

Meeting Date: 27 February 2025

PERSPECTIVES ON REGIONAL RESILIENCE

SECURITY AND RELIABILITY COUNCIL

This paper introduces presentations from Transpower, as grid owner, NEMA, Northpower and Unison, giving their perspectives on regional resilience and its criticality in supporting a secure and reliable power supply for consumers.

Note: This paper has been prepared for the purpose of the Security and Reliability Council (SRC). Content should not be interpreted as representing the views or policy of the Electricity Authority except where specifically noted.

Perspectives on regional resilience

1. Introduction

- 1.1. The SRC has chosen regional resilience as the theme for this meeting and asked the secretariat to arrange a suite of papers and presentations by way of background and to support the SRC's discussion and advice to the Authority.
- 1.2. Regional resilience is a broad topic, involving every aspect of the sector and impacting all New Zealand consumers. The aim therefore is not to cover every aspect at this meeting, but to present a range of perspectives on the issues and enable the SRC to see if or where it may wish to focus further.
- 1.3. Transpower, as grid owner, the National Emergency Management Agency (NEMA) and distributors, Unison and Northpower will present their perspectives.
- 1.4. Transpower's presentation will provide an overview, including governing legislation, relationships, responsibilities and interdependencies. They will also discuss how they view and control risk in delivery of their services.
- 1.5. NEMA's presentation will cover its leadership and stewardship role and how it supports other agencies to deliver critical lifeline services, including monitoring, alerting and reporting, and the role of the national crisis management centre (NCMC).
- 1.6. NEMA will also offer their perspectives on lessons from Cyclone Gabrielle, and its vision for future sector readiness.
- 1.7. Northpower and Unison will give their perspectives, drawing from their experiences with recent severe weather events, including Cyclone Gabrielle, what they learned from them and what expectations they have for the Authority's role, ahead of, during or after such events.
- 1.8. Northpower and Unison have been asked for their views on how they assess risk to regional resilience and what barriers and opportunities there are for the sector to collaborate and learn from each other for security, efficiency and cost reduction.
- 1.9. Northpower and Unison have also been asked for their perspectives on the impact and role of large industrial users and other sectors, such as telecommunications and how risks can be mitigated.
- 1.10. Members are encouraged to consider other topics for further information or deeper dives at future meetings.
- 1.11. Representatives from Transpower, NEMA, Northpower and Unison will present and be available for discussion and questions.
- 1.12. The presentations are included as **Appendices A-D** to this paper.

2. Questions for the SRC to consider

The SRC is asked to consider the following general questions.

Q1. What questions does the SRC have for presenters about their views, especially any points of difference from members' own perspectives?

- Q2. What, if any, barriers gaps and opportunities can members identify to achieving greater levels of regional resilience?**
- Q3. What further information does the SRC seek to support its understanding of the current-state and risks to high levels of regional resilience?**
- Q4. What advice, if any, does the SRC wish to provide to the Authority?**

3. Appendix A: Transpower presentation

4. Appendix B: NEMA presentation

5. Appendix C: Northpower presentation

6. Appendix D: Unison presentation



TRANSPOWER

Managing regional resilience

Electricity Authority Security and Reliability Council

27 February 2025

EGM Grid Development, Matt Webb

Senior Principal Engineer, Andrew Renton

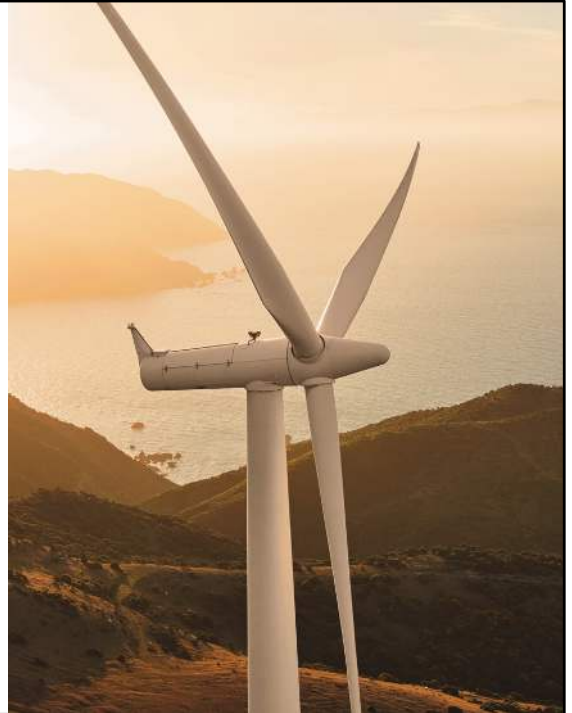


Today's meeting

Following on from SRC briefings in Oct 2022 & Feb 2024 we will brief the SRC of Transpower's approach to providing a resilient and cost-effective transmission service to New Zealand's regional communities

We will discuss

- Background and governing legislation
- Relationships, and responsibilities of TP, NEMA, electricity participants and other lifeline utilities
- Interdependencies of lifeline utilities
- How Transpower views/controls/manages service risk and resilience
- How this risk management relates to provision and support of regional resilience
- Specific question regarding space weather.
- Questions and next steps.





Background & Governing Legislation

Regulations which apply to Transpower

- Electricity Industry Act 2010 Subpart 3 S32 Content of Code Clause 1b delegates the reliable supply of electricity to consumers to “The Code”
- The “Code”, Part 12, Transport S12.55 Grid Reliability Standards (GRS), Provides for The Authority to determine the Grid Reliability Standards. S12.114 requires Transpower to report performance, identify and evaluate investments to meet the GRS
- *The Grid satisfies the GRS if all economic reliability investments are implemented and the system is in a satisfactory state following a single credible contingency event on the core grid using a range of expected relevant operating conditions*
- Civil Defence & Emergency Management Act 2002, S60 Duties of a Lifeline utility, Every lifeline utility must “ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency”

Balancing societies expectations of minimum service levels against the economic cost to achieve is a challenging balance for all involved in the industry

There is no specific reference that sets any minimum level of service or expected performance outcome

The NZ approach to service level determination is less deterministic and more probabilistic and economic

The CDEM Act requires fullest extent possible, not practicable, but acknowledges this could be at a reduced level, without defining that level, it is left to each organisation to determine their own design criteria

A landscape photograph of a green field at sunset. A power line tower is visible on the left, and a large, faint, circular graphic with concentric lines is centered in the background. The sky is a mix of blue and orange, with clouds on the horizon.

