Electricity Engineers' Association

EECA

UPDATE REPORT 1

FlexTalk:

THE DEMAND FLEXIBILITY COMMON COMMUNICATION PROTOCOLS PROJECT

ELECTRICITY ENGINEERS' ASSOCIATION

April 2023

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FIGURES

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Introduction

Message from the FlexTalk Governance Group

Demand flexibility will be crucial to transitioning to a truly renewable energy future for Aotearoa New Zealand.

A key enabler that will unlock the true value of this flexibility is access to standard industry communication protocols and information interchange tools. These tools are needed to support a 'plug and play' environment that will allow stakeholders to work together at a business-to-business level and ultimately deliver a great customer experience.

It is important to enable consumers to more actively manage energy demand, so they have control over their energy uses and costs. Furthermore, it is equally important to manage intermittent renewable energy supply, network congestion, and peak demand. That is why Government and industry are working collaboratively to jointly fund this project.

We want to thank our funding partners for their active support and contribution, and to all participants for being so highly engaged in FlexTalk.

This project aims to test OpenADR as one such standard protocol within a real-life New Zealand context and provide learnings and a valuable set of guidelines for the electricity industry to leverage.

Accordingly, this document provides a recap on the project's purpose and an update on progress made to date.

In brief, the following key milestones have been achieved so far:

- Establishment of all project teams
- Appointment of delivery partners
- Technical implementation of OpenADR Virtual Top Node (VTN) and Virtual End Node (VEN) by the delivery partners in preparation for Trial Part A
- Completion of trial design for Trial Part A
- Commencement of Trial Part A with events being deployed and messages communicated between the electricity distribution business (EDB) and flexibility supplier (aggregator)

The next steps involve trialling a variety of demand flexibility programmes with our selected delivery partners to better understand the practical opportunities and constraints involved with using the OpenADR communication protocol.

A key outcome of FlexTalk is the development of practical guidelines that can help the electricity industry move forward with confidence into an exciting future that leverages the full benefit of customer flexibility resources in a mutually beneficial way.

Rodger Griffiths	**Peter Berry**	**Brian Fitzgerald**
Industry Design Team Chair	EEA CEO	Technical Lead EECA

Project overview

Background

In accordance with the Paris Agreement (2015), Aotearoa New Zealand has committed to achieving net zero emissions by 2050. The Government has also set an aspirational goal of reaching 100 percent renewable electricity generation by 2030.

Most renewable generation connected going forward will be intermittent in nature, providing challenges to the grid owner, networks, and the system operator to manage supply and demand, and power quality.

Energy system flexibility can help to facilitate greater amounts of intermittent renewable electricity generation entering the electricity market, providing consumers the opportunity to play an increasing role in the operation of the electric grid. If left unmanaged, increased electrification will require significant investment in network infrastructure.

Project purpose

The Demand Flexibility Common Communication Protocols project (FlexTalk) is a collaborative partnership between industry, represented by the Electricity Engineers' Association (EEA) and the Energy Efficiency and Conservation Authority (EECA).

FlexTalk's purpose is to evaluate the processes that need to be in place to apply the OpenADR 2.0 (2.0a and or 2.0b) communication protocol to achieve interoperability between EDBs and flexibility suppliers (aggregators) in order to actively manage charging of electric vehicles (EVs), enabling flexibility services to be utilised in the electricity sector in Aotearoa New Zealand.

While the project focuses on the application of the OpenADR 2.0 standard (referred to simply as OpenADR from this point forward), we acknowledge there are multiple communication protocols. For the purpose of this trial, we are utilising OpenADR as an exemplar[1].

[1] The focus of this project is about EV charging and using OpenADR as the mechanism of choice to prove the benefits and establish the application logic of the protocol in the New Zealand market. While our initial work focuses on OpenADR, it does not preclude the use of other protocols that are found to have benefit throughout the project.

EVs as a starting point

FlexTalk will transform how we operate the grid in the future and support customer engagement in demand flexibility. A pilot trial will develop the procedures needed to enable communication between an EDB and flexibility supplier (aggregator) to achieve active managed charging of EVs.

This is the first step in investigating how we integrate distributed energy flexibility within our distribution networks to optimise energy use.

The expected outcome is a technical guide that will enable interoperability between distribution companies and flexibility suppliers across the sector.

