REPORT 02 - PART A
LEARNINGS

FlexTalk

THE DEMAND FLEXIBILITY COMMON COMMUNICATION PROTOCOLS PROJECT

ELECTRICITY ENGINEERS' ASSOCIATION

October 2023

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This report is intended to provide a general update on Part A of the project trial and experiences in implementing the OpenADR® 2.0a standard. It is not a substitute for specialist engineering advice

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Status of Examples and Case Studies

Examples and case studies in this report are included to assist understanding of Open ADR and demand flexibility common communication protocols. The examples or case studies are not a comprehensive statement of matters to be considered, nor steps to be taken, to comply with any statutory obligations pertaining to the subject matter of this report but they do illustrate how the electricity distribution sector has applied in practice Open ADR and the issues for consideration.

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Message from the FlexTalk Governance Group

Aotearoa NZ's transition to 100 percent renewable electricity generation including increasing penetration of variable renewable energy (VRE), in combination with increasing energy demand as the country moves towards electrification will fundamentally change how our electricity system and markets operate. To ensure that this change is well managed and does not affect the reliability of the power system nor significantly impact the cost of electricity for consumers, developing demand flexibility will be crucial to mitigate potential mismatches in supply and demand induced by these changes. Significantly, flexibility will need to be developed not only on the supply side of the system, but also on the demand side, an approach that is referred to as demand-side response or demand flexibility.

Demand flexibility is the capability to vary customer demand in response to generation, network, or market signals. Demand flexibility can operate in real time and can be incorporated into long-term investment decisions. The enablement of demand flexibility will allow New Zealand households and businesses to help balance the electricity grid by reducing or increasing their energy use dependant on renewable energy availability and demand in the system. This will ultimately lead to a more sustainable and reliable electricity system.

A key enabler that will unlock the true value of this flexibility is access to standard industry communication protocols and information interchange tools. Communication protocols provide a set of rules and guidelines to facilitate the communication and data exchange between two or more entities to ensure successful charging demand management and electricity grid integration of VRE such as solar, wind and EVs, as illustrated in Figure 1. Information interchange tools are the set of agreed cooperating software applications that enable the submission, processing, and storage of subscribed reports in an automated, electronic exchange that replicate data between market systems and registered participants.

A key challenge is that if left to their own devices, companies and technology providers could develop and implement several different proprietary protocols to manage VREs which are unable to communicate together, which could risk losing or vastly under-utilising demand flexibility, and consequently hinder proper grid integration.

Adoption of new open communication and data protocols for New Zealand will be crucial to ensuring tomorrow's grid is not only a platform – but an open platform. Open communication protocols are protocols that provides a non-proprietary, open, standardised and secure demand response (DR) interface that allows electricity providers to communicate DR signals directly to Flexibility suppliers using a common language. They also aim to create interoperability to allow diverse devices to work together. Interoperability is the ability of different information technology systems and software applications to communicate, use, and exchange data accurately, effectively, and consistently.

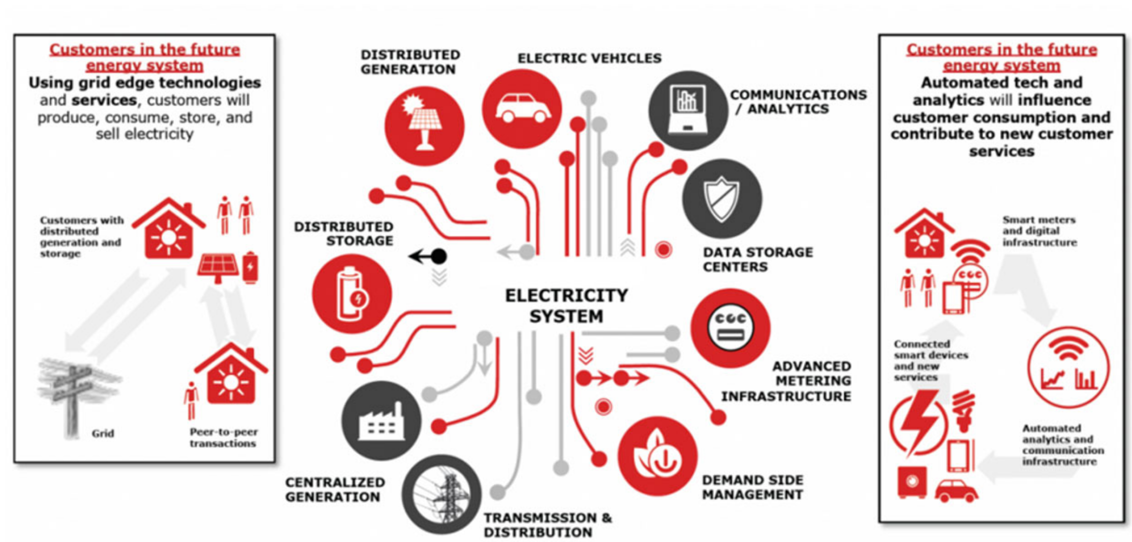


Figure: 1 The energy system will require open standards and communication protocols to provide for the additional technologies, roles and services needed for full electrification [1]