Relationships, Roles & Responsibilities

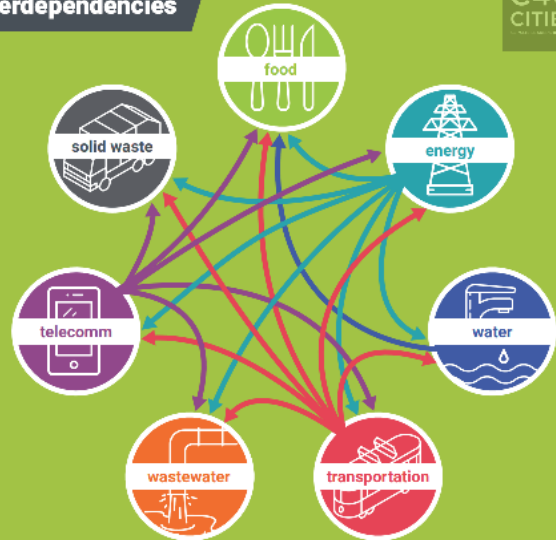
Interactions with Lifelines

To manage infrastructure interdependencies & associated cascading risks.

Lifelines is a collaboration and information sharing organisation, it has no statutory rule making or funding capability



Sectoral Interdependencies



Electricity supports all key infrastructure for communities

Electricity's key dependencies during and post event are telecommunications and transport/roading

New Zealand Lifeline Council is a voluntary organisation funded by membership for the joint co-ordination and sharing of essential lifeline utility information

Produces the National Infrastructure Hazard Assessment

In-kind participation by member organisations for regional and national organising lifeline groups engaging 1/4ly to understand risks, interdependencies, service impacts on each other

Each organisation undertakes their own mitigations as their own resources and risk appetite allow

Event management relationships & responsibilities

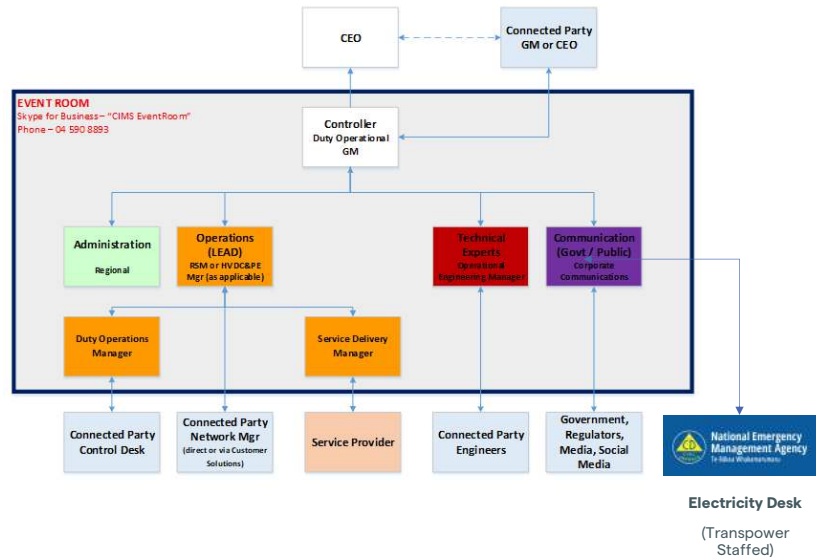
Utilises a standard and scalable CIMS structure

Operational communication and controls direct centre-centre

Management and situational awareness via CIMS Comms

Communication to Govt/NEMA via CIMS Comms

Depending on magnitude of event Transpower provides staff for NEMA functions as the electricity sector co-ordinator



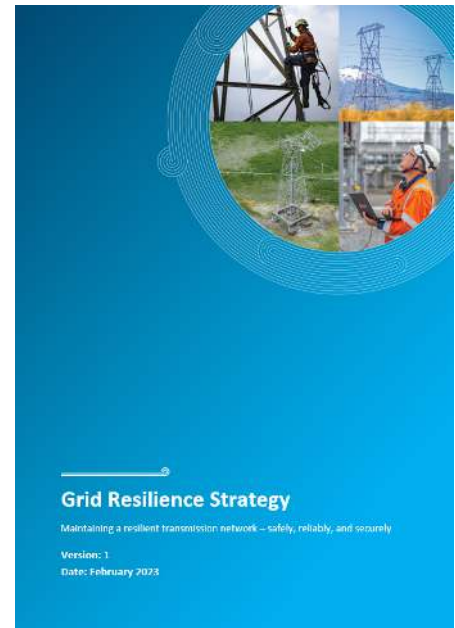
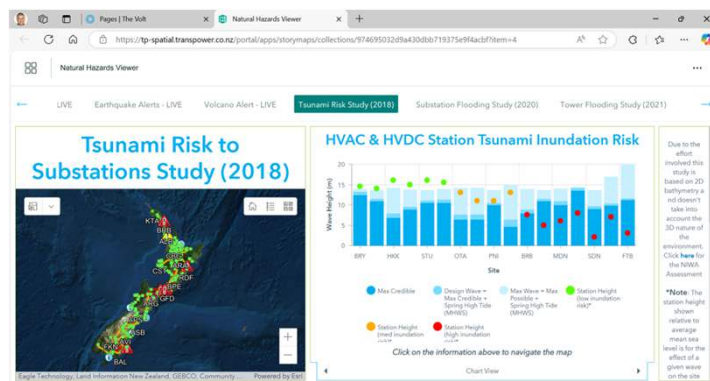


Transpower's approach to resilience

Transpower Grid Resilience Strategy

Focus on physical assets resilience to avoid outages, maintain service or quickly restore when an event occurs

Exposed to 25 actively managed Resilience threats



Strategy describes our approach to resilience, identifies our major threats and hazards and our approach to providing a resilient transmission service.

The focus is alignment with meeting the CDEM Act requirements and NZ Lifelines Council approach which differs from GRS and EIPC service performance measures.

The strategy works in co-ordination with regional, fleet and site strategies and standards

Assessing major threats using our resilience framework

Hazards are tracked, assessed, and mitigations evaluated using 4Rs, VoLL & WALDO

Changes/Gaps are prioritised using criticality and delivered where possible via integration into routine asset management cycle and regional developments



Risks and hazards are tracked on Natural Hazards Viewer [Natural Hazards Viewer](#)

8 major natural hazards with that could cause widespread issues

Other threats and major hazard groups such as sabotage, wild fires, cyber attack etc tracked and managed as part of resilience approach

Risk assessments are undertaken for each major hazard to quantify the level of risk to grid assets, systems and service.