Strategic goals

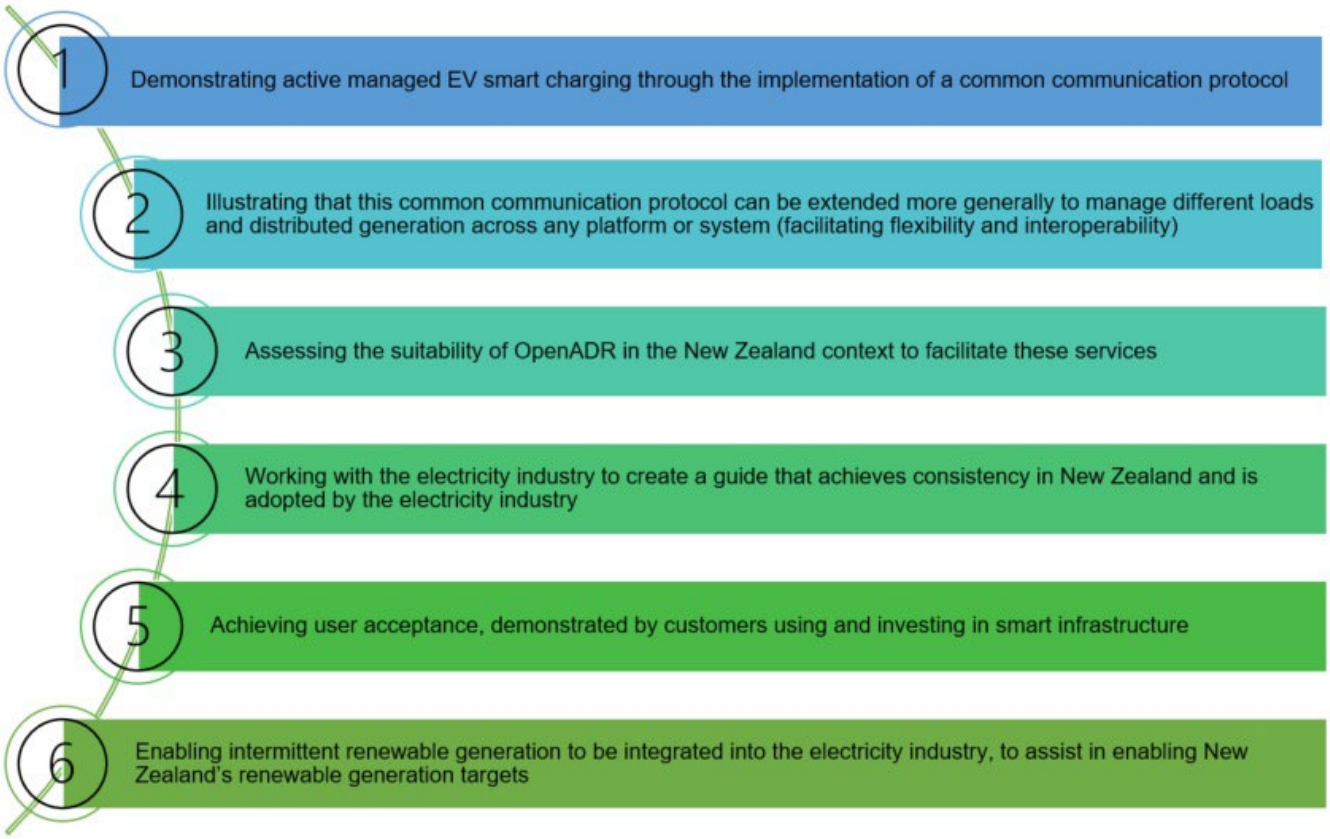

Figure 1: Strategic goals

Deliverables

1. A functional specification document (template) that provides direction for the electricity industry on the application of the OpenADR 2.0 communication protocol in Aotearoa New Zealand for actively managing EV charging; and,
2. A supporting guidance document that provides:

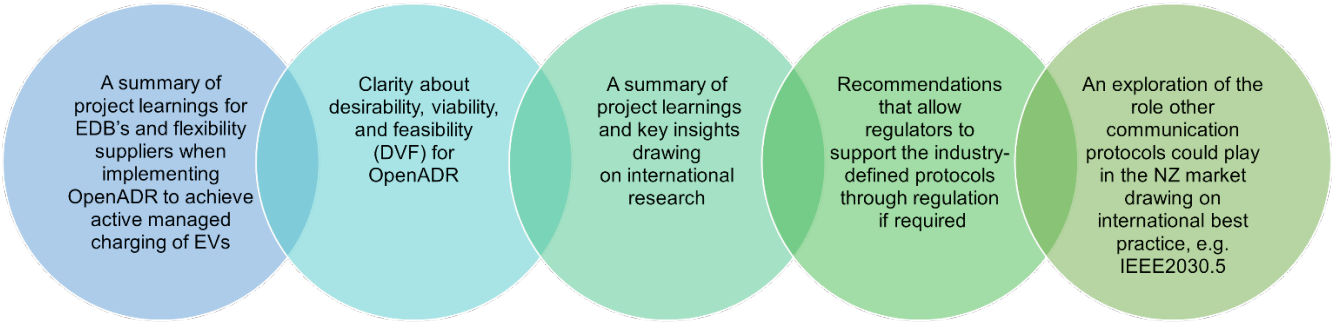

Figure 2: Project deliverables

Project approach

FlexTalk consists of seven 'project phases' as shown in Figure 3 below.

The project is tracking as planned. The team is currently focused on Phase Five - 'Protocol Implementation'.

Phase Five involves a two-part trial involving three EDBs and two flexibility suppliers. This phase seeks to evaluate the processes that need to be in place to achieve active managed charging of EVs using the OpenADR 2.0 (2.0a and or 2.0b) communication protocol.

Engaging and involving all stakeholders throughout each project phase will be critical to achieving the desired outcomes of the project. Namely, identifying any issues with interoperability and developing guidance that will apply to all parts of the industry to achieve active managed charging of EV's.

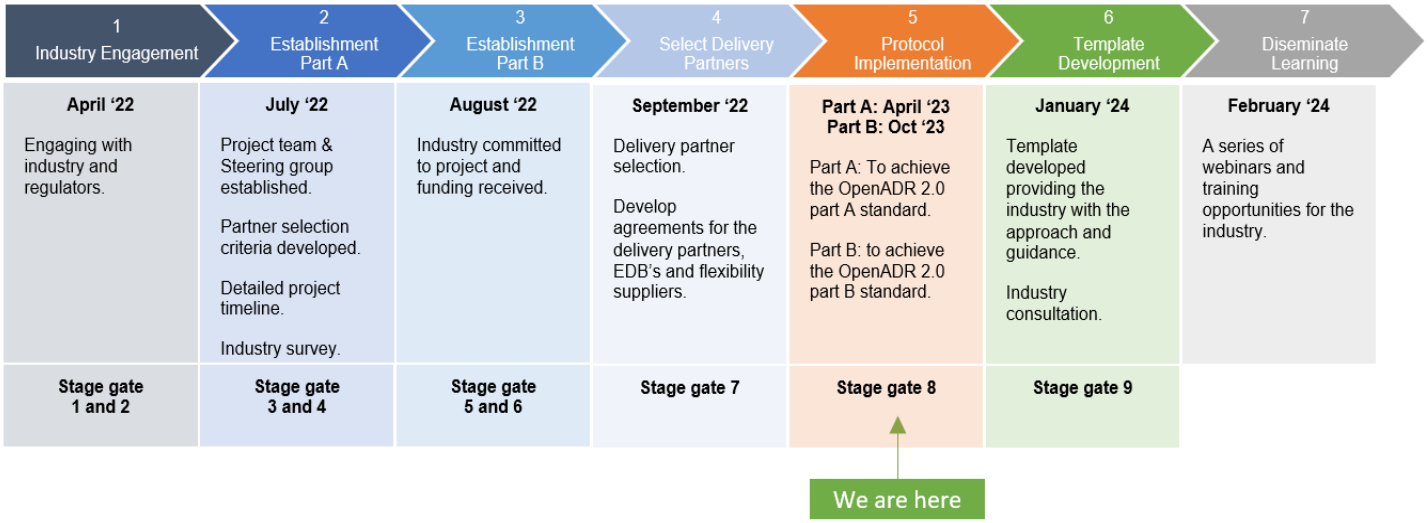

Figure 3: Project phases

Project team

The project team is comprised of industry specialists from across the sector. An Industry Steering Group is governing the project and all technical and trial design decisions are being undertaken by a project Design Team.

