
# Innovation Project Allowance Application

Commerce Commission

June 2024

# Contents

# 1. Summary of FY 2024 drawdown proposal

A summary of the drawdown proposed in this application is provided in **Table 1**.

**Table 1 Drawdown proposal capex and opex**

| | Description | Purpose | FY24 cost | | FY24 drawdown proposal |
|---|---|---|---|---|---|
| | | | Capex | Opex | |
| **Aeolian vibration monitoring and prediction** | Develop and test new solar-powered monitoring devices and software. The technology is called a Line Guard from Sentrisense and tests susceptibility to damage due to conductor vibration. | Allows for proactive and efficient management of aeolian vibration risks including automatic fault classification, location detection and prediction. Potential to lower maintenance cost and improve quality for customers by reducing outages. | $141,308 | $14,383 | $77,846 |
| **Line down detection** | Develop and test monitoring equipment and AI analysis with Eneida and ElectroNet to detect when lines are down and still live. The innovative technology uses phase relationship distortion to create an alarm alerting us to the possibility of lines down. | An engineering control that avoids reliance on public notification of lines down. Provides improved public safety and reduced environmental risk from lines down. An engineering control will provide improved targeting of Powerco fault response efforts. | $156,168 | $22,000 | $89,084 |
| **Satellite intelligent vegetation management** | Develop and test the use of satellite imagery and AI technology to provide a cost effective risk and criticality based prioritisation methodology for vegetation management | Take advantage of improved satellite technology and advancing AI. Test an alternative to LiDAR to improve understanding of risk, prioritise risk, more effectively manage work, and increase reliability and safety. | - | $150,000 | $75,000 |
| **Total drawdown** | | | 61% | 39% | $241,930 |
| **Remaining allowance** | | | | | $408,070 |

# 2. Introduction

## 2.1 Purpose of this report

This is Powerco Limited's ("Powerco", "we") application for the innovation project allowance, for three projects with costs incurred in FY24. This report collates the information required for the Commerce Commission (the Commission) to be satisfied that the projects meet the requirements for drawdown of the innovation project allowance for FY24.

This application covers three distinct projects we progressed in FY24:

- Aeolian vibration monitoring and prediction
- Line down detection
- Satellite based intelligent vegetation management.

Each project spans multiple financial years in the phases of the project. This application seeks approval for drawdown of costs incurred in FY24. The FY25 costs are also indicated in this report. We anticipate providing an updated application for FY25 costs incurred for these 3 projects in May 2025.

We are happy to discuss any aspects of this application with the Commission. The first point of contact for this application is Irene Clarke Policy Manager, Irene.Clarke@powerco.co.nz. No parts of this application are confidential, and we will publish this report in full.

## 2.2 Provisions for the innovation allowance

Under the Default Price-Quality Path Determination, Electricity Distribution Businesses (EDBs) may make an application to the Commerce Commission (the Commission) for approval of drawdown of the allowance under Schedule 5.3 of the Determination[1]. This report is guided by the requirements in Schedule 5.3. We have provided an assessment against Schedule 5.3 in section 6. The project information has also been reviewed by [Edison], an independent electricity lines specialist against the criteria and the response is provided in Appendix 2.

An 'innovation project' is one which is focused on 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[2].

The three projects in this application are developing and applying new technology and processes, to electricity lines services. The projects aim to deliver electricity lines services at a lower cost to consumers and at a higher quality, compared to traditional practices. The technologies being developed with these projects will be relevant for electricity lines services provided by all EDBs.

The full Powerco drawdown available under Schedule 5.3 is $650,000 through to FY25. This application is for drawdown of $241,930.

[1] The 2020 DPP Determination was updated to include Powerco's transition in November 2022: 5B20225D-NZCC-25-PowercoE28099s-transition-to-the-2020-2025-DPP-Final-determination-30-November-2022.pdf (comcom.govt.nz) The Commission also updated Schedule 5.3 in Novmeber 2023 to update clause 5.3(2)(c) relating to the specialist report.

[2] Input Methodologies Determination, Interpretation section 1.1.4: electricity-distribution-services-input-methodologies-determination-2012-consolidated-as-of-23-april-2024.pdf (comcom.govt.nz)

## 2.3 Powerco's commitment to innovation and customer outcomes

Alongside Powerco's core investment in network development, we have an active strategy to ready ourselves for the changes in the energy sector ahead. An underlying direction for our Strategy is to drive innovation and longer-term outcomes for improved energy services and value for money for our customers.

While the way we build and operate our electricity network is generally stable, we are continually looking for ways to improve and adapt to material changes in our operating environment. Our evolving strategies are mainly centred on three overlapping aspects:

- Adapting to changes in network and customer technology
- Adapting to a changing operating environment, driven by changing customer needs as well as environmental and legislative changes
- New ways of thinking about traditional asset management approaches.

Chapter 7 of our Asset Management Plan 2023 outlines our evolving asset management strategies[3]. In our 2024 Asset Management Plan update we have further developed our 'Future-Ready Networks Strategy' and 'Modernised Network architecture Strategy'[4]. A modernised network architecture strategy is a commitment to our customers about what we plan to achieve with our future electricity network to make it more efficient and resilient, adopting the benefits of new technology and emerging market opportunities. The three projects that are the subject of this application are part of this network evolution towards a future intelligent network.

**Figure 1 Powerco's objective for future-ready networks is supported by three network strategies**


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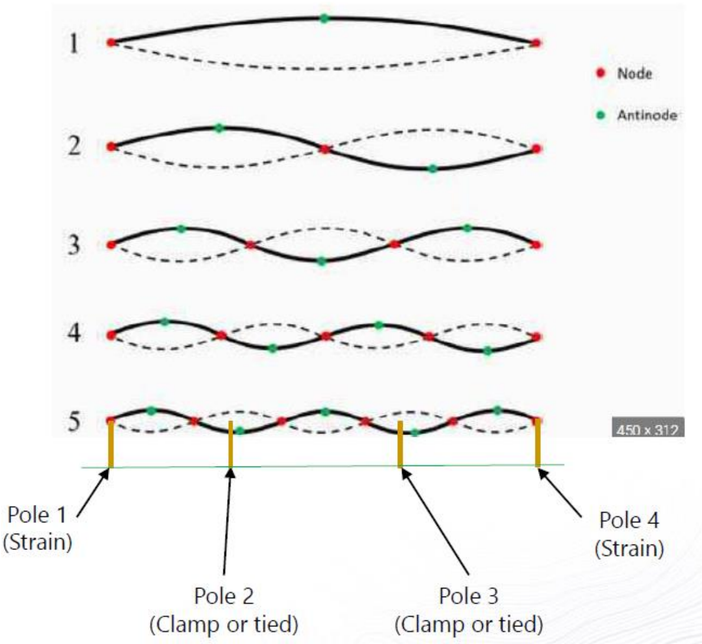
[3] 2023-electricity-asset-management-plan.pdf (powerco.co.nz)
[4] 2024-electricity-asset-management-plan---update.pdf (powerco.co.nz)

# 3. Innovation Project - Aeolian vibration monitoring and prediction

## 3.1 Project description and purpose

Aeolian vibration is the motion caused by wind on conductors with a smooth mid-range wind flow. This creates alternating eddies on the leeward side and an alternating pressure imbalance causing the conductor to move up and down. It occurs with smooth low-mid range winds rather than higher velocity winds. The natural frequencies of a conductor under tension will vibrate in a series of standing waves. **Figure 2** shows the movement between nodes (point of minimal motion) and antinodes (maximum motion).

**Figure 2 Aeolian vibration of conductors**




This aeolian vibration is relatively common (it can occur daily) and results in damage to conductors at intermediate structure attachment points- at tied or clamped points. At these positions the conductor cannot flex as it needs to due to the rigid attachment. The restrained movement at these points will fatigue and cause fretting of the conductor stands (see Figure 3), and ultimately cause the conductor to fail and drop.

Monitoring of the aeolian vibration provides for automatic fault classification, location detection and fault prediction using a tool for advanced waveform analysis. Conductors fatigue performance varies between AAAC, AAC, ACSR, with AAAC much lower than that for the ACSR.

This project tests susceptibility to damage due to conductor vibration, eg is aeolian vibration an issue for shorter spans, or lower tension or where specific ties or rods are used, or in particular climatic conditions.