All threat mitigations are considered using the 4Rs approach

Asset criticality, demand, Value of Lost Load (VoLL) for short duration outages <12-24hrs OR Wide Area Long Duration Outage (WALDO) values are utilised to quantify the impacts and search for opportunities to mitigate utilising the 4Rs

Our framework includes post event reviews, and regular environmental impact scans for changes in asset condition, environmental impacts eg land subsidence, climate change, customer demographics.

For example post Edgecumbe (EDG) earthquake Transpower increased land subsidence monitoring and funded Horizons District Council to improve stopbanks protecting the substation

Transpower Strategic Asset Management Plans

Ongoing performance improvement approach to increase asset service performance while managing cost impact to consumers

Continuous monitoring, 3-5 year strategy review cycle

New equipment and new designs improve on legacy assets



Figure 4 - Performance objectives

We do not look at resilience as a stand alone item.

Analysis is to identify the issues and consequence and cost to mitigate.

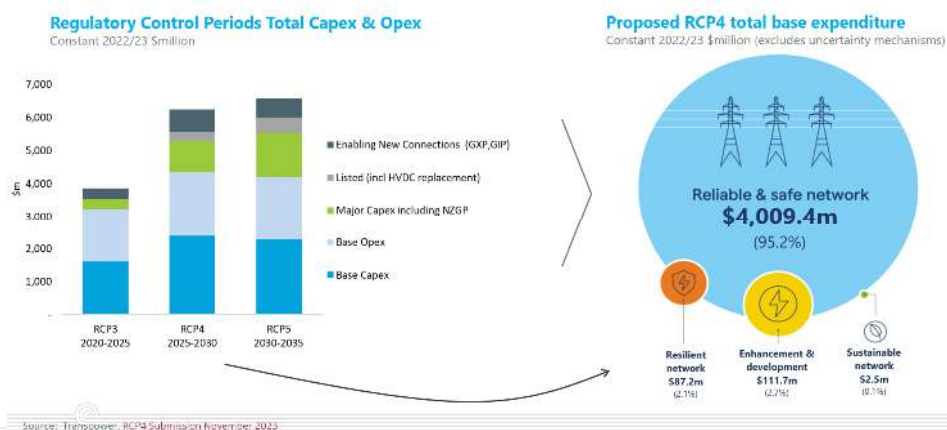
We adopt an integrated Asset Management approach consistent with PASS 55 where we manage a fleet considering all risks, issues, performance trends and identify opportunities to address items as part of the normal asset lifecycle where possible

This is demonstrated through regional and MCP planning intergration

Transpower Investments in the Grid

All expenditure increases resilience in a stepwise function as new assets are designed and configured to newer standards, eg flooding 1:100 now 1:450

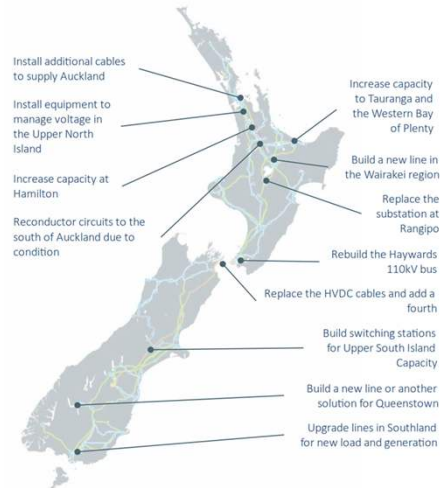
Our approved TOTEX envelope will support resilience



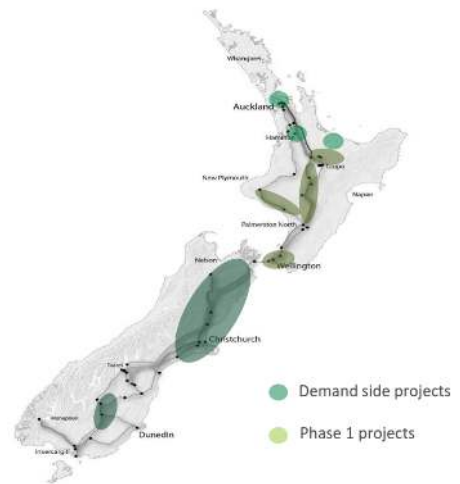
The examples of this integration of resilience into existing spending are shown across these slides

Leveraging investment growth that supports electrification, to also improve resilience

Examples of NZGP1 and MCP integration



Phase 1 2021-2035



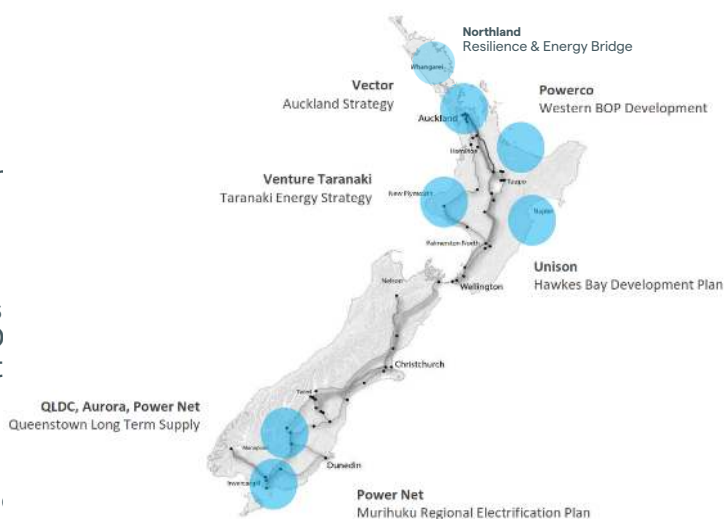
Regional Optimisations

Large amounts of local regional information held by electricity distribution businesses

Jointly working with EDBs to understand growth drivers, generation developments and opportunities for greater resilience,

We have seven regional engagements underway in close partnership with ED and their key stakeholders in different stages to develop optimised regional plans to meet local needs while also addressing reliability and resilience

These plans consider and model the mix of transmission, distribution, embedded generation to cater for varying scenarios.



