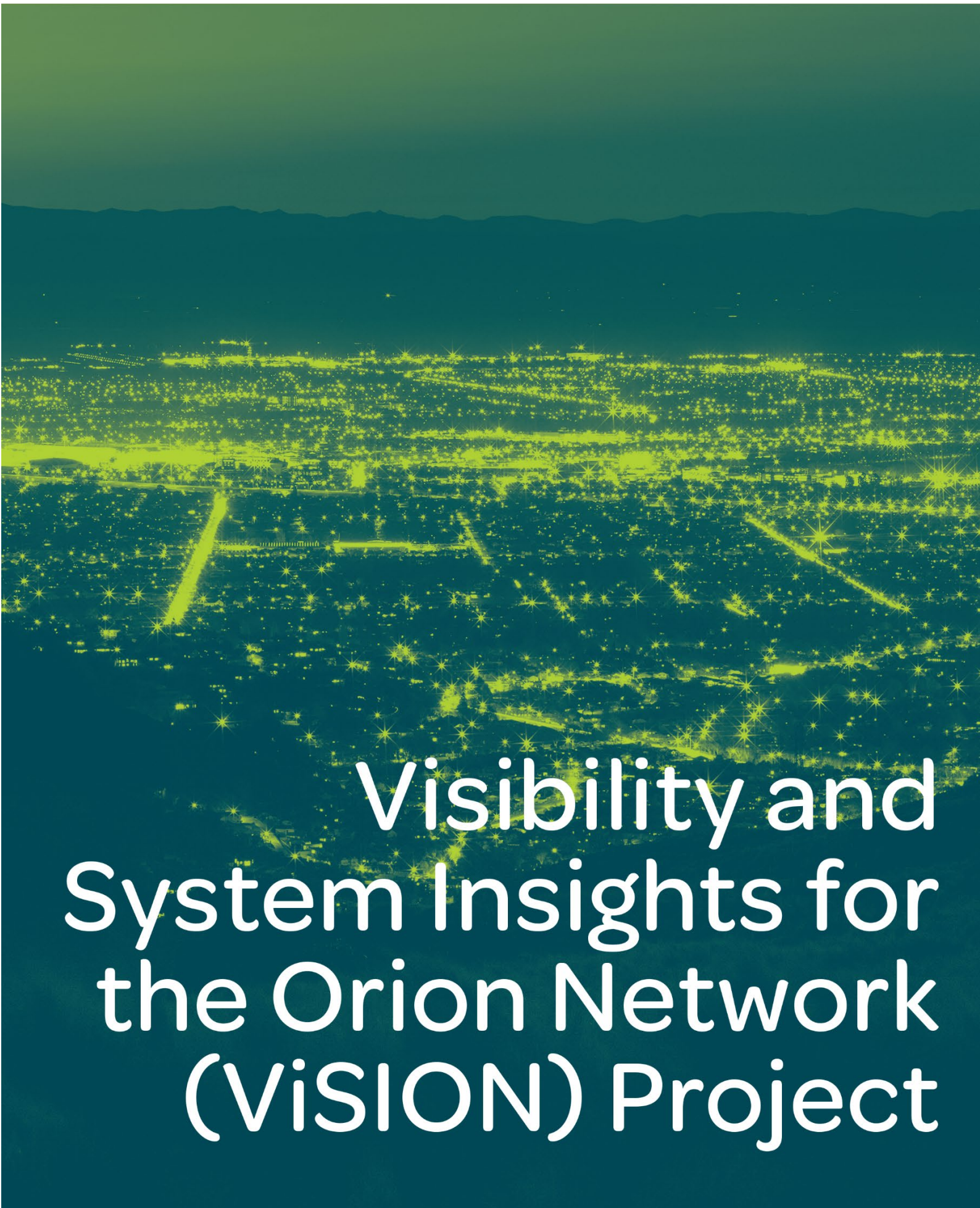
Orion

Innovation Project Allowance Application

Issued 5 June 2024



Visibility and System Insights for the Orion Network (ViSION) Project

Contents

1. Introduction

Under the Default Price-Quality Path Determination non-exempt Electricity Distribution Businesses (EDBs) may seek approval from the Commerce Commission for additional allowances to part fund innovation projects. This is an application for Orion's "Visibility and System Insights for the Orion Network" (ViSION) project.

Our ViSION project targets our ability to gain and use insights from a combination of existing and new, temporal and spatial data sources. ViSION is a new process that delivers lower costs and increased quality of electricity service to customers.

2. Executive summary

Typically, an EDBs street-level low voltage network supplies more than 99% of its customers. Despite this high percentage, EDBs have traditionally not had good visibility of the condition and behaviour of their low voltage networks, which were planned for reasonably stable passive household loads with one-way power flow. However, as more customers adopt technologies such as EVs, and solar systems and batteries create two-way power flows, developing visibility of and capability in the low voltage area is essential to efficient electricity network management, and facilitating customer choice and participation in demand response.

There are various differing approaches that EDBs can take to securely gather low voltage data and then utilise it to help optimise their networks. Orion extensively considered various visibility and insight options before settling on our ViSION project. The first stage of ViSION is the subject of this innovation project allowance application.

The insights developed through our ViSION project will help unlock latent capacity in Orion's LV network, thereby reducing the need for future network investment, lower costs to our customers, and deliver numerous other efficiency, quality and safety improvements. ViSION therefore meets the regulatory requirements for innovation projects.

ViSION will also not only benefit Orion's customers but also other EDBs. Orion's research, explorations and findings will assist other EDBs, particularly those who are not large enough to undertake a lot of the investigative work themselves, to manage their networks better at lower cost. Orion will share its ViSION learnings with other EDBs through such means as final reports to the Commerce Commission, industry papers, conferences, our upcoming 'platform as a service' RFP, and general collaboration and assistance.

The first stage of ViSION is focussed on data gathering and integration - from a combination of existing, and new, temporal and spatial data sources - and enablement of power systems insight.

Data selection

Working with international and national partners at the early stages of ViSION, we identified that through triangulated analysis of three separate data sources we would be able to achieve excellent initial low voltage visibility and learnings at lowest cost. The three sources of data being:

1) Smart meter operational data
2) Low voltage distribution transformer monitors
3) Network topology

Within New Zealand, despite the critical need for it, ongoing and widespread access to smart meter operational data has historically been problematic for EDBs that do not own meters installed at customer premises. Operational data from smart meters includes network information such as voltage, current and phase angle. Operational data, as opposed to more easily obtainable 30-minute kWh consumption data, greatly increases the analysis that can be undertaken by an EDB particularly in the areas associated with customer safety, connectivity, and topology.

As part of ViSION, in October 2023 Orion became the first EDB in New Zealand to sign a contract with New Zealand's largest smart metering provider, Bluecurrent[1] (formerly Vector Metering), for the ongoing supply of 5-minute operational data from smart meters on our low voltage network.

