenditures are likely to be proposed in their 2024AMP after they have time to consider the severe weather events that occurred in early 2023.



2.4 Good Industry Practice

2.4.1 Definition of HILP events

Resilience planning of EDBs focuses on HILP events. There is no national or international accepted definition of what constitutes HILP events although there is a general acceptance that HILP events are unpredictable and/or unexpected events that deviate from normal expectations. Impact on EDBs is to do with metrics such as percentage of customers without electricity supply or aggregated hours of customer minutes off supply. Probability of the event is expressed in terms such as “1-in-100-year” or “1-in-200-year”. The “1-in-100-year” is generally used by town planners to decide where houses can be built.

2.4.2 Definition of good industry practice

Our assessment of the resilience approach adopted by EDBs required us to identify good electricity industry practices. The following definition of good industry practice has been used in our assessment noting that there are no international standards or defined approaches to resilience planning used in the electricity supply industry:

The degree of skill diligence, prudence, foresight and economic management which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking under the same or similar circumstances.

The definition does imply a degree of subjectivity which IAEngg applies based on its collective expertise in the electricity supply industry.

2.4.3 Good industry practice for resilience planning

The characteristics of good resilience planning approach include:

- Adoption of a formal framework;

- Standards are adopted that align with industry/sector standards and clear justification provided for deviation. For example, frequency of low probability events is aligned with other electricity industry participants and other utilities such as water authorities ;
- Demonstrate balance between proactive expenditure and reacting / recovering after an event;
- For specific network hardening initiatives, such as network hardening for floods & inundation, increase in wind speed and hot dry summers, supporting evidences that these are the areas where climate change will impact and hence priority areas to address; and
- Some form of cost/benefit assessments.

These dot points are expanded further below.

2.4.4 Framework for resilience planning

We recognise that frameworks are still evolving particularly in the area of resilience planning for climate change adaptation. It is also important to point out that resilience planning needs to be a whole-of-system approach involving other lifeline utilities and local governments. For example, it may not be prudent to invest in network hardening against floods and inundation in low lying areas where consumers of electricity are likely to have evacuated when those events occur.

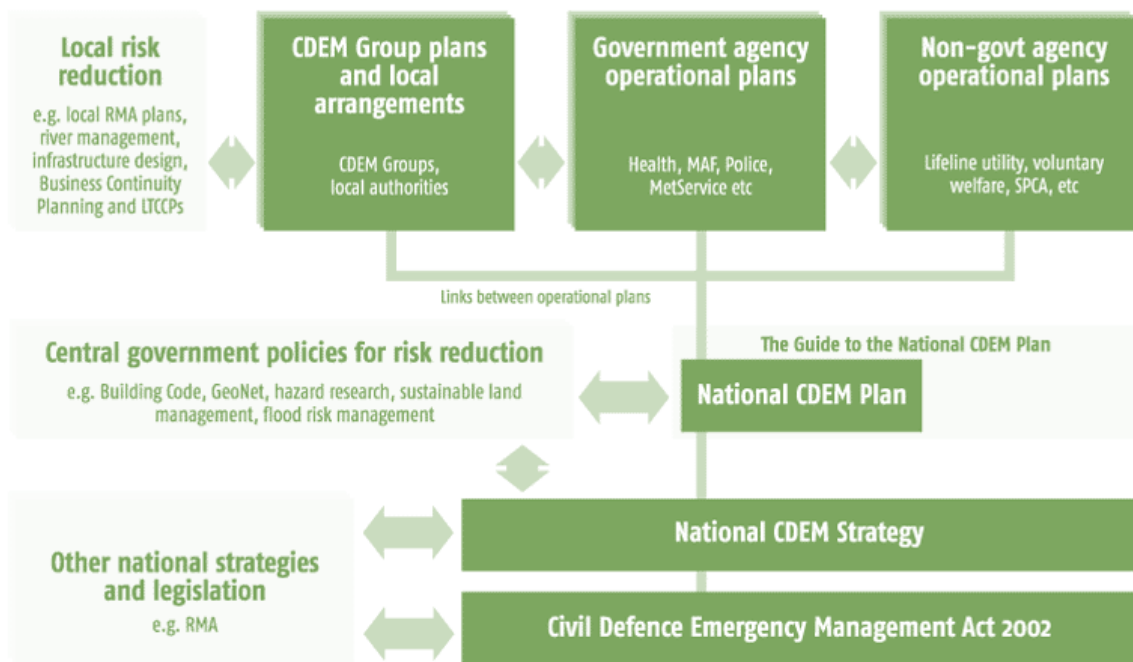
A number of formal frameworks have been adopted by utilities. IAEngg is not advocating one framework over another but emphasizes the importance of a formal framework to guide a systematic approach to resilience planning. Once a framework is adopted, regular review and comparison of business performance against the framework will also allow an EDB to assess the scale of its maturity and make improvements.

FOUR FRAMEWORKS ARE DISCUSSED BELOW:

1 NZ National Emergency Management Agency 4Rs Framework

The 4Rs are Reduction, Readiness, Response and Recovery. The first step of the framework is hazard identification:

- **HAZARD IDENTIFICATION** - The first edition of the National Hazardscape Report¹ provides a contemporary summary of the physical nature, distribution, frequency of occurrence and impacts and consequences of 17 key hazards affecting New Zealand. The hazards described in the National Hazardscape Report include geological, meteorological, biological, technological and social hazards. The report also provides information on how the hazards are currently managed across reduction, readiness, response and recovery. The document aimed at informing policy makers, hazard managers and their advisors in carrying out hazard and risk management at the national and local level.
- **HAZARD REDUCTION** – Certain sections of the CDEM Act 2002 applies to Lifeline Utilities of which EDBs are part of². The CDEM framework is reproduced below:



- Duties under the Act are mainly to do with readiness, emergency response and recovery but the Act could be used to support investments to reduce the hazard.

¹ <https://www.civildefence.govt.nz/resources/national-hazardscape-report>

² <https://www.civildefence.govt.nz/cdem-sector/lifeline-utilities/duties-of-lifeline-utilities>

2 NZ EEA Resilience Guide

The NZ Electricity Engineers' Association (EEA) has published a Resilience Guide³. The Guidelines have been developed by the EEA Asset Management Group, recognising the importance of good resilience planning in the electricity supply industry. Good resilience planning supports effective management of issues arising from major emergency events such as natural disasters, large earthquakes, extreme weather events and other extreme events that impact on network assets.

Apart from covering the principles of emergency management preparedness, the

guide also includes a spreadsheet-based practical self-assessment tool (RMMAT) that enables EDBs to rate their organisation's degree of overall resilience. The assessment tool has been structured around the 4R's framework as defined in National CDEM Plan Order.

It is noted that the EEA Resilience Guide has been used by many EDBs as framework for resilience assessment. A number of EDBs have taken the additional step of using the RMMAT to assess the maturity of their resilience and to identify opportunities for improvement.

3 EN ISO 14091:2021 Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment⁴

The recently adopted and published European Standard: 'Adaptation to climate change - Guidelines on vulnerability, impacts and risk assessment' (EN ISO 14091:2021) provides a basis for climate change adaptation planning, implementation, and monitoring and evaluation for any organization, regardless of size, type and nature.

This document gives guidelines for assessing the risks related to the potential impacts of climate change. It describes how to understand an organization's vulnerability and how to develop and implement a sound risk assessment in the context of climate change. It can be used for assessing both present and future climate change risks.

This document is structured starting with an introduction to the concept of climate change risk assessment, followed by the preparation, the implementation and the documentation and communication of the climate change risk assessment.

The standard provides guidance on the use of screening assessments and impact chains, allowing for qualitative and quantitative analysis. This type of information, documented in an internationally agreed way, helps organizations of all kinds and sizes make better business decisions. It is also a useful tool for climate-related reporting.

4 IEEE PES Technical Report (PES-TR83): Resilience Framework, Methods, and Metrics for the Electricity Sector, October 2020⁵

Unlike the frameworks discussed so far, the IEEE Technical Report focuses entirely on the electricity sector and hence more relevant to the EDBs. The report is very comprehensive and

covers resilience metrics, reliability versus resilience, qualitative and quantitative benefit assessments, and case studies of its application by US utilities.

³ (<https://www.eea.co.nz/tools/products/details.aspx?SECT=publications&ITEM=3049>)

⁴ <https://www.iso.org/standard/68508.html>

⁵ https://resourcecenter.ieee-pes.org/publications/technical-reports/pes_tp_tr83_itslc_102920

2.4.5 Standards for resilience planning

To ensure resilience planning is conducted in an open and consistent manner by each EDB, resilience planning standards should be specified. The key questions for standards are:

- What are the metrics for “high impact”?
- What are the metrics for “low probability”?

Section 4.2 of the IEEE PES Technical Report (PES-TR83) provides good discussion about metrics used by various entities in the US (IEEE & DOE) on quantifying the impact of an event. It does not, however, advocate the use of probability on the basis that the probability may change with time due to climate change. Also, inherent with unpredictable events, it is likely that there is a high degree of uncertainty associated with the determination of the probability.

IAEngg believes that EDBs should state the standards they use for resilience planning and, where possible, compare those used by other EDBs, Transpower and other lifeline utilities.

2.4.6 Cost-Benefit analysis

Due to competing priorities for capital investment and the need to ensure the investment is in the long-term interest of customers, EDBs find themselves faced with the task to quantify, in monetary terms, the benefits brought about by proactive investment in network resilience against HILP events.

There is no widely accepted or standardized method or publicly available solution that can be used to perform cost-benefit analyses involving improvements to system resilience. In IEEE PES Technical Report (PES-TR83), two methods used

to calculate resilience's value can be broadly categorized as a bottom-up approach and an economy-wide approach. These two methods are defined as

- Bottom-up approach: These include a) stated preference methods, which use surveys and interviews to ask customers about their intended or actual behaviour during interruptions, and b) revealed preference methods, which use real-world data to estimate a valuation of non-market goods.
- Economy-wide approach: These analyze the effects of power interruptions on regional economies using economic output and employment indicators, including a) input-output models, b) computational general equilibrium models, c) macro-econometric models, and d) production function approaches.

Calculating the value of resilience is a complex activity and remains an ongoing research area for the industry. Current approaches in the resilience valuation have limitations as they do not appropriately capture the potentially devastating consequences of not having adequate resilience. For example, prolonged outages lasting weeks is no longer just a mere inconvenience but results in significant pain and suffering or even deaths that are not straight forward to assign a monetary valuation. Various attempts have been made to calculate the value of resilience activities. A recent publication by the NSW Treasury in Australia sets out the framework of how to undertake disaster resilience cost-benefit analysis⁶.



⁶ NSW Treasury, Disaster Cost-Benefit Framework (TPG23-17), October 2023



3

FINDINGS



3 FINDINGS

This section presents the findings of the review including summaries of the results of the analysis and observations.

3.1 Level of Resilience Assessment by EDBs

All EDBs have considered planning for HILP events as part of their risk management, business continuity and broader asset management function.

EDBs generally have a framework that they use for resilience assessment. **A common framework quoted is EEA’s Resilience Guide:**

Northpower’s risk management is carried out in accordance with, or informed by a number of standards and guides that include EEA Resilience Guide (2022) and EEA Asset Criticality Guide (2019)

The Resilience Management Maturity Assessment Spreadsheet Tool (RMMAT) was developed by **Unison** and adopted by EEA in EEA’s 2020 version of the Resilience Guide

Wellington Electricity follows the 4R (Reduction, Readiness, Response & Recovery) approach as described in the EEA Resilience Guide for hazard management. It also uses the resilience maturity measurement tool (RMMAT) to assess its resilience thereby identifying opportunities for improvement

In 2020 **Powerco** engaged specialist climate change consultant Tonkin and Taylor to conduct a climate change vulnerability assessment. The initial assessment resulted in further work to develop Powerco’s Geographical Information System (GIS) to understand and visualise risk exposure to flooding and coastal inundation

Orion aligns their business continuity responsibilities using Civil Defence’s 4Rs approach to resilience planning – reduce, ready, respond and recover. Orion has also set a target by end FY2024 to introduce the methodology of the EEA Resilience Guide

Centralines network resilience maturity is assessed on an annual basis through the EEA’s Resilience Management Maturity Assessment Tool (RMMAT)

Horizon Energy has recently completed resilience gap analysis based on the EEA Resilience Guide. The gap analysis has been translated into an implementation plan to bridge the gap between EA’s practices and industry best practices

Network Tasman has conducted a specific risk analysis (based on ISO 31000 Risk Management framework) for each zone substation to assess the impact of incidents like earthquake, flood/Tsunami, coastal inundation/storm surge, extreme weather, landslip/movement. Network Tasman sees earthquake & liquefactions as key risks to the network. An individual assessment of each of the substations has been completed for earthquake and where required seismic strengthening activities have already been completed.

