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*Peter Hunter*

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**By email:** [REDACTED]

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Dear Peter

### **Dry Type Mobile Transformer – INTSA application**

This letter sets out Vector's response to the Commerce Commission's follow up questions dated 10 December 2025 on our dry type mobile transformer INTSA application.

### **Please provide details and findings on research undertaken on open-air transformers available on the market or being researched**

Vector has undertaken preliminary research into transformer designs that could meet our spatial, fire, electrical and thermal performance constraints while also being suitable for a transportable, mobile format. This assessment found that traditional cast-resin dry-type transformers are not suitable for our intended application for several reasons:

- **Susceptibility to vibration and impact:** Cast-resin windings are prone to cracking when subjected to vibration during road transport or physical impact, making them unsuitable for a mobile deployment model.
- **Poor thermal cycling performance:** At zone substation load profiles, cast-resin units experience significant thermo-mechanical cycling, which can shorten operational life. They also perform poorly in environments that are not humidity-controlled.
- **Difficult reparability:** Damage to cast-resin transformers is challenging to remediate because the core and windings are encapsulated. Repairs are often impractical, with full replacement usually required.
- **Limited overload capability:** Resin encapsulation traps heat, restricting short-term overload performance and reducing flexibility during contingency operation.
- **Larger footprint:** Cast-resin transformers generally require a larger physical footprint than an equivalent oil-immersed transformer of the same MVA rating, which is incompatible with Vector's spatial constraints.

Given these limitations, Vector then investigated open-ventilated dry-type designs with 3D wound cores as an alternative. These transformers are non-encapsulated and rely on natural or forced air circulation for cooling, typically using high-temperature insulation systems such as Nomex. They can operate in open-air conditions, within louvred enclosures or in suitably protected outdoor

locations. While providing similar fire-safety benefits to cast-resin units, open-ventilated transformers offer the following advantages for our intended application:

- Better resilience to vibration and transport shocks
- Improved maintainability and repairability
- Superior thermal-mechanical performance and higher short-term overload capability
- A smaller footprint suitable for mobile deployment

Our market scan identified several manufacturers producing open-ventilated designs. While the global market for open-ventilated dry-type transformers remains relatively small, it is expanding, and large-MVA units (10–15 MVA) are emerging at the early adoption stage. In New Zealand this technology is untested and therefore considered at Technology Readiness Level (TRL) 5.

Further engineering development is needed to demonstrate:

- 30 MVA short-term thermal overload capability
- Dual HV winding arrangements (33-22kV)
- Appropriate impedance characteristics
- Compliance with Vector's spatial and transportability requirements

Based on our early technical review, achieving these capabilities appears feasible but will require targeted design development, prototyping and field validation to advance to TRL 8/9. This work involves material technical uncertainty and innovation beyond business-as-usual network solutions and is therefore the subject of this INSTA funding proposal.

### **What engagement has Vector had with other EDBs on this project?**

The design of the mobile transformer unit will be such that the use of the unit will not be restricted to the Vector network.

However, following the last meeting with the Commerce Commission on this application, Vector's Chief Engineer has reached out to Northpower's Chief Operating Officer to put in place a more formal collaboration process. As such, Northpower will make an in-kind contribution to the design, field validation, and operationalisation of the unit - to prove it can be deployed on the Northpower network without any modifications.

The proof of concept will focus on Northpower's new zone substation at Mangawhai, to mitigate the risk of the loss of the substation, since the value proposition is that the mobile unit can then be connected up to the 33kV overhead line to supply the local area while the zone substation is reinstated. Potential application to the wider Northpower 33kV network will also be considered as part of the collaboration.

Northpower's contribution will be in the form of the time Northpower's engineers will dedicate to working with the Vector team to design, validate and operationalise the concept. Vector will therefore benefit from the extra resources and visibility of Northpower's specific needs, and Northpower will benefit from having access to a fit for purpose unit once it is operationalised.

A key part of the collaboration will be to formalise commercial agreements and operational procedures to enable the sharing, and fast deployment, of mobile, emergency assets across traditional EDB boundaries. The agreements and procedures will be done so that can easily be adopted by the wider industry for other opportunities for the sharing of emergency equipment.

The in-kind contribution of Northpower is estimated to be \$24,000 based on contributions from senior engineers, commercial leads and legal subject matter specialists.