Given Bluecurrent hold around 90% market share of smart meters in the Orion network area, the receipt of Bluecurrent's 5-minute operational data, when combined with LV transformer monitoring data and network topological data, enables Orion to achieve many new efficiencies.

It also means that as we learn ways to process and analyse this specific data, and as Bluecurrent hold over 30% of the smart meters in 21 of New Zealand's 29 EDB areas, we can assist many other networks as they too, over time, sign agreements with Bluecurrent.

Data integration

In ViSION Orion is working through some of the challenges associated with receipt of enormous amounts of third-party data.

[1] Bluecurrent have a greater than 60% market share of the NZ smart meter market. (https://www.ea.govt.nz/documents/961/Vector-Metering-IPAG-presentation_4ZOMEBQ.pdf

Generally, EDBs have extensive experience of receiving and processing their own in-house data. But until recently relatively little ongoing third-party data has needed to be processed. Having 5-minute 24/7 data for near 200,000 customers now flowing to Orion on an ongoing basis, has meant we are a leader in understanding some the challenges associated with such third-party data ingestion among New Zealand EDBs.

The learnings and progress we have made in the development of systems and processes to reduce third-party data issues, such as duplication and security issues, will be valuable for other EDBs as they too move into the 'big data' phase.

Further, the work we are undertaking with overseas third-party data platform providers around system security requirements to enable New Zealand privacy law to be met, will also be of benefit to other EDBs as they utilise such providers.

Power systems insight enablement

Under ViSION, to determine the range of insights that are possible from the three data sources previously mentioned, instead of immediately opting to work with one analytics company on a long-term basis, we opted to test over a trial period the modelling tools of two Australian based 'platform-as-a-service' companies. These companies are world leaders in delivering LV analytics for distribution network management.

Our approach is to provide each of these two platform-as-a-service companies with the three data sources and allow them to triangulate those data sources to provide a suite of potential uses. After learning of the potential uses, we are then determining in-house which are most beneficial to enable us to optimise the operation, quality, and safety of our network.

By working with two companies in an exploratory manner, we are learning different ways of doing things and ensuring we don't miss opportunities. Our intent is that, once we have better knowledge on the key insights available, by early 2025 we will issue an RFP to international and national data analytics companies seeking a software/platform solution(s) for our low voltage data needs.

This RFP will include a list of the various data intelligence capabilities that we are seeking, and other factors e.g., cyber security, accuracy requirements, proposed contracts, etc. We believe this RFP will be useful to other New Zealand EDBs in their understanding of the potential of such systems and save them time and resources as they implement such systems.

3. Confirmation

In the Input Methodologies (IM) Determination, an "*innovation project*" means a project which enables the creation, development, or application of a new or improved technology, process, or approach in respect of the provision of electricity lines services in New Zealand.

Orion confirms that the subject of this innovation project allowance application, namely the first stage of ViSION, is a new and improved approach to the way we provide electricity line services.

As per the regulatory requirement for an independent verification that the first stage of ViSION is an innovation project and meets the requirements set out by the Commerce Commission[2], we engaged Sapere to produce an independent report. We have included their report alongside this application.

We are happy to discuss any aspects of this application with the Commission. Please contact Orion Commercial Strategy Lead, Stephen Godfrey, via [redacted] in the first instance.

No parts of this application, or the associated report confirming how the first stage of ViSION is innovative and will improve efficiency and lower costs to our customers, are confidential, and we are happy for the Commission to publish them in their entirety.

[2] As set out in Schedule 5.3(2)(c) of the Default Price-Quality Path determination in November 2019.

4. Project costs and application amount

Orion currently has another innovation project allowance application under consideration by the Commerce Commission. This being the joint Wellington Electricity and Orion Resi-flex application[3]. The outcome of the Resiflex application affects the quantum this application is for.

Should the Resi-flex application be unsuccessful, this ViSION innovation project allowance application is for $825,000. Orion's total innovation project allowance for the DPP3 period is $825,000[4,5].

Should the Resi-flex application be successful, then the quantum granted by the Commerce Commission for the Resi-flex application should be deducted from the $825,000 total amount sought by this application. Any deduction made should be off the quantum of the capital expenditure allowance sought under this ViSION innovation project allowance application.

A breakdown of ViSION costs incurred by Orion over the DPP3 period up to 30 April 2024 is shown in Table 1. Total ViSION costs of approximately $4.8m have been incurred. These costs have been incurred over multiple years, from 1 April 2020[6] to 30 April 2024, all of which fall within the DPP3 regulatory period. Multi-year recovery of costs is allowed for under the requirements for innovation project allowances.

The maximum amount sought under this application of $825,000 is less than 20% of total ViSION costs incurred to date by Orion. This is significantly below the 50% of project costs threshold allowed in the DPP3 period.

[3] Orion's requested drawdown in the Resi-flex application is $50,175.
[4] Electricity Distribution Services Default Price-Quality Path Determination 2020; [2019] NZCC 21. Schedule 5.3.
[5] Orion has previously (excluding the applications currently being considered) not drawn down any amount from our total innovation project allowance for DPP3, and we note no costs included within this ViSION project allowance application have been included in other current or historical applications.
[6] Costs incurred in the years 1 April 2020 to 31 March 2022 were entirely in relation to Low Voltage Monitoring and amounted to approximately $1.3m of capital expenditure.

	Costs incurred from 1 April 2020 to 30 April 2024 ($)		
	Operating Expenditure	**Capital Expenditure**	**Total**
Data acquisition	778,000	3,579,000	
Data ingestion, storage and cleaning	80,000	222,000	
Analytic platform trials	138,000		
Total ViSION costs	996,000	3,801,000	4,797,000
ViSION application amount if Orion's Resiflex application is unsuccessful	498,000	327,000	825,000
ViSION application amount if Orion's $50,175 Resiflex application is wholly successful	498,000	276,825	774,825

Table 1: ViSION costs and innovation project allowance application amounts

5. The need for change

Aotearoa New Zealand's energy system is undergoing a significant and rapid transformation driven by four mega-trends: Decarbonisation, Digitilisation, Decentralisation and Democratisation. Rising to the challenge of these mega-trends necessitates a transition from the traditional distribution network operating model, which was designed for one-way energy flow to a dynamic, energy-sharing smart network that accommodates a diverse range of renewable energy sources, electric vehicles, energy storage, and low carbon technologies (LCT) at scale and pace.