3.2 EDB Initiatives to Improve Resilience

There are a number of common themes for proactive resilience investments:

A Focus on recovery from HILP events

Example of EDBs investing to improve recovery from HILP events

Mainpower has invested in five power transformers held as strategic spares. These are surplus units that are held to support network resilience and emergency responses.

FirstLight is proposing the installation of 3 x new 750 kVA generators at different locations of the network to enhance supply security.

Westpower is commissioning a trailer mounted mobile standby generator for use in emergency situation.

Wellington Electricity has mobile substations to provide an alternate method for restoring supply during a major asset failure.

B Seismic strengthening of supply substations and offices

Example of EDBs investing to improve seismic strength of their assets

Powerco has conducted seismic assessment of zone substation buildings against the New Zealand Society of Earthquake Engineering (NZSEE) grades. Powerco's standard requires all zone substation buildings to be at least 67% of the new building standard (NBS). Since the completion of the assessment, Powerco has instigated a program to seismically strengthen zone substation buildings and switchrooms.

Electra has invested in a capex program to seismically strengthen zone substation buildings and other buildings, based on an earthquake of Richter magnitude 7.5 or greater on a major Wellington fault.

Wellington Electricity has an ongoing seismic reinforcement programme to strengthen substations to a minimum of 67% of NBS at Importance Level of IL4.

Centralines is planning seismic strengthening of transformer mounts at Takapau Zone Substation.

To improve resilience to major seismic events, **Marlborough Lines** has decided that pole-mounted transformers 200kVA and above are, where practical, replaced with a ground-mounted transformer of equivalent or bigger size.

C Resilient designs and equipment specifications for new or replacement assets

Example of EDBs adopting resilient standards in new asset designs and specifications

Orion is replacing end-of-life poles with higher strength poles that can withstand higher wind loading.

Powerco's standard LV pillars are vulnerable to coastal inundation as they are not waterproof. A newer submersible design is now used in those areas.

Unison's strategy is to improving network resiliency when undertaking investment to meet customer needs.

Marlborough Lines is currently considering whether a 1:100 year flood level standard is appropriate for critical assets or whether 1:250 or 1:450 (such as Transpower now use) is more appropriate.

Northpower is introducing new design standards for network assets aimed at reducing the risk of failure related to wind damage.

D Relocation of assets and facilities from flood-prone areas

Example of EDBs Relocating Assets & Facilities from Flood-prone areas

Vector is investing in a capex program for the relocation and elevation of zone substations to mitigate the risk of flood and inundation.

Marlborough Lines Alfred Street site, which houses the network control centre, is below earthquake code and has a number of structural issues including water-tightness. A decision has been made to relocate the network control room, demolish the site and rebuild.

While there are common themes, there are also significant variations in the initiatives to address resilience. Details of each EDB's plan can be found in Section 7.

3.3 Analysing EDB Expenditure on Resilience

With the exception of a few EDBs, resilience is not grouped in specific paragraphs or chapter in the AMPs. Rather, resilience is included in discussions on topics relating to risk management, network security, asset replacement & renewal, and reliability.

There are variations in how expenditure is grouped under the resilience theme. Some resilience expenditure such as network automation and replacement of copper conductors are more to do with reliability

improvement as these activities are not related to HILP events. Improvements in the design of new assets and specifications could be resilience related however the resultant increases in project cost have not been quantified.

Explicit expenditure in improving resilience is only available from a few EDBs, with a majority of EDBs incorporating resilience expenditure within the various capex or opex categories.

3.3.1 Resilience Capex

Some EDBs have included security of supply initiatives under growth capex. While load growth is a trigger for security of supply investment in accordance with EDBs' security of supply standards, IAEngg notes that resilience has also been mentioned as a driver for some security of supply initiatives. Some of these supply security initiatives under resilience, such as re-building/reconfiguring the GXP sub-transmission supplies, can be quite costly and would need to be spread over multiple years to reduce the impact on network capex and pass-through cost to customers.

Orion is proposing to replace bulk-supply point spoke-and-hub architecture with a far more resilient interconnected GXP ring architecture to increase its urban 66kV sub-transmission network's resilience against the impact of a major seismic event.

Aurora has a 20-year plan to implement a more resilient 33 kV meshed network architecture in Dunedin.

IAEngg notes that the resilience driver has also impacted asset replacement & renewal expenditure in that some assets are going to be replaced or renewed based on resilience considerations and not end-of-life. For example, Orion is proposing to replace more of its higher altitude poles that have been identified as high risk of wind damage. Specific initiatives of replacing assets before end-of-life need to be separately itemised from the general asset replacement if they are to be assessed appropriately.

Some EDBs are proposing to relocate assets due to resilience consideration e.g. moving assets to higher ground to avoid flooding.

The resilience driver is also affecting “non-network assets” expenditure. For example, Marlborough Lines is relocating its control room because the existing building is found to be below earthquake code and has a number of structural issues including water-tightness. Wellington Electricity head office is currently located in a tsunami evacuation zone and they have commenced planning to relocate the headquarters away from the coast in order to mitigate the risk.

Vector provides the most comprehensive details of its proposed resilience expenditure under the headings of

- Network hardening for floods and inundation - \$135M
- Network hardening for increase in wind speeds – \$77.14M (total expenditure for crossarm and overhead conductor replacement. An unknown % of this is to do with resilience)
- Network hardening for hot dry summers - \$1.53M

3.3.2 Resilience Opex

Resilience considerations have affected vegetation management opex of some EDBs as they found that supply interruptions caused by wind-borne tree branches and debris increased significantly with wind speed. With the

expected increase in storms caused by climate change, these EDBs have amended their vegetation management policy which has led to a cost increase.



3.4 EDB Justification of Expenditure on Resilience

There are not enough details in the AMPs to allow us to determine the reasonableness of proactive resilience expenditure:

Anecdotal evidence gathered from experiences of recent extreme weather events may not be the appropriate basis for investment. For example, if the recent weather event is a 1-in-200-year event but the resilience standard adopted by the EDB is to cater for 1-in-100-year events.

Appropriate risk assessment, option and cost/benefit analyses should accompany any significant resilience investment proposal.

3.5 EDB Performance against Good industry Practice

The following table provides commentary on each EDB against the five characteristics of good resilience planning discussed in section 2.4.3. A negative commentary does not mean that the EDB is not meeting good electricity industry practice, it just means the information cannot be found in the AMP.

EDB	Formal Framework	Resilience Standards	Balance between proactive expenditure and reacting / recovering after an event	Supporting evidences for targeted areas	Cost/Benefit assessment
Alpine Energy	YES	Not stated	No investment proposed	Not applicable	Not applicable
Aurora Energy	YES	Not stated	No	No	No
EA Networks	YES	Not stated	No investment proposed	Not applicable	Not applicable
Electricity Invercargill	YES	Earthquake more than 8 on Richter scale; Others not stated	No	No	No

FirstLight	YES	Learning from Cyclone Gabrielle used as standard for resilience planning	No	No	No
Horizon Energy	YES	Not stated	No	No	No
Nelson Electricity	YES	Not stated	No investment proposed	Not applicable	Not applicable
Network Tasman	YES	Not stated	No	No	No
Orion	YES	Not stated	No	No	No
OtagoNet	YES	Not stated	No	No	No
Powerco	Not sure	Seismic: NZ Society of Earthquake Engineering (NZSEE); Others not stated	No	No	No
The Lines Company	YES	Not stated	No	No	No
Top Energy	YES	Learning from severe weather events in 2022 & 2023 used as standard for resilience planning	No	No	No
Unison	YES	Not stated	Current focus on strategies and modelling	Not applicable	Not applicable
Vector	YES	Flood: 1-in-500-year; Wind: >70km/h; Climate change: Hothouse scenario	No	No	No

Wellington Electricity	YES	Seismic: NZ Society of Earthquake Engineering; Others not stated	No	No	Resilience initiatives have gone through business case process however not sure if cost/benefit has been assessed
Buller Electricity	YES	Not stated	No	No	No
Centralines	YES	Not stated	No	No	No
Counties Energy	YES	Not stated	No	No	No
Electra	YES	Seismic: based on Richter magnitude 7.5 or greater; Others not stated	No	No	No
Mainpower	YES	1-in-500-year flood standard; Others not stated	No	No	No
Marlborough Lines	YES	Not stated	No	No	No
Network Waitaki	?	Seismic: NZ Society of Earthquake Engineering; Others not stated	No	No	No
Northpower	YES	Not stated	No	No	No
Scanpower	YES	Not stated	No investment proposed for 2024-28	Not applicable	Not applicable
The Power Company	YES	Not stated	No	No	No
Waipa Networks	YES	Not stated	No	No	No
WEL Networks	YES	Seismic: NZ Society of Earthquake Engineering; Others not stated	No	No	No
Westpower	YES	Not stated	No	No	No

3.6 Transpower Resilience Planning

There is one section (Section 3.35) in Transpower’s 2022 AMP that addresses network resilience. As part of Transpower’s risk-based asset management planning, Transpower reviews its transmission network to identify sites prone to major natural hazards and potential mitigation strategies.

Resilience programmes have been developed as part of the planning for the RCP4:

Seismic strengthening of buildings	Flood – hardening critical and vulnerable towers in braided rivers
Flood – resilience solutions at substations	Fire – upgrades to fire stopping and detection in buildings
Volcanic – hardening transmission lines for a volcanic ash event	Slope stability work for towers and poles
Resilience for bridges and access tracks – washouts, slips, scour	Space weather mitigation for transformers
Pre-enabling works for major failures of non-air bushings/GIS	Overhead station earthwire elimination to eliminate a common mode failure
Emergency exercise of deployment of mobile switch room	Emergency exercise for tower restoration as a physical deployment
HVDC Wind and Flood – strengthening HVDC towers that are vulnerable to high winds and improving flood resilience where towers are in rivers	

The base program of RCP4 includes resilience network capex of \$69.1M which is 3.6% of the total requested capex. It also includes resilience network opex of \$5.5M which is 0.3% of the total requested opex. Transpower intends to undertake consultations to understand customers’ appetite for this resilience work to be funded as part of RCP4.