Resilience and the impacts of climate change

- Storms since 2017 impacting our lines, tracks and substations include: Cyclone Cook, Cyclone Gita, Rangitata flood, Canterbury floods, Nelson floods, Auckland floods, Cyclone Gabrielle.
- Much of our network was built in the 1970s or earlier, to the standards and requirements anticipated at the time.
- Climate change is having an **impact** - we have been looking closely at whether resilience is sufficient through the network, for example:
 - Auckland floods - Wairau Rd site inundated to 1.7m from a 250-year return period event - no loss of supply.
 - Cyclone Gabrielle a >500-year return period flood and inundation of 1.5m.
- We have proposed expenditure specifically for **resilience initiatives** during RCP4 – we need to balance proactively hardening the grid with affordability.
- The resilience programme runs beyond RCP4 into 2030-2035 and 2035-2040.

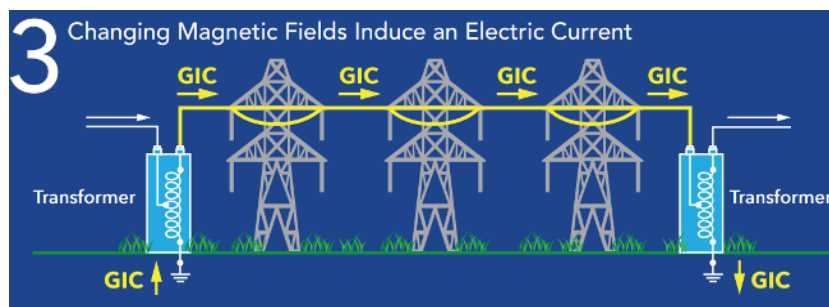


Our process of site criticality and service levels, RDF was one of the highest priority sites
It is a managed approach to work through them all



How does the sun interact with electricity network?

- Colossal earth directed explosion of charged particles squeezes the earth's magnetic field, producing a Voltage differences (10-30V/km) over the ground, driving a current between any two earthed points.
- The induced current takes the path of least resistance between the earthed points, such as transmission lines and transformers to complete the circuit.
- Effects vary across the country depending on magnetic field, ground resistance, and grid configuration.
- Grid impacts include transformer failure, protection maloperation and voltage collapse. Other lifeline impacts include GPS positioning and time services, LEO satellite and some terrestrial comms (HF, VHF radio), any functions relying on these will be degraded or impacted during the event
- Electricity Industry Space Weather Working Group established 2023, after science could provide answers to engineering questions. Goal to provide a coherent industry response and assurance to Government that the risk is adequately addressed and mitigated.



Context in NZ's national emergency management

- "Space weather" is listed as a nationally significant risk by the National Emergency Management Agency (NEMA), and is on the DPMC National Risk Register.
- The national risk owner and Lead Agency for Space Weather/GNSS disruption is NEMA.
- Transpower will be the energy sector's coordinating entity similar to other NatCat events and will co-ordinate the industry and manage the technical event
- No human health impacts at ground level with varying impacts across the country to technical infrastructure for 24 to 36hrs.
- If you have an emergency plan for dealing with disruptions to your lifeline services from flooding, earthquake, volcanic eruption, tsunami, then you have a plan for Extreme Space Weather
- Known historical phenomena. Last extreme event 1859, before grids existed. Growing scientific and engineering understanding of the HILP risk posed to modern interconnected systems and each affected asset owner, which must be addressed collaboratively to provide electricity to end consumers.
- Tight collaboration between scientific community and electricity participants required (Transpower close involvement since 2016 & Solar Tsunami Project 2019/20)



DEPARTMENT OF THE
PRIME MINISTER AND CABINET
TE TARI O TE PIRIMIA ME TE KOMITI MATUA



National Emergency
Management Agency
Te Rākau Whakamarumaru



SOLAR
TSUNAMIS
PAPAHEHEKA KŌHAKU

An aerial photograph of a town at dusk, with lights glowing from the buildings. The town is situated on a hillside overlooking a large body of water, with mountains in the background. A large, white, line-art circle is overlaid on the image, centered over the town. The text "Questions & Next Steps" is written in white, bold, sans-serif font in the lower-left corner of the image.

Questions & Next Steps

A decorative graphic consisting of a series of horizontal light blue lines. In the center, there is a spiral shape formed by concentric semi-circles, with lines entering and exiting it from the left and right sides.

Presentation Ends



Lifeline Utility Coordination and priorities for the Electricity Sector

Presentation to Security and Reliability Council and
Electricity Authority

Malcolm Johnstone

27/02/25





NEMA Role

- Leadership & Stewardship of Emergency Management System
- Lead agency for Natural Hazard and Infrastructure emergency response
- Support Agency for all other hazards
- Monitoring, Alerting Reporting
 - Warnings Earthquakes & Tsunami
 - Emergency Mobile Alert (EMA)
- National Crisis Management Centre (NCMC)



Lifeline Utility Coordination

**Inter-Infrastructure
Coordination Group
And
Lifeline Utility
Coordinator**

Telecommunications (Telecommunications Emergency Forum)

Electricity (Transpower)

Fuel (MBIE)

Transport (Ministry of Transport)

WATER (Water NZ, Taumata Arowai)

Broadcasting (Ministry for Culture and Heritage)