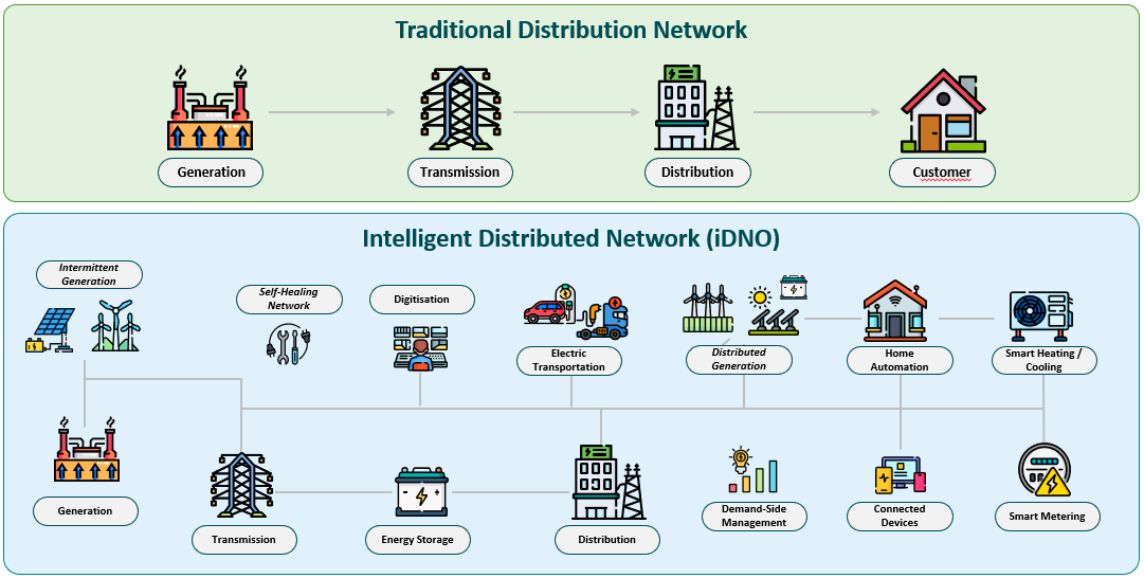


Diagram 1: The changing landscape

To support the energy transition EDBs need to evolve beyond the function of reactively managing largely one-way (and increasingly two-way) energy flow and into forward-thinking intelligent Distribution Network Operators (iDNOs). iDNO capabilities and target operating models will be essential to monitor, forecast and orchestrate the bi-directional flow of energy in a secure, sustainable, and cost-effective manner.

Drawing on experience from national and international electricity networks and consultants, and building on the ENA's work[7], Orion has developed an extensive Network Transformation Roadmap (NTR) and programme of works to guide it to move at pace to becoming an iDNO serving its customers in line with world best practices.

[7] Energy Networks Association, New Zealand Electricity Distribution – Network Transformation Roadmap, 2019

A foundational part of Orion's transition to an iDNO, namely our **'Visibility and System Insights for the Orion Network' (ViSION)** project, is the subject of this application. Other future steps in our transition to an iDNO may be the subject of future allowance applications.

Our ViSION project targets our ability to gain and use insights from a combination of existing and new, temporal and spatial data sources. This requires significant increases in the accuracy, volume and timeliness of data ingestion and a transition from human manipulation of data in spreadsheets to a heavier reliance on automated systems that will include aspects of artificial intelligence and machine learning.

6. ViSION's place in our NTR

To achieve iDNO capability, we have set five Network Transformation (NT) key outcomes that we wish to achieve, which in turn will be delivered through six NT workstreams.

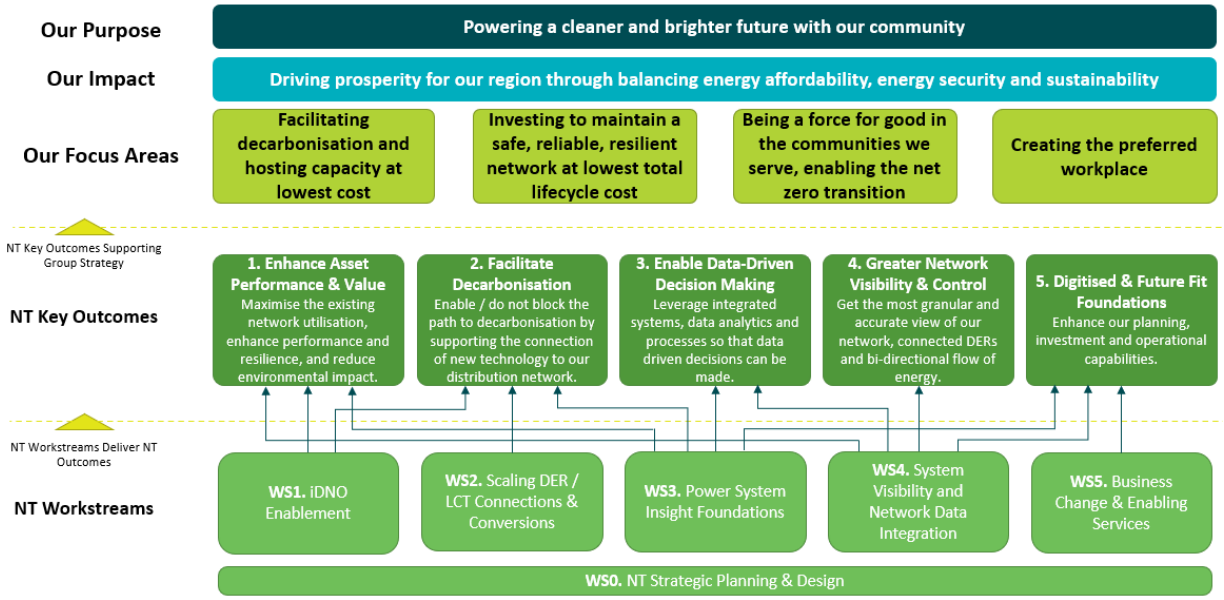


Diagram 2

Each workstream has a multi-year, multi-horizon programme of works developed for it, with different and changing areas of focus as the programme progresses over time. Diagram 3 illustrates the high-level delivery plan and respective focus areas in each workstream over the duration of the NT Programme.