CAPEX OF

\$69.1M

Which is 3.6% of the total requested capex

OPEX OF

\$5.5M

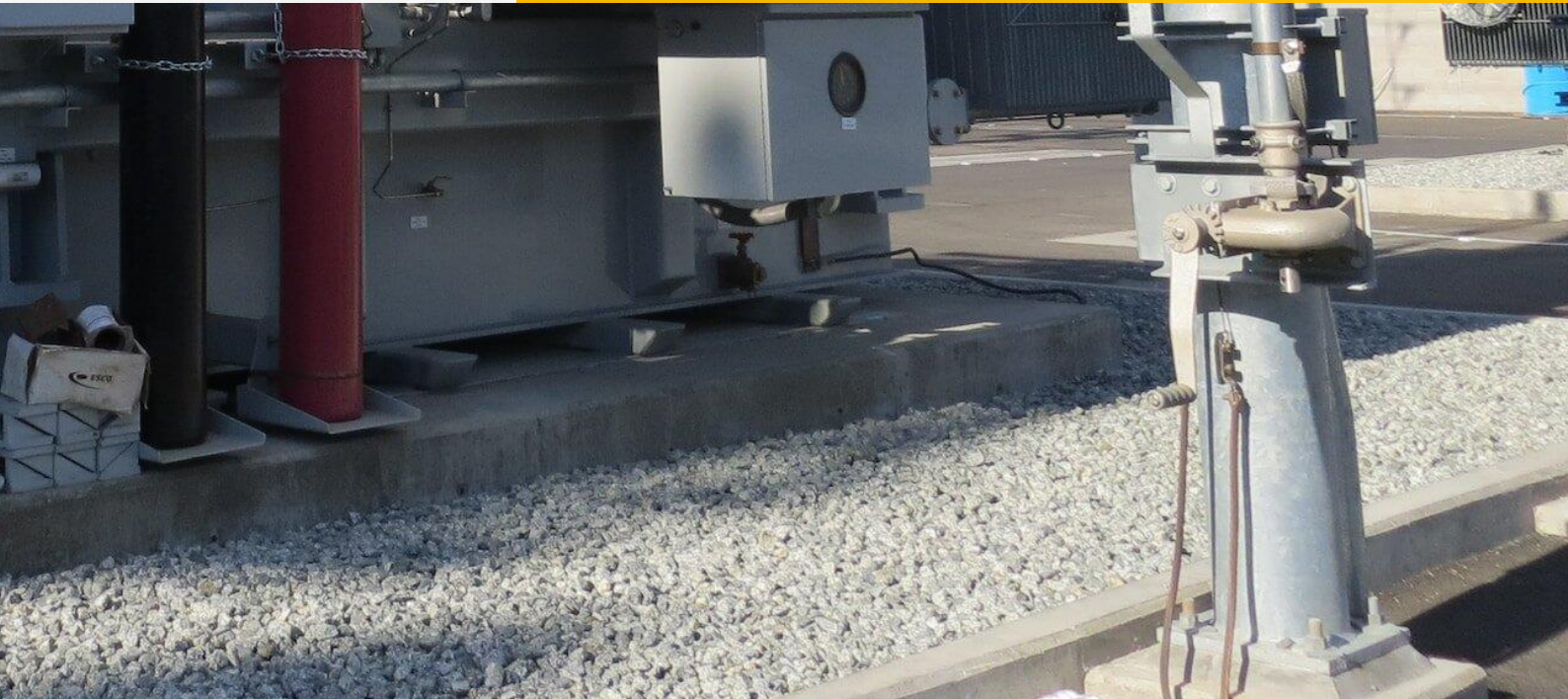
Which is 0.3% of the total requested opex

More details of Transpower’s resilience planning can be found in Section 6.



4

CONCLUSIONS



4 CONCLUSIONS

As a country New Zealand has experienced a number of natural disasters over its history including volcano eruptions, earthquakes, storms, cyclones and flooding. New Zealand is ranked as the second riskiest country in the world when it comes to natural disasters⁷ by Lloyds of London. EDBs operating in this environment have fine-tuned their emergency response capabilities using formal frameworks in emergency management, corporate risk management and asset management planning.

The commonly used 4Rs framework by NZ National Emergency Management Agency focuses on Reduction, Readiness, Response and Recovery. In the past EDB's emergency management has less focus on "Reduction" than the other 3 Rs. Proactive investments in risk reduction, however, have gathered pace and are seen in the 2023 AMPs.

The EDBs give a number of reasons for this transition:

Electricity is already an essential service but its importance has escalated due to forecast increase in electrification as a result of de-carbonisation.

Climate change modelling is pointing to an increase in the frequency and severity of droughts, storms and floodings.

Energy infrastructure is classified as "lifeline" utility so EDBs have existing duties as lifeline utilities under the Civil Defence Emergency Management Act 2002 to "function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency" (s. 60 (a)). While these duties are not new obligations, there is heightened awareness of the impact of extreme weather events from recent experiences in particular in 2023.

In January 2023, regions across the upper North Island of NZ experienced widespread catastrophic floods caused by heavy rainfall, with Auckland being the most significantly affected. Shortly afterwards, in February 2023 Cyclone Gabrielle caused significant devastation in northern and eastern regions of North Island. A national state of emergency was announced for only the third time in New Zealand's history. At the height of the cyclone's impact, around 225,000 homes were without power, and thousands of people were displaced as flood waters rose. Cyclone Gabrielle was described as NZ's costliest non-earthquake natural disaster.

⁷ Lloyds, "A world at Risk – Closing the Insurance Gap", October 2018 (<https://assets.lloyds.com/assets/pdf-lloyds-underinsurance-report-final/1/pdf-lloyds-underinsurance-report-final.pdf>)

Natural disasters resulting in large-scale disruption do not occur frequently. These rare events are normally referred to as High Impact Low Probability (HILP). Many EDBs have discussed the approach and framework they use to assess the risk posed by HILP events in their AMP. EDBs also discuss about climate resilience initiatives arising from their HILP risk assessment.

The initiatives can be broadly classified into four categories:

Initiatives to improve supply reliability such as network sectionalisation, installation of reclosers, new Advanced Distribution Management Systems to increase situation awareness and automatic switching order generation.

Modifying existing assets to increase their resilience against floods, earthquakes and strong wind.

Initiatives to rapidly respond and recover after large-scale supply disruptions, mostly to do with ready access to mobile generators, mobile substations & network asset spares, regular emergency exercises and mutual aid arrangements.

Design resilience in new assets and network configuration, making use of the opportunities presented by load growth augmentation, new customer projects and asset renewals.

IAEngg’s scope of resilience assessment includes the analysis of expenditure in resilience. Analysis of resilience expenditure has not been possible as the majority of EDBs do not separately itemise the expenditure they define as resilience related. Rather, the expenditure has been grouped into the various capex and opex regulatory categories. For the minority of EDBs who have stated the value of the resilience expenditure, the details can be found in EDB detailed analysis in Section 7.



IAEngg has found that there are differences in how EDBs classify resilience expenditure. We are of the opinion that reliability improvement expenditure should not be included under the resilience theme as their benefits apply to both normal supply interruption as well as HILP events. The expenditure can be justified based on current EDB approach in reliability improvement.

Even though IAEngg cannot determine the quantum of the proposed resilience expenditure, good industry practice for investment planning in a capital constrained industry would require methods to prioritise the expenditure to ensure the appropriate areas are targeted. Little details can be found in the AMPs to justify the areas targeted for resilience expenditure, the standards that have been applied (e.g. is resilience for a 1-in-100-year flood event, and if yes, is the standard appropriate?), cost/benefit assessments for capital rationing, and modelling to support an increase probability/ frequency of occurrence of the HILP events (if required for justification). This is not to say that the background work has not been undertaken, but that the work has not been presented in the AMPs.

In conclusion, IAEngg supports the notion of investing to “harden” the EDB networks against HILP events. Standardisation of the assessment framework, the resilience standards to be used, and approach for cost/benefit assessment is desirable as this will lead to more consistency in network resilience and should result in improved decision making. Last but not least, customers should be consulted on the level of resilience they are prepared to pay.





5

GLOSSARY



5 Glossary

4R	Reduction, Readiness, Response, Recovery
ADMS	Advanced Distribution Management System
AMP	Asset Management Plan
CAPEX	Capital Expenditure
CBRM	Condition Based Risk Management
CDEM	Civil Defence Emergency Management
ComCom	Commerce Commission
DPP	Default Price-quality Path
DSO	Distribution System Operator
EDB	Electricity Distribution Business
EEA	Electricity Engineers Association
GXP	Grid Exit Point
HILP	High Impact Low Probability
HV	High Voltage
HVDC	High Voltage Direct Current
IT	Information Technology
LV	Low Voltage
OMS	Outage Management System
OPEX	Operational Expenditure
RCP4	Regulatory Control Period 4
REPEX	Replacement Expenditure
RMMAT	Resilience Management Maturity Assessment Tool
RSE	Reliability, Safety & Environment
SCADA	Supervisory Control and Data Acquisition
SoSS	Security of Supply Standard



6

TRANSPOWER ANALYSIS



6 TRANSPOWER ANALYSIS

Name	Transpower
<p>Describe initiatives raised to improve resilience</p>	<p>In Transpower’s RCP4 proposal (as documented in Transpower’s 2022 AMP):</p> <ul style="list-style-type: none"> ● Seismic strengthening of buildings ● Flood – hardening critical and vulnerable towers in braided rivers ● Flood – resilience solutions at substations ● Fire – upgrades to fire stopping and detection in buildings ● Volcanic – hardening transmission lines for a volcanic ash event ● Slope stability work for towers and poles ● Resilience for bridges and access tracks – washouts, slips, scour ● Space weather mitigation for transformers ● Pre-enabling works for major failures of non-air bushings/GIS ● Overhead station earthwire elimination to eliminate a common mode failure ● HVDC Wind and Flood – strengthening HVDC towers that are vulnerable to high winds and improving flood resilience where towers are in rivers ● Emergency exercise of deployment of mobile switch room ● Emergency exercise for tower restoration as a physical deployment

Outcome area	Base (\$ million constant 2021/22)		Uncertainty mechanisms (\$ million)	
	Reliable and safe network	Capex	1,731.8	Listed projects
Opex		1,755.8	TransGO – low incentive rate project	88.0
Resilient network	Capex	69.1	Resilience uncertainty mechanism	35.0
	Opex	5.5		
Enabling electrification and connecting new renewables	Capex Opex	107.0 3.8	Enhancement and development: Reopener	5.0
			Customer capacity	75.0
			Connection anticipatory capacity	25.0

Proposed resilience expenditure in FY26-30 (Capex and Opex)

In Transpower’s RCP4, both capex and opex initiatives have been proposed for customer consultation:

<p>What assessment has been done to ascertain natural disaster risk to networks?</p>	<ul style="list-style-type: none"> ● Within the overall framework of asset management system and corporate risk assessment framework. ● As part of Transpower’s planning for the RCP4 programme of work, Transpower has developed resilience programmes to manage these risks.
<p>What standards are used for resilience initiatives</p>	<p>The AMP states that “the resilience planning is based on current research, and specific investigations to identify vulnerable and critical assets and then identify credible solutions to reduce the risk”.</p>
<p>What are the triggers for the resilience initiatives?</p>	<ul style="list-style-type: none"> ● The decarbonisation of the energy sector will see more reliance on electricity and societal expectations for a resilient service is increasing. ● Improve network resilience in the face of climate change.
<p>What assessment has been done to support the resilience expenditure?</p>	<p>The AMP states that “the resilience planning is based on current research, and specific investigations to identify vulnerable and critical assets and then identify credible solutions to reduce the risk”.</p>








7

**INDIVIDUAL
EDB
ANALYSIS**



7 INDIVIDUAL EDB ANALYSIS

7.1 Alpine Energy

 <p>EDB Name of EDB</p>	<p>ALPINE ENERGY</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Alpine sees significant uncertainty about impact of climate change-related weather events. In 2023/24 Alpine plans to carry out a risk assessment to better inform the future System Interruption and Emergencies (SIE) forecasts and support network resilience projects.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>No specific capex and opex provisions have been made for proactive resilience initiatives.</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>A risk assessment is planned for 2023/24 to inform climate-related resilience projects. The risk assessment will lead to the development of a network climate resilience strategy.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>ISO 31000 Risk Management — Principles and Guidelines is used for risk assessment.</p>



TRIGGERS

What are the triggers for the resilience initiatives?

- » Scientific research by Te Herenga Waka - Victoria University indicates that there is a 75% probability of an Alpine Fault earthquake occurring in the next 50 years, with an 82% chance that it will be a magnitude 8+ event which would likely have a significant impact on Alpine’s infrastructure
- » Alpine’s region experiences cold winters and is subject to weather extremes including snow and high wind events, especially in the Mackenzie District
- » The frequency of high wind events in South Canterbury is projected to increase as a result of climate change
- » Urban clean air restrictions on solid fuel heating sources across Alpine’s region has resulted in an increased reliance on electricity for home heating
- » Alpine’s network spans several rivers prone to flooding during north-west weather patterns. The frequency and severity of north-west flood events for Canterbury rivers are projected to increase because of climate change
- » Parts of Alpine’s network, including infrastructure connecting large industrial customers, are within coastal high hazard erosion and inundation areas








ASSESSMENT

What assessment has been done to support the resilience expenditure?