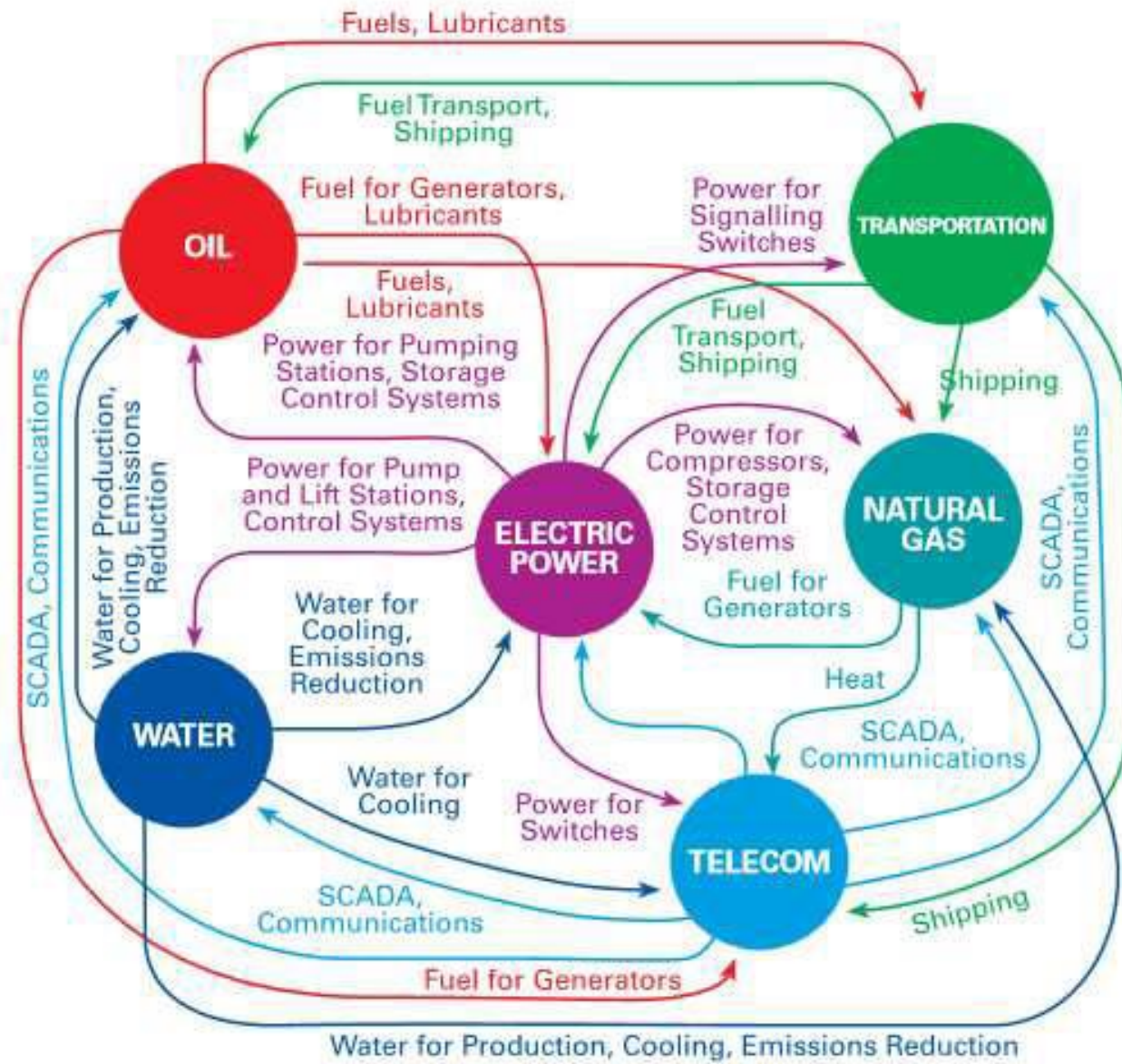
Cash industry (Reserve Bank of NZ)

Gas (First Gas- in development)

Fast moving consumer goods (Not an SCE)



Interdependencies



National – CDEM LUC relationship

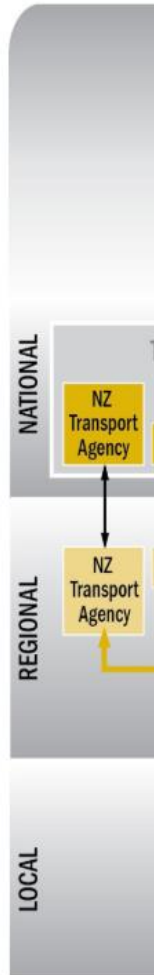


Figure 13.2:



Figure 13.3: An emergency

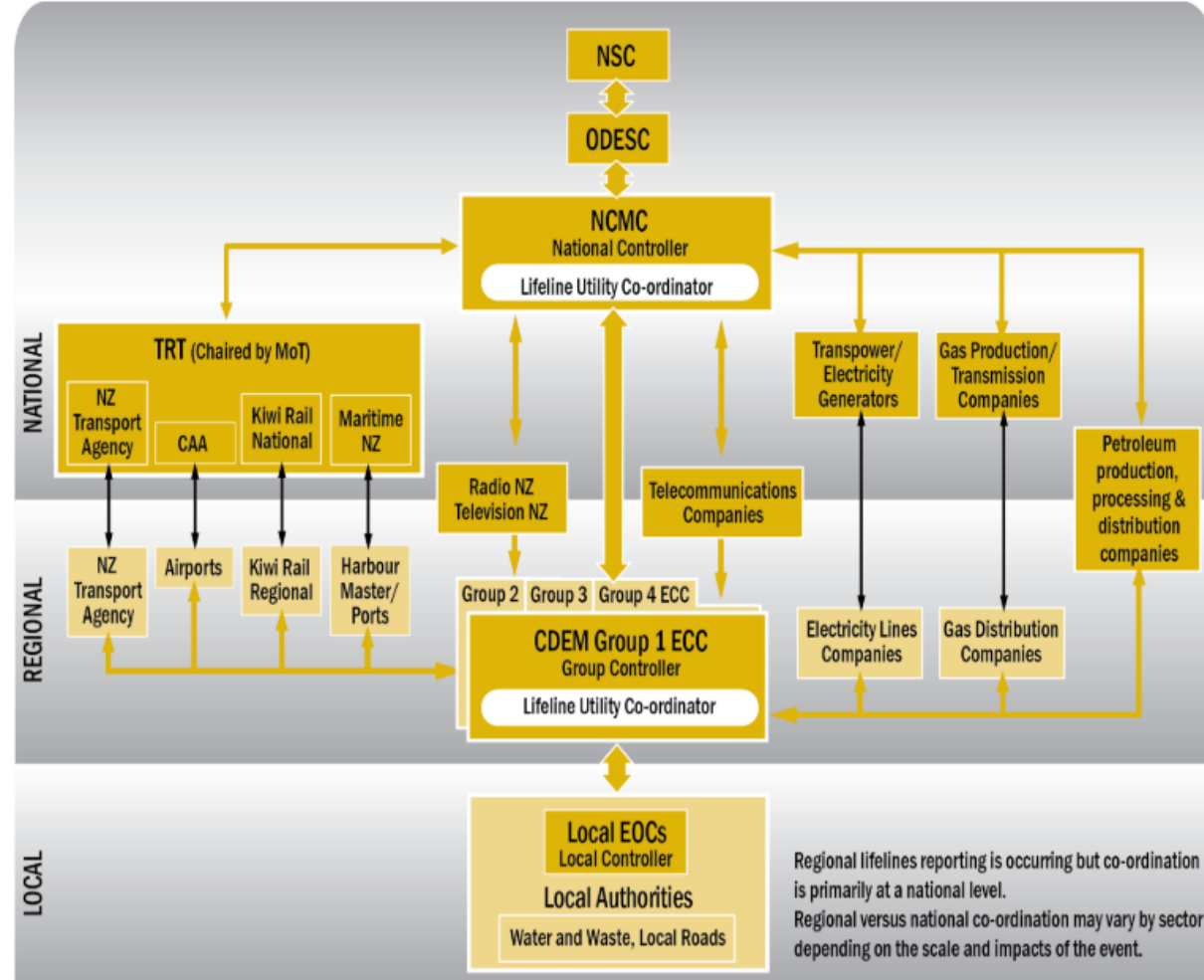


Figure 13.4: An emergency of national significance affecting multiple CDEM Groups.