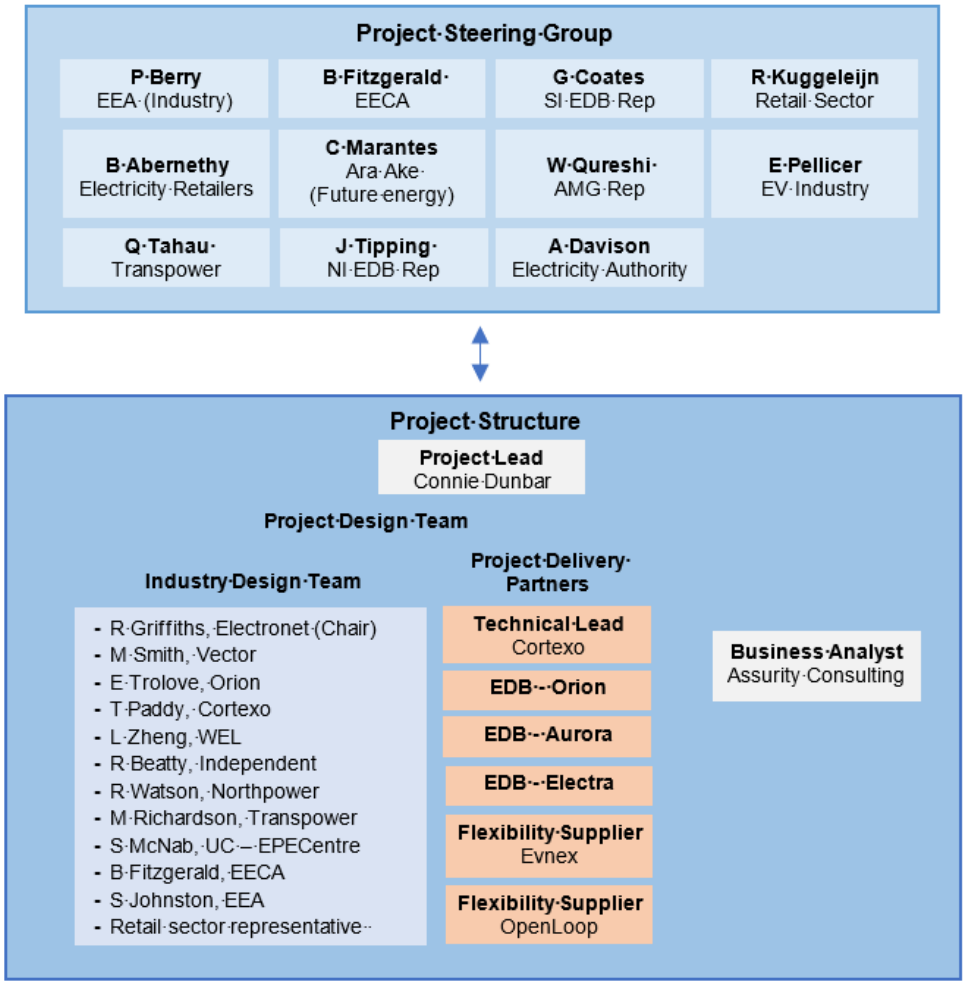

Figure 4: The project team

The trial – implementing OpenADR

Trial overview

The trial delivery process is shown in Figure 5 below. It comprises project phases 4 and 5.

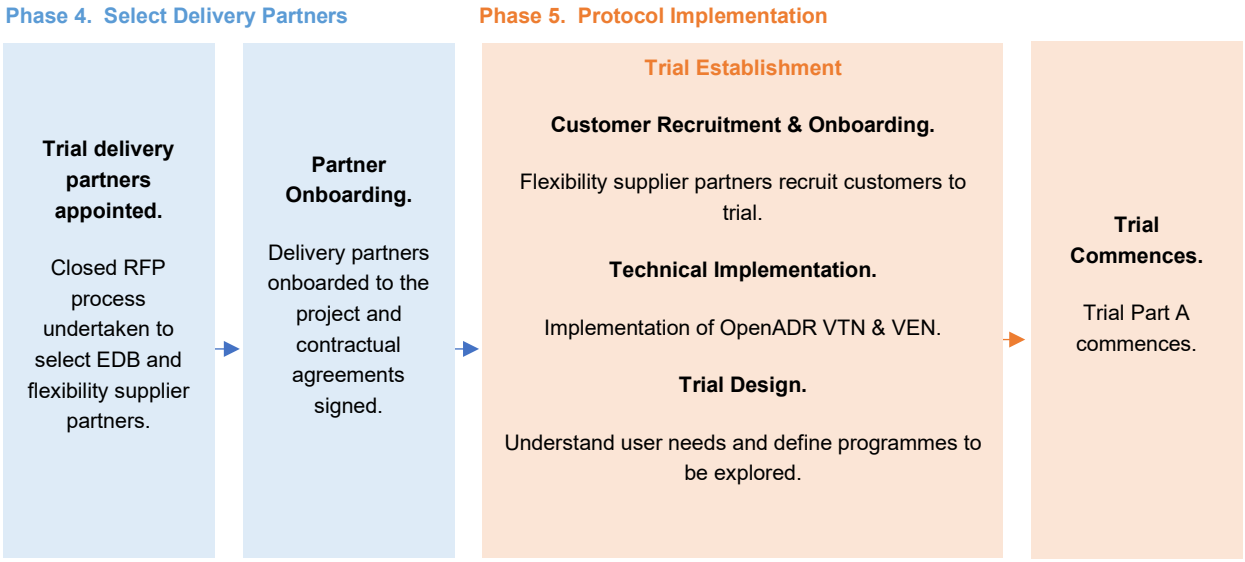

Figure 5: The trial delivery process

Phase 4: Select delivery partners

Phase 4 is complete, and we're pleased to have appointed three EDB's, two flexibility supplier partners, a technical lead and business analyst to lead the trial.