Climate change impact on weather patterns and seismic academic research

7.2 Aurora Energy

 <p>EDB Name of EDB</p>	<p style="text-align: center;">AURORA</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Accelerated renewals for assets at risk to major events – sea level rise, wind, snow storm and earthquake and fires. Options and solutions for integrated risk quantification and investment optimisation uncertain.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Apart from the Dunedin project, there was insufficient details to separate out the resilience improvement expenditure.</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Aurora conducts asset health and risk modelling and included resilience as one of the drivers of their asset replacement program. Opportunities to increase resilience are taken, where cost is comparable to like-for-like replacement.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Aurora’s approach is based on the 4 Rs of business continuity – Reduction, Readiness, Response and Recovery, as used by emergency services and other lifeline utility operators in New Zealand. Aurora have added an additional R of Review as part of its business continuity framework.</p>



TRIGGERS

What are the triggers for the resilience initiatives?

Aurora stated their role is ‘to ensure the safety and resilience of the network and deliver a reliable electricity service to over 93,600 homes, farms and businesses throughout the regions we serve’. In line with this corporate mission, Aurora’s stated throughout the AMP that ensuring / improving resilience is one of main drivers of their asset management activities, eg. resilience is an asset portfolio objective in Aurora investment planning.










ASSESSMENT

What assessment has been done to support the resilience expenditure?





Aurora stated in 2023 AMP “To improve resiliency, we have created and started a 20-year plan to implement a more resilient 33 kV meshed network architecture in Dunedin..... In RY24 we will replace all pole mounted 11 kV fuses in the Central Otago high risk fire zone with a type that prevents an arc forming when operating. Apart from these two programs, Aurora has not identified explicitly in the AMP other forecast expenditure relating to resilience improvement. There are also no details (qualitative or quantitative) on how Aurora conducts the risk assessments and cost benefit assessments relating to resilience improvement expenditure. Aurora did state in 2023 AMP executive summary “Following our review of resiliency preparedness, we will update our forecasts in our 2024 AMP to reflect the actions and investments we propose are in the long-term interests of consumers.”

7.3 EA Networks

 <p>EDB Name of EDB</p>	<p>EA NETWORKS</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>EA Network’s plan for network resilience is based on the use of emergency response plans and mutual support agreements.</p> <p>Natural disasters are assessed by evaluating the risk cost for each event (probability times the consequences of failure cost) and developing appropriate contingency plans and procedures to ensure business continuation and mitigation of impacts respectively.</p> <p>The recent rapid rate of network development has resolved some of the most critical historical risks that have been identified in the past.</p> <p>During 2024, a complete review of the network risk register will be carried out to ensure the evaluation of risks is consistent with the current version of the EA Networks risk management standard.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>No specific capex and opex provisions have been made for proactive resilience initiatives.</p>

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Assessment carried out as part of the EA Networks' risk management process.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>ISO 31000 Risk Management — Principles and Guidelines is used for risk assessment.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Not applicable</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>No specific resilience expenditure has been proposed.</p>

7.4 Electricity Invercargill

 <p>EDB Name of EDB</p>	<h3 style="text-align: center;">ELECTRICITY INVERCARGILL (EIL)</h3>	
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<ul style="list-style-type: none"> » Projects underway to investigate and improve survivability through large seismic events. » Completion of Seismic strengthening works » Design of Networks to avoid high event probability areas » Design Structures and buildings to cater for Seismic events 	
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Resilience expenditure not identified in the AMP</p>	
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>During planning stages, EIL takes into consideration potential areas of flooding as well as possible long term sea level rises into consideration</p>	



STANDARDS

What standards are used for resilience initiatives

- » Risk Management framework consistent with ISO 31000: 2018 Standard: Risk Management – Guidelines
- » Impact of extreme weather has been identified as a risk and treatment plans are put in place
- » For HILP especially earthquake an event of Richter scale measurement >8



TRIGGERS

What are the triggers for the resilience initiatives?

Part of EIL’s BAU risk management process involves the assessment of “High Impact Low Probability” (HILP) events which includes earthquake, Tsunami and Liquefaction.
 Snow, wind & Flood are also considered under weather related risks




ASSESSMENT

What assessment has been done to support the resilience expenditure?

High risk areas on the network are identified and indicated in EIL GIS system and these areas are avoided as far as possible in the planning phase

7.5 FirstLight

 <p>EDB Name of EDB</p>	<p>FIRSTLIGHT</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Firstlight has enhanced its resilience strategy post Cyclone Gabrielle. The following are the resilience improvements initiatives of Firstlight</p> <ul style="list-style-type: none"> » Assessing wind, flooding and geotechnical hazards and implementing mitigation plans where appropriate (consistent with climate change) » Assess the worst-performing feeders to determine if there are improvement opportunities available » Assessing the risk posed by pre-2000 overhead lines and implementing mitigation plans where appropriate » Enhancing contingency plans, mutual aid plans, and spares holding » Enhancing SCADA and OMS » Enhancing vegetation management activities concerning key feeders and the out-of-zone trees » Increasing distribution network automation and security enhancements, particularly the opportunities to enhance generation use



CAPEX / OPEX

Proposed resilience expenditure in FY26-30

Firstlight has included three new development projects in 2023 AMP

- » Installation of 3 x new 750 kVAe generators at different locations of the network to enhance supply security at a cost of **\$3.2million**
- » The installation of a second transformer at Tolaga Bay to improve the firm 11kV capacity available from Tolaga Bay to support adjacent substation at a cost of **\$1.57million**
- » Replacement of SCADA master station and development of switch-order management and outage management system at a cost of **\$2.6million**



RISK ASSESSMENT

What assessment has been done to ascertain natural disaster risk to networks?

Firstlight uses EEA’s Resilience Management Maturity Assessment Tool (RMMAT) to ascertain its strengths and weaknesses in network resilience.

The weaknesses in risk identification and mitigation, design standards, contingency planning and response systems and processes have been considered in developing its resilience strategy.



STANDARDS

What standards are used for resilience initiatives

Firstlight uses the 4R framework defined in the National CDEM Plan – Reduction, Readiness, Response and Recovery, as used by emergency services and other lifeline utility operators in New Zealand.



TRIGGERS

What are the triggers for the resilience initiatives?

Firstlight’s main triggers for the resilience initiatives are the effects of extreme weather events brought about by the impact of Climate change. Cyclone Gabrielle is also a major contributing factor to resilience initiatives.

Firstlight has made a material change to the asset management strategy in this AMP. The material change is to enhance the resilience initiative.










ASSESSMENT

What assessment has been done to support the resilience expenditure?





Each of the resilience initiatives identified has been converted into a project through the investment planning process. Solutions are identified for each issue including alternative options and weighed against each other before an option is finalised and funding approved.

7.6 Horizon Energy

 <p>EDB Name of EDB</p>	<p>HORIZON ENERGY</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<ul style="list-style-type: none"> » Recently completed resilience gap analysis based on EEA Resilience Guide. The gap analysis has been translated into an implementation plan to bridge the gap between EA’s practices and industry best practices. Focus for FY24 is identifying building strengthening work of substation buildings and assets, and verification of EEA’s contingency and switching plans through a collaboration with the University of Auckland. » Climate change risk matrix developed in conjunction with the Bay of Plenty Lifeline Utilities Group (BOPLG) and Tonkin & Taylor (T&T). In the process of assessing climate change risk and adaptation plan which may lead to increase in future capex.
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<ul style="list-style-type: none"> » New resilience-related expenditure on seismic assessment and strengthening of approximately \$2.8M over the 10-Y period. Will be updated in 2024 AMP once all seismic assessments are completed. » An allowance made in Routine & Corrective Maintenance & Inspection for additional maintenance requirements to adapt to the new climate change environment

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Initial self-assessment on EA’s Resilience Management Maturity (RMMAT) against the EEA Resilience Guide and New Zealand’s 4R approach to hazard management.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Not provided</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Gap analysis from application of EEA Resilience Guide and Maturity assessment</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>Building seismic assessment</p>

7.7 Nelson Electricity

 <p>EDB Name of EDB</p>	<p>NELSON ELECTRICITY (NEL)</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>NEL sees earthquake, liquefactions, tsunami, flooding and sabotage as key risks to the network</p> <p>NEL, as part of the design process, considers resilience to mitigate catastrophic risks associated with a natural disaster.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>IAEngg couldn't identify any proposed expenditure specific or related to Resilience in NEL's 2023 AMP</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>NEL being the smallest network in New Zealand has only one substation on the network. A specific risk analysis to assess the impact of incidents like earthquake, liquefaction, tsunami, flooding and sabotage has been undertaken by NEL.</p> <p>An individual assessment of NEL's substation has been completed for earthquake and, where required, seismic strengthening activities have already been completed.</p> <p>NEL has conducted an additional study to identify areas of liquefaction risk to NEL. Reports have highlighted that assets are more likely to suffer damage and potentially assist NEL in the future development of the network, but we couldn't identify further details of this in the AMP</p>



STANDARDS

What standards are used for resilience initiatives

NEL approach is based on ISO 31000 Risk Management framework. Exposure to Natural Disasters is assessed and mitigation plans are put in place to manage these risks.



TRIGGERS

What are the triggers for the resilience initiatives?

NEL's risk management process involves the assessment of Earthquake, Liquefaction, Tsunami, Flooding and Sabotage.






ASSESSMENT

What assessment has been done to support the resilience expenditure?

No forecast spend or assessments related to resilience are detailed in the 2023 AMP.

7.8 Network Tasman

 <p>EDB Name of EDB</p>	<p>NETWORK TASMAN (NTL)</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>NTL sees earthquake & liquefaction as key risks to the network</p> <p>NTL designs all their new facilities to seismic strengths in line with infrastructure importance level and they are progressively upgrading their structures to provide earthquake resilience.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>AMP states “Treatment options of the identified risks take the form of network capital works projects to reduce exposure to the risk and/or mitigate the impact”.</p> <p>Apart from \$35k forecast for SCADA System Resilience Project in 2024, NTL has not identified any other projects in the AMP forecast expenditure relating to resilience improvement.</p>



RISK ASSESSMENT

What assessment has been done to ascertain natural disaster risk to networks?

A specific risk analysis has been completed for each of the Zone Substations to assess the impact of incidents like earthquake, Flood/Tsunami, Coastal inundation/Storm surge, extreme weather, landslip/movement and the expected performance of the network has been undertaken by NTL.

A response plan has been put together for each of these incidents under the Disaster Readiness and Response Plan.

An individual assessment of each of the substations has been completed for earthquake and where required seismic strengthening activities were already completed.



STANDARDS

What standards are used for resilience initiatives

NTL approach is based on ISO 31000 Risk Management framework. Impact of extreme weather events are assessed treatment plans are put in place to mitigate risks.



TRIGGERS

What are the triggers for the resilience initiatives?

Part of NTL's BAU risk management process involves the assessment of "High Impact Low Probability" (HILP) events which includes earthquake, Tsunami, storm, flood and Liquefaction.

Feedback from Consumers for improving power supply infrastructure to increase resilience in case of more weather events.





ASSESSMENT

What assessment has been done to support the resilience expenditure?

No assessments are detailed in the AMP to support the new expenditure related to Resilience identified in 2023 AMP.

