

**The Future is here - Applying a People Centric Digital Approach to Deliver a Net Zero
Electric Future**

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Abstract

The road to decarbonisation is electric for Aotearoa New Zealand and this requires an estimated spend of NZD \$22 billion by electricity distribution businesses (EDBs) on their networks over the next six years.

The sector wide challenge is changing from a steady state and incremental network upgrade approach to one that can meet the timelines set by decarbonisation goals.

This imminent step change to a new normal will drive the review and update of multiple business processes and systems for EDBs, and potentially at an industry level. All this while dealing with sector wide skills shortages, high turnover, the retirement of skilled and experienced staff, while meeting community service delivery, health and safety and other governance expectations.

This paper explores the significant opportunities from adopting a people centric digital approach that supports both network upgrade projects and normal operations. Using real world examples from the power distribution and other industrial sectors, it explains the digitisation process and confirms its multiple benefits. It covers the inevitability of digital convergence and how the development of digital workflows can be used to provide essential people centric inputs to digital twins.

It also considers how the scalability, consistency, and application of this approach at a sector level can better support the 10,000 decision makers who work for the 27 New Zealand EDBs. Ultimately it is their performance that will unlock future decarbonisation outcomes while reliably and safely delivering electricity to two million New Zealand homes and businesses.

Introduction – the New Normal

New Zealand's decarbonisation commitment timeline and the consequential energy system changes and upgrades required have been well described by strategic advisors and accepted by electricity industry decision makers across all sectors, from generation, transmission, distribution, through to retail [1] [2].

The future low carbon economy requires an estimated two thirds increase in reliable and sustainable electricity by 2050 to support population growth and the electrification of transport and process heat in the New Zealand energy system [3]. The enabling contributions required from the 27 lines companies, who operate, maintain, and construct the poles and wires that distribute this electricity are outlined at a sector level in the Network Transformation Roadmap (NTR), first released by Electricity Networks Aotearoa (ENA) in 2019, with updates in 2022 [4].

In turn, the decarbonisation challenge for senior decision makers at an EDB and associated lines company level is how to rapidly move from an incremental network upgrade approach to a new normal that can efficiently deliver significant network upgrade projects for decades. Over the same period, these same senior decision makers must guide their organisations as they adapt to sector wide skills shortages, high employee turnover, the retirement of skilled and experienced staff, technology integrations, regulator capital restrictions, Fourth Industrial Revolution (4IR) and Distributed Energy Resources (DER) growth and demands from customers, while meeting community service delivery, health and safety, and other governance expectations.

These system-level pressures will test current business-as-usual practice and will significantly increase demands on decision makers at all organisation levels. Given the industry wide skills shortage and competition for resources, options for rating up staff numbers and increasing specialist capability are limited. Beyond this, rapidly evolving business demands will inevitably require upgrades to multiple processes and systems.

As developed in Table 1 below, more of the same in the electricity distribution sector cannot guarantee a successful transition to the new normal.

Table 1 - System-level pressures and New Normal Requirements by Organisational Level

Level	System Level Pressure	New Normal Requirement
Task level decision maker	Skills shortages, high employee turnover, the retirement of skilled and experienced staff, health and safety, customer demands.	Safe production, customer liaison, public safety, managing interfaces with other work groups, records management
Supervisor level decision maker	Skills shortages, high employee turnover, the retirement of skilled and experienced staff, health and safety and other governance expectations, customer demands.	Employee engagement, people, materials and equipment logistics, planning, scheduling, performance monitoring, workgroup coordination, maintaining employee skills and competence, building capability and knowledge
Manager level decision maker	Skills shortages, high employee turnover, the retirement of skilled and experienced staff, meeting community service delivery, health and safety and other governance expectations, customer demands, DER management, project upgrade delivery, regulator capital restrictions	Internal capability for employees and supervisors, materials and equipment resourcing, project delivery, contractor management, managing variable workgroup performance, process redesign, business system improvement, operational integration of technology, governance and assurance, outage management, cost management, contractor management, materials, logistics etc.
Functional decision maker	Retirement of skilled and experienced staff, meeting community service delivery, health and safety and other governance expectations, project upgrade delivery	Redesign and alignment of business systems, procedures, design standards, references etc. that support personnel in the field, accurate performance reporting, governance, meeting accreditation and compliance outcomes.
Senior Manager and Director level decision maker	Technology integrations, Fourth Industrial Revolution (4IR) and Distributed Energy Resources growth and demands from customers, community service delivery, health and safety, and other governance expectations. project upgrade delivery, regulator capital restrictions	Company performance, funding capital upgrades, meeting community service requirements, customer demands, strategy and planning, climate change, industry roadmaps, Government liaison, Stakeholder management and communication, organisational capability, technology integration.