Lifeline Groups – reduction and readiness

- Lifeline Groups –regional:
 - Include lifeline utilities, scientists, regional CDEM group staff.
 - Focus to reduce the risk of damage from hazards; and
 - Readiness for response and recovery.
 - Emphasis on individual lifeline utility performance and collaboration.
- New Zealand Lifelines Council (NZLC) –national:
 - Advise Lifeline Groups on best practice and encourage projects;
 - Provide a link between Lifeline Groups and government;
 - Promote research on infrastructure resilience; and
 - Organise the annual National Lifelines Forum.



Sector Coordination Entities

Under [Section 60\(2\)](#) of the Guide to the National CDEM Plan

“National Lifeline Utilities are to—

(a) work with the NEMA to prearrange a means of national level sector coordination that best suits their sector (this ***usually*** entails establishing a single entity that takes responsibility for managing sector readiness, response, and recovery information, which in turn promotes coordinated activity); and

(b) participate in testing of SCE arrangements.”



Activities of Sector Coordinating Entities

Readiness

- Establishing emergency communication protocols: maintaining and sharing updated contact lists,
- developing Standard Operating Procedures (SOP's) for working in the NCMC,
- developing sector response and recovery plans,
- participating in a quarterly meetings with all SCE chairs facilitated by NEMA,
- participating in national response exercises, and
- identifying situation reporting needs and requirements
- facilitating sector emergency exercises and contingency planning



Activities of Sector Coordinating Entities

Response

- establishing set written Situation Report schedule, both into and out of the NCMC,
- arranging regular calls/meetings of SCE Chair(s) and the NCMC Lifeline Utility Coordinator (LUC),
- facilitate solutions to issues that are sector specific and do not require Government assistance/support,
- coordinate and provide consolidated sector situational information to the NCMC



Lessons from cyclone Gabrielle

Report of the Government Inquiry into the Response to the North Island Severe Weather Events:

- NEMA does not have the capacity or depth of technical or local knowledge to effectively manage and coordinate critical infrastructure restoration across the country. Sector Coordinating Entities and critical infrastructure entities can assist in organising timely restoration in a way that responds to local conditions and populations, with the support of local Emergency Operations Centres. The Inquiry proposes that NEMA retains oversight for leadership and coordination of the critical infrastructure response with operational support from the relevant Sector Coordinating Entities.
- Restore power and telecommunications early and improve electricity resilience



Lessons from cyclone Gabrielle

- More active coordination and advisory role for SCEs –
 - Inter Infrastructure Coordination Group
- Recognise a wider group of Critical Infrastructure with formal MoU
 - Cash Industry, Gas, Waste
- More responsibility for SCEs
 - Guidance document for SCEs, expectation of sectoral planning with NEMA
- Better Common Operating Picture
 - Working on lifelines utility viewer
- Vulnerability for rural areas – communications and power
 - Awareness of these issues, encouragement of end of line solutions



Vision

- Information management between lifelines is coordinated and effortless.
- Strong role (MoU?) for Sector Coordination Entities to work on sector readiness.
- Critical Infrastructure entities are prepared for power and communications outages
- Lifelines Viewer, integrated into Common Operating Picture
 - Example for Electricity:
 - <https://poweroutage.us/area/state/california>
- Use of distributed generation for remote areas
 - diesel/battery/solar
 - Minimum requirements / minimum requirement of detailed risk info provided to customers



Questions

- Role of SRC in:
 - Sector Coordination
 - EDB Coordination
 - Monitoring the resilience of the sector
 - Joint Projects – e.g. mapping

Northpower

Security and Reliability Council

Andrew McLeod, Chief Executive, Michael Gibbs, COO - Network

February 2025

The focus of this presentation is:

- Resilience focus for Northpower
- Some key events and learnings (Cyclone Gabrielle and recent Mangawhai Tornado)
- The Energy Bridge – what it is, benefits and challenges

Resilience focus for Northpower

On a semi-rural network, resilience strategy must address both **investment** and **response** capability

Proactive investment (Reduction)	Reactive response (Readiness, Response and Recovery)
Security of supply standards	Contingency planning (incl. temp generation)
Network and comms architecture	CIMS & Operator training
Risk-based vegetation strategy	Communications plan
HILP studies	Lifelines engagement
Landslip risk investigations	Spares management
Flood and coastal inundation planning	ADMS/OMS system
Asset lifecycle planning	Criticality framework
	Contracting arrangements