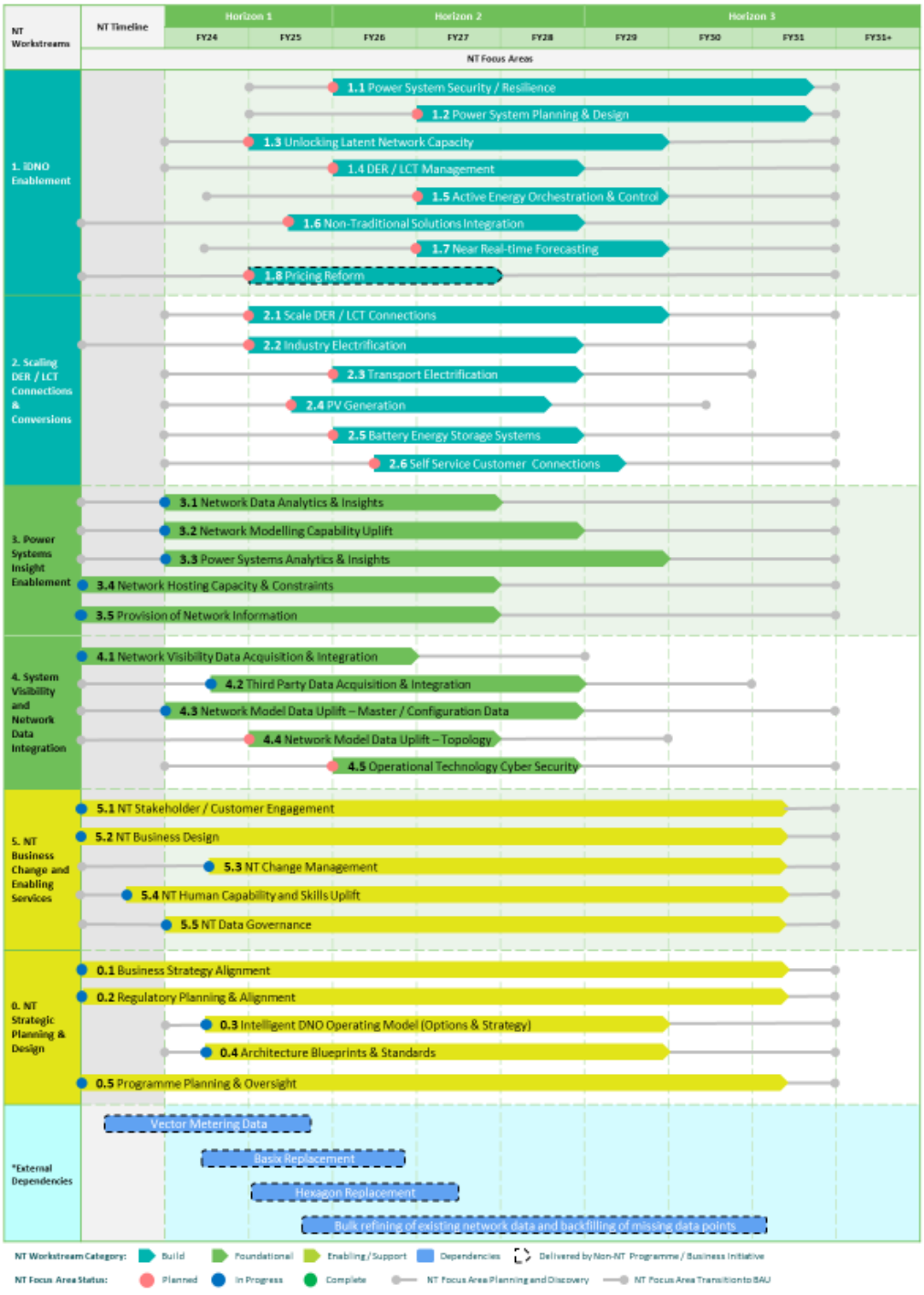


Diagram 3

It is the work that Orion has undertaken to date in Horizon 1 in the 'Foundational Build' (green) area that is the subject of this ViSION innovation project allowance application. The Foundational Build green area is split into two workstreams:

- System visibility and network data integration, and
- Power systems insight enablement.

7. System visibility and network data integration

To help consolidate Orion's view on the value of differing types of data we engaged respected international consultants, EA Technology, to investigate what data is being collected overseas and compile a Network Insights, Visibility & Data Strategy report for Orion. The report identified several use cases for data and specified the strengths and weaknesses of using differing types of data.

The EA Technology report and other work undertaken by Orion identified that the best approach to take in the first few years of our programme would be to base our programme on improving LV spatial visibility using three key data sources. Critically we identified that it is only through triangulation of these three data sources into power flow modelling tools that we would be able to achieve the excellent initial low voltage visibility and learnings we sought.

The three sources of data being:

1) Smart meter operational data

2) Low voltage distribution transformer monitors

3) Network topology

Each of these three data sources is required. Each data source can be thought of as a leg on a three-legged stool – remove one leg and the result is significantly less effective.

Having identified the need to triangulate these data sources we then set to obtaining this data.

Smart meter operational data

Orion initiated discussions with Bluecurrent, the majority metering provider in our network area, several yearsago on operational data (e.g., voltage, current, phase angle, as opposed to kWh consumption data).

Partially through these discussions we believed that waiting for access to operational data would provide greater benefits, at lower overall costs, than securing immediate access to unlimited consumption data (30-minute kWh data). We consequently bypassed the step of using more easily obtainable kWh data for network planning purposes and went straight to negotiating access to operational data and planning for the use of that.

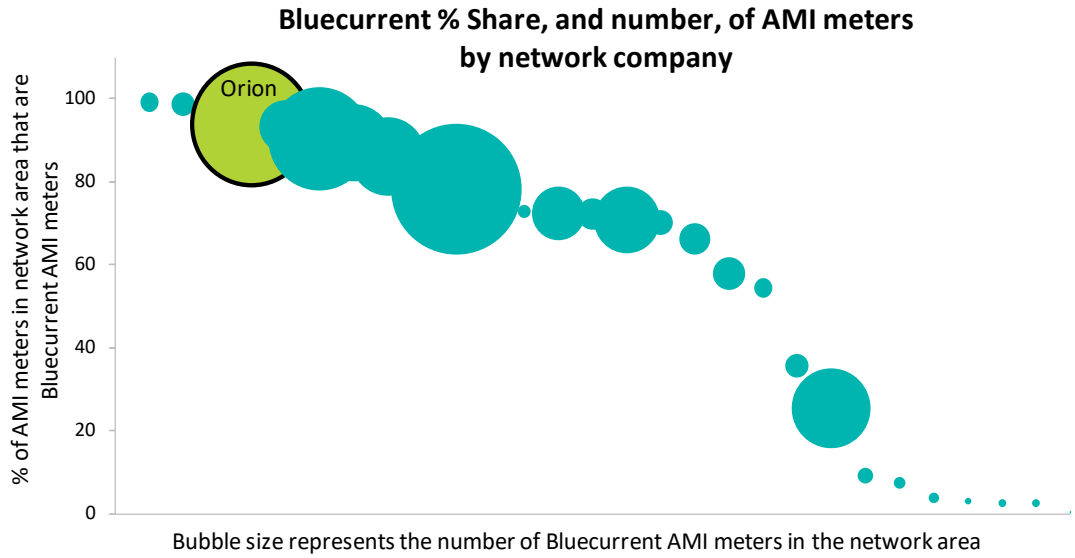


Diagram 4

The development of the technical solution by Bluecurrent, to enable data collection and processing, and negotiations took over two years, with the result being that we were the first EDB in New Zealand to sign a contract[8] with Bluecurrent for the ongoing supply of 5-minute interval operational data from smart meters[9]. 5-minute operational data, as opposed to 30-minute kWh consumption data, greatly increases the analysis that can be done on the data set, particularly in the areas associated with customer safety, connectivity, and topology.

