INNOVATION AND NON-TRADITIONAL SOLUTIONS ALLOWANCE (INTSA) APPLICATION

DRY-TYPE 33-22/11 KV 15/30 MVA MOBILE TRANSFORMER

1 OCTOBER 2025

vector

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Eligibility Criteria (Clause 6 of Schedule 5.3)

Summarize how the project meets the INTSA eligibility criteria:

INTSA Eligibility Criteria	Yes/No	How the Project meets the Criteria
6(a) Relates to the supply of electricity distribution services	Yes	This project involves the design, build and trial of a **dry-type** 33-22/11kV 15/30MVA mobile transformer to be used at Vector's zone substations. It directly supports the continuity and resilience of electricity distribution services by enabling rapid return to service (restoration of electricity supply/security) timeframes in response to unplanned and planned power transformer outages. If proven successful, this more compact alternative to traditional oil-filled transformers will allow rapid deployment at zone substations with physical space constraints or heightened fire risk, where oil-filled units cannot be installed on a non-permanent basis. In addition, this type of transformer may be able to replace most of Vector's existing fleet of strategic spare transformers which would over time reduce overall maintenance and holding costs going forward.
6(b) Promotes the Part 4 Purpose of the Act	Yes	s52A of the Commerce Act 1986 sets out the purpose of Part 4. This project promotes the purpose of Part 4 of the New Zealand Commerce Act 1986 by: • Strengthening Vector's strategic spare transformer strategy through the design and construction of innovative mobile dry-type transformers. • Enhancing service quality by enabling faster restoration of supply/security to customers. • Improving operational efficiency by potentially replacing multiple strategic spare units with a single mobile dry-type transformer, thereby reducing associated maintenance and storage costs.
6(c)One or both of the following apply: (i) The project or programme is unlikely to otherwise result in any financial benefits to the EDB in the five disclosure	Yes under 6(c)(ii) and potentially under 6(c)(i)	**The benefits are sufficiently uncertain that Vector would not carry out the project without INTSA funding** The proposed application and engineering design for a mobile transformer is a novel, unproven approach within the electricity distribution sector.

years after the date by which it indicates that it expects it will complete its project: (ii) the benefits of the project or programme are sufficiently uncertain that the EDB would not carry out the project or programme if it could not recover some or all of the forecast costs of the project from its INTSA		The unit will incorporate a 3D-printed core, an open-ventilated configuration with enamel and Nomex insulated conductors, departing from the conventional resin-cast design used in typical dry-type transformers. Achieving the required thermal performance (particularly the short-term 30 MVA rating) will be a significant engineering challenge. The design, build and trial of a compact large-capacity dry-type 33-22/11kV 15/30MVA transformer with integrated switchgear and control systems is a novel and untested approach within the electricity distribution sector. Due to the technical uncertainty and the early-stage nature of this innovation, an investment of this kind falls outside Vector's standard risk appetite. Consequently, without INTSA funding support, this project would not be funded under Vector's DPP4 expenditure allowance. **The project is unlikely to deliver financial gains within the next five years** The project is not expected to deliver capital expenditure savings, as it will not defer any planned investments. While there is potential for long-term operational savings, through replacing multiple strategic spares and reducing SAIDI at single-transformer sites during emergency deployments, these benefits remain highly uncertain given the risks and challenges of the technical design and build and the relatively low likelihood of transformer failures. As a result, the uncertainty significantly outweighs the potential benefits, and it is unlikely that the project will deliver any financial gains within the next five disclosure years. **Vector application** We are applying for 75% recovery under criterion 6(c)(ii) on the basis the benefits are sufficiently uncertain that Vector would not carry out the project without INTSA funding. We also consider the project may qualify for 100% recovery under criterion 6(c)(i). We request the Commission also consider whether the application also meets the criteria for 100% recovery.

INTSA Application Information (Clause 4 of Schedule 5.3)

Project Contact

Vector welcomes the opportunity to engage with the Commission on any element of this application. For further information or clarification, please contact Imogen Welling, Senior Regulatory Council, at [redacted].

Project purpose and steps Vector intends to take to achieve that purpose (clause 4(a) of Schedule 5.3)

Context
Vector's role as a lifeline utility is becoming ever more critical as electricity continues to support Auckland's energy, transport, and digital infrastructure. At the same time, customer expectations have evolved and there is now an implicit expectation that utilities will maintain continuity of supply and restore service quickly after any unplanned network event or planned network activities. These expectations will only intensify in the years ahead.