The trial delivery partners were selected through a closed request for proposal (RFP) process with organisations that had expressed an interest in being involved.

Our EDB partners are Aurora Energy, Electra, and Orion. They are responsible for co-ordinating the integration of OpenADR 2.0 with their systems , utilising an OpenADR VTN, network management in support of the project, and the dispatching of distributed energy resources.

Our flexibility supplier partners are Evnex and OpenLoop. They are responsible for establishing the OpenADR VEN connection, establishing relationships with trial customers, and providing insights into their customers experience (residential and workplace charging customers), and controlling the distributed energy resource (DER) assets.

Cortexo has been appointed in the role of Technical Lead, and Assurity Consulting are providing Business Analysis services, completing the appointment of the trial delivery partners.

Our trial delivery partners bring a range of expertise and practical experience in demand flexibility to the team. This group has a central role in the trial process and are responsible for applying OpenADR to achieve active managed charging of EV's.

Phase 5: Protocol implementation

The Protocol Implementation phase (phase 5) consists of a two-part trial (Trial Part A and Trial Part B). The trial is aiming to assess the suitability of OpenADR in New Zealand and evaluate the processes that need to be in place to apply OpenADR to achieve active managed charging of EV's.

During the trial we will be deploying a market model to enable value stacking, ultimately creating a better outcome for the end consumer with a flexibility supplier aggregating services between the EDB's and end consumers.

Trial Part A is underway. It began with an establishment period involving:

- Recruiting and onboarding customers to the trial;
- Identifying the demand flexibility programmes we are seeking to test;
- Undertaking the technical implementation required to implement the OpenADR VTN and VEN, enabling messages to be sent and received from an EDB to a flexibility supplier; and,
- Beginning to assess the associated business logic/processes.

Trial Part A is focused on applying the OpenADR 2.0a communication protocol to achieve one-way communication from the EDB to the flexibility supplier. The outcomes from Part A of the trial are expected to be released to the industry in May 2023.

Figures 6 and 7 below illustrate the OpenADR 2.0a and 2.0b communication flow for the trial (Part A and B), summarised as follows:

- An 'Event Signal' refers to the signals that are communicated via OpenADR from the EDB to the flexibility supplier. A SIMPLE messaging structure with signal levels 0 to 3 mapped, will be used for Part A. Each identified demand flexibility programme will have a defined messaging structure.
- The 'Event Response Signal' refers to the signals communicated from the flexibility supplier to the EDB. OpenADR 2.0a allows an acknowledgement to go back to the VTN, however any additional information sent from the flexibility supplier to the EDB will sit outside of OpenADR e.g. email or text message communication. For Part B of the trial the Event Response signal will occur via OpenADR.
- Post event reporting will provide details of what was achieved during an event. For Part A of the trial this will be provided outside of OpenADR.

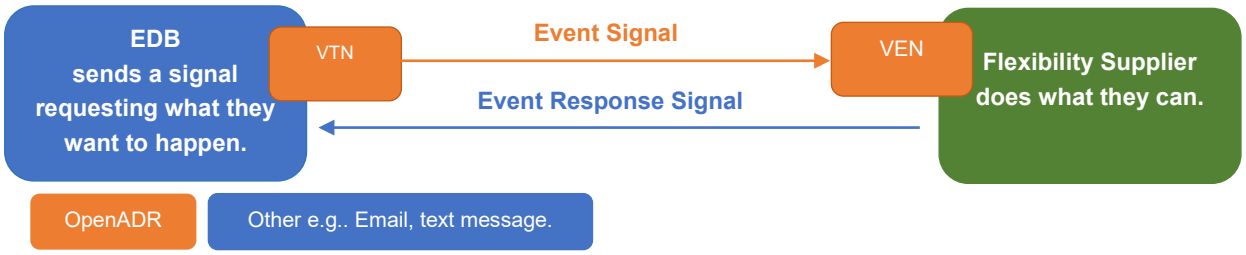

Figure 6: Trial Part A - OpenADR 2.0a communication flow

Figure 7: Trial Part B - OpenADR 2.0b communication flow

Technical implementation

Figure 8 below illustrates the trial configuration our delivery partners will be using to implement the OpenADR VTN and VEN for Part A of the trial.