The Government and industry are working collaboratively to jointly fund the FlexTalk project which is testing the OpenADR® 2.0 communication protocol to achieve active managed charging of EVs by ensuring that it is synergistic with the operation of the electricity system, and therefore enabling flexibility services to be utilised in the New Zealand electricity sector.

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 an update on progress made to date with Part A of the trial and experience implementing OpenADR 2.0a standard. The document also provides key learnings emerging from a wider technical, commercial (business), market and consumer lens.

In brief, the following key milestones have been achieved within the FlexTalk project 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 for Trial Part A
- Completion of trial design for Trial Part A
- Completion of Part A VEN integration with Charge Point Management System for Part A
- Completion of VTN integration with EDB's internal systems for Part A

[1] Standards and Interoperability in the Electric Distribution System, ICF October 2016.

- Completion of Trial Part A with events being deployed and messages communicated between the electricity distribution business (EDB) and flexibility supplier (aggregator)[2]
- Commencement of VEN integration with Charge Point Management System Part B
- Commencement of VTN integration with EDB's internal systems Part B
- Technical implementation of OpenADR virtual top node (VTN) and virtual end node (VEN) by the delivery partners in preparation for Trial Part B
- Reporting design and refinements to programme design in preparation for Trial Part B.

The next steps involve trialling Part B programmes which involve more complex messaging and 2-way communication between EDB's and Flexibility Suppliers using the OpenADR 2.0B standard.

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.

Stuart Johnston	**Rodger Griffiths**	**Peter Berry**	**Brian Fitzgerald**
EEA Lead Advisor, Engineering & Technical	Industry Design Team Chair	EEA CEO	Technical Lead EECA

2 OpenADR and the OpenADR Logo are trademarks owned by OpenADR Alliance

Executive Summary

FlexTalk's purpose is to define and 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 achieve active managed charging of EVs, enabling flexibility services to be utilised in the electricity sector in Aotearoa NZ.

Part A of the OpenADR trial has been an enabler for getting the delivery partners started with the OpenADR trial and participating in simple signal demand flexibility events. Results for Part A have been manually captured, with each trial participant recording the event outcomes and learnings. Thirty-nine events were triggered through Part A, a summary of the event outcomes is presented in figure 2 below.

Part A has demonstrated interoperability with EDBs and Flexibility suppliers' ability to send, receive and act on requests for demand flexibility using OpenADR 2.0a communications protocol and their internal systems. Two of the six industry designed flexibility services (programmes) within FlexTalk project have been tested through Part A, allowing EDBs and Flexibility suppliers to participate in dynamic (non-price) and immediate emergency requests for demand flexibility.

The trial has a sample size of 49 customer EV chargers, however the OpenADR solution has ability to scale.

Further to the OpenADR learnings to date, the FlexTalk trial (Part A) is providing insights into the wider implications that need to be considered to engage operationally (outside of trial settings) in demand flexibility. For example, it has been identified that further work is required to define the roles, responsibilities, and potential regulatory settings as this will help industry navigate the transition to greater electrification.

Through Part B, which involves 2-way communication and the ability to send more complex requests for flexibility (actual load reductions in kW's and pricing signals) FlexTalk will continue to assess OpenADR's advantages and limitations in the NZ context, revise flexibility programmes based on learnings and assist industry participants to understand the systems investment involved when implementing the technology and processes to utilise flexibility services.

The output report at the end of the project will provide a detailed assessment of OpenADR (2.aA and 2.0B) as a communications protocol in the NZ context. The report will share insights and learnings identified through EDB and Flexibility Supplier's participation in demand flexibility events. Ultimately moving industry forward on how we might enable demand flexibility as a mechanism to support the wider energy transition.