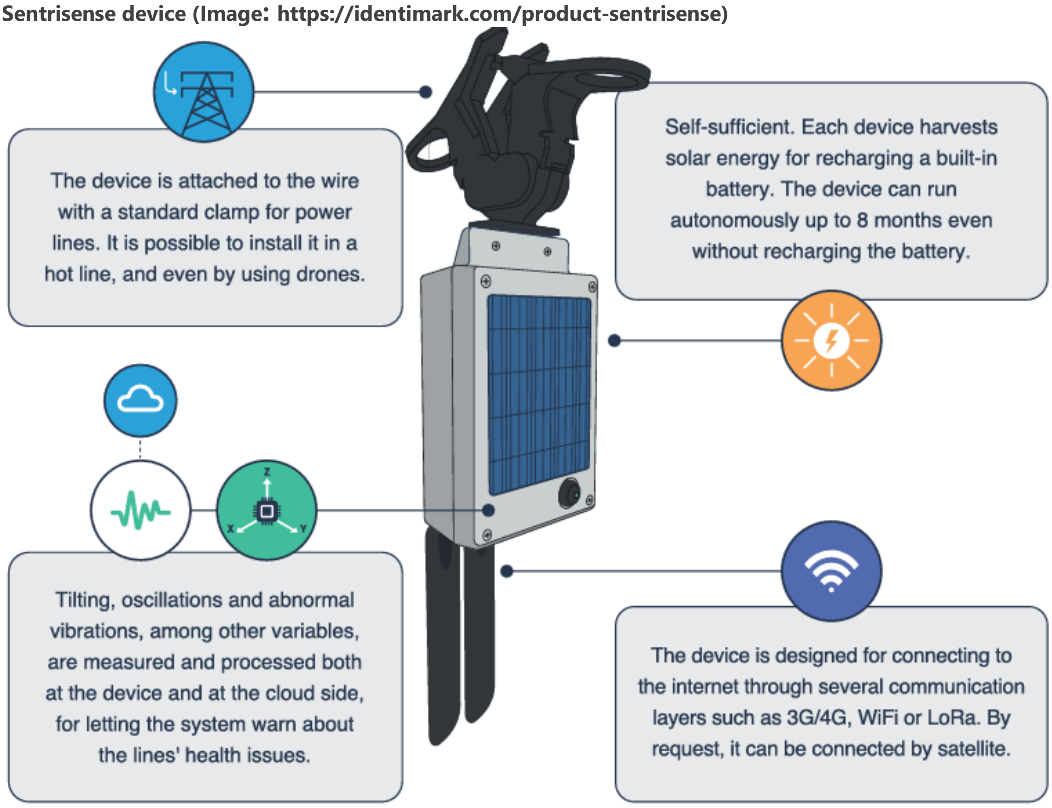
**Figure 3 Damage to conductor at attachment point**


The project will develop and test new solar-powered technology called a Line Guard from Sentrisense, provided by Identimark. The device is attached to the power line and measures vibrations. A weather station is attached to the nearest power pole to the device to capture localised weather data. The device monitors aeolian vibration, as well as capability to detect broken cables, fallen towers, very high winds, sag and oscillation frequency.

The project will create a layer for the Overhead Planning tool in ArcMap GIS to highlight potential conductor fatigue and problem locations. The monitors will provide site specific data and build our knowledge of vibration effect in different conditions. Data is monitored live on a dashboard.
The improved data about conductor damage due to vibration will enable potential conductor fatigue to be reliably identified and proactively addressed prior to premature conductor replacement or conductor failure.

This provides the opportunity for efficiency in prioritising use of vibration dampers, and reduced public safety risk due to fallen lines.

**Figure 4 Sentrisense device (Image: https://identimark.com/product-sentrisense)**




## 3.2 Innovation and consumer benefits

The aeolian vibration monitoring device is accompanied with a Sentrisense weather station with both sets of data sent to the dashboard. Data is used to model the probability of aeolian vibration. Identifying where aeolian vibration occurs will allow the engineers to recognise where there is a need for vibration dampers at the time of conductor replacement and to prevent premature conductor failure.

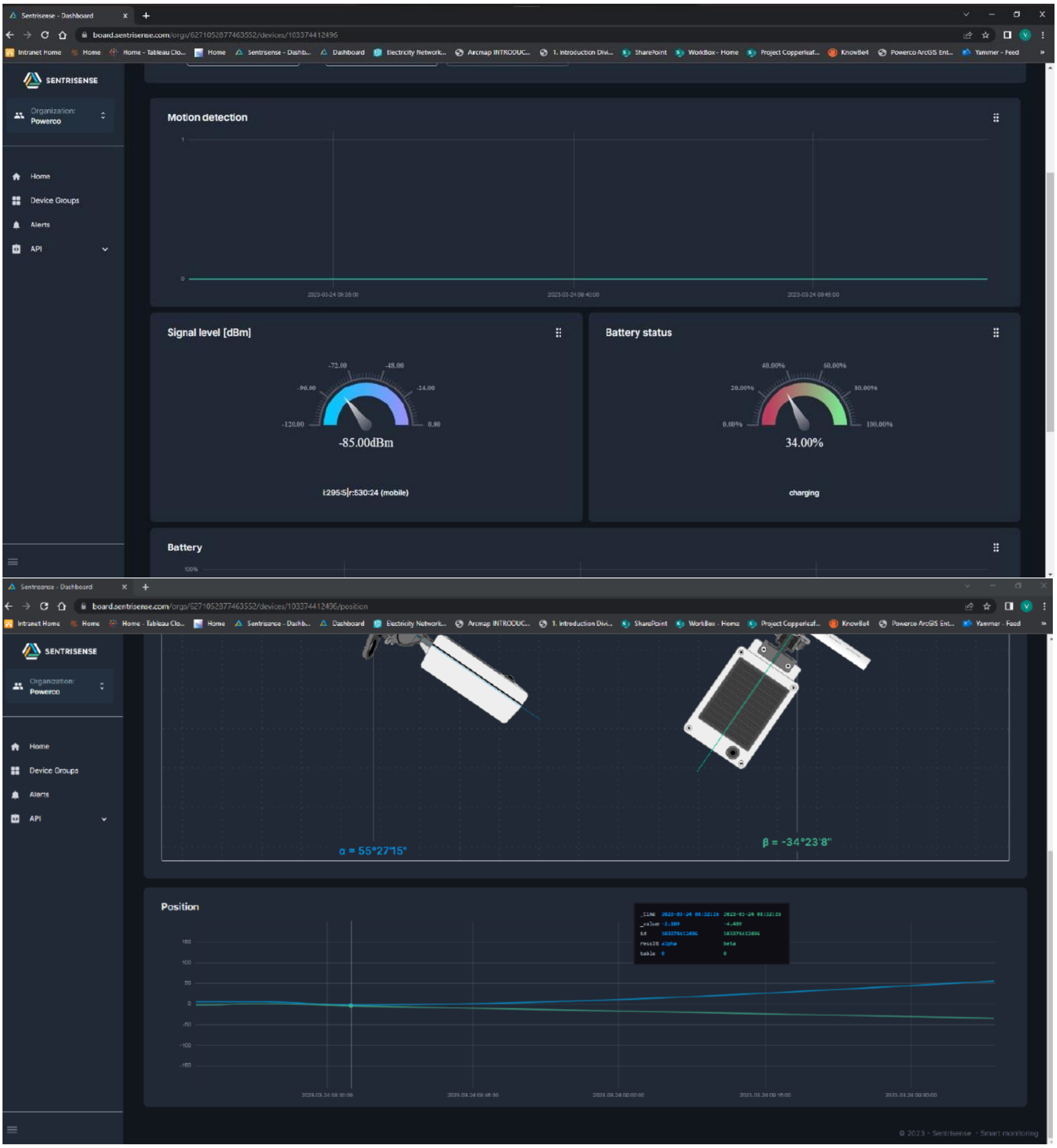
The technology has significant potential for benefits in correlating conductor parameters, risks, and work prioritisation. This will bring cost and quality benefits for consumers in managing aeolian vibration risks more proactively and efficiently. Failure of a conductor due to damage at the attachment point, will ultimately cause the conductor to fall to the ground. This causes power outage to customers as well as a serious public safety risk.

As far as we are aware, this research is not being done by any other EDBs in New Zealand or Australia. Dashboard display examples and data from the test install are shown in the excerpt in **Figure 5**.

## 3.3 Application to other situations and EDBs

The units, software, integration with GIS, and modelling for equipment replacement strategy, are all scalable and applicable across networks. The trial will help inform how/where the aeolian vibration monitoring has highest potential benefit, and options for integration into asset risk tools.

**Figure 5 Dashboard examples and data from first install**




## 3.4 Project cost / benefit

The risk with aeolian vibration is undetected damage causing a dropped conductor. This is a cost for equipment replacement and also a significant public safety hazard. The damage caused by the aeolian vibration is hidden and by the time it causes failure of the conductor it is too late, eg the conductor is already on the ground.

The project will test if aeolian vibration is happening on our network and where it's happening, so we can start putting vibration dampers on affected sections of lines to counteract it – before conductors fall. The trial enables immediate asset management where indicated for the locations that are part of the trial, noting that the trial includes higher risk locations on the Powerco network.

Pre-emptively alleviating the damage potentially avoids the need for replacement of conductors. For example to prioritise locations where vibration dampers need to be included in design when conductors are replaced, or to retro-fit vibration dampers to prevent further damage (when internal fretting occurrence identified) to avoid premature conductor replacement. Timely asset enhancement or replacement will provide cost savings.

The monitoring device and weather station can be easily moved and set up in different locations. There is no network interruption during the instalment. This provides efficiency and options to use the devices in different areas should risk factors change.

The Line Guard is a smart device. The trial is to detect aeolian vibration occurring on overhead conductors. However the device has multiple benefits as it can potentially detect other conditions such as conductor ageing, corrosion and conductor inclination. If the aeolian vibration trial is successful, there is the opportunity to trial the devices on further sites to test detection of conductor aging and corrosion, offering potential for complementary benefit.

The Sentrisense monitoring devices and software licencing are cost effective at around $5,000 per unit (capex + opex). Investigation has identified that accurate local weather data is an important component co-related to the Sentrisense Line sensor measurement. The weather station devices and software are around $12,500 per unit (capex + opex). The devices per unit are cost effective compared to other monitoring devices seen in the market at $60,000 - $80,000 per unit.

The weather station from Sentrisense sends data to the same dashboard as the monitoring device. This provides confidence in compatibility of software, makes looking at the two sets of data easier, and avoids the cost of additional software. We have investigated alternative weather station options but this technical benefit of the Sentrisense weather station means they are the preferred option.