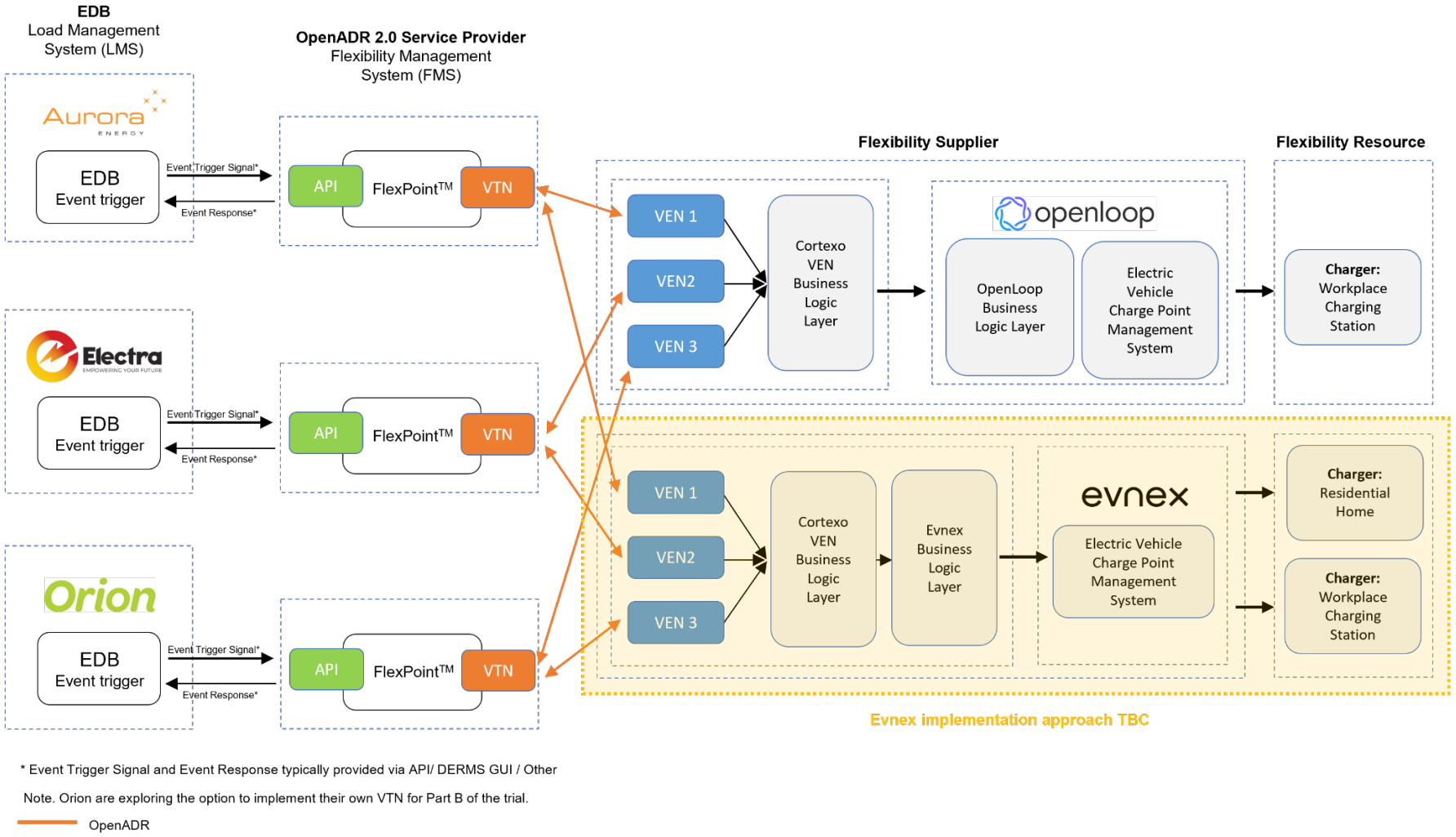

Figure 8: Trial configuration Part A

To assist with the implementation process, Transpower have provided access to their Flexibility Management System (FMS) FlexPoint™, which is certified for the OpenADR 2.0 standard (2.0a and or 2.0b).

Our EDB trial partners have the opportunity to integrate with the FlexPoint™ system to establish the OpenADR VTN connection. This will enable a simpler implementation process to getting started and beginning to build the capability, and a shared language needed to develop and deploy demand flexibility programmes utilising OpenADR.

All three EDB partners have opted to integrate with FlexPoint™ for Part A of the trial.

Orion and Aurora are also exploring the option to implement other OpenADR VTN's for Part B of the trial, providing the opportunity to broaden the trial learnings as EDB's navigate the OpenADR VTN implementation process.

The trial configuration diagram (refer Figure 8 above) depicts how a VTN talks to many VEN's, but a VEN can talk to only one VTN. The VEN then connects to a business logic layer which receives the message, decodes it, and stores it in a database for reference and action. That database has a GUI that enables someone to look at the events, edit, delete, or manually accept or reject. There is a second business logic layer that takes those events in the database and creates the signals to send commands to the EV chargers.

For the purpose of the trial both flexibility supplier partners are integrating with a third party VEN. OpenLoop have confirmed they will work with Cortexo to implement the VEN and Evnex are due to confirm their implementation approach in April 2023.

The communication flow from the flexibility supplier to the EV chargers sits outside the scope of the trial. The flexibility suppliers will be using their existing communication protocol to achieve this. We are however assessing the flexibility supplier's ability to receive a message and correctly action with the EV charger. We are also working with the flexibility supplier partners to gather feedback on the impact to the customer.

In addition to the above, OpenLoop and Evnex intend to explore the feasibility of communicating with customers via their mobile Application through Part B of the trial.

Flexibility suppliers will be:

- Exploring how they respond to the needs of the customer.
- Considering factors such as:
  - How customers might be notified of demand flexibility events.
  - How they can choose to participate (and change their minds).
  - What incentives might exist for participation.
  - Their overall customer experience.

Customer recruitment

In April 2023 we will be commencing live trials with customers and finalising the recruitment of 50 customers to participate in the trial.

Customers are being recruited across two target customer sets – residential and workplace charging stations, with the factors outlined in Table 1 below being considered throughout the recruitment process.

CRITERIA	DETAIL
Customer Types	Residential Workplace – chargers provided at employee's home Workplace – overnight charging fleet Workplace – daytime charging available
Location	Customers need to be part of the EDB Trial Delivery Partners network.
Battery Size	Small vs. large
Charging Behaviour	Time-of-day of charging: Day vs. night Frequency of charge: Every day vs. once a week
Driving Behaviour	Weekday vs. weekend car user
Additional Considerations	Retail tariff customers Customers with Solar & an EV Smart Home customers
Fleet Size (Commercial customers)	Small vs. large
Charging Duration	Charge time vs. plug in time
Already Controlling Charging	Yes vs No

Table: 1 Customer recruitment criteria

Trial design

The output of the project is the development of a New Zealand technical guide which will include examples of typical demand flexibility programmes for EDB's and EV flexibility suppliers so that they can be used as models for their own flexibility programme implementation. This will include defining a set of standard flexibility programme templates modelled after the common characteristics of the most popular flexibility programmes trialled to date, with actors and roles clearly identified.