7.9 Orion

 <p>EDB Name of EDB</p>	<p>ORION</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Resilience is one of Orion’s Asset Management Objectives and as such, is an investment driver. The following are some of Orion’s initiatives to improve resilience:</p> <ul style="list-style-type: none"> » 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 » Increase our vegetation management programme to reduce the incidence of trees damaging our network, particularly in windstorms » Replace more of our higher altitude poles » Climate adaptation of distribution substations and kiosks in areas that are vulnerable to increased flooding or higher summer temperatures; » Replace bulk-supply point spoke-and-hub architecture with a far more resilient interconnected GXP ring architecture to increase our urban 66kV sub-transmission network’s resilience against the impact of a major seismic event, and







- » Replace the remaining 40km of oil filled 66kV cables over ten years or so.
- » Region A 66kV subtransmission resilience – HV major projects
- » Southwest Christchurch and surrounding areas’ growth and resilience – HV major & minor projects
- » Lincoln area capacity and resilience improvement – HV major & minor projects
- » Rolleston area capacity and resilience – HV major projects
- » Hororata GXP capacity and resilience – HV major projects
- » Enhancing our Advanced Distribution Management System (ADMS) to enable improved grid efficiency and resiliency to allow us to remotely respond to outages and other grid conditions quickly and safely
- » Orion is partnering with community groups such as Community Energy Action and engaging with our customers to address energy equity and community resilience.










CAPEX / OPEX

Proposed resilience expenditure in FY26-30



IAEngg did not come across the individual costs of these programmes.

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment undertaken to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Orion aligns its business continuity responsibilities using Civil Defence’s 4Rs approach to resilience planning – reduce, ready, respond and recover. Orion has also set a target by end FY2024 to ‘Introduce the methodology of the EEA Resilience Guide (The guide offers advice to electricity providers on how to prepare their networks and their organisations and respond better to disruptions of any kind; be it earthquakes, volcanic events, pandemics or technology change).</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Resilience is an Orion asset management objective and, as such, is considered in most investment cases.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>Not provided in the AMP</p>

7.10 OtagoNet

 EDB Name of EDB	OTAGONET
 INITIATIVES Describe initiatives raised to improve resilience	<p>There's very limited resilience related information in Otago Net's AMP, the AMP did indicate improving resilience against seismic activity is the focus within the planning period. For example, Otago Net planned to replace ten buildings during the ten year planning period when outdoor structures are replaced with seismically resilient indoor switchboards.</p> <p>IAEngg did not come across any individual costing of resilience improvement programmes.</p> <p>IAEngg also did not come across details on specific assessment done to ascertain natural disaster risk. OtagoNet did state their design standard specifies wind loading, snow loading resilience levels. OtagoNet (document no AM-STD-0026 EXTERNAL) has adopted the methodology of the EEA Resilience Guide (The guide offers advice to electricity providers on how to prepare their networks and their organisations and respond better to disruptions of any kind; be it earthquakes, volcanic events, pandemics or technology change).</p> <p>IAEngg did not come across information indicating whether OtagoNet aligns its resilience planning with the 4Rs approach – reduce, ready, respond and recover.</p>
 CAPEX / OPEX Proposed resilience expenditure in FY26-30	
 RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?	
 STANDARDS What standards are used for resilience initiatives	
 TRIGGERS What are the triggers for the resilience initiatives?	
 ASSESSMENT What assessment has been done to support the resilience expenditure?	

7.11 Powerco

 <p>EDB Name of EDB</p>	<p>POWERCO</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Powerco considers the most efficient way to incorporate climate adaption or resilience is to include it into the design standards, so that resilience and climate adaption planning is “baked in” to Powerco’s asset management approach and is not a separate undertaking or consideration.</p> <p>In 2020 Powerco engaged specialist climate change consultant Tonkin and Taylor to conduct a climate change vulnerability assessment. The initial assessment resulted in further work to develop Powerco’s Geographical Information System (GIS) to understand and visualise risk exposure to flooding and coastal inundation.</p> <p>An in-depth review of network resilience to emerging climate extremes is planned for 2023. Following this, Powerco will consider the architecture of the network and design standards, to ensure appropriate resilience. Re-designing the network of the future to be resilient to climate change impacts will be a core activity going forward.</p> <p>Powerco’s climate change adaptation strategies cover five options:</p> <ul style="list-style-type: none"> » “Do nothing” - Climate change is not considered a threat to this asset class; » “Organic” - The rate of renewal through age or condition is sufficient to allow adaptation with minor evolutionary changes to asset specifications that marginally affect costs;

- » **“Proactive”** - Climate change-related threats require proactive action in the near-term future;
- » **“Remediation”** - The asset is at risk. Improvements can be justified against current climate conditions;
- » **“Redevelopment”** - while climate change drivers may not render the asset unsuitable, land use or other public infrastructure changes may drive the need to replace the asset. For example, road raising, or relocation works to allow for adaptation to sea level rise.

Examples of these options include:

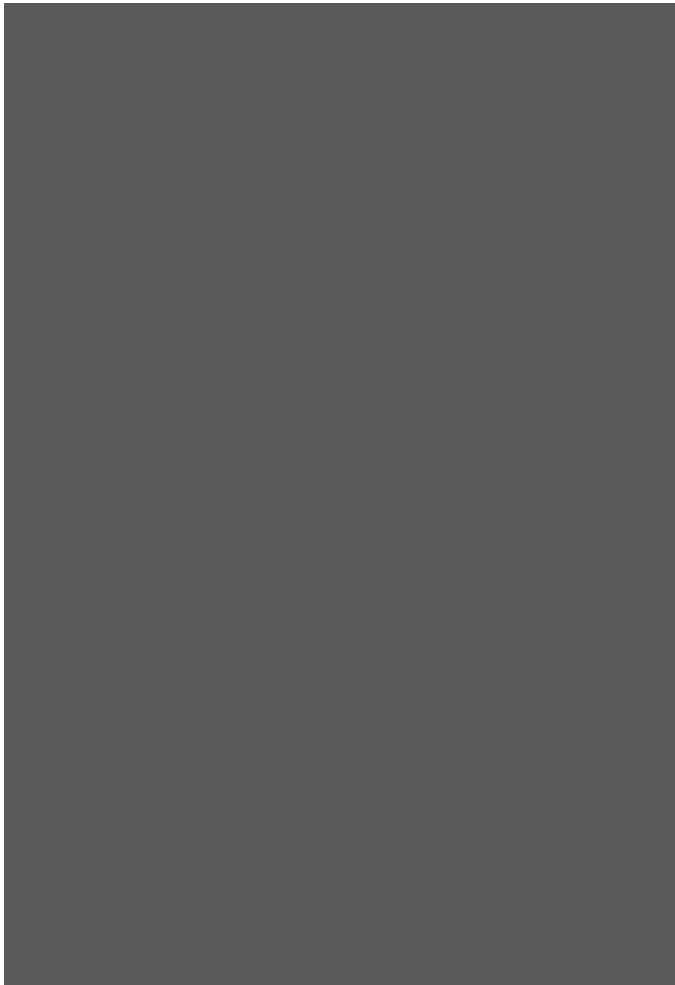
- » **Organic adaptation** – (1) standard LV pillars are vulnerable to coastal inundation as they are not waterproof. A newer submersible design is now used in those areas; (2) as part of the power transformers renewal programme, Powerco undertakes opportunistic review and upgrade transformer foundations to ensure appropriate seismic performance.
- » **Remediation adaptation** - In 2012, Powerco started a programme to seismically assess all our substation buildings. 140 of the zone substation buildings were assessed against the New Zealand Society of Earthquake Engineering (NZSEE) grades. Powerco’s standard requires all zone substation buildings to be at least 67% of the new building standard (NBS), equivalent to B grade or better. The review indicated 53 of the buildings required seismic strengthening. A programme has been put in place to strengthen these buildings. To date, 17 buildings have been reinforced and the remaining 36 will be reinforced during the next 10 years.

- » **Redevelopment adaptation** - Where equipment within the building has reached end of its service life, the suitability of the building to meet future demand is assessed before completing any reinforcement works. If the building is no longer suitable for the future growth of the network or replacement equipment, a new building is constructed.

The 2023AMP contains only “no-regrets” expenditure to increase network resilience. Cyclone Gabrielle (12 Feb 2023, considered New Zealand's costliest non-earthquake natural disaster affecting northern and eastern regions of North Island) has had significant impact on the Powerco network - more than 105,000 households and businesses (30% of customer connections) on the network were without power for periods during and after the cyclone. More expenditure could be proposed in the 2024AMP after completion of Cyclone Gabrielle investigation.

General Network risk assessment (Appendix 5) has included the following descriptions on natural disasters and severe weather events:

- » “Natural disaster which severely impacts the network (likely to be on a regional basis e.g., Palmerston North earthquake or Taranaki eruption)”. Existing control measures summarised as “(a) Crisis response plans and business continuity framework (b) Backup network operations facilities in New Plymouth and network triage capability from Tauranga (c) Material damage and business interruption insurance for office / network restoration (d) \$100m revolving facility for non-insured assets (e.g., poles and lines) Scenario analysis of sufficient access to funding. The current risk score is “medium”;



- » "Severe weather event which adversely affects Powerco's ability to respond to network and customer issues". Existing control measures summarised as "(a) Capital programme resources to respond to storms and other events (b) Resource planning and local hub activation to mitigate dependence on control room co-ordination in peak events (c) CIMS Training of Powerco and Downer employees (d) Alternate NOC facilities.

Capex

- » Seismic strengthening of substation building and switchroom e.g. Whangamata 11kV switchroom has a seismic strength of 15% NBS, which is below the 67% NBS value required for seismic compliance. Seismic strengthening was carried out in 2022-23 at a cost of \$223k (p.417); The Kerepehi switchroom has been seismically strengthened, however, the adjacent crane room has not been seismically strengthened and there are geotechnical issues with the existing switchroom foundations. Proposal to install a new 11kV switchboard in a new Kerepehi switchroom as part of a \$2.6M project planned for 2026-28 (p.413).

Opex





- » Cut out-of-zone vegetation near critical network sections – cater for severe storm situations






CAPEX / OPEX

Proposed resilience expenditure in FY26-30

It is not clear what capex and opex provisions have been made for proactive resilience initiatives.



 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Seismic assessment of zone substation buildings was carried out against the New Zealand Society of Earthquake Engineering (NZSEE) grades. Powerco’s standard requires all zone substation buildings to be at least 67% of the new building standard (NBS)</p> <p>More expenditure could be proposed in the 2024AMP after completion of full assessment of network damage caused by the Cyclone Gabriele.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Powerco sees the need to enhance reliability and resilience standards to harden the network to meet increasing climate extremes.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Part of Powerco’s BAU asset management and risk management process involves the assessment of “High Impact Low Probability” (HILP) events which includes network resilience.</p> <p>Powerco considers improving maturity will include new ways to analyse the risk. This includes understanding the impact of natural disasters on vulnerable portions of the network.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>As above</p>






7.12 The Lines Company

 <p>EDB Name of EDB</p>	<p>THE LINES COMPANY (TLC)</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>TLC recognises that decarbonisation and growing reliance of electricity in future will require networks to be significantly more resilient. In the short to medium term, TLC stated that building resilience in their power transformer fleet is amongst one of their five planning objectives.</p> <p>TLC analysis indicates the total marginal cost to provide capacity (including increased capacity of regional supply points, zone substations and lines) for its network is ~\$2.95m per MW increase.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>IAEngg did not come across sufficient information in the AMP to estimate the amount of investment that can attributed to increasing resilience. For example, TLC indicated they have allocated an average of \$3.1m per annum during the planning period (excluding the Hanganatiki GXP upgrade) to increase the reliability and capacity of their 29 substations. Since 2019 TLC have maintained a high annual vegetation expenditure of ~\$1.4m resulting in an improvement of in zone vegetation outages.</p>




 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment undertaken to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>TLC resilience planning is guided by the 4Rs: risk reduction, readiness, response and recovery, Resilience of networks will improve by focusing on the 4Rs: risk reduction, readiness, response and recovery.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>TLC overlays asset resilience, criticality, and fault history with localised weather forecasting to predict where extreme weather is most likely to impact supply on our network.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across details on specific assessment.</p>





7.13 Top Energy

 <p>EDB Name of EDB</p>	<p>TOP ENERGY</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Top Energy is reviewing a resilience package which is likely to be included into its 2024 AMP. Top Energy has identified the following resilience initiatives that are yet to be approved by the board to be included in 2024 AMP</p> <ul style="list-style-type: none"> » Group fusing to isolate spurs » Distribution Feeder Interconnection » Network Automation » Covered conductors on targeted lines » Undergrounding of Vulnerable spans of existing lines » Pole replacements » Connect Mobile Diesel Generation Units to HV & LV Circuits » Provide Individual Portable Generation Units » Top Energy’s 110kV Kaikohe-Kaitaia line route is becoming more geotechnically unstable, presumably due to climate change, and there is increase in risk of a structure failure. Top Energy has identified the most vulnerable structures on the 110kV Kaikohe-Kaitaia line and are working with a consultant to develop preliminary designs and identify possible locations for permanent replacement structures, should they be needed.