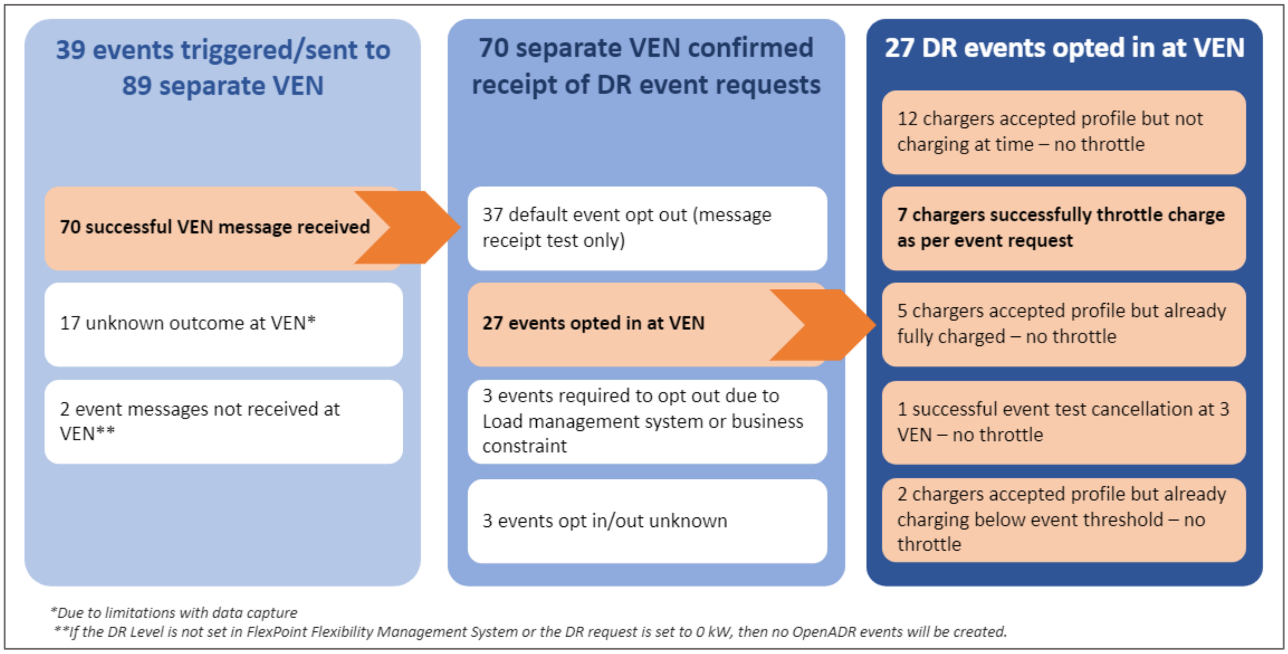


Figure: 2 Overview, event outcomes Part A

Acknowledgements

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).

EEA and EECA would like to thank 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 projects Steering Committee, Industry Design team and Delivery Partners have provided their knowledge and expertise in-kind. The enthusiasm to collaborate and share the learnings will transform how we operate the grid and support customer engagement in demand flexibility moving forward.

Project Overview

Background

In accordance with the Paris Agreement (2015), Aotearoa NZ 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.

To meet the Governments decarbonisation goals, there will be fundamental changes to Aotearoa NZ's energy system and its operation. A recent report by BCG identified four key trends that will take place as NZ moves to decarbonise - , 1) Higher rates of electrification, 2) More intermittent renewable generation, 3) Less thermal generation and 4) A more distributed electricity system.

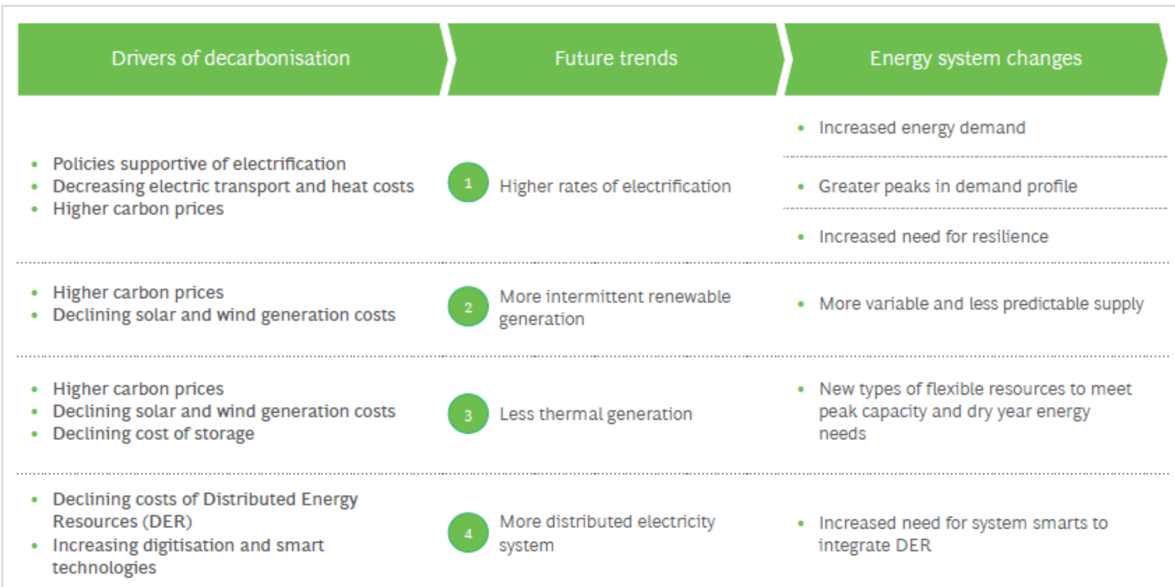


Figure: 3 The four key trends changing New Zealand's future energy system. [3]