The Project Design Team have undertaken a trial design process to understand what is needed to apply OpenADR in New Zealand and to inform the demand flexibility programmes in the trial.

Figure 10 below shows the trial methodology used to inform the trial design inputs. It focuses on gathering insights from user groups (EDB's and flexibility suppliers) and uses a 'learning by doing' approach that is followed throughout the trial.

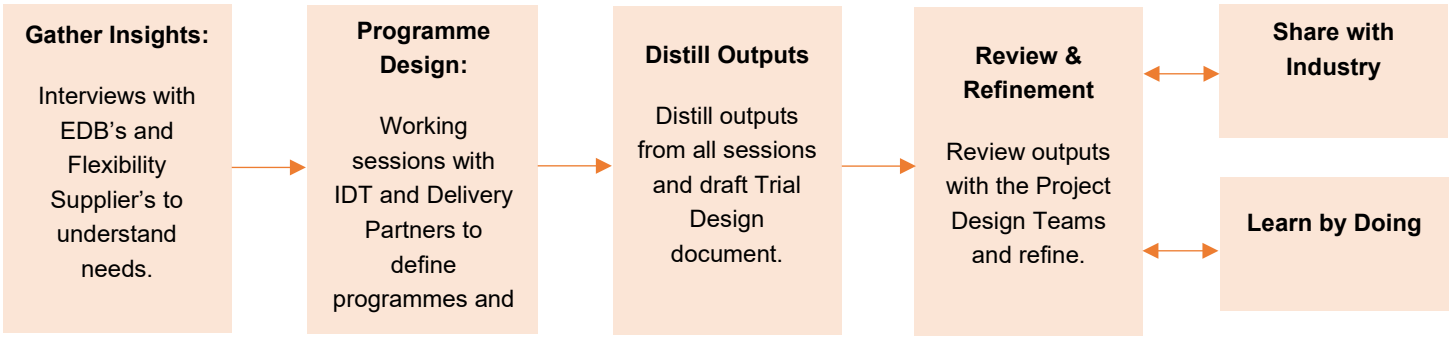

Figure 9: Trial methodology

When reviewing the trial design progress it's important to keep in mind:

- This forms the foundation for what we believe we need to achieve through OpenADR in New Zealand. It is a starting point and will continue to evolve throughout the trial.
- We are learning by doing.
- The trial will be used to assess the advantages and limitations of OpenADR in the New Zealand context.
- The detailed user requirements will form part of the final deliverable and will emerge as we trial different events and assess outputs.
- The overall design aims to minimise disruption to the customer and the use of their EV vehicle.

Table 2 below summarises the seven event triggers identified as examples of the types of network scenarios that are likely to trigger the need for flexibility services. These triggers have been used to inform the inputs of the demand flexibility programmes. However this does not limit the scope of what might trigger an event.

TRIGGER	DEFINITION
01. Temporary Distribution Network Constraint	Physical network constraints forecast ahead of time to enable more renewable distributed generation to be connected. This could include management of thermal limits on the MV\HV network or on LV network.
02. Power Quality Issues	Power quality issues caused by: – Low voltage on the LV network due to high demand. – High voltage on the LV network due to solar PV or low demand.
03. Unplanned Outage Management	A short notice network event requiring reconfiguration. This could be caused by a severe weather event.
04. Planned Outage Event	A pre-scheduled, planned maintenance event.
05. Network Investment/Deferral Replacement	Controlling peak demand on networks facing capacity constraints due to an increase in demand caused by electrification to defer the need for large capital investment in network infrastructure.
06. Grid Emergency	Grid emergency notice received from the System Operator requiring an immediate response to reduce demand or increase generation.
07. System Operator/Market Support	The System Operator calls for offers to reduce demand, particularly during times of constraints such as extremely dry years. This may include market mechanisms to fund participation. This could also occur through a reserves market with, money offered to customers to have fast response shed-able load available.

Table: 2 Event triggers

Figure 12 below provides an overview of the programme characteristics used to inform the design of the six demand flexibility programmes. The two defining characteristics include:

- Price: Is the price for services agreed between the EDB and flexibility supplier at the time of the event or in-advance through a contractual agreement?
- Notification period: Is the event occurring in near real-time or is the EDB able to forecast the event and provide advance notice?