In the two years the negotiations took, three critical things occurred:

1) We were, under strict usage and privacy conditions, able to obtain early access to three months of 5-minute operational data for 1,000 ICPs that were fed from Milton substation. This provided us with an early set of operational data to analyse and learn from. To optimise results of the testing, the 1,000 ICPs were carefully selected to include:
   - ICPs at the start and end of the LV feeders downstream of Milton substation. Such ICPs maximised the visibility of voltage variability for customers.
   - ICPs that were downstream of low voltage transformer monitors, to enable cross checking of findings between smart meter operational data and LV transformer monitors.

[8] In October 2023
[9] Presently this 5-minute operational data is being provided through daily download. We are in discussions with Bluecurrent as to the ability to increase the frequency of download.

2) We asked Bluecurrent to store all available operational data in advance of contract signing. This meant that once Bluecurrent made the necessary investment in its digital systems to unlock sharing data and once an agreement between parties was reached, we could receive a data dump of historical information from 1 May 2023.

3) We were able to work with Bluecurrent to understand data format, transfer mechanisms and expected volumes to prepare our digital systems ahead of contract signing.

   In the weeks following contract signing with Bluecurrent, we received in, and stored, over 13 billion historical LV operational data points collected since 1 May 2023. This provided us with data for our critical peaking winter period and effectively advanced our understanding of winter performance of our network by one year (i.e., we didn't have to wait until end winter 2024).

We understand that Orion is ahead of other networks in analysing and using operational data supplied by New Zealand's largest smart meter provider and we believe no other 'big 6[10]' EDB has the quantity of third-party operational data that Orion has access to (i.e., near 90% of ICPs). Consequently, our learnings from the receipt and analysis of this quantum of data are likely to be of significant benefit to other EDBs.

Low voltage distribution transformers monitors

In 2020, NZ consultancy firm Sapere produced a report titled "Low Voltage Monitoring – Prime and Guideline". In that report Sapere noted that *"Reconciling operational smart meter data[11] with LV monitoring allows for the detailed LV topology to be reverse engineered. This can be helpful for planning and forecasting transformer and LV feeder loadings for various scenarios of customer load growth or DER uptake.".*

Various other consultants, including EA Tech, and EDBs including SSEN and Energy Queensland have come to a similar conclusion. Consequently, EDB low voltage monitor installation is a critical part of our foundational ViSION project.

As Sapere noted *"LV monitoring has the potential to significantly improve the customer experience from their electricity supply, even as the LV network becomes more complex to manage. For example, investigating increasing incidence of transient disturbance will lead to the discovery of some faults before they ever occur. Even where faults do occur, LV monitoring*

[10] Aurora, Orion, Powerco, Unison, Vector and Wellington Electricity
[11] Operational smart meter data was termed AMI data by Sapere.

should significantly reduce restoration times, potentially even pinpointing fault locations as they occur.

When an LV feeder is being reviewed or there is concern around future capacity or congestion concerns, LV monitoring can assist better decision-making, potentially even concluding that feeder reinforcement is not necessary, or that acting early to increase capacity will be beneficial. Measuring active, reactive and apparent power per phase will help highlight the actual power loading on the feeder or major branch and how much of the problem may be due to poor power factor or out-of-balance phase loadings.

The expected benefits of LV monitoring on feeders are reduced expenditure through optimising investment, avoiding faults, failures and urgent replacement, and potentially installing less capacity on average."

Since 2020, Orion has installed LV monitors on 9% of distribution transformers . The high-resolution data from distribution transformer and LV feeder monitoring is enhancing our network planning, power quality, connections, and outage management practices. This data is also being used to validate early prototyping results from smart meter analytics.

Network topology

The third critical piece of data being gained under Orion's ViSION project is building a more accurate network topology, primarily through identifying customer phasing. Ultimately, phase balancing is one of the tools we can use to optimise the low voltage network. Knowledge of customer phase connections also significantly increases the accuracy of network analytics and power systems modelling by reducing the number of assumptions.

Phase balancing refers to the even distribution of electrical load across the three phases of a three-phase electrical system. Even distribution prevents overloading one phase whilst underutilising the other two, leading to better utilisation of assets. Aside from phase balancing being a low cost, least regrets method to free up capacity, it can also resolve voltage issues, prevent neutral current exceeding the rated value of the asset and reduce transformer losses which can extend the life of assets.

To achieve phase balancing a critical, and obvious, first step is to understand what phase each customer is on. Unfortunately, and we suspect this would be the case for most other NZ EDBs, the phasing of most of our historic customers has not been recorded[12] so we need to obtain this phase information if we are to optimise our low voltage network.

[12] Since September 2022 the phase that a new residential customer is connected to has been recorded by Orion.

To learn what phase a customer is on, we could send teams out into the field and examine, effectively house-by-house, each residential customer's phase. This obviously would take considerable time and incur significant cost. An alternative is to determine if analytical systems can accurately – utilising operational smart meter data and the low voltage transformer monitoring data – predict what phase a customer is on.

Orion's ability to access both low voltage transformer monitoring data and operational smart meter data for near 90% of our customers enables us to innovatively test, across a wide and diverse customer base, phase identification predictive analytics capabilities.

To begin with we are testing such capabilities in the Milton substation area[13]. The trial involves in-field investigation, using non-contact phase identification equipment, of Milton customers phases and electronically recording these. These records are then tested against what the predictive models estimate customers phases to be.

Should the Milton trial prove analytical systems can predict phases based on a sample % of phases being field identified, rather than 100%, this will save considerable time and money understanding the topology of the remainder of our network. It will also prove useful for other EDBs plans to identify phases on their network should they be accessing similar operational data to that provided by Bluecurrent.

Initial results are proving very successful for single phase detection, but further work is required to improve identification of phases where a customer is on two or three phases. We note that an ICP being on two phases is more common in New Zealand than it is in Australia, so the exploration of how to accurately identify two phases is another innovative piece of work that will be useful to other NZ EDBs.

[13] Milton being the area we initially obtained operational smart meter data for and where we have deliberately installed a number of low voltage monitors.

8. Power systems insight enablement

Gaining access to required data is the first phase of ViSION. The second phase is to use the data to lower costs to customers and increase reliability etc.

The use of the data involves several different stages, each critical before an EDB can optimise its low voltage network. These include:

1) receipt, storage and protection of the data

2) 'cleaning up the data' so that duplicates and inaccurate recordings are filtered out, and

3) using digital systems to understand and assess the low voltage network's electrical flows down to LV feeder level.

While it is the third stage above, namely the analysis of the data, that often receives the most attention and interest, the first two stages are also critically important.

As data becomes more granular (e.g., today smart meter data is recorded in 5-minute packets, in the future it could be every second) and received in near real-time, all EDBs, even those with a relatively low number of customers, will be receiving in huge volumes of data. All EDBs will need to consider how they collect and store this data and many existing methods (e.g., using in-house servers, in-house cleaning up of data via spreadsheet formulas) are unlikely to be scalable.

Recognising this future of vast data inflow, Orion is introducing new methods and techniques for data receipt, storage, cleansing and security.

Data receipt, storage and protection

Diagram 5 visualises Orion's ETL pipeline[14]. The "Orion Lakehouse" is hosted in the cloud, not on inhouse servers.