These trends leave the electricity sector facing some key challenges that will need to be addressed to ensure that energy security, reliability and power quality are maintained whilst also ensuring energy equity and sustainability for all consumers. One solution that will assist in mitigating some of these challenges will be the development of smart, flexible demand-side and network solutions.

The development of flexible demand-side solutions will provide another way for the network operator to manage peak demand as it allows electricity consumption to be flexed in-line with supply. Some of the technology types that can be used to flex household and small business demand include PV systems, batteries, EVs, hot water systems, heat pumps, smart appliances, and thermal/cold stores.

[3] The Future is Electric: A Decarbonisation Roadmap for New Zealand's Electricity Sector, BCG, October 2022.

By adjusting their demand as required, local 'flexibility services' unlock additional capacity and support the connection of more low-carbon technology like solar and wind power. This in turn will benefit the sustainability of the electricity sector by decreasing the generation required from traditional sources and will help facilitate greater amounts of intermittent renewable electricity generation at both grid and local scale entering the electricity market. It can also lower power prices by avoiding, or at least delaying, the cost of new generation and network expansion investment, whilst also providing consumers with the opportunity to play an increasing role in the operation of the electric grid.

An example of the benefits of flexibility is highlighted in Transpower's Whakamana i Te Mauri Hiko - Empowering our Energy Future 2020 report that estimated that by 2035, smart EV charging and 'Time-of -use' pricing could reduce peak demand from 10.8 GW down to 8.9 GW (Figure 4) and could save the New Zealand economy and estimated $3 billion in avoided costs.

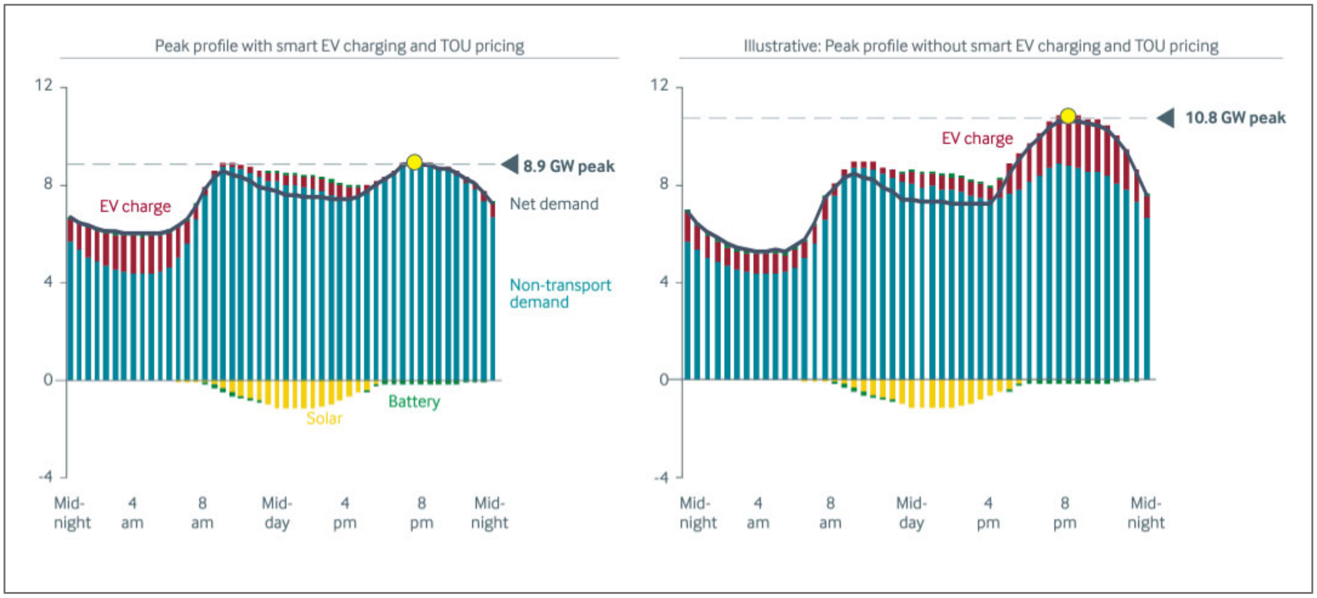


Figure: 4 Smart charging and Time of Use pricing can reduce peak demand by 1.9 GW[4]

The first step in delivering demand flexibility is the adoption of common communication protocols that deliver interoperability and openness. Interoperability and openness facilitate an integrated infrastructure of compatible entities; seamless data exchange; freedom of choice; cost savings; better services; competition; innovation; and scalability. These possible outcomes are intrinsic to properly defined and implemented open protocols and facilitate widespread DER/EV adoption and grid integration.