**Figure 6 Sensor device and weather station in place**

The cost of the project is relatively small, and the potential benefit large, when considered in the context of both the cost and safety risk of a conductor drop. The cost of reinstatement of a failed conductor can vary from $1,500 to $12,000+, noting that trial locations, and where aeolian vibration is known to be a higher risk is in locations such as river crossings where reinstatement of conductors is at the higher end of this range.

The project will provide a data set about vibration risk on the Powerco network which we can build on to refine design standards, fleet management strategy and models for equipment placement across the network.

## 3.5 Costs incurred, project delivery and next steps

The devices in the trial for FY24 had a cost of $85,000 (weather station device) + $57,000 (aeolian vibration device). This provides for 10 monitoring units, installation, software/platform development and support. Accurate local weather data (from Sentrisense All in one weather station) co-related to the Sentrisense Line sensor devices includes 10 weather stations with solar panels, telemetry logger, internet access, software, and installation.

The 10 trial units were located based on parameters that make the occurrence of aeolian vibration probable. Three sites are in Taranaki, two on the Coromandel Peninsula, two in Manawatū-Whanganui, two in Waikato, and one in Wairarapa. An example of the modelling to determine probability of aeolian vibration, and suitability of a site for the trial is shown in the excerpt in **Figure 7**.

**Figure 7 modelling to determine probability of aeolian vibration**

erground (wunderground.com)

| | Min. Coldest Temp. of Year | | | | Av. Coldest Temp. of Coldest Month | | | | | | Base Tension Constraint | | | | | | LIDAR Tension %CBL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | **0.7°C** | | 9°C | 10°C | **11.7°C** | 12°C | 13°C | 14°C | 15°C | 16°C | **17°C** | 18°C | 19°C | 20°C | 21°C | 22°C | **23°C** | 24°C |
| Tension (%CBL) | **20.5%** | | 17.5% | 17.2% | **16.7%** | 16.4% | 16.1% | 15.8% | 15.6% | 15.3% | **15.0%** | 14.8% | 14.7% | 14.5% | 14.2% | 14% | **13.43%** | 13.60% |
| Type A- No Armour Rods- 15%CBL | Aeolian vibration **is likely** to occur and cause damage | | | | | | | | | | | Aeolian vibration is **not likely** to occur or cause damage | | | | | | |
| Type B- Armour Rods- 16.5%CBL | Aeolian vibration **is likely** to cause damage | | | | | Aeolian vibration **not likely** to cause damage | | | | | | | | | | | | |
| Vibration Dampers-21.5%CBL | Aeolian vibration **not likely** to cause damage | | | | | | | | | | | | | | | | | |

Following the devices being in place for up to six months, the trial results will be assessed for further use of the technology. This will include assessment of a case to select alternative sites and trial use of the devices to detect conductor aging and corrosion for conductor life cycle predictions.

Completion of the aeolian vibration trial, undertaking analysis, and deciding on next steps (for further trial or integration) is anticipated for completion around November 2024. If the analysis confirms the anticipated benefit, then the further trial for conductor aging and corrosion will be undertaken in future years (probably FY26). A decision on a future rollout of devices integrated into the fleet asset management system will be made following all trials and analysis.

A summary of the project phases and costs is provided in **Table 2**.

**Table 2 Project activities and costs – Aeolian vibration monitoring and prediction**

| | FY24 incurred | FY25 estimate | Future years |
|---|---|---|---|
| **Key activities** | • Procure, install and commission 10 Sentrisense vibration monitoring devices<br>• Procure, install and commission 10 Sentrisense weather station devices | • Complete trial over approx. 6 months<br>• Review trial results and determine next steps<br>• Dependent on results – prepare for trial of conductor aging/ corrosion<br>• Develop integration with GIS and fleet management tools | • Undertake trial for conductor aging / corrosion<br>• Dependent on results – rollout of devices across network and integration into fleet asset management |
| **Capex** | Monitoring devices and installation $49,943<br>Weather devices and installation $77,365<br>Cost for trial management and system integration $14,000 | Device procurement and installation for ongoing trial $42,169<br>Cost for aeolian vibration trial review, set up additional trial and strategy development $4,166 | TBC –device procurement and roll out $500,000 |
| **Opex** | Software annual licensing<br>Monitoring $6,748<br>Weather $7,635 | Software annual licensing<br>Monitoring $6,748<br>Weather $7,635 | |
| **Total cost incurred** | $155,691 | $60,718 | |
| **Application drawdown** | $77,846 | $30,359 | |

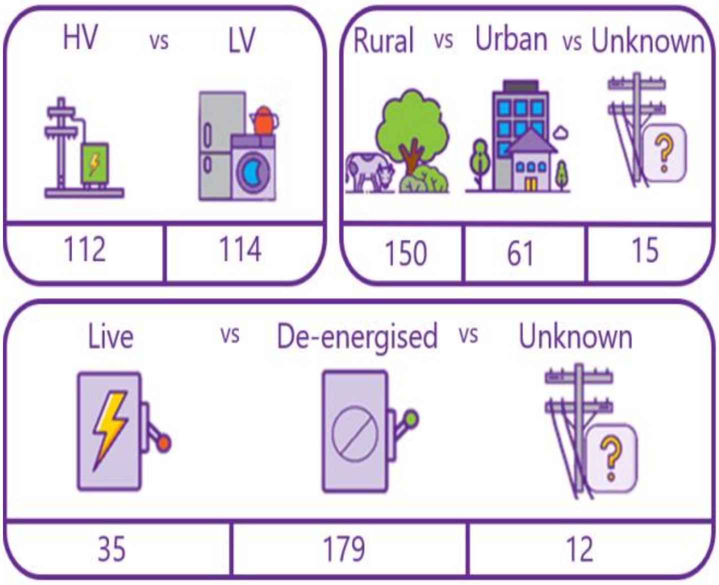
# 4. Innovation Project – Line down detection

## 4.1 Project description and purpose

Powerlines fail and fall. A downed powerline is not isolated by traditional lines protection devices and remains live. These instances pose a significant risk to the public and the environment. This project is to trial a new function of existing monitoring devices to detect HV connection failure and downed HV lines so that they can be isolated.

Lines are brought down for a range of reasons such as falling vegetation, wind, asset failure, and car v pole incidents. We track lines down incidents as summarised in **Figure 8**.

**Figure 8 Lines down annual data across Powerco network (Source Powerco AMP23 Figure 6.6)**




We have a dedicated team who analyse and seek improvement opportunities for lines down management. We have implemented system wide sensitive earth fault protection that reduces the sensing current of our protection equipment, this means we can detect a line down better than ever before. However, where a line fails and is energised by back feed via down stream transformers the fault cannot be detected as open circuits and high impedance at the fault point restricts current flow and imitates normal load situations. This results in traditional protection methods, such as ground overcurrent devices being unable to detect low-current faults due to a lack of sensitivity.

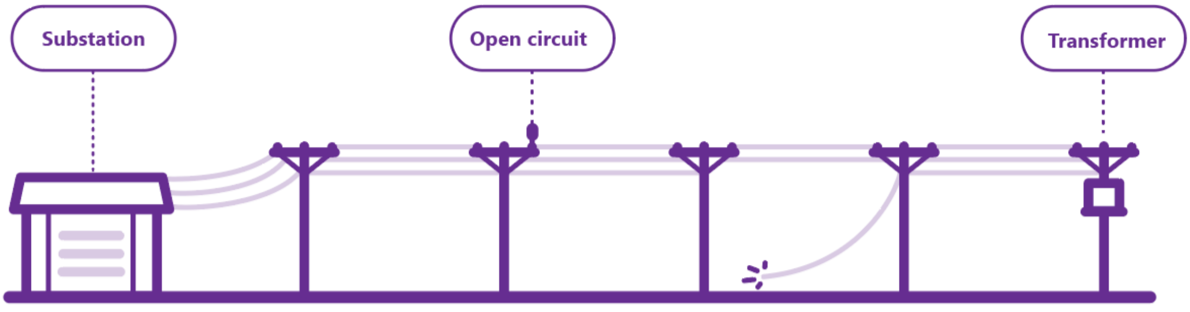
Engineering controls are limited and we rely on emergency calls to alert us when a line is down. This creates significant risk as the public may not be aware of the hazard with a line down. We are looking for opportunities to detect lines down remotely so we can quickly respond and protect public safety. Powerco has been trialling other monitoring on our low voltage network through equipment on poles.

**Figure 9 Monitoring device in place**

This project takes use of existing monitoring equipment to the next step in using the technology to detect for HV connection failure and HV lines down and whether the lines down are live. The equipment provides engineering controls to detect the line down by monitoring phase shift on the low voltage side of transformers, as illustrated in **Figure 10**.

We have been developing and testing the new and improved technology with two manufacturers, one based in New Zealand and one from overseas. The manufacturers are Eneida and ElectroNet who are already providing performance monitoring equipment to EDBs, but not yet to detect lines down.