[14] An ETL pipeline is an ordered set of processes used to move data from one system to another. ETL stands for 'extract, transform, load'.

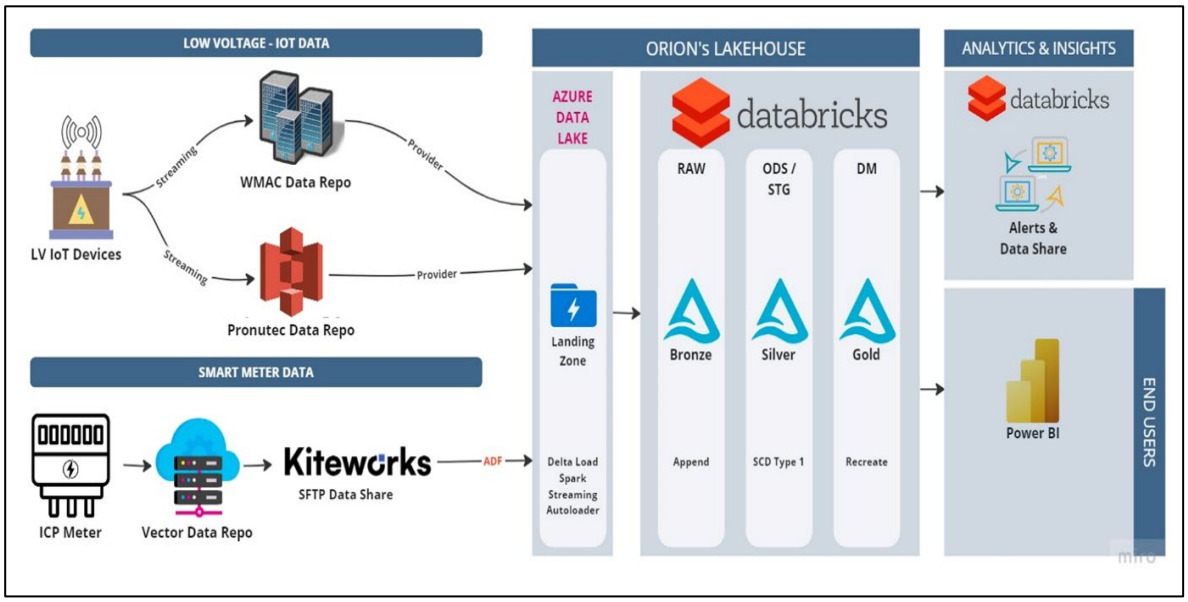


Diagram 5

All data is pushed (LV feeder data) or pulled (smart metering data) onto our Azure landing zone's "blob" storage. This blob storage account is isolated from other applications and access is restricted to admin access only. From the blob storage account, the data is picked up by Orion's modern data platform powered by Azure DataBricks by which most of the transformation steps and analytics are being performed.

Databricks is a scalable data platform that provides us with the computing, storage and functionality needed to perform advanced analytics such as machine learning and AI model building or to build reports based on large volumes of data.

Using this architecture allows us to finetune access control and audit data usage and consumption to ensure privacy requirements are met. Data access is granted based on individual requests and is regularly reviewed.

We have also established detailed data governance frameworks, policies, and guidelines for our network visibility data and IoT devices. Such frameworks maintain data integrity, enhance decision-making, and ensure regulatory compliance.

Data quality

As more and more data is received in from third-party owned devices (e.g., smart meters, EV chargers, customer owned batteries etc) EDBs will need to learn to cope with not only the quantum of data received, but also the quality and cyber risks associated with such data.

The risk of cyber-attack is ever present and well understood. Also, when dealing with large volumes of data, particularly those that are collected via cellular links, from a variety of devices installed internally or externally on homes and cabinets, there is always going to be an issue of data integrity. Missing data, duplicate data and inaccurate data are all to be expected.

Orion has made significant steps in understanding and managing such issues. As the first EDB in New Zealand to sign an agreement with the largest smart meter provider, we lead the way in understanding some of the challenges associated with such data.

We have worked collaboratively with Bluecurrent since October 2023 to develop systems and processes to reduce data issues. For instance, Bluecurrent and Orion have together significantly reduced the amount of duplicate operational data coming from the smart meters. Duplicate data fell from a rate of 2% to 0.05% over the first three months of the contract.

Our learnings will be valuable for other EDBs, including but not limited to those who sign a smart meter operational data contract with Bluecurrent, and for Orion as we seek to utilise other forms of third-party data.

Future steps within our programme of works are likely to be to utilise AI bots to scan big data sets for anomalies and outliers, diagnose the cause and prescribe the best course of action. The aim is that eventually data flows through first time without any need for manual intervention or checking leading to efficiency gains and crucially improved data quality and integrity improvement.

Digital systems

Once data is stored and cleansed, the next step is to utilise the data for the benefit of the network and its customers. Ultimately, Orion wants the data to provide valuable insights and information to:

- support decision-making by improving understanding of network performance,
- test future scenarios,
- identify trade-offs and quantify risks,
- provide a visual representation of complex network configurations.

For an EDB to achieve the above benefits in an optimal long-term manner and avoid a situation where the EDB adopts a digitisation approach that it regrets later, many different questions need answering. For instance:

- what insights are possible?

- what are the priority insights that are needed initially, and what are the secondary insights that can be added over time?
- should an EDB develop its own in-house analytics, modelling, and visualisation platforms, or utilise third-party platforms?
- if the decision is to utilise a third-party platform, which of the multitude of possible companies offering such services should be used?

To help answer these questions, Orion has sought to explore and trial things first, in a step-by-step low-cost approach, rather than assume we know everything we need to know already.

For instance, to determine the range of insights that are possible and which of these are the most valuable, we opted to first test modelling tools on a 'wide use case, narrow network' basis rather than 'narrow use case, wide network basis'.

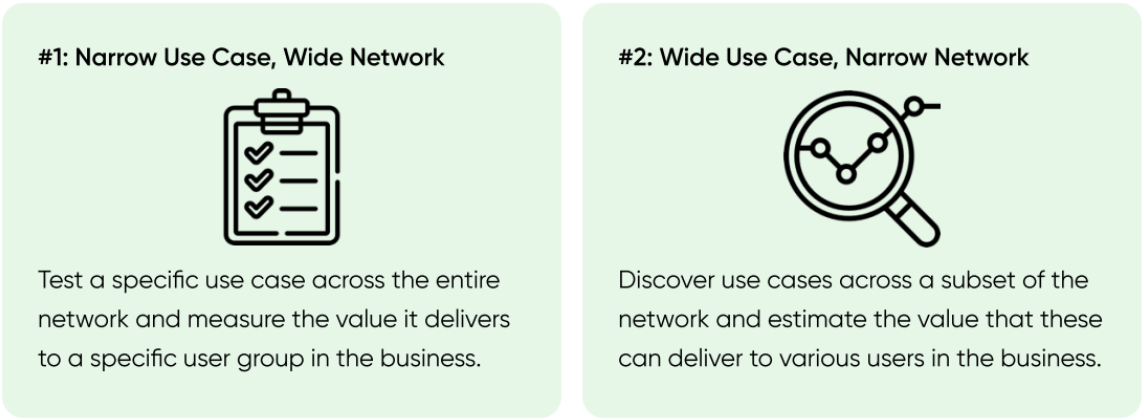


Diagram 6

This means that in ViSION we first looked in detail at a relatively small part of our network[15], and tested a large range of possible learnings on this part of our network, rather than choose to immediately examine our whole network. We adopted this approach as if we elected to look at our entire network first then we would invariably have either spent considerable dollars unnecessarily exploring potential learnings that aren't that valuable in comparison to the cost, or simply overwhelmed ourselves with too much information given the size of our network.

