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electricity networks association

New Zealand Electricity Distributor

Network Transformation Roadmap

OVERVIEW

Introduction

Traditional production and use of electricity is changing. Newly affordable technologies are disrupting generation, use, and consumer behaviour – driving unprecedented change and unpredictability in the electricity sector, as well as creating opportunities.

These fundamental changes, and the consumer preferences and technology they give rise to, will have a profound impact on the electricity industry in the next 30 years.

These changes, or megashifts, include:

1. The requirement to meet climate change objectives, which can be achieved largely by switching energy use to renewable electricity

2. New consumer technology, which is increasing the options for consumers to produce, store and use electricity in new ways

3. The rise of prosumers – consumers who actively engage with their electricity supply.

Given the difficult-to-predict nature of future technology development and consumer behaviour, New Zealand electricity distribution businesses (EDBs) must plan in an environment of considerable uncertainty.

The Network Transformation Roadmap has been developed for EDBs by the Electricity Networks Association's smart technology working group. Its purpose is to provide information, insights and recommended actions for EDBs to navigate the changes in the way electricity distribution networks will be used in the future.

It aims to guide EDBs in planning and developing their networks and operations in a way that maintains flexibility in a period of disruptive change.

It also provides stakeholders with a coherent vision of the future role of electricity distribution networks in New Zealand.

Interacting drivers of change

The megashifts are linked; the need of nations to reduce greenhouse gas emissions has given rise to clean energy technologies such as wind power, photovoltaic solar (PV), electric vehicles and storage batteries, which in turn enable greater consumer choice and active engagement with their electricity supply.

At one extreme is a potential increase in large-scale, centralised renewable generation with the required capacity of the transmission and distribution infrastructure to transport greater volumes of electrical energy to the consumer. Renewable energy will provide a more efficient and emissions-free substitute for existing fossil-fuelled processes such as industrial heating and transport.

At the other extreme is the growth of distributed generation (e.g. solar, batteries and micro-grids). Such technology might be supplemented by energy-dense renewable fuels such as hydrogen or biofuels. Some energy end use (such as transport) might change to electricity, while other uses continue with combustion, but with renewable fuels.

The reality is likely to be somewhere between these extremes, just as consumer behaviour will range between passive and active extremes, as identified in the scenarios that underpin this roadmap.

At the centre of the changes are consumers, who have increasing options for using electricity. They will exercise those options depending on the economics, ease of use, environmental attractiveness, and their circumstances, thereby exhibiting more individual behaviour than in the past.

However, no one knows exactly how consumer behaviour will evolve, nor what new technology will be available in the future and how consumers will use it.

Network adaptation

Also at the centre of these changes is electricity distribution, delivering renewable energy to almost every consumer, and increasingly providing them with the network services to sell their electricity.

It is the role of EDBs to support consumers in adopting new technology in the future, thereby facilitating innovation, and aiding the transition to renewable energy in order to meet climate change objectives.

Ultimately, consumers should be free to connect any new electrical technology they wish to the network, provided the cost of connecting that technology is communicated appropriately and the technology meets appropriate standards to ensure safety and reliability for all connected consumers.
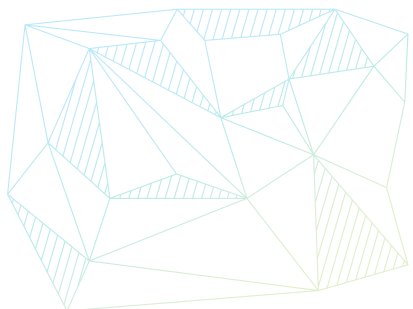
The Roadmap

The roadmap focuses on the intersection of new technologies with electricity distribution networks, rather than traditional aspects of electricity distribution.

It provides a set of guidelines for EDB boards and senior management to consider when setting their strategies and future-focused plans. Its emphasis is on the new activities and functions EDBs will need to undertake in the future.