### **How has Vector considered staging the project?**

Vector has not yet formally engaged a manufacturer for this equipment. As such, the final delivery approach will be informed by the selected manufacturer's detailed design, build and testing processes. Notwithstanding this, Vector has outlined a staged delivery model to manage technical risk, enable iterative learning, and ensure that investment decisions are informed at each stage. The anticipated high-level project stages are outlined below.

1. Engineering Design:

The transformer will be designed by the selected manufacturer in accordance with Vector's technical specification. This phase is expected to include structured design milestones, such as 20%, 80% and 100% design reviews, providing formal hold points for review, challenge and iterative refinement as the design matures.

The engineering phase will also include detailed thermal analysis, including computational fluid dynamics (CFD) modelling, to demonstrate at a desktop level that the proposed design can meet performance requirements under real-world operating conditions.

2. Transformer Build:

Given that the transformer represents the highest technical risk within the project, it will be manufactured first. This approach allows early validation of the most critical component before committing to the construction of the broader mobile substation systems.

3. Transformer Factory Testing:

Upon completion of manufacture, the transformer will undergo comprehensive factory testing to validate compliance with the approved design and to confirm performance assumptions established during the engineering phase.

4. Trailer and Ancillary Systems Build:

Once confidence in transformer performance is established, the trailer and associated ancillary systems will be constructed. This will include primary switchgear, LVAC and DC systems, protection and control, communications, and heat rejection systems. The transformer will then be mounted onto the trailer and mechanically integrated with these systems.

5. Integrated Factory Testing:

Following assembly, integrated testing will be undertaken at the factory with all systems connected and operational. This stage will verify correct functional integration, system interactions and overall operational performance prior to shipment.

6. Shipping and Delivery:

Subject to successful integrated factory testing, the complete unit will be shipped to Vector.

7. Field Trial/s:

The mobile transformer will be deployed to a selected Vector/Northpower zone substation site for a controlled field trial. This trial will validate installation, operability, thermal performance and integration with Vector/Northpower's network under real operating conditions.

8. Network Deployment:

If the field trial is successful, the unit will be formally commissioned into service as part of Vector's operational network and made available for emergency response and planned outage support.

9. Reporting and Knowledge Capture:

Throughout all stages of the project, outcomes, test results and key learnings will be documented in a structured manner. This will ensure that insights gained from the design, manufacture, testing and field trial phases are captured, shared and used to inform future deployment decisions and wider industry learnings.

### **What governance controls are in place for any identified go/no go decision points?**

This project is being delivered within Vector's INTSA Programme, which has a dedicated governance with executive oversight. Vector will establish a cross-functional project steering group to provide guidance and to act as the decision-making body for all key go/no-go points.

Each project stage (as listed above, to be confirmed during contracting) will include clearly defined technical, safety, cost and risk acceptance criteria. These will be reviewed by the steering group at formal hold points. Progression beyond each hold point will require steering group approval. Through the tendering process Vector will also explore contracting options to stage expenditure based upon meeting acceptance criteria.

This governance structure ensures that:

- Risks are actively identified, assessed and managed as issues emerge
- Design or scope adjustments can be made in a controlled manner
- Expenditure is staged and contingent on demonstrated performance
- The project can be paused, redirected or terminated if outcomes do not meet expectations

**Could you please provide some additional information regarding the procurement process Vector plans to undertake for the transformer?**

Vector intends to procure the transformer through a structured, competitive market process. An initial Expression of Interest (EOI) will be issued to the market to identify and engage suitably qualified suppliers, including any participants not identified through Vector's initial market scan, who have the capability to design, manufacture and test this type of equipment.

The EOI stage will be followed by a competitive tender process based on a design-and-build delivery model. This approach recognises the innovative nature of the solution and allows suppliers to propose optimised designs while meeting Vector's functional and performance requirements.

Tender evaluation will be undertaken using a value-for-money framework, considering both technical and non-technical criteria. This will include, but not be limited to:

- Technical compliance and performance capability
- Demonstrated experience and delivery capability
- Approach to design development, testing and risk management
- Safety, quality and assurance processes
- Whole-of-life cost and commercial terms

This procurement approach ensures transparency, competitive tension and robust assessment of supplier capability, while supporting innovation and delivering value for consumers.

Yours sincerely

Imogen Welling  
Senior Regulatory Counsel