Also, as reflective of our approach of recognising 'we don't know, what we don't know', we elected to work with two respected Australian based 'platform-as-a-service' companies who are world leaders in delivering LV analytics for distribution network management. By working

[15] As previously mentioned, the 'narrow' part of our network that we chose to examine was the Milton Zone Substation area. This region was selected as it is experiencing an acceleration of new connections and distributed energy resource (DER) uptake, making it an ideal area for investigating proactive LV network management.

with two companies, rather than one, we are learning different ways of doing things and ensuring we don't miss opportunities.

Our approach is to provide each of these two platform-as-a-service companies with the three data sources discussed previously[16], and get them to triangulate those data sources as they wish to provide a suite of potential use cases for us. After learning of the potential uses, we are then in-house determining which use cases are most of benefit to us now[17] to help us optimise the use, quality, and safety of our network.

In parallel with the collaboration with external providers, we are undertaking internal user group testing and searching for where efficiencies and workflow improvements could be made given the data now available. In other words, where previously a decision may have been made with limited information or only after an event, can we now make better decisions based on more data or earlier decisions. An example of this is can we speed up even further our connections process through knowing immediately thermal and voltage constrained and non-constrained areas.

As part of ViSION we are also gaining a better understanding of the approaches that have been taken in other regions to utilising low voltage data to improve the use of the network. For instance, some Australian EDBs have had access to smart meter operational data for a significant majority, or all, of their customers for some time now, so valuable insights can be gained from them. By holding discussions with such EDBs we are improving our knowledge of what is possible and what transformational pathways deliver less value than anticipated.

After digesting these learnings, our intent is that by the end of FY25 or early FY26 we will issue an RFP to national and international data analytics companies seeking a software solution(s) for our data needs. This RFP will naturally need to include a list of the various data intelligence capabilities that we are seeking and other factors (e.g., cyber security, accuracy requirements, etc).

This RFP will most likely be useful to other EDBs in their understanding of the initial potential of such systems, and potentially save time and resources for other EDBs seeking to adopt a 'platform as a service' approach.

[16] Namely smart meter operational data, low voltage monitoring and phase information
[17] Noting that in the future as our capabilities improve, and as the electricity environment changes, we will step-by-step alter and add to our information requirements.

9. Benefits of being LV intelligent

Despite historic limited visibility of low voltage networks, Orion has been able to manage low voltage networks effectively over time using a generally reactive approach of waiting for a problem to occur and then fixing it. This approach has been possible due to the predictability of customer demand, one-way power flow, and the relatively slow rate of change on the network. However, the forecasted rapid uptake of LCTs and in-fill housing will increase the magnitude and occurrence of network constraints, with load patterns and constrained locations becoming less predictable and more volatile.

As previously indicated, to manage the level of uncertainty associated with future electrical usage and flows, EDBs need to evolve into forward-thinking intelligent Distribution Network Operators (iDNOs). iDNO capabilities and target operating models will be essential to monitor, forecast and orchestrate the bi-directional flow of energy in a secure, sustainable, and cost-effective manner.

A foundational part of Orion's shift to being an iDNO is the ViSION project. Once ViSION is fully implemented and other future steps in our transition to an iDNO are complete, there are numerous benefits that will result. These include but are not limited to:

- developing a better understanding of existing areas of network constraint to inform targeted network investment.
- identification and release of latent capacity from the network to optimise the utilisation of an existing feeder. That released network capacity can then be used to assist wider electrification and decarbonisation initiatives, without building new expensive network.
- an ability to host an increased amount of renewable generation while maintaining network safety, stability, and resilience, by seamlessly maximising the two-way throughput of energy across our network.
- the capacity to identify unregistered low carbon technologies associated with segments of LV feeders for further safety investigation and validation.
- improve outage, customer and safety outcomes. For instance, identify poor voltage conditions before a customer does[18].
- improved ability to issue cost-effective and more timely connection quotes.

[18] *Voltage levels observed on the network will change and potentially move beyond the regulatory limits of 230V±6% as new technology is connected. When electrical equipment in a house/business uses power from the grid, the voltage to that property and other properties on the line decreases. Conversely, if a solar panel on a home exports electricity back into the grid, the voltage to other houses on the line rises. With many devices, of differing types, voltage is constantly changing particularly where there is a high concentration of variable generation eg PV, wind.*

- further reduction in fault levels through smart switching in the network as constraints on the network are identified before faults occur, and where faults do occur restore load to customers quicker and undertake timelier repair of faults.
- provision of network information to our customers and third parties in an open and accessible manner. This will better enable market participation in flexibility and other services.
- increase asset life and improve condition-based asset management through maintenance targeted to assets with increased loading.
- reduce electrical losses, as well as improve our ability to calculate and report losses more accurately. Most losses on an EDBs network occur on the low voltage network and measured data will enable better understanding of where these losses are occurring and hence enable targeted maintenance.

These benefits will ultimately lead to increased customer satisfaction, a higher quality of supply to customers and lower cost.

10. Cost-benefit analysis

The benefits that will ultimately result from a transition to an iDNO, of which ViSION is a critical first step for Orion, are extremely difficult to quantify financially. The speed of uptake of LCTs and the rate of network demand increase are significant factors which affect any benefit calculation, and both these factors are uncertain.

Internet searches reveal several studies worldwide that endeavour to calculate the cost-benefit of various elements of low voltage data strategies, for instance the cost-benefit of a particular type of low voltage transformer monitoring or the cost-benefit of supporting increased hosting of solar. However, Orion could not identify any research paper that exactly examined a similar situation to Orion's ViSION project.

Given the Commerce Commission does not seek detailed modelling of costs savings for an innovation project allowance application and it is designed to be a low-cost mechanism, Orion did not consider it cost effective to commission its own economic research on the costs and benefits of ViSION or our transition to being an iDNO.

However, there are several factors that strongly indicate our programme will ultimately lead to a higher quality of supply and lower cost for customers. Some of these are:

1) If Orion does not transition to being an iDNO we will need to either continue to react to low voltage network constraints as they appear or commission a widespread reinforcement programme to significantly increase capacity on our low voltage network.