The Intelligent Solution Alternative

An alternative for EDBs and lines companies is to apply the NTR ‘least regrets’ principle and accelerate the development of intelligent solutions that increase decision maker capability and improve performance. At a business level, good decision making improves efficiency, flexibility, and service quality while reducing incidents, losses, and other costs.

You can't run a 21st century power system on a 20th century grid. The huge investment we are seeing in renewable generation and storage will get stuck in bottlenecks without enabling network investment.

Andrew Dillon CEO of Energy Networks Australia [5]

Intelligent solutions apply technologies and processes that digitize workflows, connect business systems, report and analyse information to create content and decision agents that assist with making informed decisions in rapidly changing environments [6]

Technologies and digital processes relevant to the power distribution sector include the Internet of Things (IoT) technology, Cyber-Physical Systems (software informed by monitoring sensors), Big Data management covering Artificial Intelligence, Data Mining, and Machine Learning, along with cyber security, Power Coupling, and Digital Twins [7].

While lines companies already deploy some of these technologies e.g. digital twins for network operations, a commitment to further digitize will enable the systematic upgrade, redesign, consolidation, or replacement of multiple business processes to become the intelligent solutions that will manage system-level pressures and navigate the new normal.

Technology digitization opportunities for asset optimization through maintenance, production planning, operational efficiency, and risk mitigation are described in the NTR (Tables 16 and 17) [4], ENA commissioned expert advice [8] and the New Energy Platform described in the recent KPMG publication on the future of energy in Aotearoa is reproduced below.

“The primary aim of the NEP was to rapidly collect and analyse data from millions of smart meters that securely gather information on energy consumption and network performance. We can use these insights to better plan energy networks, drive smarter investment decisions, and increase network reliability. Data and insights are critical to understanding consumer needs and behaviours, network investment behaviours, and the impact of new technology - good and bad - on networks and the wider energy system. This enables us to invest in much smarter targeted ways than historically have been seen, hence significantly contributing to an affordable transition.”

Simon Mackenzie CEO Vector Limited [9]

The value and opportunity of applying Digital Twin approaches in the electricity sector are recognised by global service providers such as General Electric [11] and the total value of the global digital market twin market across all industries is expected to grow to USD \$150 billion by 2030 [12]. These approaches are being deployed globally across all business sectors and will transform society in the coming years.

An extract from a case study from Essential Energy Australia confirming the value of intelligent solutions for reassessing network operations constraints follows [10].

Networks have previously needed to make very conservative estimates about the temperature rating and therefore the capacity of their overhead lines. By implementing this 3D digital twin modelling, Essential Energy can determine the true temperature rating based on how the network has actually been constructed, which means that more informed decisions can be made based on the actual capacity of the overhead network-not the assumed capacity.

In the case of the Essential Energy, this large-scale analysis is validating that the capacity of the overhead network is up to double the previously assumed capacity.

People Centric Intelligent Solutions

A people centric design approach has a primary focus on supporting and connecting good decision making at all organisational levels. It begins at the task level, working with individuals and groups to identify the information and process support required to make consistently good decision during work execution.

An industry level example of a focus on decision making and integrating people centric intelligent solutions follows.