**Figure 10 Illustration of network placement for line down detection**

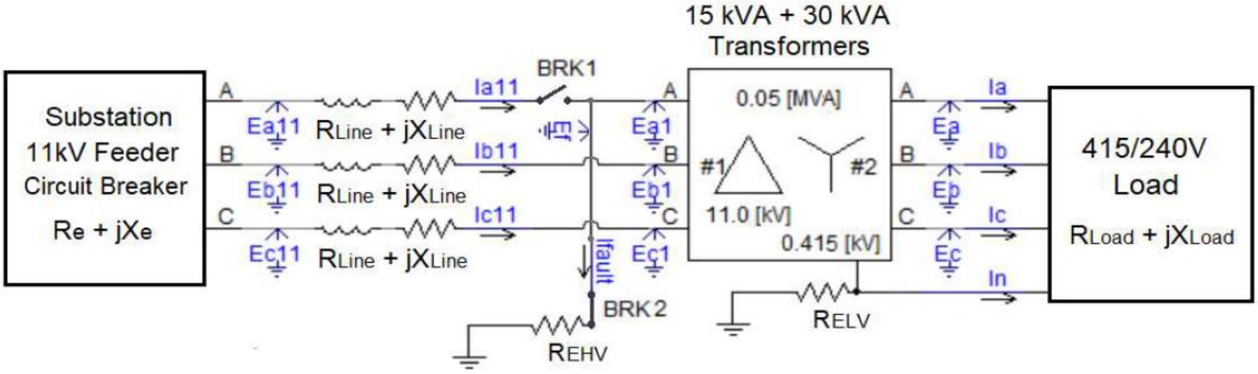



The innovative technology we are trialling uses phase relationship distortion to create an alarm alerting us to the possibility of lines down. The changes in magnitudes and phase angles of voltage measurements are used to determine if a downed-conductor event can be reliably detected. An important part of this trial is to test reliability of the detection mechanism to avoid unverified detection and with a response resulting in unnecessary network interruptions.

To carry out electromagnetic transient simulation of the downed line faults, simulation software PSCAD (V4.2 Free Edition) is used. An approximate network model of the test circuit was developed for the trial as shown in **Figure 11**.

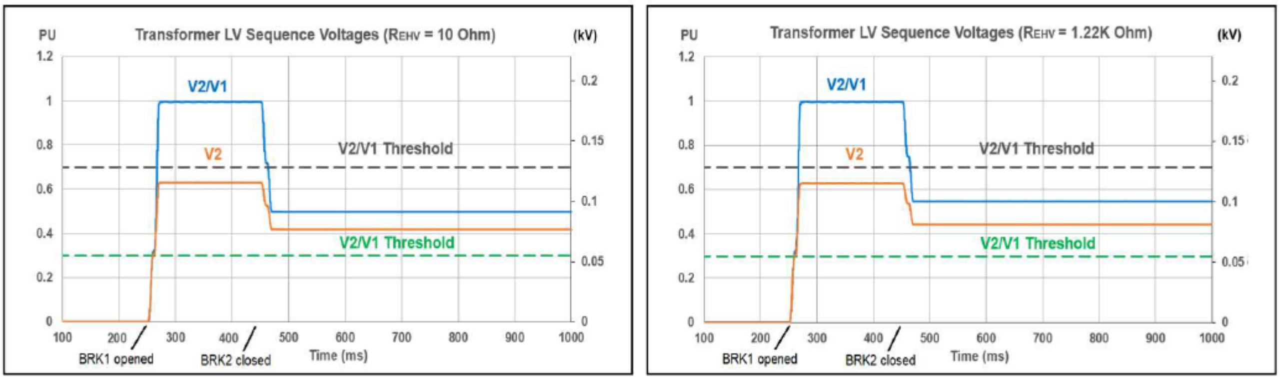
The simplified network model is used to simulate load side HV A-phase downed line faults with different HV earth resistances (10–1,220 Ohm). The simulated results are plotted with the behaviour of the LV sequence voltages during the fault illustrated in Figure 12. The magnitude of V2 and hence the ratio V2/V1 during the fault are much higher than their normal steady state values. When the HV line is open circuited but does not come in contact with the ground, V2 will increase to its maximum values and (V2/V1) will approach unity. The simulation results have suggested that downed line faults can be detected by analysing the measured LV phase and sequence components voltages.

**Figure 11 Simplified network model for the fault simulation study**




A field test was also undertaken. A 11kV overhead line was dropped from the load side at a test site. A number of scenarios were trialled, including line down on a car (but not ground), line on car and ground, line on ground, line on fence post only. The results of the field trial showed that using LV voltage measurements could reliably detect all different line down scenarios as suggested by the simulation study. A short video about the field trial to test the new technology is available on our website here.

**Figure 12 LV sequence voltages results from an HV A-phase downed line fault**




(a) - HV Earth Resistance = 10 Ohm

(b) HV Earth Resistance = 1,220 Ohm

## 4.2 Innovation and consumer benefits

LV monitoring technology has been tested and implemented in various forms. However, using these devices for an engineering control for HV connection failure and lines down is innovative. The monitoring devices could provide a cost effective method for all EDBs to detect HV connection failure and lines down, improving the safety and reliability on networks across the country.

The technology uses complex algorithms to identify failure and line down. It is our understanding that this combination of monitoring technology and AI to identify and report on specific lines down incidents has not been trialled in New Zealand.

The project offers the benefit of engineering control for system alerts of lines down. This is a significant benefit compared to current reliance on someone reporting a line down to Powerco or emergency services. An engineering control offers opportunity to avoid public safety risk, including risk of fatality from lines down and to avoid environmental risk such as fire.

Through the remote monitoring and alerts system, the equipment and technology will improve the speed and reliability of detection, helping with security of supply and safety in our electricity services. The technology has particular opportunity for consumer benefits where installed in high consequence areas such as near schools or high use public areas. We also plan deployment on circuits with a history of lines down faults.

## 4.3 Application to other situations and EDBs

The project has attracted interest from across New Zealand and Australia. This has included interest from technology research organisations with an interest in technology development. Some EDBs are already scoping or rolling out monitoring devices. This is a complementary (or completely new) technology that would be applicable and scalable for other EDBs.

## 4.4 Project cost / benefit

An engineering control will reduce the need for inspections or response effort for lines down instances providing for improved targeting of our fault response efforts. Importantly, the technology provides the benefit of a control for the silent lines down – those live lines down that we don't know about until a member of the public advises us, by which time there is a significant public safety risk.

A number of incidents of live (or unknown) lines down occur across the network in a year (refer **Figure 8**). Once we are aware, a reported line down has a response time target of 45 minutes (urban) to 90 minutes (remote)[5] for crew inspection which could each be reduced to a 10 minute public exposure to these incidents, or nil public exposure as we have tripped the line before the public are exposed. In the absence of an engineering control providing reliable information of a lines down, we need some supporting information to de-energize a line. Thus we would need the site crew inspection report rather than a public caller report (eg it could be a telephone line down or service line rather than live electricity line). Focusing use of the devices in high public use areas increases this potential benefit of reduced public safety risk.

It will also reduce the need for, and associated costs with, signage or advertising campaigns about what people should do if there is a line down. Avoided environmental incidents from lines down is also a key benefit, although difficult to quantify.

Where previously we had poor visibility of load increases and reacted to signs of network stress by reactive monitoring, this new technology enables more proactive remote management and therefore more efficient investment in risk areas and opportunity for improved power quality.

**Figure 13 Lines down dashboard at field trial**


An initial risk/impact assessment following the FY24 development phase will be completed for internal review prior to the trial of a number of units on the network in FY25. If the network trial of the units and the post-trial assessment proves beneficial in cost-benefit terms, additional units may also be deployed later in FY25.

One point of discussion will be how this technology interacts with SAIDI. Under current arrangements, if emergency services alert us to a line down and asks for the power to be disconnected then we do not impact SAIDI. However if our own technology alerts us to that emergency and power is consequently disconnected, this disruption may count toward SAIDI. This technical interrelationship with SAIDI does not reflect the potential improvement in power quality that this technology offers, and will therefore be a consideration for discussion with regulators as part of the trial review.

## 4.5 Costs incurred, project delivery and next steps

In FY24, the first phase of our evaluation was to establish a safe network environment and field test scenario that could enable as close to real life testing as possible, and then carrying out this simulation and field test. This involved technology development and building a small network of Transformers and switches that would allow simulation of lines down. This phase cost $156,168 capex. This includes $62,000 construction costs, $58,000 for specialist works and set up. In addition it includes costs for systems integration and managing the project, and additional costs for field test support such as traffic management and fire brigade. There is also an opex cost for licensing fees (additional for line down features) required to be incurred in FY24.

The field trial involved the two technology providers testing the response to simulated incidents of a car v line, line on the ground, and line across a farm fence. The field trial detected high-voltage lines down 100% of the time on both sets of monitors. This phase has proved the technology and we are satisfied the technology has

[5] Noting response times do vary and actual times may exceed these targets depending on time of day, traffic conditions, or where storm conditions have caused the incident.

the ability to provide reliable remote detection and reporting which the project set out to achieve. The development phase 1 of the project is now complete.

The second phase works in FY25 is to trial up to 500 units on a wider network area and will involve integration of systems and monitors into our operations. This phase 2 part of the trial will be monitored and a cost/benefit assessment carried out later in FY25.

Each of the monitors is $2300 to $3300 capex (depending on configuration) which provides for multi-purpose monitoring. The trial of the units on the network will also involve additional development of systems (alarms, data hosting, integration with scada) and further development work to evaluate the impact of PV and harmonics on the detection capability. The FY25 development capex is an estimated cost of $250,000 being a proportion of a larger FY25 capex cost for monitoring devices, proportionate to the additional devices, features and development work for the line down aspect. Opex cost is an additional $22,000 opex for the devices to have the line down detection capability and related licencing.