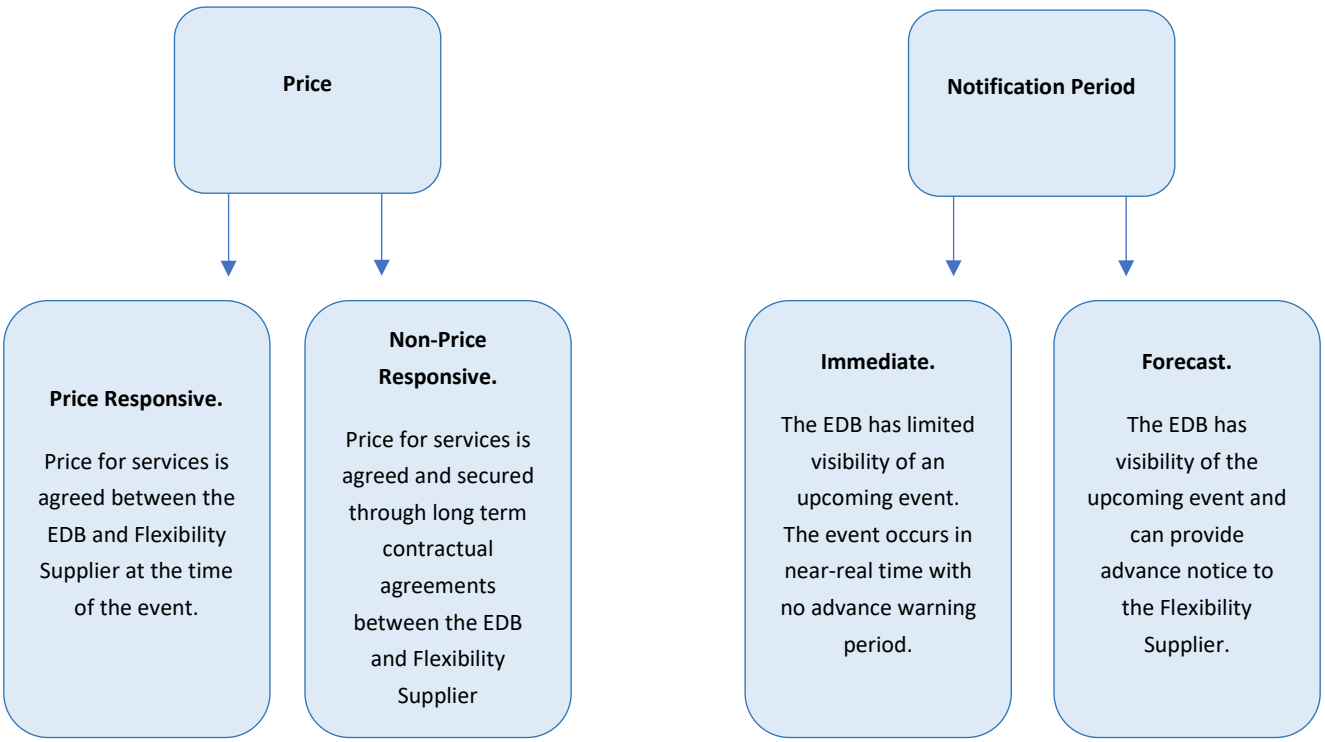

Figure 12: Programme Characteristics

Table 3 below summarises the six demand flexibility programmes defined for testing during the trial. These programmes will continue to evolve throughout the trial.

PROGRAMME NAME	DEFINITION	DETAIL
01. In Advance Non-Price Responsive	The EDB procures, ahead of time, a pre-agreed change in capacity over a defined time. - This programme is used for managing lingering constraints on the network (e.g. constraints at a GXP level). - Requires long-term contracts to be procured in advance, including detail such as availability, utilisation, penalty fees.	- The EDB notifies the Flexibility Supplier of the event at least 7 days in advance. - The flexibility supplier can opt in or out of an event at this point. - Dispatch instructions confirming details of the event are provided 24 hours in advance and confirmation of participation is required from the flexibility supplier up to 12 hours in advance. *Note: Timeframes are general and may be agreed between both parties as part of their contractual agreement.
02. Dynamic (short-term) Non-Price Responsive	The EDB procures, in near real-time the ability to secure a pre-agreed change in capacity to reduce the impact of an unplanned event. - Based on long-term contracts which include detail such as availability, utilisation, penalty fees. The EDB acts without being influenced by price. - Typically used for an unplanned event. - May be deployed last minute if in advance price responsive programme" is not actioned or doesn't provide to need.	- No pre-event notification will occur. - The dispatch instruction will occur in near real time.

PROGRAMME NAME	DEFINITION	DETAIL
03. Immediate Emergency Response (Non-Price Responsive)	The EDB procures, in near real-time the ability to secure a pre-agreed change in capacity to reduce the impact of a grid emergency. - Based on long-term contracts which include detail such as availability, utilisation, penalty fees. The EDB acts without being influenced by price. - In this scenario the Flexibility Supplier must action the response.	- No pre-event notification will occur. - The dispatch instruction will occur in near real-time. - For the purpose of the trial, this scenario will not be actioned with the end customer.
04. Price Responsive Bid	The EDB provides offers to flexibility suppliers specifying the amount they will pay for different levels of capacity. This programme is procured at short notice to provide market and system support. - Procured at short notice i.e. day ahead.	- A 'price bid' message is provided at least 12 hours in advance and may expire within an hour of receiving. - The flexibility supplier can opt in or out of the event at this point. - The dispatch instruction confirming details of an event is provided at least 30 minutes in advance. - The flexibility supplier does not have the option to opt out once the dispatch instruction has been issued. - Post event settlement occurs outside of OpenADR. *Note: Timeframes are general and need to be explored through the trial, particularly time required for the procurement process with flexibility suppliers.

PROGRAMME NAME	DEFINITION	DETAIL
05. Price Responsive Discovery	The EDB requests, ahead of time, bids to be put forward by the flexibility supplier detailing the load reduction they can offer at a specified price. - The EDB procures while arranging an in advance service request.	- The price discovery message will be provided at least 48 hours in advance. - The dispatch instruction confirming details of an event is provided 24 hours in advance. - Confirmation is required by the Flexibility Supplier 12 hours in advance. - The price discovery message will include a maximum price. - The flexibility supplier and EDB can enter a negotiation on price and capacity. - The EDB can send an offer to a price discovery message to an unlimited number of flexibility suppliers and accept as many offers as required. - Post event settlement occurs outside of OpenADR.
06. Dynamic Operating Envelopes*	A signal is sent to the flexibility supplier to maintain the load in a geographical area, or an overall load on the local distribution substation, to below a specified limit. The load control system of the flexibility supplier is then responsible for managing the individual loads (such as EVs) within each installation so that the aggregate load at the distribution substation (or geographical area) is maintained within a certain limit. - This may be static if the load setpoint is constant or, - Dynamic, varying during the day because of other external conditions.	- The setpoint is controlled by the EDB, but the management of the loads is up to the DERMS of the flexibility supplier. - We are exploring if DOE's will be a programme or could become a feature of all programmes. *Note. The detail of programme 06 has not been developed as we need to refine what EDB's are seeking to achieve with Dynamic Operating Envelopes. We will revisit this programme during Part B.

Table: 3 Demand flexibility programmes

Table 4 below provides an overview of the Event Message Types identified that we foresee being sent between the EDB and flexibility supplier requesting flexibility services utilising OpenADR.

We anticipate this will evolve throughout the trial as more programmes are identified.