[4] Transpower, Distributed Energy Resources and Flexibility Services, 2020 https://static.transpower.co.nz/public/publications/resources/TP%20Whakamana%20i%20Te%20Mauri%20Hiko.pdf?VersionId=FljQmfxCk6MZ9mIvpNws63xFEBXwhX7f

Project Purpose

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 NZ.

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[5].

EV's as a starting point

FlexTalk will help transform how we operate the grid in the future and support customer engagement in demand flexibility. FlexTalk is developing 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.

[5] 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.

Strategic goals

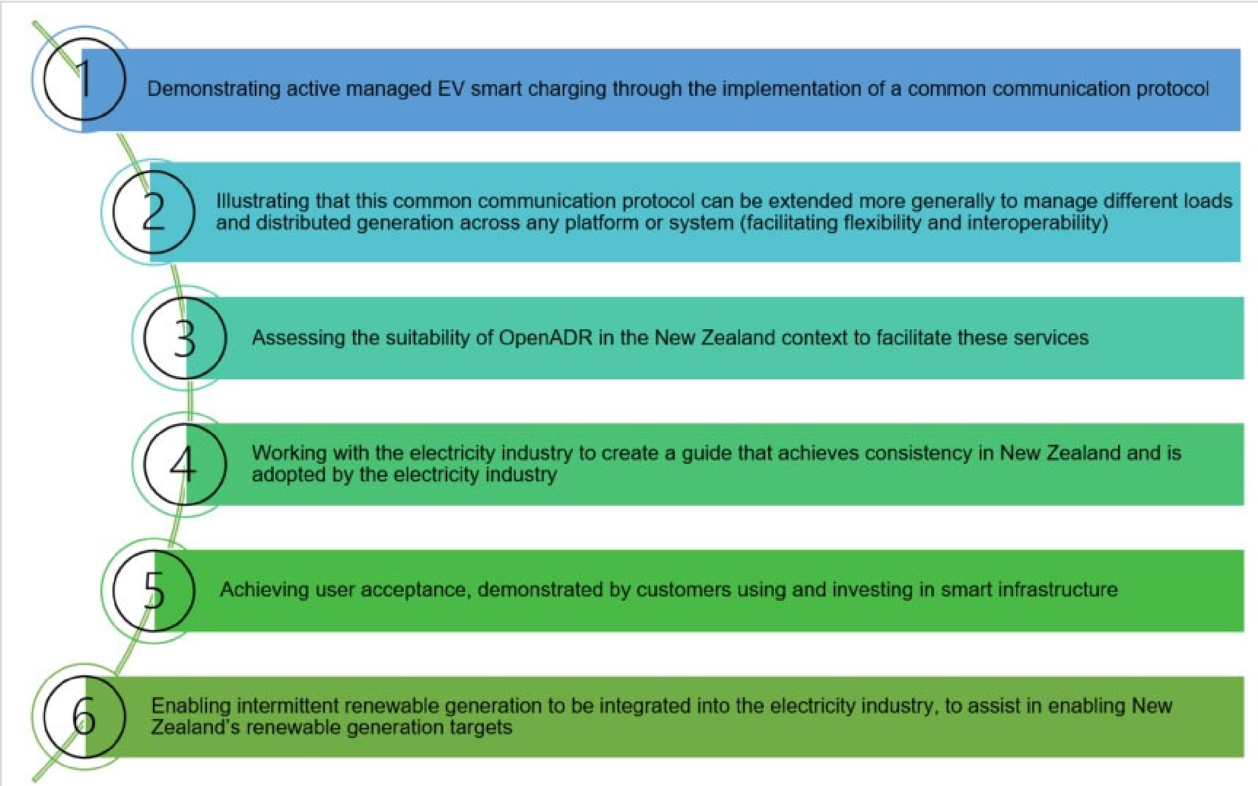


Figure: 5 Strategic goals

Project Objectives

1. Determine the use cases for flexibility services to be communicated and create process maps for these.
2. Assess the advantages and limitation of OpenADR within the New Zealand context, including a high-level comparison against other communication protocols.
3. Demonstrate interoperability of communication protocols between EDBs, flexibility providers and consumers.
4. Assist industry participants to understand the systems investment involved with utilising flexibility services.