Case Study – Integration of Collision Avoidance Technology in the Mining Industry Globally

Vehicle interactions are the highest fatality category for International Council on Mines and Metals (ICMM) member companies and the industry ambition is that by 2025 vehicle interaction technology is available to support and improve industry operational practices. Over the last five years, collaborations between mine operators, industry associations, researchers, OEMs, and third-party technology providers, coordinated through the ICMM and directly supported by the Earth Moving Equipment Safety Round Table (EMESRT), have developed and refined resources to support this ambition. Collectively these resources are being applied by operating sites to assess vehicle interaction control effectiveness, address gaps, and assist with selecting and operationally integrating technology to deliver ‘Capable Solution’ outcomes as defined below:

- *A capable solution delivers better vehicle interaction control performance by improving the quality of decision-making from task execution through to mine operations and design.*
- *A capable solution considers relevant aspects of the operating environment, production requirements and equipment design.*
- *Where technology is a part of a capable solution, it is operationally integrated.*

Initiative for Cleaner Safer Vehicles Vehicle Interaction Working Group in October 2022

People centric digital approaches use intelligent solution technologies to develop a digital model of how company processes and systems support task execution [13]. Once the digital model is stabilised, digital task-level workflows are built to support in-field decision makers. The build process makes connections between business systems so that current data can be harvested and pushed to relevant workflow steps for use by task level decision makers.

At a task level the person becomes both a sensor and a local processor, and providing that the workflows are codesigned, accepted, and can be improved by field staff then this people centric design delivers two essential outcomes:

1. The process introduces the capacity to self-monitor and record that tasks are being completed to standard
2. The digital workflows provide precise and contextual information to assist decision makers at the supervisor, manager, senior manager and director levels.

Digital Workflows use by Field Teams

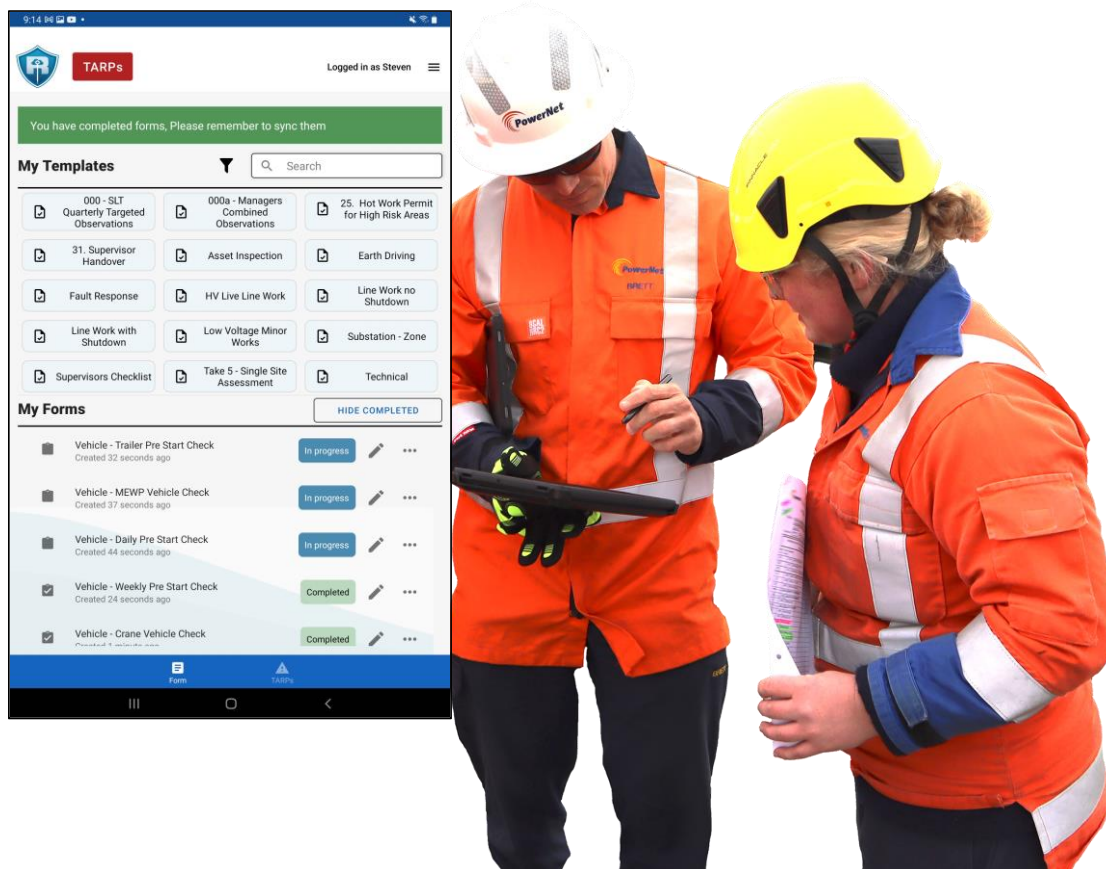
Once in production digital workflows assist field teams with work planning, hazard management and task step execution while introducing the capacity to self-monitor and record that tasks are being completed to standard.