Roadmap focus and structure

The actions in the roadmap are grouped by programmes. An *open network framework* forms the centre of the roadmap and is one of its seven programmes. In the open network framework consumers will be able to connect and operate any device, with appropriate consideration for:
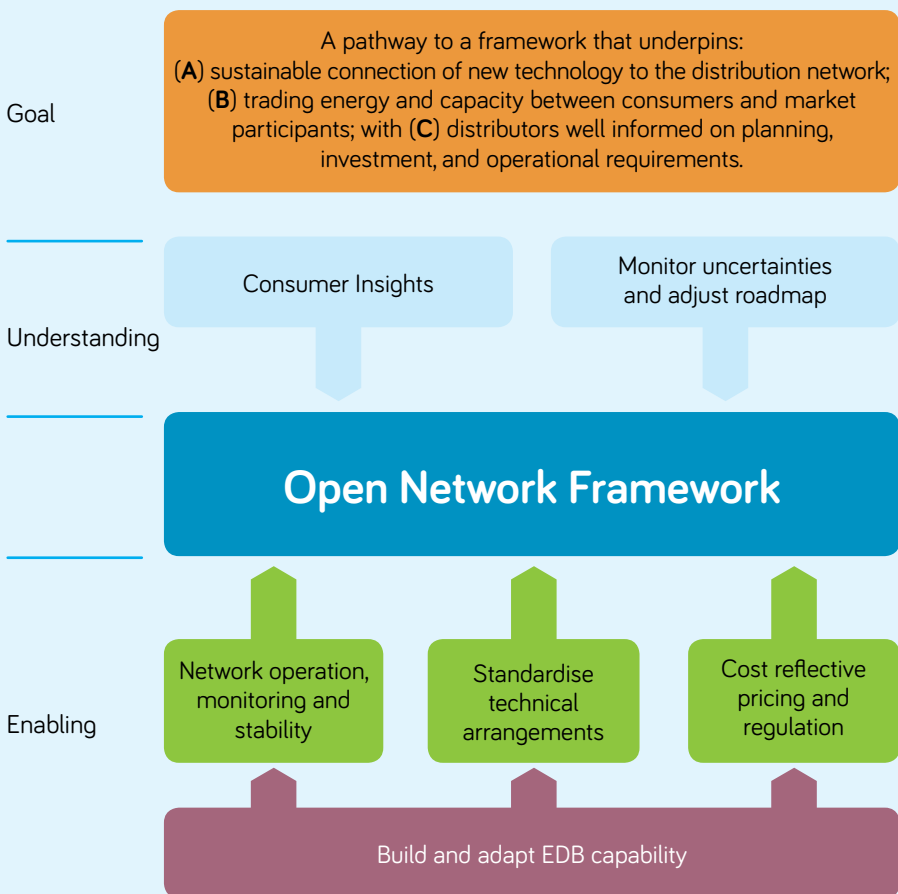
- cost of access;

- network operation and system security for all users connected to the common network;

- standard equipment;

- standard access arrangements.

The open network framework also enables the trading of electrical energy and capacity between consumers and market participants using the distribution network.

As shown in the roadmap representation opposite, six programmes within the NTR either provide understanding to inform the open network framework, or directly enable it.

The open network framework programme and the six constituent programmes informing and enabling it are detailed over the page.

NTR structure and relationship of programmes

Goal

A pathway to a framework that underpins:
(**A**) sustainable connection of new technology to the distribution network;
(**B**) trading energy and capacity between consumers and market participants; with (**C**) distributors well informed on planning, investment, and operational requirements.

Understanding

Consumer Insights

Monitor uncertainties and adjust roadmap

Open Network Framework

Enabling

Network operation, monitoring and stability

Standardise technical arrangements

Cost reflective pricing and regulation

Build and adapt EDB capability

Consumer Insights

Objective: Understand consumer motivations and behaviours to determine: (1) the impact on distributed energy resource (DER) deployment and consumption patterns; and (2) new load requirements.

Access to smart meter data

Progressively over time address barriers to access half-hourly consumption data to understand emerging behaviours, and ultimately sub half-hourly consumption and power quality data.

Understand DER deployment

Data on DER deployment (location, type etc) is available, moving to consumer understanding and scenario modelling to understand DER deployment possibilities.

New loads

Start by understanding connection requirements (location and type) of new loads, move to actively planning for and delivering network services to new loads.

New distributed generation (DG)

Understand new DG connection requirements. Develop and trial new DG connection standards, move to implementation consistently across all EDBs.

Monitor Uncertainties and Adjust Roadmap

Objective: Stay abreast of technology developments and update the EDB industry. Update this roadmap to remain relevant.

Monitor uncertainties

Monitor uncertainties, megashifts and consumer behaviours regularly and feed into roadmap programmes where necessary.

Open Network Framework

Objective: Access to the electricity distribution network by existing and new consumers and traders to connect and operate any equipment they desire (specifically DERs and new loads) with appropriate consideration of: (1) cost of access; (2) network operation and system security; (3) standard equipment; and (4) standard access arrangements.

Enable distribution network trading

Understand access requirements for DERs, open up access, and move to full and equal access to the distribution network as a vital platform for delivery of energy and capacity to and by consumers.

Third party DER and demand response (DR) for network support

Start by trialling DER and DR support to putting in place processes and systems for acquiring and using it, to DER and DR being an important contributor to network operation and support.

Demand response framework

Work with regulators on the challenges of multiple users of DR – trial and move to full scale use of third party supplied DR to manage the distribution network.

Cost Reflective Pricing and Regulation

Objective: Enable the open network framework through ensuring the development of appropriate incentives to coordinate DERs for network and system support, and to avoid congestion.