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 NZ for actively managing EV charging.
2. A supporting guidance document that provides:

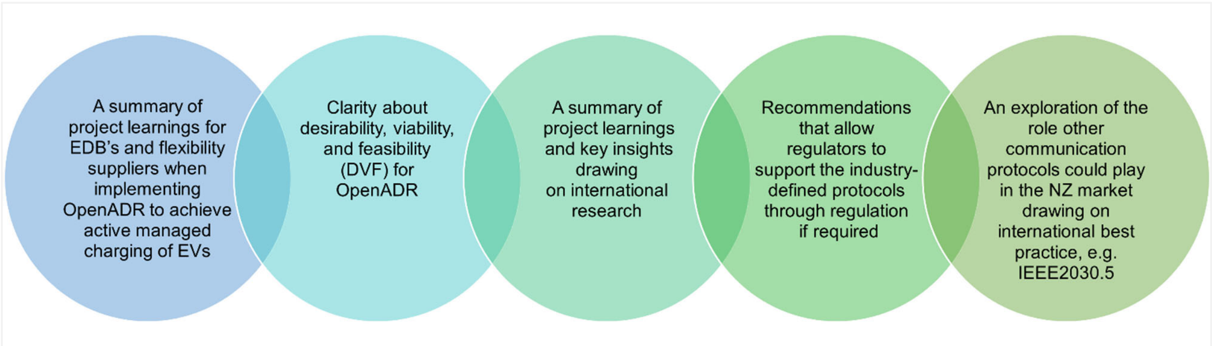


Figure: 6 Project report deliverables

Project Approach

FlexTalk consists of seven 'project phases' as shown in figure 7 below.

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.

At the time of publishing this report, the project has completed Part A of the OpenADR trial. Findings are documented in the report below.

The project team has commenced with Part B virtual top node (VTN) and virtual end node (VEN) technical implementation activities in readiness for live events with customers from 1st October 2023.

Engaging and involving all stakeholders throughout each project phase is critical to achieving the desired outcomes of the project. The goal is to identify any issues with interoperability and ultimately develop guidance that will apply to all parts of the industry to achieve active managed charging of EV's.

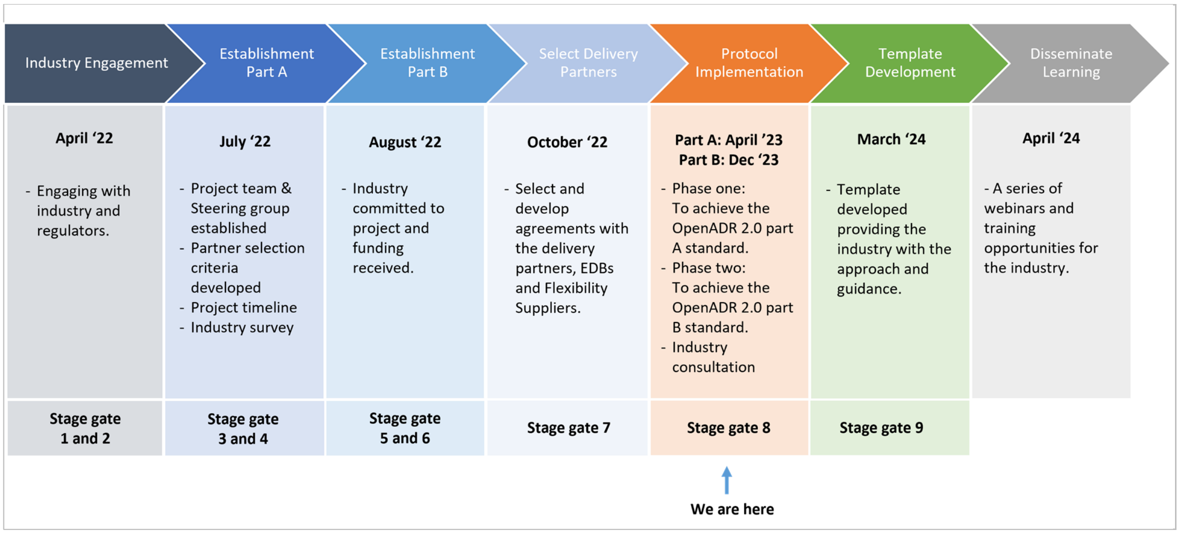


Figure: 7 Project phases

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.