A summary of the project phases and costs is provided in **Table 3**. The phase 1 development, simulation and field trial is complete. The phase 2 trial of 500 units on our network and development for integration into our systems will occur in FY25.

**Table 3 Project activities and costs – Line down detection**

| | FY24 incurred | FY25 estimate | Future |
|---|---|---|---|
| **Key activities** | • Develop new technology<br>• Network simulation<br>• One field trial of line down incidents<br>• Working with 2 technology providers | • Risk/impact assessment to support network trial<br>• Trial 500 units on the network<br>• Development of alarms and integration into scada<br>• Data hosting services<br>• Further evaluation and complete cost/benefit assessment | • Additional roll out based on trial/assessment<br>• Project reporting and sharing information with other EDBs |
| **Capex** | $156,168 | $250,000 | TBC |
| **Opex** | Licensing $22,000 | Licensing $22,000 | TBC |
| **Total cost incurred** | $178,168 | $272,000 | |
| **Application drawdown** | $89,084 | $136,000 | |

# 5. Innovation Project – Satellite intelligent vegetation management

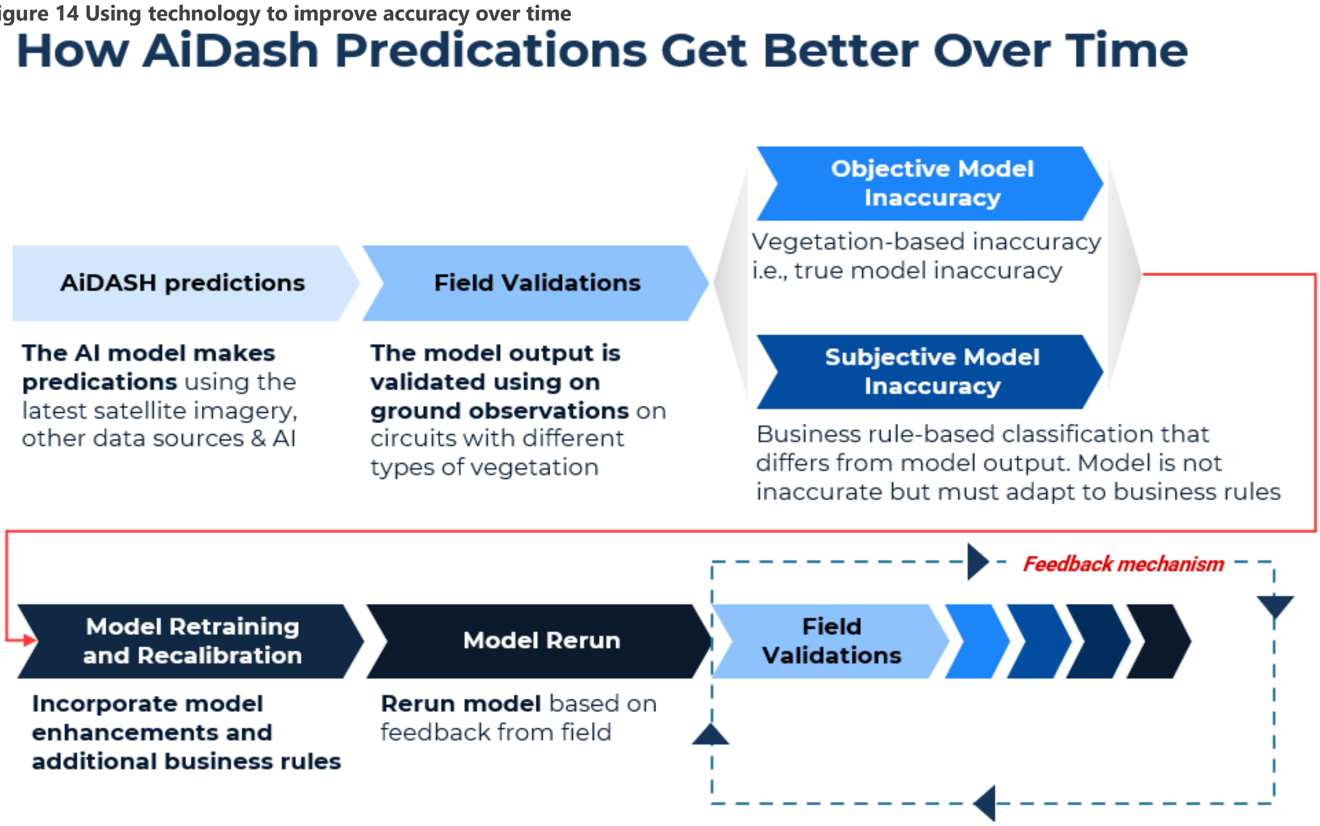
## 5.1 Project description and purpose

Vegetation is our highest risk factor in reliability. The purpose of the project is to test the use of satellite technology plus AI to provide a cost effective risk and criticality based prioritisation methodology for vegetation management.

Effective vegetation management is a growing challenge across our network, but the level of risk varies in different areas. Vegetation risks are currently identified through LiDAR surveys and field inspections. LiDAR is an optical remote sensing technology based on "light detection and ranging" that measures the light reflected by ground objects and transforms it into accurate 1-2 cm[6] resolution digital elevation models (DEMs), depending on the device. This is a standard vegetation management tool for EDBs.

We are looking to take advantage of improved technology to improve understanding of risk, prioritise risk, more effectively manage work, and increase reliability. The technology uses images to classify vegetation and clearance, predict growth rates for every line using historical images and AI, and identify segments of the network for planned trim years or risk rating. An overview of the process for predictions improving over time is shown in **Figure 14**.

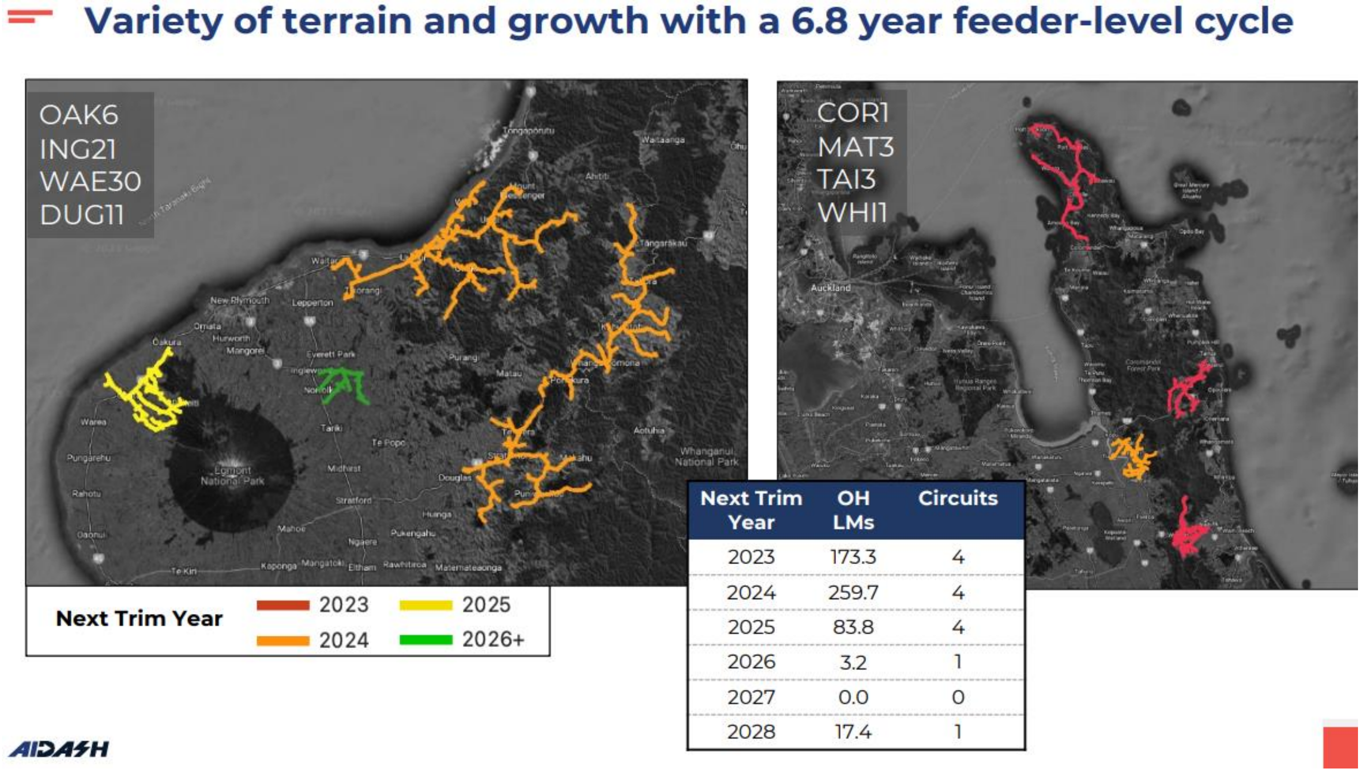
**Figure 14 Using technology to improve accuracy over time**




An example of the output of risk identification and then prioritising locations for vegetation management is shown in **Figure 15**.

[6] Compared to 30 – 50 cm for satellite

Figure 15 Output of prioritising vegetation management locations for cycle trim planning




## 5.2 Innovation and consumer benefits

The project takes advantage of improved satellite technology. There are almost 8,000 satellites orbiting Earth with repeat cycles of 1 to 26 days or on demand. This means you can consistently monitor infrastructure and vegetation. AI algorithms are available that can create growth curves based on the type of vegetation, predicting the growth rate for every span to predict trim years. This provides an ability to consistently and frequently monitor infrastructure and surrounding vegetation, clearances (both horizontal and vertical) and areas of risk.