 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Top Energy has not made provisions for HILP Resilience type events in the 2023 AMP. Top Energy has completed an assessment which takes into account various HILP scenarios. Top Energy is reviewing a CAPEX resilience package of around \$5million that will feed into the 2024 AMP if approved by Top Energy executive Management.</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Top Energy evaluates its network resilience performance on a periodic basis through the use of EEA’s Resilience Management Maturity Assessment Tool (RMMAT).</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Top Energy’s Emergency preparedness and response plan is based on the 4R framework of resilience – Reduction, Readiness, Response and Recovery, as used by emergency services and other lifeline utility operators in New Zealand.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Top Energy Asset Management policy is to develop a network that is resilient to high impact, low probability events.</p> <p>Top Energy’s main triggers for the resilience initiatives are the effects of weather events brought about by Climate change. The recent storms & cyclones between 2022 and 2023 are a major contributing factors to resilience initiatives.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>No forecast spend related to resilience is detailed in the 2023 AMP.</p>

7.14 Unison

 <p>EDB Name of EDB</p>	<p style="text-align: center;">UNISON</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Providing a resilient electricity supply is a feature of Unison’s mission statement: “Unison provides a safe, reliable, and resilient electricity supply to over 118,000 consumers across the Hawke’s Bay, Rotorua, and Taupō districts”</p> <p>Section 1, 1.10 of the AMP detailed Unison’s Network Resilience Initiatives which include:</p> <ul style="list-style-type: none"> » Development of a climate change adaption strategy » Development of a network vulnerability assessment model » Adoption of the Coordinated Incident Management System (CIMS) » Compilation and institutionalisation of a critical sites register and » Review and refresh and network spares strategy and associated documentation.
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Unison stated in the AMP that it is their preference to consider improving network resiliency at the same time when undertaking investment to meet customer needs. Predominant contributions to Unison’s 2023/24 defined project renewal spend includes three major substation rebuilds following Cyclone Gabrielle.</p>

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Unison’s network resilience maturity is assessed on an annual basis through the EEA’s Resilience Management Maturity Assessment Tool (RMMAT).</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>The Resilience Management Maturity Assessment Spreadsheet Tool (RMMAT) developed by Unison was adopted by the EEA and included in EEA’s Resilience Guide. The tool is very similar to the Commerce Commissions, Asset Management Maturity Assessment Tool (AMMAT) which measure EDB’s maturity across the “4R’s of Resilience Management (Readiness, Reduction, Response & Recovery).</p> <p>Unison stated in its AMP that in the 2023/24 financial year, Unison will be undertaking a companywide, strategic initiative to better understand the most likely impacts of climate change on its asset portfolio and network, to determine what responses will be required. A specific, climate change adaptation strategy will be developed and include the formulation of proactive, risk mitigation pathways to any identified network vulnerabilities including likely implementation timeframes.</p> <p>At part of its resilience planning, Unison stated that it is in the process of updating and formalising a comprehensive register of critical sites connected to its electrical network.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Unison’s asset management strategy included “Network resilience should be reviewed based upon climate change projections.”</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across any detailed assessment relating to resilience expenditure</p>

7.15 Vector

 <p>EDB Name of EDB</p>	<p>VECTOR</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Capex Significant uplift is found in “reliability, safety and environment – others” capex. The explanation offered in the 2023 AMP is “additional provisions are allowed to improve network resilience in distribution overhead line hardening (\$70m), sub-transmission undergrounding (\$105m), and relocation and elevation of zone substations to mitigate the risk of flood and inundation (\$14m)”. (The comparison is to 2022AMP.) Our analysis indicates an average annual uplift of \$45.8M when comparing FY21-23 with FY24-FY33, which cannot be explained by the AMP variance analysis alone. It is possible that the 2022AMP has already factored in network resilience expenditure and the 2023AMP has further increased the provision. Details are:</p> <ul style="list-style-type: none"> » Sub-transmission line undergrounding (P.276) and four sub-transmission cable replacement projects (\$27m) in FY26. » Proposes the start of a program of fault Passage Indicator (FPI) installation from FY26 onwards, with an annual spend of \$0.36M » A step-up in “Network automation & isolation” capex of \$2.7M per year from FY26 onwards (P.154). The strategy is to try and limit the number of customers impacted by an outage to less than 500.

- » Network hardening for floods & inundation of \$27M per annum starting in FY26.
- » Network hardening for increase in wind speed consists of the use of CCT (trials, no \$ for widescale rollout as yet), replacement of wood with composite crossarm (a step-up of around \$2.7M per annum – compared with FY24-25 – from FY26-33) (P.160), increasing use of lightning arresters (no \$ provided in AMP), overhead conductor renewals (\$74.33M from FY26-FY33) (P.160)
- » Network hardening for hot dry summers consists of replacement of expulsion drop-out fuses by the current limiting equivalent (\$300k per annum) (P.162)

These represent capex programs specifically targeting resilience. There are other reliability improvement initiatives that have more focus on reliability but also include a component on resilience e.g. 11kV RMU replacement where opportunity is taken to either rebuild the RMU in an elevated position or relocate to sites less prone to flooding.

Opex

- » \$5.5M increase in Service interruptions and Emergencies expenditure is largely attributable to an increase in exceptional maintenance expenditure provided for major weather-related events
- » \$15.1M increase in vegetation expenditure including allowance of additional \$1.5m per year from FY26 for network resilience for expected increase in future weather-related events



CAPEX / OPEX

Proposed resilience expenditure in FY26-30

Capex summary

- » Network hardening for floods and inundation - **\$135M**
- » Network hardening for increase in wind speeds – **\$77.14M** (total expenditure for crossarm and overhead conductor replacement. An unknown % of this is to do with resilience)
- » Network hardening for hot dry summers - **\$1.53M**

Opex summary

- » Service interruptions and emergencies - **\$2.92M**
- » Vegetation management - **\$10M**



RISK ASSESSMENT

What assessment has been done to ascertain natural disaster risk to networks?

Network hardening for floods and inundation

- » The Auckland Region Climate Change Projections and Impacts report from NIWA, and GIS modelling conducted against Vector’s asset base provides a base level of knowledge to prepare for the impacts of climate change with regards to floods and inundation.
- » From actual experiences from the 2023 floods: Wairau zone substation, that is in an overland flood path, no damage was sustained to the 33 kV/11 kV switchgear room which was constructed at a height well above the flood plain (designed for a 1-in-500-year flood). However, the power transformers at Wairau, that were installed in the 1960’s, all sustained damage to their control circuits that were not installed at height, at the time. This resulted in water penetration, damage and outages of transformers at this zone substation.

Network hardening for increase in wind speeds




- » Reliability analysis indicates increased supply interruptions for wind speed above 70km/h caused by wind-borne debris. The risk associated with higher wind speeds was shown during the April 2018 storm and the severe winds of the January and February 2023 flood and storm events.
- » Climate scenario model (the hothouse represents a worst-case climate change trajectory where the world maintains a business-as-usual trajectory of fossil fuel consumption) provides projections of hours of wind speeds per year greater than 70km/h.
- » To manage the impact of vegetation, Vector utilises a risk-based approach to plan and then carry out opex related remediation work. This involves an independent company to scope, plan and package the work using the risk-based approach and also carry out audits of work undertaken, in conjunction with Vector's in house expertise, to ensure work has been undertaken correctly.

Hardening for ground geotechnical conditions

- » Under study

Hardening for hot dry summers

- » Replacement of expulsion drop-out fuses which can emit molten materials during operation and cause fire ignition. There is well proven experience of utilities in Victoria that such fuses can cause bushfire ignition.

	<p>» It is, however, not clear if the sites chosen for fuse replacement have high bushfire ignition risks.</p> <p>At the time of preparing the 2023 AMP, Vector was unable to complete its full assessment of network damage caused by the extreme weather events in January/February 2023.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>As above</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Part of Vector’s BAU risk management process involves the assessment of “High Impact Low Probability” (HILP) events which includes network resilience. Concrete proposals for capex and opex are based on experience and investigations performed for those events.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>As above</p>

7.16 Wellington Electricity



EDB
Name of EDB

WELLINGTON ELECTRICITY (WELL)



INITIATIVES
Describe initiatives raised to improve resilience

WELL's has carried out a number of initiatives to improve network resilience.

- » WELL uses a relatively high wind loading when designing overhead lines to improve network resilience
- » WELL network's system security standard is designed to provide a security of N-1 at zone substation level
- » Cable route resilience is considered as part of the route selection process for new sub transmission cables.
- » WELL'S mobile substations provides an alternate method for restoring supply during a major asset failure
- » Central Park substation – work is ongoing between WELL and Transpower looking at potential solutions to improve the resilience of the site.
- » To reduce reliance on cellular networks a modern digital radio system has been installed to improve connectivity and coverage



- » WELL has an ongoing seismic reinforcement programme to strengthen substations to a minimum of 67% of NBS at Importance Level (IL4)
- » 3 x data centres were constructed within the network to provide access to critical operating software and data if communications fail to a Network Control Room
- » WELL has commenced planning to relocate its head office to move away from the coast in order to mitigate the Tsunami risk.
- » Critical spares and were procured and store locations setup throughout the network
- » Construction of Central Park II Substation
- » Replacement of sub transmission cables as part of an integrated cable replacement programme



CAPEX / OPEX

Proposed resilience expenditure in FY26-30

CAPEX – Seismic Strengthening of Zone substation buildings & other buildings - \$1.62million

Central Park Substation improved resilience - **\$40million** (The work is to be funded under a new customer connection contract with Transpower and recovered as a pass-through cost to end customers)

Seismic upgrade of cables and creation of 33kV rings -**\$160million**



RISK ASSESSMENT

What assessment has been done to ascertain natural disaster risk to networks?

WELL has used different methods to identify HILP events, They categorise these Transmission, distribution & Environmental risk reviews.

Transmission risk reviews – WELL participates in the Connection Asset Risk Review projects undertaken with Transpower every 3-4 years to identify risks on the transmission circuits and substations, and develop mitigation measures

Distribution risk reviews –WELL as part of its network planning process, identifies the HILP events. Contingency response plans have been drawn up to mitigate impacts from such events; and

Environmental risk reviews – WELL engaged GNS and studies were undertaken to understand and identify the risk posed by earthquake and tsunamis. WELL has also developed a storm inundation policy.



STANDARDS

What standards are used for resilience initiatives

WELL follows the 4R (Reduction, Readiness, Response & Recovery) approach as described in the EEA resilience guide for hazard management.

WELL has used the resilience maturity measurement tool (RMMAT) to assess its resilience thereby identifying opportunities for improvement.



TRIGGERS

What are the triggers for the resilience initiatives?

WELL has different portfolio strategies under WELL'S Asset Management, Resilience being one of the portfolio strategies.

WELL uses each portfolio strategy to develop Network Standards, work plans and programmes which include the activities and budgets presented in the 10-year AMP and five-year business plan.

WELL has also has a separate resilience framework which covers all aspects of WELL'S network resilience










ASSESSMENT

What assessment has been done to support the resilience expenditure?




All the projects mentioned under proposed resilience expenditure have gone through a proper investment planning process where multiple options have been identified for the issues and solutions are proposed through a business case for management approval prior to being converted into a project. However, IAEngg is not clear if the business cases for chosen resilience initiatives provide positive Net Present Value (NPV).