- Cost reflective pricing is an essential aspect of the open network framework

- It communicates the cost of using the distribution service for energy delivery to and from prosumers, and of the need for capacity for network support

- The NTR recognises the importance of cost-reflective, service-based pricing of distribution services in order to ensure efficient and effective use of the distribution networks now and in the future.

(The ENA distribution pricing working group has been tasked with supporting EDB cross-industry efforts in pricing reform and the NTR reflects the mandate that group has to lead this work.)

Standardise Technical Arrangements

Objective: Provide consistent method of connection of any equipment (DERs or appliances) across all EDB areas. Ensure equipment complies to approved standards to minimise its impact on the electrical power system.

DER connection codes

EDBs jointly develop and implement new agreed connection frameworks/codes, moving to regular and consistent use by all EDBs, with consistency maintained across all EDBs.

Appliance and DER equipment standards

EDBs collectively assess and contribute to international standards to ensure they are appropriate for NZ, and adopt equipment standards appropriate to NZ. Test houses to approve equipment as compliant before being allowed on the network. All equipment connecting to the network is compliant to approved standards and codes, with consistency across all EDBs.

Cyber security and autonomous DERs

Research appropriate cyber security standards and standards for autonomous DERs. Trial, and implement standards to ensure stability of autonomous DERs.

Network Operation, Monitoring, and Stability

Objective: Ensure the stability of the open network through deeper monitoring of the network and improved planning techniques.

Low voltage (LV) network monitoring and visibility

Roll out of LV monitoring systems with data management systems and provision of advanced metering infrastructure data to assist with network management. This will improve quality and type of monitored data over time and lead to extensive knowledge of each LV network.

Network stability

Research the implications of numerous autonomous DERs and methods of control. Trial control systems and implement control systems across EDBs.

Provision of network information

Investigate and trial provision of network information to operators, moving to regularly providing network information to operators, and extensive provision of information.

Build and Adapt EDB Capability

Objective: Understand networks in greater depth, their ability to host DERs, congestion, and contracting for network support. Ensure working understanding of regulations and obligations of those.

Network understanding

Understand congestion in LV networks (which may include medium voltage networks). Understand the ability of the LV network to host DERs, and opportunities for DERs to mitigate congestion.

### Contracting for network support

Trial framing of EDBs requirements for network support and introduce contestable procurement to discover a range of solutions. Develop the necessary processes to support contestable procurement of network support from trial experience. Move to regular practice, practiced consistently across all EDBs.

Asset management practice

EDBs collectively explore, trial, and implement improved asset management practices and consistent frameworks across all EDBs.

Off grid power supplies

Move from trialling remote area power supplies to best practice between EDBs and industry, practised where it is more economic than traditional networks.

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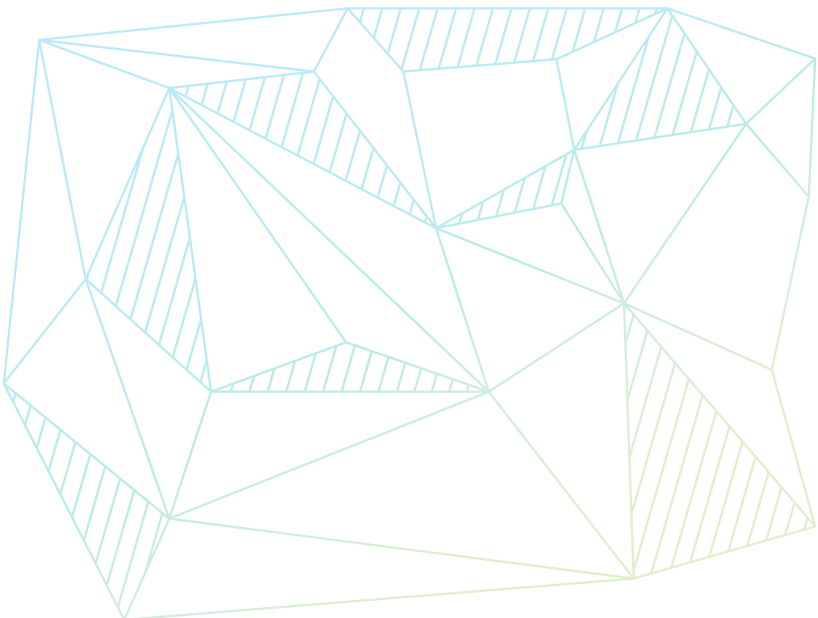
electricity networks association

Electricity Networks Association

The Electricity Networks Association represents the 29 distribution networks that provide and maintain the power lines that deliver electricity to individual homes or business.

The association supports its members in terms of developing policy, regulatory matters, compliance and government relations.