Based on global trials of similar applications, the potential benefits could be
- ✓ Up to **15% reliability** improvement
- ✓ Up to **20% budget** reduction

Powerco has seen a trend of increasing vegetation-related events causing electricity outages. A review of our vegetation management strategy is needed to reverse this trend and improve reliability of service to customers.

An indirect benefit is emissions savings due to less field inspections, and more targeted field work based on need. There is also the opportunity for more prevention of fires and use of imagery before and after storm events. The use of technology for risk-based prioritisation has a range of benefits for Powerco, and our consumers as illustrated in **Error! Reference source not found.**

## 5.3 Application to other situations and EDBs

The technology is 100% scalable and configurable. It has been used in Australia and USA, but not in use in New Zealand (as far as we are aware).

## 5.4 Project cost / benefit

The current cost for LiDAR acquisition is approx. $5 – 6 million every five years. This provides accurate data but also requires intense work on interpretation and analysis, and by the time the data is ready for use it can be already outdated. It is possible to estimate trees' growth with LiDAR and obtain some health information such as presence or absence of leaves. It is often used in combination with satellite imagery to gather more precise information necessary to make informed decisions, such as on the greenness of the vegetation.

A review of alternatives to LiDAR for vegetation management considered satellite and drone options. A summary of considerations is provided in **Table 4**.

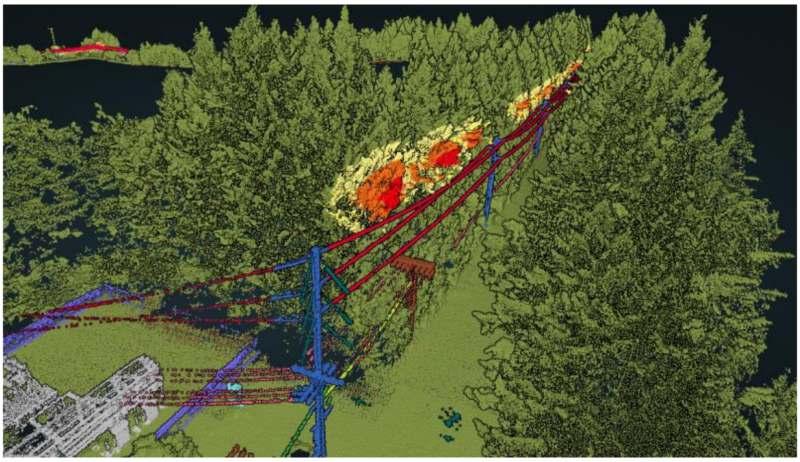
**Table 4 LiDAR alternatives considered**

| Satellite imagery | Drone imagery |
|---|---|
| • With nearly 6000 satellites orbiting around the Earth, a high level of affordability<br>• With a single acquisition, satellites can cover 3600 km$^2$ or more, with an accuracy of 30 - 50 cm, saving time and resources with just one monitoring, whereas other solutions require multiple operations<br>• Satellite imagery can help generate highly accurate information on general condition of vegetation:<br>– Health: Enables growth prediction based on actual conditions rather than generalized estimates<br>– Satellites are in constant orbit around the Earth, facilitation quick, real-time data updates and allowing for more precise and timely interventions<br>• Satellite imagery offers a clear advantage in vegetation management<br>– Reliability: Highly accurate and constantly up to date<br>– Flexibility: Can be used in combination with LiDAR and drones to compensate for their drawbacks<br>– Accessibility: Publicly available and more affordable than any other types of equipment | • Powerco currently has several drones that can be utilised to assess vegetation management these include a *Matrice RTK 300* and several *Mavic's*<br>• Drones can carry out the same light detection and ranging (LiDAR) used by helicopters, by capturing millions of data points to map out kilometres of power line right-of-way. There is the benefit of a reduction in inspection expenses and a reduced human risk.<br>• A drone cannot fly beyond line of sight, meaning inspectors would still need to venture into challenging terrain. This makes acquisition much slower.<br>• Drone inspections allows for utilities can find existing and potential issues more efficiently. With the right drone capabilities for vegetation can include automated analysis, species recognition, growth forecasting and normalized difference vegetation management. With the use of drones, we can become more conscious of potential encroachments earlier as we can leverage drone collected data to address issues without delay. Having more frequent inspections at a lower cost, data is up to date, risk-based targeting of vegetation management and improved reliability and resilience. |

Based on global application in similar scenarios, there is potential for 15% improvement in reliability and 20% reduction in cost of vegetation management compared to LiDAR. A full cost/benefit is to be completed in phase 2.

A number of potential satellite imagery sources were scoped and reviewed considering cost, accessibility, ease of use, in-house capability to integrate and use, and outcomes.

**Figure 16 Example of LiDAR survey identifying vegetation issue**

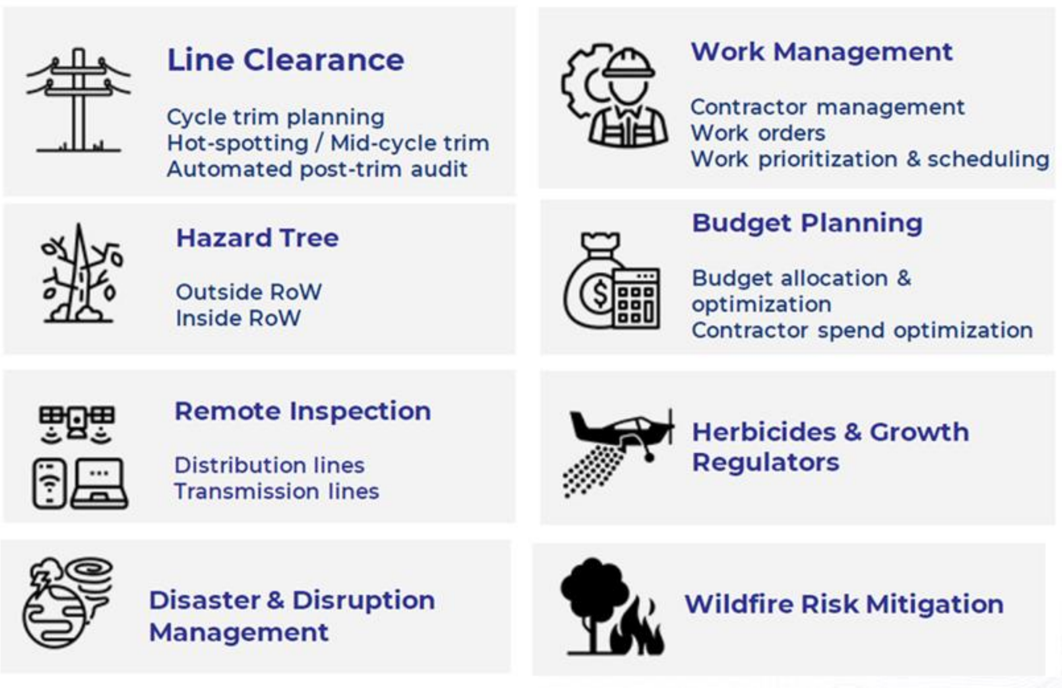


AiDash IVMS (Intelligent Vegetation Management System) with Software as a Service was selected. AiDash IVMS is the World's first satellite-powered vegetation management product deployed at scale with operation in 5 continents and across more than 500,000 miles of electricity lines. This product offers the advantage of multiple modules that can be selected for use including line clearance module (cycle trim planning), hazard tree module (proactive high impact analysis), remote survey module (report on suggested actions), work management module (contract management and interactive dashboards), budget planning module (more accurate estimates and budget planning), wildfire risk module (quantify and plan). The product creates customised reports and dashboards.

The AI analysis available with this particular trial application is unique and more advanced than other satellite imagery providers. In particular the way the technology can package together the imagery, analysis of the imagery, risk identification and work scheduling has significant potential benefits. There is also potential for savings in current cost of LiDAR, which is a common current approach across EDBs.

The trial is focused on vegetation management only, but the technology has other potential use cases for example monitoring land stability, gas leaks or other hazards and resilience impacts. Some of the broader uses and benefits are shown in Figure 17.