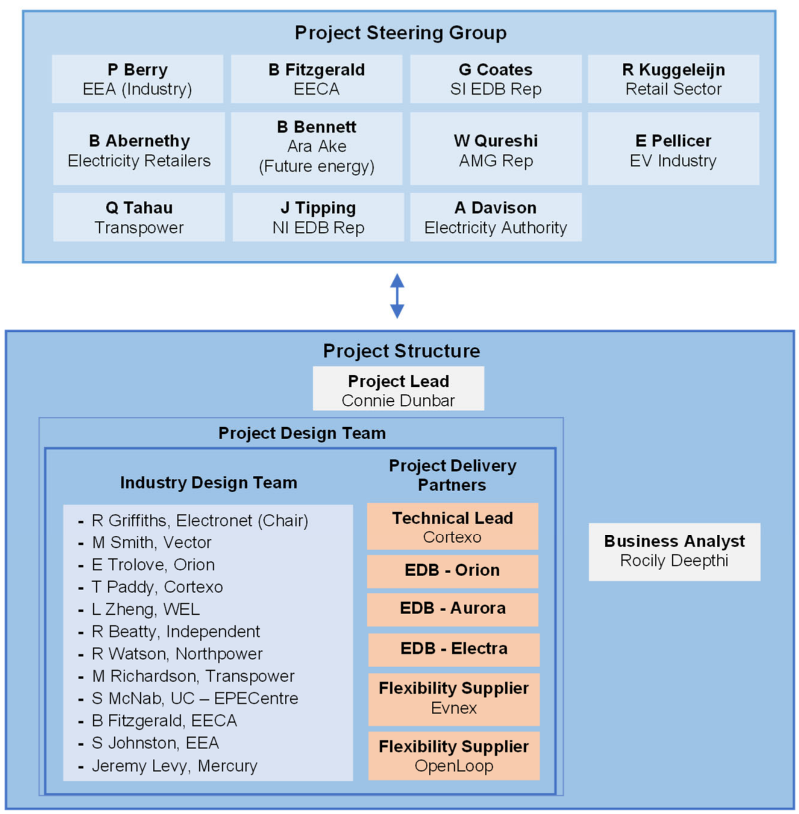


Figure: 8 The Project Team

OpenADR Trial Part A

Trial overview

The protocol implementation (phase 5) is expanded in Figure 9 below, Trial Part B manual testing is currently underway in preparation for live customer trials.

Trial Part A – Technical Implementation	**Trial Part A – manual testing**	**Trial Part A – Customer Trials**	**Trial Part A – Report**	**Trial Part B Establishment**	Trial Part B – manual testing	Trial Part B – Customer Trials	⇔	Share with Industry
ADMS / LMS, VTN, CPMS & VEN	OpenADR messaging deployed for Part A	Part A programmes deployed with customers.	Part A Outcomes report and recommendations	Programme design refinement. ADMS/LMS,	OpenADR messaging deployed for Part B	Part B programmes deployed with customers	⇔	Trial Part B - Learn by Doing
√ COMPLETED	√ COMPLETED	√ COMPLETED	√ COMPLETED	√ COMPLETED				

Figure: 9 Key activities, protocol Implementation (Phase 5)

Trial Part A focused on applying the OpenADR 2.0a communication protocol to achieve one-way communication from the EDB to the flexibility supplier. This phase of the project has allowed FlexTalk to get up and running, testing 2 of the 6 designed flexibility services (programmes). Part A has allowed for testing of "simple" signals as demonstrated below. Part B will test more complex interactions including the inclusion of pricing signals and demonstration of dynamic operating envelopes.

Figure 10 illustrates the OpenADR 2.0a communication flow for the trial Part A, 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, has been used for Part A. Each identified demand flexibility programme has a defined messaging structure *(see appendix table 4 – Simple 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 sits 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 has captured the details of what was achieved during an event.

Figure: 10 Trial Part A - OpenADR 2.0a communication flow

Figure: 11 Trial Part B - OpenADR 2.0b communication flow

In below sections we explore the core requirements of Part A, technical implementation, event outcomes and wider flexibility learnings in further detail.

Core Requirements and Gaps

The following Figure 12 shows the process when participating in demand flexibility between an EDB, events with the requirements for Part A assessed using a traffic lighting system. The output report at end of project will provide the full assessment on what has been achieved and the recommendations and next steps for out of scope activities (gaps).