The first option of continuing to react after constraints appear will significantly negatively impact customer supply, likely slow decarbonisation, not enable response to customer need, reduce safety, and most likely lead to both resource constraint and ultimately increased pricing.

The second option of widespread reinforcement would be prohibitively expensive. Orion's low voltage network is estimated to have a replacement value of over $600m. Widespread reinforcement of the network would therefore likely cost hundreds of millions of dollars.

2) Numerous transformation roadmaps around the world have been commissioned by regulators, industry bodies and electricity networks. We are unaware of any that do not state the fundamental need to improve low voltage visibility and insights.

3) Perhaps the most comprehensive New Zealand study produced, relevant to the cost-benefit of ViSION and an EDB transitioning to being an iDNO, was Sapere's 2020 report on the "Business Case for Investment in Low Voltage Monitoring". That report concluded the net benefit to EDBs of a scenario where monitors are installed on 10% of low voltage transformers in New Zealand, would result in a net NPV benefit of between $170m and $320m. Sapere noted not all benefits were included in their calculations.

4) A high level assessment undertaken by Orion on two counterfactual approaches to data collection on the low voltage network showed that these alternative approaches both resulted in poorer quality of supply for customers and/or greater ultimate cost for customers compared to the approach we have taken under the first stage of ViSION.

   The two counterfactual approaches are:
   - not obtain smart meter operational data but instead rely wholly on low voltage transformer monitoring rolled out to near 100% of low voltage transformers combined with improved network topology information.
   - not invest in low voltage transformer monitoring and instead rely wholly on smart meter operational data and improved network topology information.

We also note there is no 'evolutionary new technology' on the horizon that will mean a cheaper solution to our data needs is available.

11. DPP3 Final Decision – reasons paper

As Vector in their May 2023 PRISMED innovation project allowance application noted:

> During the reset of DPP3, EDBs argued that greater visibility of the LV network was increasingly important as it was likely to be the first part of the network impacted by emerging technologies, such as electric vehicles or battery storage. EDBs argued that accessing smart meter data to monitor these networks is likely to be a step change cost.
>
> However, the Commission did not consider that LV monitoring satisfied the step change criteria. This viewpoint was shared in the DPP3 Final Decision reasons paper alongside a suggestion that it could instead be subject to innovation funding[19]:
>
> > *"Where LV monitoring is achieved using methods or technologies that are innovative (in the New Zealand context) this expenditure is likely to qualify for inclusion within the innovation allowance recoverable cost."*

This statement supports the first stage of Orion's ViSION project qualifying for an innovation project allowance.

[19] Paragraph A73, Default price-quality paths for electricity distribution businesses from 1 April 2020 – Final decision https://comcom.govt.nz/__data/assets/pdf_file/0020/191810/Default-price-quality-paths-forelectricity-distribution-businesses-from-1-April-2020-Final-decision-Reasons-paper-27-November-2019.PDF

Appendix 1 – Meeting the IM Determinations criteria for innovation project allowance

The table below outlines how our application meets all the criteria set out in Schedule 5.30 of the Determination.

Schedule 5.3: Approval of drawdown of innovation project allowance	**How we meet requirement**
(1) In order to draw down an amount from its innovation project allowance, a non-exempt EDB must:	
(a) no later than 50 working days following the end of an assessment period submit an application to the Commission, which includes a description of:	Submitted 5 June 2024
(i) the innovation project in respect of which that non-exempt EDB has incurred costs and for which it proposes to apply amounts drawn down from the innovation project allowance;	See Section 4
(ii) details of the costs incurred by the non-exempt EDB in undertaking that innovation project (being costs that have not previously been the subject of applications for drawdown amounts from the innovation project allowance) and the proportions of those costs that were opex or capex; and	See Section 4
(iii) that innovation project's purpose, including the steps that the non-exempt EDB has taken or intends to take in order to achieve that purpose;	See Sections 5 to 9
(b) make the application specified in sub-paragraph (1)(a) of Schedule 5.3 publicly available on its website at the same time as it submits it to the Commission; and	Published 5 June 2024
(c) obtain approval from the Commission in accordance with paragraph (2) of Schedule 5.3.	N/A
(2) The Commission may by notice in writing to the non-exempt EDB approve an application by that non-exempt EDB to draw down an amount from its innovation project allowance if that non-exempt EDB satisfies the Commission that—	
(a) the sum of the amount of the proposed drawdown amount for the innovation project and amounts already approved by the Commission for draw down from the innovation project allowance by that non-exempt EDB does not exceed that non-exempt EDB's innovation project allowance for the DPP regulatory period in Table 5.1 of Schedule 5.3; and	See Section 4
(b) that non-exempt EDB has already incurred an amount of costs on the innovation project that is at least equivalent to 200% of the proposed drawdown amount (provided such costs have not already been used in a previous application to justify a drawdown amount from the innovation project allowance); and	See Section 4
(c) the non-exempt EDB received a signed report from an engineer or suitable specialist, where the engineer or suitable specialist stated in their opinion that-	See Sapere report
(i) the proposed project is an innovation project;	See Sapere report

(ii) the purpose of the innovation project is either:	See Sapere report
A. delivering electricity lines services at a lower cost to consumers; or	See Sapere report
B. delivering electricity line services at a higher quality of supply to consumers; or	See Sapere report
C. delivering electricity lines services at a lower cost to consumers and at a higher quality of supply to consumers; and	See Sapere report
(iii) the benefits of the innovation project will be of general application to the activities of that non-exempt EDB or of other EDBs;	See Sapere report
(d) if the non-exempt EDB has elected to use a suitable specialist to procure a signed report in terms of paragraph (2)(c) of Schedule 5.3, the suitable specialist has sufficient expertise in a field relevant to the project, which must be evidenced by the non-exempt EDB providing a copy of the suitable specialist's curriculum vitae to the Commission together with the application to draw down from its innovation project allowance.	See Sapere report
(3) The Innovation project allowance for the DPP regulatory period:	Orion $825,000
(4) When the Commission issues an approval for a drawdown amount for an innovation project from the innovation project allowance for a non-exempt EDB in accordance with paragraph (2) of Schedule 5.3, it must state in its approval the proportion of opex and capex in that drawdown amount, which should be equivalent to the proportion of opex and capex in the costs incurred by that non-exempt EDB for the innovation project and included in its application under paragraph (1) of Schedule 5.3.	N/A
(5) Where the Commission has approved a drawdown amount for an innovation project from the innovation project allowance for a non-exempt EDB in accordance with paragraph (2) of Schedule 5.3, that non-exempt EDB must within 50 working days of completing that innovation project:	
(a) submit a report to the Commission that outlines the key findings of that project;	N/A
(b) make the report in sub-paragraph (5)(a) of Schedule 5.3 publicly available on that non-exempt EDB's website at the same time as it submits the report to the Commission.	N/A