Cyclone Gabrielle



30,000

Customers without power at the peak

45,000

Customers affected in total

83%

Of feeders damaged

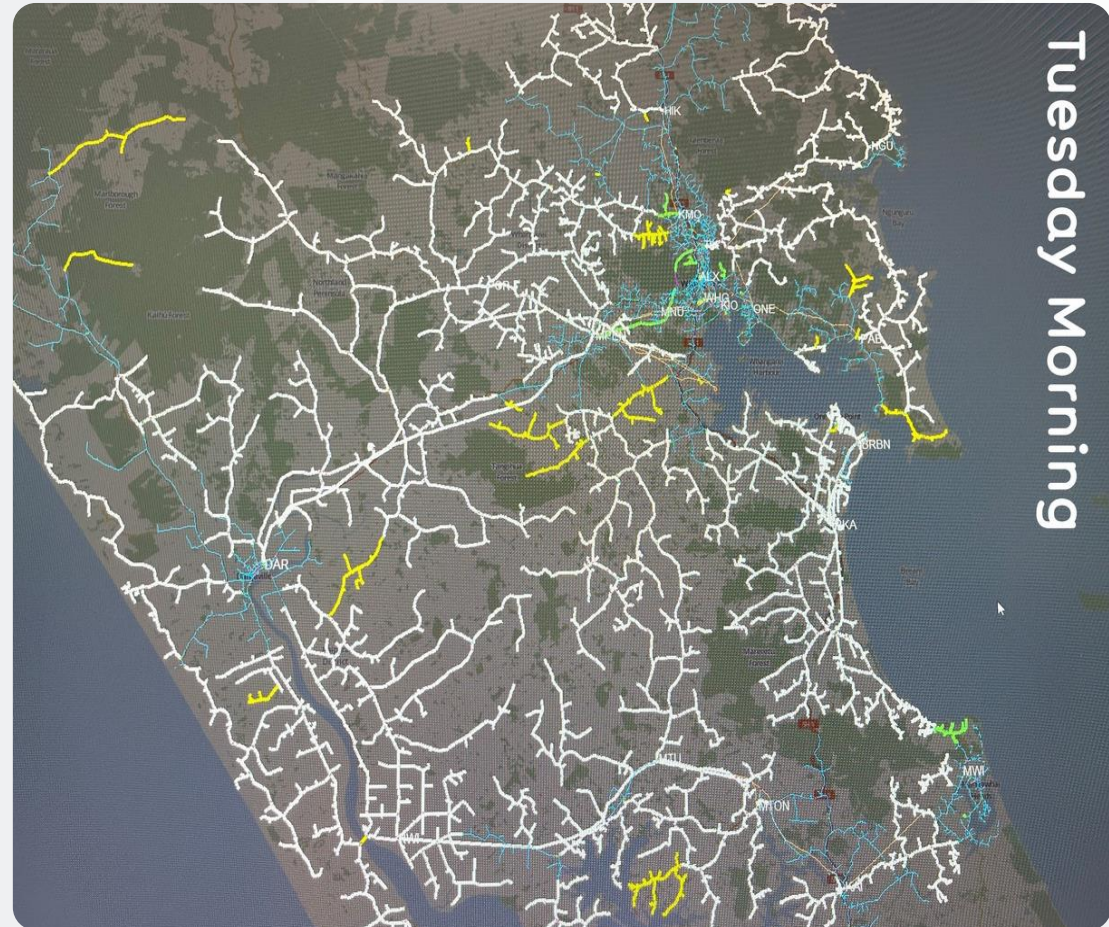
\$5.7M

Repair cost

Customers **without** power



Customers **with** power



Resilience = 80% of customers back on supply within 3 days, 99% of customers back on within 3 weeks

Cyclone Gabrielle – learnings

What worked well?

Proactive planning	Reactive response
Subtransmission network architecture 'strong'	Customer communications (our people / our response)
Asset condition / renewal (>95% faults were tree related)	Scalability- scaled from 12 fault staff, to 200+ field personal within days.
Core IT systems scalability and resilience	Core control / customer systems scaled well. ADMS supported controllers from elsewhere

What could be improved?

Proactive planning	Reactive response
Distribution Network architecture improvements	Improve criticality information availability
Risk-Based Vegetation Management	Systems designed to instantly 'switch' to major event management
Communication architecture	CIMS – range of experienced staff to enable full rotation on key roles
Land stability risk oversight	Standard information sharing protocols

Cyclone Gabrielle learnings in action – Mangawhai Tornado

Key stats from the Mangawhai event

4,700

Customers affected

~300

Customers remain without power 4 hours after event

100%

customers restored within 2 days of event

What worked well?

Proactive planning	Reactive response
Network architecture – isolation of damage	Contracting resource available and deployed quickly
Design 'smart' to enable quick repair	Joint up response from council and other key responders
	Reactive budget appropriately sized to cover costs

What could be improved?

Proactive planning	Reactive response
Communications architecture rollout.	Seamless translation of repair plans to customer impact.

80% of customers back on in 4 hours, 95% of customers on within 24 hours



What is the Energy Bridge?

Key investments

- Upgrade MPE – KOE (Transpower Connection Asset)
- New KOE – KAI line (Top Energy Asset)
- Upgrade MPE – DAR (Northpower Asset)

- ✓ Rapidly scale renewables in Northland, to bring 600MW of renewables on within 5 years, and support Auckland from the North.
- ✓ Optimise across Transpower connection assets, Transpower interconnection assets, and Distribution HV assets to unlock lowest cost of 'Transmission'



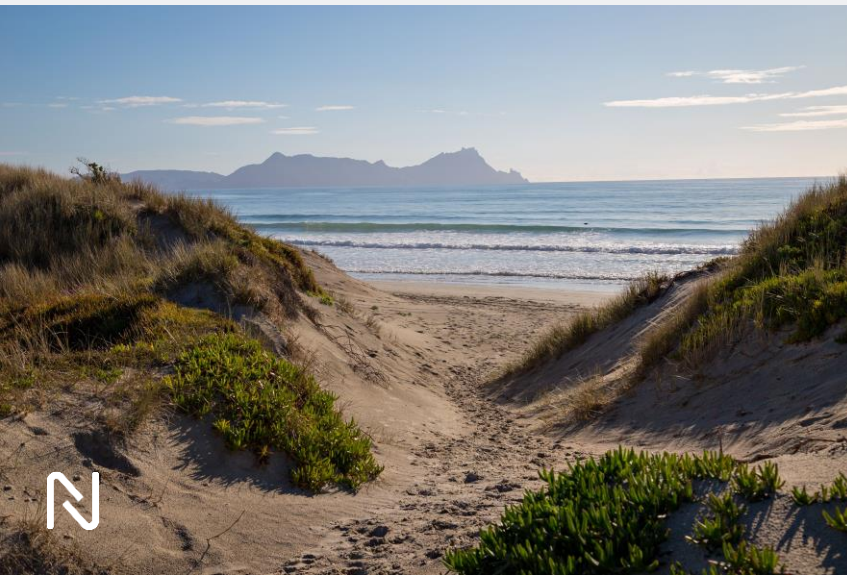
Energy Bridge benefits

National benefits (80% of benefits)

- Rapid deployment of renewables (in the right location)
- Grid support to Auckland from the North, avoiding / deferring cost to 'build through' Auckland.
- Regional (rather than project by project) optimisation of the energy system.

Benefits for Northland (20% of benefits)

- A step in unlocking Northlands economic contribution.
- More 'options' to maintain supply during events.
- Regional energy autonomy (and pricing)



Optimised distribution solutions have a part to play, but there are regulatory barriers

Traditional grid enabled solutions



Connection Asset costs typically to generators.
Interconnection costs to users / beneficiaries.
HV distribution assets at incremental costs.

Suits large central generation schemes, with
renewables only in 'pockets' of spare capacity.

Optimised distribution solutions



Generators take a share of total costs.
Balance of T&D costs to energy users / beneficiaries.
HV distribution treated like interconnection assets.

Suits distributed generation
Renewables emerge where lowest whole of system cost.

Wrap up

- Semi rural networks must invest well, and ensure scalable and effective response capability.
- Optimising across T&D an essential next step to effectively exploit renewables for the national good.