7.17 Buller Electricity

 <p>EDB Name of EDB</p>	<h3>BULLER ELECTRICITY LIMITED (BEL)</h3>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>IAEngg was only able to identify the Buller Bridge crossing purchase project in the AMP that BEL stated explicitly is to improve resilience. BEL cited, in the AMP, that the shifting of residential load to the western side of the Buller Bridge has the potential to require major development of additional distribution infrastructure. The purchase and connecting of Transpower’s Buller River crossing 110kV line to Whareatea and Carters beach 11kV circuits is for resilience and reliability improvements.</p> <p>Under their risk management policy and framework, BEL examines its physical risk exposure that include earthquake, flood, fire, tsunami and IT systems failure.</p> <p>BEL stated that remaining outstanding priority items to complete from their 2020 assessment of network resilience status includes network emergency spares, assessment of overhead two pole substations earthquake resilience and, diesel and other fuel supply availability.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>IAEngg did not come across the individual costs of these programmes.</p>




 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>BEL uses consultants to regularly review various aspects of its AM practices including the AMP, SMS, Resilience and financial system and processes against evolving requirements and compliance is reported to the Board.</p> <p>In 2020 BEL engaged Mitton Electronet to carry out an independent review of the state of Buller Electricity’s existing emergency preparedness plans and overall network resilience status. Although IAEngg did not come across any details on the review, apart from outstanding (priority) items.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>BEL’s independent review of its existing emergency preparedness plans and overall network resilience status was in the context of the so-called “4 R’s” (reduce, ready, respond and recover) of emergency preparedness, relating to electricity networks.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Although we did not come across the triggers for resilience initiatives, IAEngg believes the trigger points for resilience initiatives might be embedded in BEL’s trigger points for planning new capacity which consider asset location, capacity, reliability, security or voltage.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across any assessment in the AMP relating to resilience expenditure.</p>





7.18 Centralines

 <p>EDB Name of EDB</p>	<p style="text-align: center;">CENTRALINES</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>One of the initiatives is a capability project to better understand network vulnerability. The Project aims to develop a sustainable, dynamic and effective model, that based on various scenarios, can estimate the damage to infrastructure and subsequent likely impact on the supply of electricity to its customers and the communities it serves.</p> <p>Waipukurau substation resilience improvement along with the secondary substation establishment works</p> <p>Seismic strengthening of transformer mounts at Takapau Zone Substation</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>CAPEX</p> <p>Takapau Zone Substation Seismic Strengthening of Transformer Mounts - \$25k (FY24)</p> <p>Waipukurau secondary substation project - \$6 million (FY25-FY28) (Note: percentage allocation for resilience works not provided in AMP)</p>



 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Centralines’ network resilience maturity is assessed on an annual basis through the EEA’s Resilience Management Maturity Assessment Tool (RMMAT).</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Centralines aligns its resilience improvement with EEA’s Resilience Guideline and has recently adopted the co-ordinated Incident Management System (CIMS) to manage HILP events.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Centralines Strategic Asset Management objectives include improving the resilience of the network.</p> <p>Resilience forms a key part of Centralines approach to asset management; cyclone Gabrielle has reinforced the importance of network resilience for Centralines.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across any detailed assessment relating to resilience expenditure</p>

7.19 Counties Energy

 <p>EDB Name of EDB</p>	<p>COUNTIES ENERGY</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Counties Energy considers flood, wildfires & earthquakes as part of the design process for all critical assets like substations and sub-transmission lines on the network.</p> <p>Counties Energy assets are designed to provide a certain level of resilience under a normal operating environment as defined in the security of supply and planning guidelines.</p> <p>Counties Energy plans to undertake a network-wide zone substation buildings/structure seismic review against the latest New Zealand Society of Earthquake Engineering (NZSEE) seismic grades with a building importance level of 4 (IL4); this includes both indoor and outdoor structures.</p> <p>Replace kiosk buildings with pad-mount transformers to address the seismic risk and ongoing maintenance of the kiosk building itself.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Seismic Study & Corrective Actions - \$250k (FY24)</p> <p>Seismic Study & Corrective Actions - \$300k (FY25)</p> <p>\$4.1 million in current AMP period for the renewal of transformers and associated equipment due to condition and seismic risk</p>

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment done to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Risk Management framework consistent with ISO 31000: 2009 Risk Management – Principles and Guidelines standard</p> <p>New Zealand Society of Earthquake Engineering (NZSEE) seismic grades with a building importance level of 4 (IL4)</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Counties Energy’s main triggers for the resilience initiatives are the effects of weather events brought about by Climate change.</p> <p>Any changes to Counties Energy plan or expenditure relating to network resilience triggered by the learnings from cyclone Gabrielle will be addressed in the next Asset Management Plan.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across any detailed assessment relating to resilience expenditure</p>

7.20 Electra

 <p>EDB Name of EDB</p>	<p>ELECTRA</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Electra has identified a number of improvement initiatives to improve network resilience.</p> <ul style="list-style-type: none"> » Electra is mid-way through a programme of works to seismically strengthen its Zone substations and other buildings. » 33kV protection study and strategy development » Increase network sectionalisation » Replacement of Copper conductors » Reduce number of risky assets » Migration to risk based tree trimming » Identification of 11kV worst feeders » Replacement of Copper earthing



CAPEX / OPEX

Proposed resilience expenditure in FY26-30

CAPEX – Seismic Strengthening of Zone substation buildings & other buildings - **\$2.51million**

IAEngg did not come across the individual costs of the programmes listed above except for seismic strengthening.



RISK ASSESSMENT

What assessment has been done to ascertain natural disaster risk to networks?



Electra has completed a flood risk analysis of its assets, Electra obtained flooding datasets from the two local councils and details have been overlaid onto the GIS systems to provide insights of the assets at risk.



STANDARDS

What standards are used for resilience initiatives

- » An earthquake of Richter magnitude 7.5 or greater on a major Wellington fault
- » Volcanic activity at Ruapehu resulting in ash coverage of about 10mm throughout the Northern part of Electra’s area
- » A one in 100-year flood of the Ōtaki, Waikanae or Manawatu rivers
- » A tsunami impacting on the West Coast that could inundate up to 2km inland.

	<p>Electra follows the 4R's of robustness, resourcefulness, recovery and redundancy to improve the resilience of its network.</p> <p>Electra has also adopted a Climate Resilience Framework and adapted its existing governance and risk practices to ensure climate opportunities and risks are systematically identified, quantified and mitigated within Electra's existing framework of strategies, asset management plans and business plans. Electra has strategically aligned its governance, strategy and risk activities with the Task Force on Climate-related Financial Disclosures (TCFD) framework.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Resilience is an important objective of the Electra's Asset Management policy and strategy and is considered during investment planning process.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>Other than Seismic Strengthening of Zone substations, IAEngg did not come across details on specific assessment done to support the resilience expenditure.</p>

7.21 Mainpower



EDB
Name of EDB

MAINPOWER








INITIATIVES
Describe initiatives raised to improve resilience




Examples of MainPower initiatives to improve resilience include:





- » MainPower is developing a collaborative framework with external service providers to improve weather prediction and forecasting capability, and to overlay those predictions with network information to better manage the network in extreme situations and improve the resilience of the network.
- » MainPower’s ADMS real-time and historical information will be integrated with climate data to find network constraints in modelled scenarios. Additionally, ADMS data will be used to fine-tune resilience models for specific application in MainPower’s region. With this data, MainPower will be able to proactively reinforce network areas that are potentially vulnerable to the impacts of climate change, and to improve network resilience to adverse weather-related events.
- » MainPower has an ongoing initiative to assess the impact of HILP events and network resilience in coordination with local authorities across North Canterbury and Civil Defence and Emergency Management (CDEM) agencies

- » Kaiapoi–Island Road Upgrade - Installation of an additional 11 kV cable section between a previously installed cable section and Neeve Street to improve network resiliency.
- » The 33 kV radial spur line supplying Hanner zone substation is being upgraded with stronger conductor and structures to minimise the risk of prolonged outages during extreme weather events over FY20–FY25 to improve resilience and reliability.
- » MainPower’s sub-transmission line between Oaro and Kaikōura, along the Kaikōura coast, was affected by the 2016 Kaikōura earthquake. Short-term repairs were performed on the line section that crosses over the Raramai Tunnel; however, these require review and replacement to provide a long-term resilient solution for this section of the sub-transmission network.
- » MainPower has invested in a LiDAR capture survey of its entire overhead network, which was completed in August 2022. This overhead network LiDAR survey will provide a dynamic virtual network representation that will allow MainPower to leverage accurate, up-to-date data for assessment of network clearances, identification of defects, and to model environmental scenarios to gauge network resilience.
- » MainPower has five power transformers held as strategic spares. These are surplus units are held to support network resilience and emergency responses.




 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>IAEngg did not come across the individual costs of these programmes.</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment done to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>MainPower designs substations for a 1-in-500-year flood event.</p> <p>MainPower is taking part in a pilot programme to model network vulnerability to hazard events and climate change using nationally accepted impact assessment modelling tools (MainPower did not disclose the name of this tool). The outputs from this vulnerability assessment will inform MainPower’s resilience planning and the Network Regional Plans.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Although not explicitly stated, most resilience improvement initiatives are triggered by renewal needs or security/reliability of supply such as radial supply.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across details on any specific assessment done to support resilience expenditure.</p>





7.22 Marlborough Lines

 <p>EDB Name of EDB</p>	<h1>MARLBOROUGH LINES (MLL)</h1>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Examples of initiatives sighted in the AMP include:</p> <ul style="list-style-type: none"> » For the ten-year planning period covered by this AMP (1 April 2023 to 31 March 2033 = RY2024 to RY2033), investment will focus on renewal of areas of the 11kV and Low Voltage (LV) network driven by Asset Health Indicator (AHI) ratings and type-based replacement, to further build resilience of the network and to maintain a high level of network reliability. » Vegetation control is a key requirement for storm resilience. » MLL commissioned seismic strengthening programme of works involving structural assessments of the zone substation buildings, and strengthening works to the buildings that were deemed earthquake prone » To improve resilience to major seismic events, pole-mounted transformers 200kVA and above are, where practical, replaced with a ground-mounted transformer of equivalent or greater size. Smaller pole mounted transformers are replaced like-for-like.
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>IAEngg did not come across the individual costs of these programmes. A significant proportion of Marlborough Lines asset renewal expenditure has resilience benefits.</p>

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>MLL considers improved resilience for new assets and is currently considering whether a 1:100 year flood level standard is appropriate for critical assets or whether 1:250 or 1:450 (such as Transpower now use) is appropriate. IAEngg did not come across details on specific assessments done to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>IAEngg did not come across any statements on standards used for resilience initiatives.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Continuous review of network security and resilience to extreme natural events is undertaken by MLL, which feeds into MLL’s asset management planning.</p> <p>Apart from seismic or extreme weather events, MLL also has resilience concerns for areas with only a single source of supply eg GXP station with only one transformer or an area with a single HV feeder supply.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>Further work undertaken by GNS, and other experts has identified that Marlborough is at risk from the Hikurangi subduction zone which runs under the sea out from the east coast of the North Island to Marlborough. This subduction zone has the potential to generate a major earthquake and/or tsunami.</p>

7.23 Network Waitaki

 <p>EDB Name of EDB</p>	<p>NETWORK WAITAKI</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<ul style="list-style-type: none"> » Lessons learnt from previous HILP prevents are fed back into the operational procedures, design standards & procurement standards to make Network Waitaki more resilient » Reinforcement of Zone Substations to meet new building standard for IL4 (%NBS IL4) rating by 2024 » Collaboration with other South Island EDBs’ to review Overhead Design Standards » Chelmer St Substation 33kV line replacement with Underground cable to improve resilience of the substation. » Construction of a new earthquake rated (IL4) operations building and control room (Increase resilience operations of operations)
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Non-Network CAPEX - FY 24 – FY 26 - \$7.8million Chelmer Street site (Network Waitaki Admin & Operations Site)</p> <p>Network CAPEX - Chelmer St Substation 33kV line replacement with Underground cable FY24 – FY25 - \$417K</p> <p>Network Waitaki expenditure forecasts does not include any additional allowances for resilience in 2023 AMP.</p>

 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Network Waitaki has assessed the Seismic capacity of all the Zone Substations on the network against the new building standard for IL4 (% NBS IL4).</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>As above</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>One of Network Waitaki’s goals is to ensure during and after an HILP event the network and business systems are able to return to “business as usual” mode of operations as quickly and as efficiently as practicable after an event.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>No forecast spend related to resilience is detailed in the 2023 AMP.</p>

7.24 Northpower



EDB
Name of EDB

NORTHPOWER



INITIATIVES
Describe initiatives raised to improve resilience

Northpower believes that ensuring appropriate renewal and modernisation (refurbishment) of existing assets is a critical foundational element for delivering resilient infrastructure, and they have included a material uplift in expenditure in this area. In addition, Northpower also believes improving resilient to external threats such as cyberattack is important.