Power transformers are critical network assets, supplying large customer bases and underpinning energy system resilience. When a power transformer experiences a major fault, restoration times can be lengthy due to the complexity of repairs and extended lead times for key components or full replacements. When this occurs, it puts Vector's network at risk by degrading the level of security of supply and potentially stressing other parts of the network for extended periods of time (as load is transferred to other parts of the network).

Need Statement
Vector currently manages a fleet of diverse power transformers across its zone substations. To manage unplanned outages, we maintain four strategic spare transformers. However, deploying these spare units is time-consuming and resource-intensive, involving:

- Dismantling and transportation from storage
- On-site assembly and commissioning
- Site-specific civil or structural modifications (e.g. oil containment bunds, foundations, or fire walls/enclosures) to ensure compliance, safety and compatibility

This process can take between four weeks to three months. As such, there is a need for quicker and more agile deployment of strategic spare power transformers to improve service restoration times and reduce risk to other parts of the network.

Project Purpose
The purpose of this project is to deliver an innovative solution that strengthens the resilience of electricity distribution networks against power transformer faults arising from unplanned events and planned network activities.

By designing and demonstrating a mobile dry-type power transformer with fully integrated switchgear and ancillary systems, the project aims to significantly reduce service restoration times across the following use cases:

- Emergency response to transformer failures
- Planned transformer replacements where maintaining security of supply is critical
- Temporary network support or major customer supply applications

If proven successful, this solution will enable safe, rapid deployment at substations including sites

with physical constraints or heightened fire risk. It will aim to provide a flexible response capability that is currently unavailable. Ultimately, it will contribute to a more reliable, adaptable, and sustainable electricity network for the future.

Steps Vector will take to achieve the project purpose:
This project will design, build, and trial a **33-22/11 kV, 15/30 MVA mobile dry-type transformer** with integrated primary and secondary systems, engineered to connect to over 95% of Vector's zone substations (33/11 kV and 22/11 kV sites, excluding the 110 kV fleet at this stage).

This project will test the hypothesis that a large-capacity dry-type transformer, featuring a 3D-printed core, an open-ventilated design with enamel and Nomex insulated conductors, can deliver the performance, reliability, and operational flexibility needed to improve network resilience. This type of design would be unprecedented at this voltage and rating, particularly when combined with integrated switchgear and control systems in a mobile format.

The outcomes of the trial will confirm the following:

1. The ability of a mobile dry-type transformer of this size to be deployed safely and rapidly to restore supply following a major transformer outage.
2. Whether its compact, oil-free design can overcome physical site constraints, heat rejection requirements and fire risk limitations that restrict the use of traditional oil-filled units.
3. The potential for a single mobile unit to replace multiple strategic spares, lowering operational costs without compromising on network requirements.

Project Outputs and expected benefits for consumers (Clause 4(b) of Schedule 5.3)

This project will deliver a design as well as the construction of a fully operational, trailer-mounted 33-22/11kV mobile transformer unit. This will include:

- A unit that is physically and electrically designed to cover >95% of Vector's zone substations.
- A unit integrated with protection, SCADA, and communication systems for plug-and-play operability across Vector's network.
- A unit that is compliant with NZ road transport regulations.
- Assessed operational feasibility and compatibility across Vector's network through deployment trials at multiple zone substations.
- Technical documentation including engineering specifications, installation/maintenance procedures, and safety protocols.
- Final project report summarising trial results, technical performance, operational learnings, and recommendations for future deployments of mobile transformer units.

Key Benefits for Consumers:

- **Enhancing network resilience** during unplanned network events (such as a transformer fault) or planned network activities (such as transformer repair) by minimising return to service times thereby maintaining security of supply levels during contingency situations.
- **Reduced outage durations** at sites with limited network contingency (such as single transformer substation), by enabling faster response times to customers following unplanned and planned outages involving power transformers.
- **Potentially reducing costs** of delivering electricity line services as a single mobile transformer would cost significantly less to deploy, store and maintain than the current fleet of traditional transformers.