Questions?

An aerial photograph showing a power substation with several transformers and power lines. The surrounding area is heavily damaged, with large areas of dark, muddy ground and debris. In the background, there are industrial buildings and a body of water. The sky is clear with a few birds flying.

NETWORK RECOVERY & RESILIENCE

Post-Cyclone Gabrielle



RECAP: CYCLONE GABRIELLE IMPACT & RESPONSE



RECAP: CYCLONE GABRIELLE IMPACT & RESPONSE



UNISON ASSETS + PEOPLE

500 POLE STRUCTURES
DAMAGED



168 STAFF CUT OFF IN
NAPIER



3 SUBSTATIONS
FLOODED + OUT OF SERVICE



2 FIBRE LINKS
DAMAGED



REGION

18 BRIDGES
DESTROYED



SH5 ROADS
SH2 CLOSED



450 MILIMETRES OF
WATER 
1/4 OF THE USUAL ANNUAL RAINFALL

(1) MOST TELCO TOWERS DOWN
COMMS LOST TO THE REGION

+900 HOMES RED / YELLOW
STICKERED

CUSTOMERS

25K IMMEDIATELY
FOLLOWING
CYCLONE



75K CUSTOMERS WITHOUT POWER
FOLLOWING LOSS OF TRANSMISSION
SUPPLY TO HAWKE'S BAY



TRANSPOWER

2 SUBSTATIONS
FLOODED + OUT OF SERVICE



APPROX 10 DAMAGED
TOWERS



CYCLONE GABRIELLE RESPONSE



RESPONSE

- CIMS structure supported effective organisation of response.
- Proactive communication to all stakeholders and community critical using situation-appropriate means (including boots on the ground).
- Excellent support from across industry especially for material and contracting resources.
- Close collaboration with Transpower as we worked together to restore a secure supply into Hawke's Bay from the national grid.



KEY LEARNINGS

- Lack of detailed studies in the public domain associated with HILP events
- Customer engagement and employee wellbeing is key
- Focus on recovery is as important as reduction of risk
- Highly dependant on utility services to get the power on, especially for rural communities
- People who had solar and batteries fared a lot better and became hubs for their streets
- Electricity is not considered a welfare service under the CDEM legislation - unhelpful in an emergency where it is critical to community welfare outcomes
- The consequence of an outage is the same to the public, whether in one of the main centres or in the regions, however resilience solutions need to be tailored according to the customer and the location.



HOW REGULATORS CAN HELP

- Be empathetic and pragmatic around adherence to regulations in these situations. Alongside public safety, preserving life by ensuring the power comes back on as soon as possible is the primary goal.
- Advocate for the sector and coordinate across all of government throughout response and recovery phases.
- Educate stakeholders regarding risks to energy systems from natural hazards and individual and community responsibilities for ensuring their own resilience.
- Ensure the economic regulation approach to the treatment of insurance is consistent with 'natural justice' by keeping EDBs whole with respect to payments received for losses incurred.
- Align the catastrophic event reopener process with the EDB insurance claim and settlement process to better recognise and manage interdependence.
- Electricity is not considered a welfare service under the CDEM legislation - unhelpful in an emergency where it is critical to community welfare outcomes



FOCUS AREAS TO ENHANCE RESILIENCE



REDUCTION

Understanding/integrating risk

- Detailed studies on flooding and other climate-change related events.
- Pinch points with other lifelines utilities.
- Integration into Unison's Asset Management System to generate visibility.

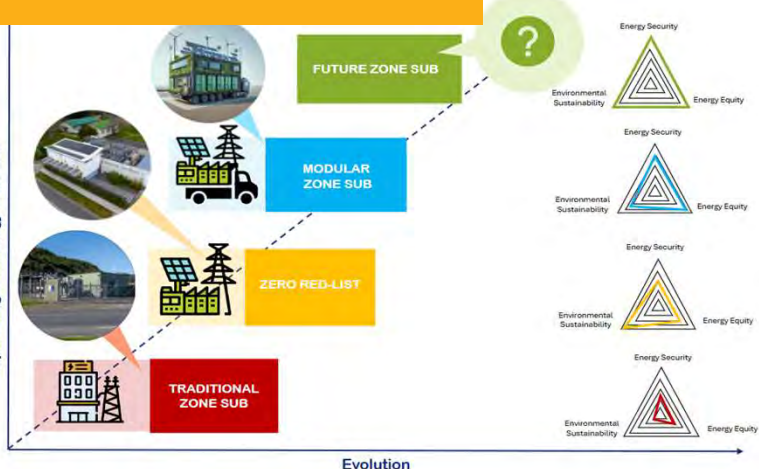
Working with our partners and communities

- Working with generators and Transpower to create solutions to build resilience, for example in Taupō where there was only one GXP (Wairakei). Unison has partnered with Contact and, by capitalising on synergies, Taupō consumers will have n-1 security at transmission level.
- Community engagement to tailor resilience solutions balancing affordability and performance.

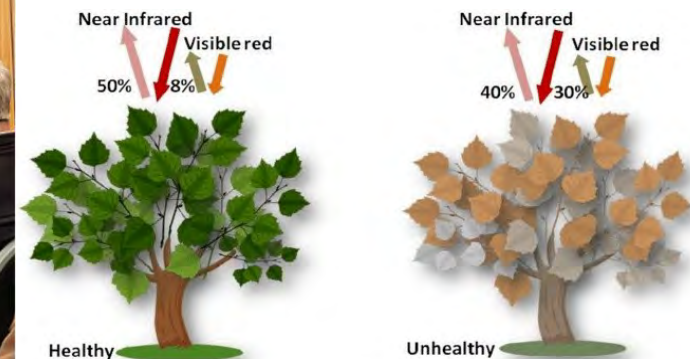
Harnessing technology

- Transition to running the network as multiple small microgrids when there is adequate penetration of DER and storage.
- Satellite imagery and machine learning to identify ill-health trees.

ENHANCED SUBSTATION DESIGN



TECH TO REDUCE VEGETATION RISKS



FOCUS AREAS TO ENHANCE RESILIENCE



READINESS

- Agreements with councils regarding temporary routes
- Promoting standardisation across EDBs, for example equipment specifications, construction methodologies etc.

RESPONSE/RECOVERY

- Leveraging technology to capture and prioritise defects
- Use of AI, especially machine learning to automate creation of switching plans
- Changing our design standards i.e. designing and developing modular and transportable substations.