**Figure 17 Range of benefits through use of satellite imagery and AI technology**

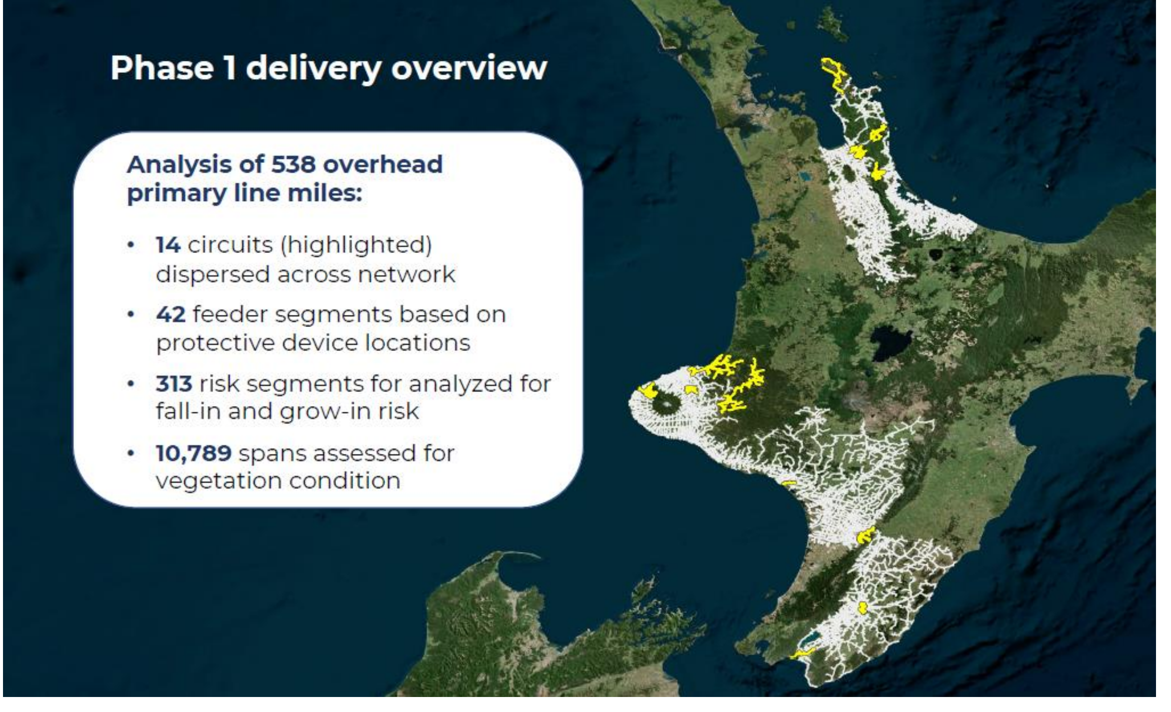


While the full cost/benefit analysis is still in development, the preliminary results of the phase 1 trial indicate that the benefits are likely to be aligned to trials run outside New Zealand.

## 5.5 Costs incurred, project delivery and next steps

During FY24, a trial project has been initiated with AI Dash. This Phase 1 has involved data acquisition and technology set up and a 4 month field trial across a range of feeders on the Powerco network. Multiple feeders were chosen as representative of different terrains, urban density, and vegetation types (see **Figure 18**).

**Figure 18 Representative overhead lines selected for trial project**




The trial has completed a cycle trim analysis and risk analysis (example in **Figure 19**) across the phase 1 representative lines.

The cost of the Phase 1 trial is $150,000 (all opex) and has already been incurred in FY24. Following the field trial, AI Dash provided one set of initial results, and are due to complete a cost/benefit/impact analysis in FY25 following completion of the field trial and analysis (expected at around the time of writing).

In FY25, Powerco will determine whether to progress to phase 2 of the project. The next phase would be to purchase a first capture of the entire network (capex), all set up for the system, and subsequent adjustment to operational practices for implementation across the network. Cost of phase 2 is still to be determined, as there are a number of variables and options to consider. However, it is estimated that the phase 2 establishment cost would be around $2.7 million (combined capex and opex) including data acquisition. Subsequent years would then involve a BAU cost.

**Figure 19 Example risk assessment results for a part of the trial**


A summary of the project phases and costs is provided in **Table 5**. Phase 1 completion was 31 March 2024, and Phase 2 (once scoped and agreed) will be completed by 31 March 2025.

**Table 5 Project activities and costs – Satellite based intelligent vegetation management**

| | FY24 incurred | FY25 estimate | Future |
|---|---|---|---|
| **Key activities** | • AI Dash commission: Data acquisition, create GIS layers, setup model, test model /reconfigure model, run field pilot. | • Review pilot, analyse results, assess RoI, complete cost/benefit analysis<br>• Assess module options (eg storm response)<br>• Decide if proceeding and if so, acquire first data capture of entire network | • Integrate into existing systems and processes (SAP).<br>• Adjust strategy and operational processes, training and support<br>• Ongoing data captures |
| **Capex** | - | TBC dependant on options, estimate $2.4 million FY25 combined capex/opex (mostly capex) | TBC |
| **Opex** | $150,000 | | TBC |
| **Total cost incurred** | $150,000 | | |
| **Application drawdown** | $75,000 | TBC | - |

# 6. Preparing this application for innovation project allowance

## 6.1 Addressing the Schedule 5.3 criteria

In Appendix 1, we have outlined the criteria for the innovation allowance in Schedule 5.3. The table summarises how each criterion is met, and/or where in this application the relevant information can be found. We are satisfied that all the criteria have been addressed.

## 6.2 Specialist review and report

In Appendix 2, we have provided a copy of the verification from a suitable specialist that the projects:

- Are innovation projects
- Have a purpose of delivering electricity lines services at a lower cost to consumers and at a higher quality of supply to consumers
- Have benefits and learnings that will be of general application to other EDBs.

The attached report sets out the qualifications of the specialist of their appropriate expertise to provide this verification for the three lines services projects that form this application.

## 6.3 Liaison with the Commission

In February 2024, Powerco met with Commerce Commission officials in the electricity distribution team to discuss the three projects being scoped for an application, key learning from other applications, expectations in our application (including level of detail), approach to the specialist adviser, and approach to projects with phases over multiple financial years. We have had subsequent follow up with the Commission in preparing this application on matters of clarification.

Powerco has also been active in the Commission's DPP4 work programme and developing approach to innovation under the DPP. This has included submissions on Commission consultation papers and collaborating with other EDBs to obtain expert reports on possible solutions to incentivise and drive innovation under the DPP framework. Powerco is committed to looking for innovative solutions to improve electricity lines services across the sector, and having the right incentives and/or framework to support this is essential.

## 6.4 Reporting on completed projects and sharing learnings with other EDBs

The Commission has emphasised the focus of the innovation allowance to encourage projects that will benefit NZ Inc, and reporting on the projects and sharing learnings with other EDBs is an important part of the process. Should this application be successful, Powerco anticipates the following activities to share learnings:

- Prepare report as required by Schedule 5.3 (5). As all three projects span multiple phases and years, we anticipate an interim report following completion of the FY24 components. The report will be made available on our website
- Share updates on our application, key findings and related reports on our website and social media channels
- Present an overview of the projects and key learnings to a suitable ENA or EEA forum to raise awareness amongst all EDBs. For example an ENA Future Networks Forum meeting.

## 6.5 Anticipating a FY25 application

We have provided the overview of each of the three projects, cost/benefits, delivery and costings in this application. All projects include aspects to be continued in FY25. We anticipate putting in a further application to the Commission in May/June 2025 to confirm the FY25 activities, costs incurred, and proposed FY25 drawdown. This further application will be supplementary to this report rather than a completely new application.

# 7. Conclusion

Powerco has an active strategy to ready ourselves for the changes in the energy sector ahead. An underlying direction for our Strategy is to drive innovation, with Powerco taking an active role in identifying and testing innovative new technology. This new technology will not only be an integral part of operating our future network, but it will also provide longer-term outcomes for our customers through improved quality and cost in energy services.

In our focus on connecting communities and best outcomes for customers, being innovative as illustrated in the three projects in this application, demonstrates Ngā Tikanga – Our Way.

**Figure 20 Powerco Ngā Tikanga – Our Way**

## Appendix 1 – DPP Determination 2020[7] Check of application against Schedule 5.3 innovation project criteria

**Table 6 Innovation project allowance criteria and how the requirement is met**

| Schedule 5.3 requirement | How the requirement is met |
|---|---|
| 5.3(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: | 50 working days following 31 March is 12 June 2024<br>Application submitted on 6 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; | Description: see sections 3.1, 4.1, 5.1 |
| (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 | Costs: see sections 3.5, 4.5, 5.5.<br>No costs have previously been drawn from the innovation project allowance |
| (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; | Purpose: see sections 3.1, 4.1, 5.1 |
| (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 on 6 June 2024<br>Available on our website electricity disclosures page: Electricity disclosures (powerco.co.nz) |
| (c) obtain approval from the Commission in accordance with paragraph (2) of Schedule 5.3. | Awaiting approval |
| 5.3 (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 | The proposed drawdown relates to $241,930<br>The full Powerco drawdown available is $650,000 |
| (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 | Application relates to $241,930<br>Project costs for FY24 are $483,860 |

[7] As updated including for Powerco's transition in 2022, and the Commission's update to clause 5.3(2)(c) in 2023. 5B20225D-NZCC-25-PowercoE28099s-transition-to-the-2020-2025-DPP-Final-determination-30-November-2022.pdf (comcom.govt.nz)

| | |
|---|---|
| (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-- | Refer report attached in Appendix 2 |
| (i) the proposed project is an innovation project; | Refer report attached in Appendix 2 |
| (ii) the purpose of the innovation project is either:<br>A. delivering electricity lines services at a lower cost to consumers; or<br>B. delivering electricity line services at a higher quality of supply to consumers; or<br>C. delivering electricity lines services at a lower cost to consumers and at a higher quality of supply to consumers; and | Refer report attached in Appendix 2 |
| (iii) the benefits of the innovation project will be of general application to the activities of that non-exempt EDB or of other EDBs; and | Refer report attached in Appendix 2 |
| (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. | Refer report attached in Appendix 2 |
| 5.3(3) The Innovation project allowance for the DPP regulatory period: Powerco Limited $650,000 | The application is below the allowance |
| 5.3(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. | Costs incurred in capex and opex: see sections 3.5, 4.5, 5.5<br>Drawdown amount $241,930<br>Capex proportion 61%<br>Opex proportion 39% |
| 5.3(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:<br>(a) submit a report to the Commission that outlines the key findings of that project; and<br>(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. | The report will be prepared following completion of the projects |

# Appendix 2 – Engineer independent review report

good people, **great results**
www.edison.co.nz

31 May 2024

Irene Clarke
Level 4/1 Grey Street,
Wellington Central,
Wellington 6011

Dear Irene

## POWERCO INNOVATION ALLOWANCE APPLICATION

I have reviewed and I support Powerco`s application for the Innovation Allowance for their three projects relating to vibration monitoring, line down detection and vegetation management. Each of the three projects is truly innovative, will benefit the industry and the people the industry serves. In my opinion, the three projects qualify for the innovation project allowance.