The field user interface for people centric intelligent solution already deployed in the New Zealand Power distribution sector has multiple structured workflows that confirm:

- The assigned work activity has been planned and approved (linked to work orders)
- The equipment and materials necessary to complete the planned work activity are available (planner inputs)
- Personnel assigned to specific roles are competent (linked to HR records)

- Any contractors are prequalified (linked to contractor management records)
- Work environment hazards are identified and controlled (prompts organised by task with decisions logged)
- Job set up meets standards and details are logged
- Guidance and prompts are provided for workflow steps
- Confirmation and logging that task steps are completed to standard
- Opportunities for improvement are captured for feedback to planners and supervisors

Figure 1 - Field User Interface Example for a people centric intelligent solution



Performance Reporting and Improvement for Line Managers

The precise and highly contextual information from the digital workflows can be aggregated, reported, visualised, and analysed to support supervisor, manager, and functional decision makers.

For supervisors and line managers, a digital knowledge and reporting platform assists with performance support across multiple teams while identifying improvement opportunities, before incidents and other losses occur. Supervisors accountable for multiple field teams can increase their span of management by monitoring workgroup performance beyond site attendance e.g. equipment checks, job planning, confirmation that critical controls are in place, opportunities for improvement feedback etc.

For senior leaders and directors, a range of comprehensive and up-to-date reports covering performance monitoring, analysis, active compliance connecting external obligations through to business activities, assurance, and other outcomes can be validated against completed work.

Conclusions

If the energy system future of Aotearoa New Zealand is electric, then the business process evolution for EDBs and line companies is digital.

Leaders in EDBs and line companies have a key role in supporting the societal transition to a low carbon future. They also are accountable for keeping the economic lights on while meeting obligations to their employees, shareholders, customers, and the communities they serve. Beyond this, they must guide their organisations through sector wide challenges of decarbonisation growth while managing capability and skill shortage head winds during ever increasing operational complexities.

These system-level pressures combine to create the new normal and while the electricity distribution sector in New Zealand is mature, well managed, and requirements for the safe and productive network operations are clearly defined, continuing with business as usual approaches, supported by more of the same thinking will not continue to deliver required outcomes.

The Network Transformation Roadmap recognises this, and the in-company deployment of intelligent solutions, based on technologies and processes that digitize workflows, connect business systems, report and analyse information to create content and decision agents to support decision makers has started.

This trend to intelligent solutions is global and uptake will accelerate inside companies and across the sector creating opportunities to link and scale content and share processes. It will transform how industries operate, and its impact will be analogous to the electrification of New Zealand following the first world war.

The opportunity through this transformation is to apply a people centric design approach that focuses on good decision making beginning at the task level. When task level digital workflows are codesigned, accepted, and can be improved by field staff they support self-monitoring and task level performance improvement, while providing precise and contextual information that assists decision makers at the supervisor, manager, senior manager and director levels.

The future is here, it is digital and based on people centric intelligent solutions that increase capability of decision makers at all organisation levels to navigate and prosper in the new normal.

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