Example of resilient initiatives include:

- » Increase network resilience in the Whangārei area and make opportunistic improvements during renewal works, e.g. raising assets at flood-prone sites.
- » A future zone substation in the Waipu area to allow for future anticipated load growth and development, improve supply resilience in the area and provide greater backstop capability to Mangawhai and Ruakākā substations.


Northpower has introduced a number of strategies designed to mitigate storm impact and increase the resilience of the network to adverse weather.

These include:

- » The introduction of new design standards for network assets aimed at reducing the risk of failure related to wind damage,



- » Increased corrective maintenance expenditure on defect remediation
- » Better identification and management of fall-zone trees and reduction of wind-blown vegetation debris
- » Increased focus on the sub-transmission network to ensure the backbone of the network is increasingly resilient to weather-related events.
- » Consider greater diversity of supply routes to improve resilience. This can include creating meshed or ring architecture for a more reliable, resilient network.
- » As significant renewals programmes are carried out over the next decade, undertake opportunistic network reconfiguration to improve the resilience to major events.







CAPEX / OPEX
Proposed resilience expenditure in FY26-30




Examples of resilience related expenditure:





- » Kensington 110/33kV transformer replacements **\$9.7M**.
- » Replacement of two Kensington to Tikipunga 33kV sub-transmission UG cables **\$3.8M**.

IAEngg believes the main driver for the above replacement projects is reliability, with resilience an additional benefit.




 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment done to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Northpower’s risk management is carried out in accordance with, or informed by, a number of standards and guides that include EEA Resilience Guide (2022) and EEA Asset Criticality Guide (2019).</p> <p>Northpower also carries out HILP analysis to increase its understanding of their relative risk exposure to major events, and supports good engineering judgement when making decisions about network resiliency improvements.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Northpower defines network resilience as the ability to adapt and respond quickly to external impacts.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across any project that targets resilience only. Resilience and reliability are inextricably tied together.</p>





7.25 Scanpower

 <p>EDB Name of EDB</p>	<p style="text-align: center;">SCANPOWER</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Scanpower is planning to undertake the following resilience initiatives</p> <ul style="list-style-type: none"> » Reinforce the low voltage network » Reinforce the high voltage network » Install more Air break switches to help improve the security and reliability of the network
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>No forecast spend for FY26-30 (Capex and Opex) in 2023 AMP</p> <p>Forecast Resilience Expenditure for 2032 - \$260k</p> <p>Forecast Resilience Expenditure for 2033 - \$260k</p>



 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>During network planning stages, Scanpower takes into consideration the resilience aspect of the network.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Scanpower’s approach is based on ISO 31000 Risk Management framework. The possible impact of major natural disasters and hazards are assessed and treatment plans are put in place to mitigate risks.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Part of Scanpower’s BAU risk management process involves the assessment of “High Impact Low Probability” (HILP). No other triggers have been highlighted in the AMP.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>No forecast spend for FY26-30 (Capex and Opex) in 2023 AMP.</p>






7.26 The Power Company

 <p>EDB Name of EDB</p>	<h3>THE POWER COMPANY (TPC)</h3>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>TPC stated that: TPC’s (asset management) decisions is to provide their customers receive a resilient, reliable and future-ready electricity supply.....AMP has a strong focus on the future, particularly as they look towards the impacts of decarbonisation and process heat conversion in our region, the increasing reliance on electrification and the growing uptake of electric transportation, as well as the need for a resilient network in the face of the effects of climate change.</p> <p>Below are resilience initiatives that IAEngg identified:</p> <p>Asset replacement – Zone substation and distribution substations - Buildings and fences when not economic to maintain after significant accumulating deterioration or seismic resilience concerns. One TPC’s tactics to manage operational risk is to build appropriate resilience into network assets.</p>
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>IAEngg did not come across specific expenditure proposals relating to resilience.</p>



 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment done to ascertain natural disaster risk.</p> <p>TPC cited that they have received proposals to connect data centre in Southland and this will take up the spare capacity at the GXPs and on the sub-transmission networks, decreasing the overall resilience of the network.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>‘AM-STD-0026 EXTERNAL - EEA Resilience Guide 2022’ is one of TPC’s Asset Management and Operating Standards.</p> <p>TPC’s design standard specifies wind and snow loading resilience levels, and their Inspections recognise asset criticality and resilience requirements.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>TPC stated its general approach of monitoring network demand, and initiating projects when standardised development triggers are reached, serves to maintain existing service levels. Where a change in service level is desirable, this may be undertaken directly (e.g. targeted seismic remediation program to improve safety and resilience under earthquake conditions).</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across details on specific assessments done to support resilience expenditure.</p>



7.27 Waipa Networks




 <p>EDB Name of EDB</p>	<p>WAIPĀ</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>Examples of resilience initiatives:</p> <ul style="list-style-type: none"> » Implementing a programme to improve the reliability and resilience of distribution feeders that includes: installing reclosers to segment feeders, automating open feeder points to reduce restoration times, installing dropout fuses on spur lines, and installing loop protection schemes to allow faults to be isolated to the smallest possible extent and restore healthy network sections quickly. » Upgrade of the existing analogue-based communication network to a digital network via Microwave ring will provide resilience and high bandwidth to enable a safer, more secure, and more reliable voice and data network. » Waipā is currently investigating a purpose-built disaster recovery SCADA control room with a fibre or microwave based communication interface independent of the Harrison Drive depot to improve the resilience of both voice and data networks. » In FY21 Waipā approved the option to build a new 220/33kV GXP to the west of Cambridge at an estimated cost of \$36m (2022 figure) to provide additional capacity and resilience through the diversity of transmission connection into the Cambridge area. » To improve resilience to major seismic events, new pole mounted transformers are limited to 100kVA and below, with standard designs detailing pole and foundation requirements. When transformers are replaced, the pole may also be upgraded to comply with modern standards, and size selected to meet expected demand.

 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>The 2024 AMP will provide visibility on our resilience maturity and set out the results of our assessments completed and the potential implication of our resilience improvement programme on network expenditure.</p> <p>One example found: In FY21 Waipā approved an option to build a new 220/33kV GXP to the west of Cambridge at an estimated cost of \$36m (2022 figure) to provide additional capacity and resilience through the diversity of transmission connection into the Cambridge area. Other than this projects, IAEngg did not come across the individual costs of these programmes.</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>IAEngg did not come across details on specific assessment done to ascertain natural disaster risk.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Waipā defines Resilience as “the ability of assets, networks, systems, organisations, and people to anticipate, prepare, absorb, adapt to and / or rapidly recover from a disruptive extreme event.”</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Resilience is considered during risk assessments.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>As part of Waipā network resilience path, Waipā networks has changed from traditional hardwood crossarms to steel cross arms. The existing hardwood crossarms are coming up for renewal and failures have increased in the last three years (compared to the previous 10). This analysis is also confirmed by the inspections completed in FY22, with a large number of crossarms in the H1 an H2 categories.</p>

7.28 WEL Networks

 <p>EDB Name of EDB</p>	<p>WEL NETWORKS</p>
 <p>INITIATIVES Describe initiatives raised to improve resilience</p>	<p>The following are the significant resilience improvements planned by WEL networks for the next 10 years</p> <p>Readiness:</p> <ul style="list-style-type: none"> » Ongoing event exercises » Continuous improvement of contingency plans » Ongoing and refresher training in event management (CIMS) <p>Response:</p> <ul style="list-style-type: none"> » Two tier one contractors onboarded » DSO implementation » Improved outage maps » Improved outage management tools » Cyber security » Automated Under Frequency Load Shedding – system upgrade

	<p>Reduction:</p> <ul style="list-style-type: none"> » Huntly area resilience projects to address potential liquefaction issues » Raglan and Te Uku area resilience » Seismic upgrade of substations » Network reliability projects » Security of supply projects (including a GXP review)
 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>Legislative & Regulatory</p> <ul style="list-style-type: none"> » Seismic Strengthening of Substations & Switching Stations - \$2.62 million <p>Other Reliability, Safety and Environment</p> <ul style="list-style-type: none"> » Raglan Area Resilience work – \$5 million » Weavers Zone Substation Relocation - \$3.63 million » Network Reliability projects - \$3.25 million
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>To align with industry practice, WEL network is planning to conduct an assessment against the 4R framework in EEA Resilience guide 2022. The 4R framework defined in the National CDEM Plan – Reduction, Readiness, Response and Recovery, as used by emergency services and other lifeline utility operators in New Zealand.</p>

 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>WEL networks has assessed all of its substations and buildings for seismic strength. New Building Standard (NBS) has been used for building all new network buildings. The buildings are built to meet the IL4 standards</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>WEL networks network development investment is driven by three main factors & climate change driven is one of them.</p> <p>Network resilience is one of the key aspects of WEL's network planning.</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>Each of the resilience initiatives identified has been converted into a project through the investment planning process. Solutions are identified for each issue, including alternative options, and weighed against each other before an option is finalised and funding approved.</p>

7.29 Westpower



EDB
Name of EDB






WESTPOWER



INITIATIVES
Describe initiatives raised to improve resilience

Westpower has identified a number of improvement initiatives to improve network resilience.

- » Setting up a new alternative operations centre to ensure continuity of network control in a major event
- » Commissioning a trailer mounted mobile standby generator for use in emergency situation
- » Dedicated storage facilities
- » Improvements to increase seismic strength of a range of structures
- » Enhancing or creating inventories of critical spares and facilities
- » Updating and developing relevant policies procedures and Staff training
- » Vulnerability study on Zone substations has identified improvements, these improvements have come from other networks from recent earthquakes
- » Setting up alternative communications paths/equipment for digital data back to Advanced distribution Management Systems (ADMS)
- » Replacement of pole mounted distribution transformers greater than 100kVA with concrete pad mount
- » Fox Glacier Resilience programme

 <p>CAPEX / OPEX Proposed resilience expenditure in FY26-30</p>	<p>CAPEX - \$1.95million</p>
 <p>RISK ASSESSMENT What assessment has been done to ascertain natural disaster risk to networks?</p>	<p>Westpower has completed an assessment using the EEA Resilience Management Maturity Assessment Tool (RMMAT) to arrive at a baseline score against which Westpower can monitor future resilience improvements.</p>
 <p>STANDARDS What standards are used for resilience initiatives</p>	<p>Westpower has adapted the principles outlined in the National CDEM Act 2002 the 4R framework – Reduction, Readiness, Response and Recovery, (as used by emergency services and other lifeline utility operators in New Zealand) to establish and implement a resilience improvement strategy.</p>
 <p>TRIGGERS What are the triggers for the resilience initiatives?</p>	<p>Westpower is committed to ensuring an appropriate level of network resilience to major emergency events. It is one of the Key Asset Management drivers.</p> <p>Westpower’s Asset Management objective is to plan and provide a resilient network operation which is capable of meeting major emergency situations as a Lifeline Utility, as required by the Civil Defence Emergency Management Act 2002 (CDEM 2002).</p>
 <p>ASSESSMENT What assessment has been done to support the resilience expenditure?</p>	<p>IAEngg did not come across details on specific assessments done to support the resilience expenditure.</p>