I make this assessment as a Chartered Professional Engineer with over 20 years of experience (registration number: 245077). I have expertise in targeting innovation investment for Network and community benefit from my four years in WEL Networks where I was Network Planning and Engineering Manager. In this role I was responsible for all Network Capex, Network SAIDI performance, engineering standards, and innovation.

The three Powerco projects show the potential for good return on investment. Each of the projects is well targeted, small and discrete, and may deliver long lasting primary and secondary benefits. These benefits are tabled below:

| Innovation | Primary Benefit | Secondary Benefits |
|---|---|---|
| **Aeolian Vibration Monitoring and Prediction** | Planning and replacement of conductor before it breaks reducing unplanned outages | Determining the characteristics that lead to vibration and changing construction to avoid vibration therefore reducing replacement costs. |
| **Line Down Detection** | Immediate response to line down failures reducing risk to the public.<br>Improved response time for faults reducing outage time | Where monitors are fitted, a lack of line down signal will assure the Control Room that lines can be promptly restored to service, further lowering SAIDI. |
| **Satellite Intelligent Vegetation Management** | Reduced line survey time/cost<br>Targeted tree trimming to lower cost | Data that can drive automatic landowner notification of tree-owners<br>Data to drive tree growth models and predictive cost curves and optimisation models |

I have provided a summary of our analysis for each of the projects in the pages that follow.

## Project 1: Aeolian Vibration Monitoring and Prediction

**Project summary and core challenge**

This project aims to develop and test new solar-powered line vibration monitoring devices and software. The product is called Line Guard and it will monitor the aeolian vibration on power lines. The vibration, caused by wind flowing over conductors, can lead to fatigue and potential failure at attachment points.

The core challenge is to detect and mitigate this hidden problem before it escalates into larger issues, causing power outages and public safety risks. Targeting replacement is critical given Powerco's Network comprises of over 1,500 km of sub-transmission overhead conductor and almost 15,000 km of distribution overhead conductor. Annual replacement budgets range between $15M and $20M.

My experience with overhead conductor condition assessment and replacement is that large lengths of moderately deteriorated conductor are replaced where there are a few patches of severely deteriorated conductor. This makes sense from an asset management view as patch replacement is costly and less reliable than complete replacement. However, major savings can be made if the accelerated deterioration can be understood and prevented.

If vibration is detected, then vibration dampers can be fitted. The performance of the vibration damping can then be tracked. In time, techniques for vibration damping can be refined and damage can be prevented. This extends the line of overhead conductor, reducing spend and improving reliability (through less planned and unplanned outages).

In the longer term, the line design and weather parameters that lead to vibration can be identified and designs improved. Better understanding will enable the industry to extend the life of overhead conductor and reduce costs.

**Areas where this project is an innovation:**

*Real-Time Monitoring of lines for Aeolian vibration:* The project uses solar-powered devices attached directly to power lines and can be installed without network interruptions during installation. The equipment continuously measures vibrations and provides early warnings when vibration levels exceed safe thresholds. This real-time monitoring capability allows for proactive intervention, preventing conductor fatigue and potential failures.

*GIS integration with site specific data:* The project also innovates by creating a GIS layer that highlights potential conductor fatigue locations. By integrating this layer into the existing Overhead Planning tool, engineers can gain valuable site-specific data. This data will be able to inform decisions related to maintenance, replacement, and the installation of vibration dampers.

**Additional considerations:**

The equipment also has the capability to detect broken cables, fallen towers, very high winds, sag, and oscillation frequency, which can provide further input into ongoing systems used to undertake FMEC analysis. It is moveable and therefore provides the optionality to shift locations if there is a change in requirements.

## Project 2: Line Down Detection

**Project summary and core challenge**
This project focuses on detecting fallen power lines, a significant safety hazard and service interruption issue. The challenge lies in developing a reliable, real-time detection system that can alert the appropriate parties immediately.

The current system relies on staff or members of the public observing the conductor drop and calling Powerco control. There can be a significant delay which creates significant public risk and extends the outage duration. Some members of the public approach downed power lines despite educting advertising campaigns. This presents a risk of death.

Certain line-down situations can't be detected by traditional protection devices. This typically occur where a line break leaves the supply side suspended above ground. Here the downstream conductor, on the ground, is energised by back feed via downstream transformers.

The line-down detection will be achieved through software updates to existing monitoring equipment. Once the algorithm is developed it can adapted for different measurement devices and used across the industry. This will lead to a broad and significant improvement in safety.

Its worth noting that WEL Networks is developing similar capabilities through their smart meters. However few distribution companies own the residential smart meters within their network and meter data access is not real time (often not even daily). Therefore the WEL Networks application can not be widely adopted and this Powerco innovation has wider industry benefit.

**Areas where this project is an innovation:**
*Utilizing existing equipment for increased functionality including real time monitoring:* The project utilises existing monitoring equipment to detect line down incidents by monitoring phase shift on the low voltage side of transformers. The technology uses phase relationship distortion to create an alarm that alerts the team to the possibility of lines down. The changes in magnitudes and phase angles of voltage measurements are analysed to determine if a downed-conductor event can be reliably detected.

*Predictive Analysis for Early Warnings:* By analysing historical data and patterns, the project aims to predict potential line down events. This predictive capability allows for proactive measures, such as rerouting power or dispatching repair crews.

**Additional considerations:**

The use of this technology provides engineering controls for system alerts of lines down, reducing the reliance on emergency calls and improving response time. Rapid detection of fallen lines ensures timely response and prevents accidents, fires, and other hazards associated with downed power lines. This will also help minimizing downtime due to fallen lines leading to improved overall service reliability for customers.

Given that the project improves public safety by avoiding risks associated with live downed powerlines. The technology also offers opportunities for cost reduction, improved power quality, and scalability for other electricity distribution businesses (EDBs).

## Project 3: Satellite Intelligent Vegetation Management

### Project summary and core challenge

The purpose of this project is to test the use of satellite technology and artificial intelligence (AI) to prioritise vegetation management based on risk and criticality. The goal is to improve the effectiveness of vegetation management which will reduce cost and reduce the number and length of interruptions caused by vegetation.

Powerco's 2023 AMP shows an increasing trend of tree related outages longer than 1 minute[1]. In 2022 there were over 500 of these interruptions. This is despite an annual vegetation budget of $10M. Other EDBs experience similar results. Improving the efficiency and effectiveness of vegetation management has the potential to save tens of millions of dollars across New Zealand.

Global trials have suggested benefits such as up to 15% improvement in reliability, up to 20% reduction in budget for vegetation management, and emissions savings due to less field inspections. For the industry, where in 2023 they collectively spent almost $60M on vegetation management and at least 27% of interruptions were caused by vegetation[2] these savings correspond to savings of $12M 4% of all SAIDI. This shows the value of trailing this system in New Zealand.

### Areas where this project is an innovation:

*Use of satellite imagery and Artificial Intelligence*: The project utilises satellite imagery and AI algorithms to classify vegetation and clearance, predict growth rates, and identify segments of the network for planned trim years or risk rating. The satellite technology provides consistent and frequent monitoring of infrastructure and surrounding vegetation, allowing for proactive management and targeted field work based on need. This would be especially useful in case of fire or after a storm.

Avoid other costly vegetation survey techniques: Current EDB practice for vegetation management include line patrols or helicopter/drone LiDAR surveys. Both methods require significant effort, equipment and personnel. The surveys are conducted periodically with higher survey rates proving expensive. Satellite imagery offers almost continual monitoring with little human effort once the system is configured.

### Additional considerations:

The technology is scalable and configurable, making it applicable to other situations and EDBs. It has been used in Australia and USA, but not in use in New Zealand (as far as we are aware).

The continuous monitoring of trees allows effective use of the Tree Regulations Notices. Often EDBs find that administering notices is more costly than simply trimming trees. However, with satellite monitoring communications with Tree Owners can be improved. Systematic checks for tree trimming can be made following notices. This lowers the cost to administer the Tree Regulations and they may become effective.

Used internally or with Tree Owners, we expect that this system will provide better targeting of vegetation management, an improved ability to trace the cause of tree outages and overall lower vegetation management costs.

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[1] Power 2023 AMP, pg335 - https://www.powerco.co.nz/-/media/project/powerco/powerco-documents/who-we-are---pricing-and-disclosures/disclosures/electricity-disclosures/2-electricity-asset-management-plans/2023-electricity-asset-management-plan-version-1.pdf

[2] Commerce Commission, Electricity distributors' information disclosure data 2019-2023, (14 December 2023).

**I give permission for this letter to be used with the application and to be contacted.**

I understand that this letter may accompany the Powerco Innovation Allowance Application. I give consent for this and for recipients of this Application to contact me for further clarification.

Kind regards

**Richard Kingsford |** General Manager Design & Engineering Solutions

**Edison Consulting Group** | *good people, **great results***
Level 2 | 127 Alexandra Street | Hamilton 3204
m: +64 27 505 7236 | www.edison.co.nz | Follow us on LinkedIn