MESSAGE TYPE	CATEGORY
01. In Advance Non-Price Responsive	**1a. Price Discovery Message** A Price Discovery Message is issued by an EDB, requesting offers to be put forward for how much capacity a Flexibility Supplier can provide at a specific price.
	1b. Price Bid Message A Price Bid message is issued by an EDB: - Specifying a set amount an EDB will pay a Flexibility Supplier for capacity or, - Providing a 'price-volume' curve with what the EDB can pay for different levels of capacity. The Flexibility Supplier responds with an opt In message specifying what 'price-volume' option they can supply or opting out.
02. Notification	**2a. Event Notification** An Event Notification is issued in advance of an event by an EDB, notifying the Flexibility Supplier of a pending event.
	2b. Event Withdrawn An Event Withdrawn notification is sent from the EDB to a Flexibility Supplier recalling an event if it is no longer required following an Event Notification being released.
03. Instruction Message	**3a. Dispatch Instruction Message** A Dispatch Instruction is a message issued from an EDB to Flexibility Supplier instructing a Flexibility Supplier to respond with a defined amount of capacity. This typically occurs following a previously issued Event Notification. The Dispatch Instruction details may differ to an issued Event Notification, however an EDB can't request more capacity than what was previously agreed.

MESSAGE TYPE	CATEGORY
04. Response Message	**4a. Offer Response Message** An Offer message is issued by a Flexibility Supplier to an EDB in response to a Price Discovery message. The Offer message details how much load reduction a Flexibility Supplier can provide at a specific price.
	4b. Negotiation Message Negotiation messages are issued between a Flexibility Supplier and EDB to negotiate the capacity a Flexibility Supplier can provide or the price the EDB will pay. A capacity negotiation may occur in the In Advance Non-Price Responsive programme, and a price and capacity negotiation may occur in the Price Responsive Discovery programme.
	4c. Confirmation Message A Confirmation message is issued by a Flexibility Supplier in response to a Procurement Message, Event Notification, Dispatch Instruction or opting in or out of an event.

Table: 4 Event message types

The OpenADR 2.0b communication protocol enables:

- Two-way communication flow between the EDB and flexibility suppliers; and,
- Reports to be sent from the flexibility supplier to the EDB.

The report types described in Table 5 below have been identified for testing during Part B of the trial. These reports are designed to provide EDB's with additional insight to enable more informed decisions to be made about the demand flexibility options that are available.

REPORT TYPE	OVERVIEW
01. Post Event Report	- Service provided in mW from the flexibility supplier. - Provides assurance that load control has been received, exercised and effective.
02. Location Data	- Providing visibility of where flexibility is located. - Used to determine which Flexibility Suppliers to dispatch to and gain insight into the LV network.
03. Utilisation Data	- Understanding the status and availability of flexibility resources at any given time. What is active and online? What is available at any time? - Could this be set up to be sent every 30 minutes? - Providing access to HHR, PQ an ICP metering data.
04. Device Data	- Insight into type of device, size, and location (not necessarily a flexibility service).
05. Service Availability (Live)	- To be confirmed.
06. Forecasting	- Forecast of flexibility capacity available. - Provided in actual half hour demand and/or forecast. - Used to assess operational risk and get insight into the LV network.
07. Power Quality Data	- Power quality data such as frequency and voltage excursions. - Providing visibility of local network constraints to support with uncovering network issues.

Table: 5 Reporting requirements

**Please note, the desired reports were identified during the trial design workshops and will be further explored in Part B of the trial. They are subject to technical development including further exploration of potential data and privacy implications.*

Next steps

Trial Part A is on track and an Outcomes Report sharing the latest learnings and outputs of the trial is scheduled to be released at the end of May 2023.

Trial Part B is also expected to commence in May 2023 with implementation of the OpenADR **2.0b** communication protocol. Part B seeks to achieve **two-way** communication between an EDB and a flexibility supplier, and enabling more complex communication flows such as reporting.

Part B of the trial will run through to October 2023 with the reports due to be released for industry consultation in late November 2023. The final technical guide and supporting report will be released in February 2024. These key next steps are summarised in Figure 15 below.

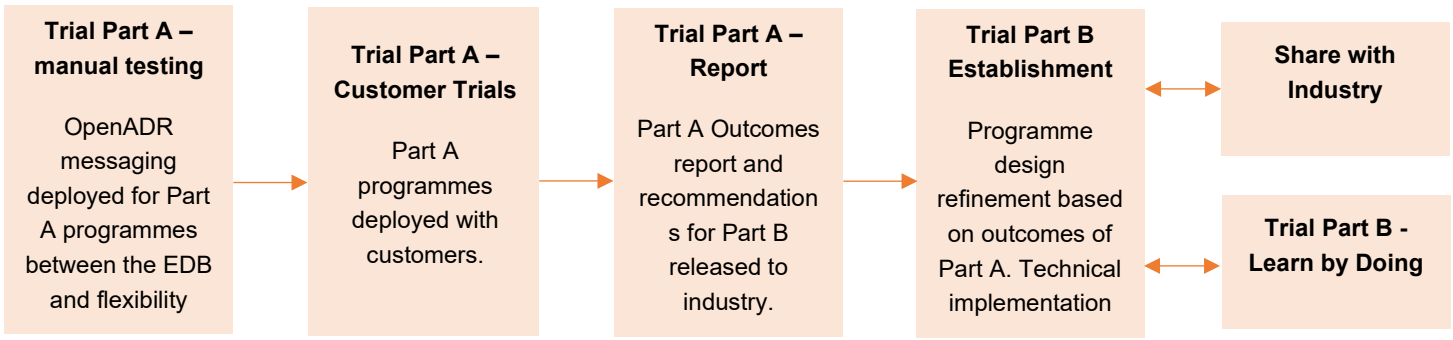

Figure 16: Trial Next Steps

Our partners

Thank you to our partners for making the FlexTalk project possible. Your representation on the Project Steering Group, Industry Design Team, as a trial delivery partner, or as a funding partner is invaluable. The enthusiasm to collaborate and share the learnings will transform how we operate the grid and support customer engagement in demand flexibility moving forward.

For more information or to provide feedback on the project's progress, please contact Connie Dunbar, Project Lead: connie@eea.co.nz.