Key Benefits for Vector:

- **Increased flexibility and resilience** by providing a rapidly deployable mobile transformer that can be deployed at >95% of Vector's zone substations.
- **Multiple potential applications** such as:
    - Emergency response to a transformer failure/fault
    - Transformer asset replacement projects to maintain security of supply during replacement or upgrade works
    - Possible customer network applications outside the zone substations
- **Potentially lower future operation costs** by potentially replacing multiple strategic spares with a single mobile transformer.

The expected benefits, if the trial is successful, extend well beyond Vector's network and has the potential to change how electricity distribution networks prepare for and respond to transformer outages.

Dates by which Vector expects the project outputs to be delivered (Clause 4(c) of Schedule 5.3)

The indicative milestone dates for this project are provided below:

- Engineering design and technical information: **End of Q3 FY26**
- Mobile transformer unit completed and tested: **End of Q1 FY27**
- Deployment trials completed: **End of Q2 FY27**
- Final report submitted to Commerce Commission: **End of Q3 FY27**

Financial Summary of INTSA (clause 4(d)-(e) of Schedule 5.3)

This project is seeking 75% funding to design and build a mobile 33-22/11kV 15/30 MVA power transformer (as discussed above, we also request the Commission consider whether the application meets the 100% funding criteria).

Vector expects this project to have a timeline of up to 24 months in line with the milestone dates provided above.

The cost allocation per financial year has been provided in the table below.

Table 1: Project Cost Timeline

Annual Forecast Costs	
FY26: $1,600,000 (capex)	To fund the design and build of a mobile 33-22/11kV 15/30 MVA power transformer.
FY27: $400,000 (capex)	To fund the balance/retainer and testing operational performance.

The financial summary of Vector INTSA allocation is provided in the table below.

Table 2: Vector INTSA Financial Summary Table

	Collaborative Allowance (0.2% MAR)	Vector Allowance (0.6% MAR)	Total
DPP4 Decision	$7,100,000	$21,300,000	$28,400,000
Applications Previously Approved	$0	$0	$0
Applications Pending Decision	$237,000 (local flex platform)	$0	$237,000 (local flex platform)
This Application	$0	$1,500,000	$1,500,000
Remaining Allowance	$6,863,000	$19,800,000	$26,663,000

Reason for the Proportion of Forecast Costs Requested From INTSA

The proposed application and engineering design for this mobile transformer is a novel, unproven approach within the electricity distribution sector. In particular, the transformer itself will incorporate a 3D-printed core, an open-ventilated configuration with enamel and Nomex insulated conductors, departing from the conventional resin-cast design used in typical dry-type transformers. This architecture aims to overcome the performance limitations found in conventional resin-cast designs - namely MVA size constraints and susceptibility to thermo-mechanical failure modes. However, achieving the required thermal performance (particularly the short-term 30 MVA rating) remains a significant engineering challenge. Given the technical uncertainty and early-stage nature of this innovation, the investment falls outside Vector's standard risk appetite. Without INTSA funding, the project would not be prioritised or funded within Vector's DPP4 expenditure allowance.

Requested SAIDI / SAIFI value due to Project (clause 4(f) – (h) of Schedule 5.3)

We do not anticipate any service interruptions or any negative SAIDI or SAIFI impacts when testing the mobile transformer unit.

Is the project a collaborative project? (clause 4(i) of Schedule 5.3)

The project is not a collaborative project.

Additional Information

Geographic Area

This project will cover the entirety of Vetor's operating area being a mobile unit.

Building on Prior Learning

There are examples of oil-filled mobile transformers/substations being built by other utilities in NZ (Powerco, Transpower). Some learnings can be gained around the switchgear and secondary systems design however the transformer technology is quite different to that proposed for this project (traditional oil-type versus proposed dry-open-ventilated type). We are not aware of any precedent, in New Zealand or internationally, for a mobile transformer of this design and technology built to comparable specifications.

Potential for New Learning

This project will generate valuable insights into the design and application of open-ventilated power transformers. The learnings will be relevant not only to electricity distribution businesses, but also to other high-energy-use industries such as data centres, manufacturing, and oil and gas. By demonstrating a rapidly deployable, compact, and low-maintenance alternative to traditional oil-filled transformers, the project has the potential to influence future transformer design standards and deployment strategies across multiple sectors.

Alignment with Sector Programmes

We are not aware of this type of project being aligned with any sector programmes.

Replicable in New Zealand

Once developed, there are potential uses cases with other large power users in NZ – electricity distribution businesses being the obvious examples.