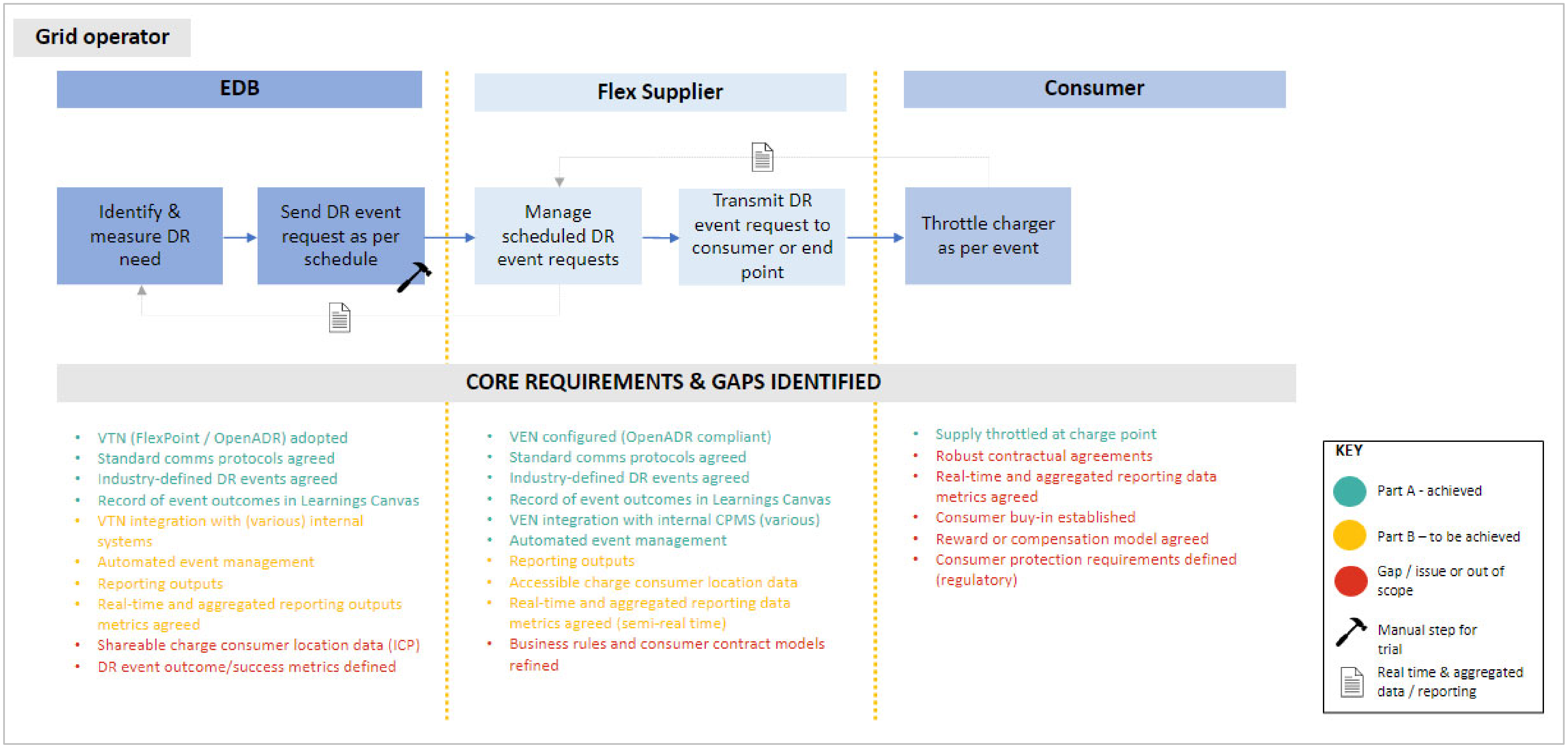


Figure: 12 FlexTalk Part A process map, with core requirements and gaps identified

Technical implementation

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

Our EDB trial partners had the opportunity to integrate with the FlexPoint system to establish the OpenADR VTN connection. Using FlexPoint in Part A simplified the implementation process allowing our pilot partners to accelerate the deployment of demand flexibility programmes utilising OpenADR.

The trial configuration diagram (refer Figure 13 below) 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 Graphical User Interface (GUI) that displays the events, which can be edited, or manually accepted or rejected. 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. Open Loop and Evnex worked with Cortexo to implement the VEN.

The communication flow from the flexibility supplier to the EV chargers sits outside the scope of the trial. The flexibility suppliers use existing communication protocols (OCPP) to achieve this. The FlexTalk project is assessing the flexibility supplier's ability to receive a message and correctly action with the EV charger and thus have supported the integration from the VEN to the Flexibility Suppliers Charge Point Management System (CPMS) to achieve this.

Following training and support from Transpower, Our EDB partners began the trial by using the FlexPoint GUI with each exploring the API to automate triggering events via their internal systems through Part A.

The EDBs' API sent DR requests from their internal systems to the FlexPoint VTN when substation load limits were reached.

Figure 13 below illustrates the trial configuration our delivery partners used to implement the OpenADR VTN and VEN for Part A of the trial.

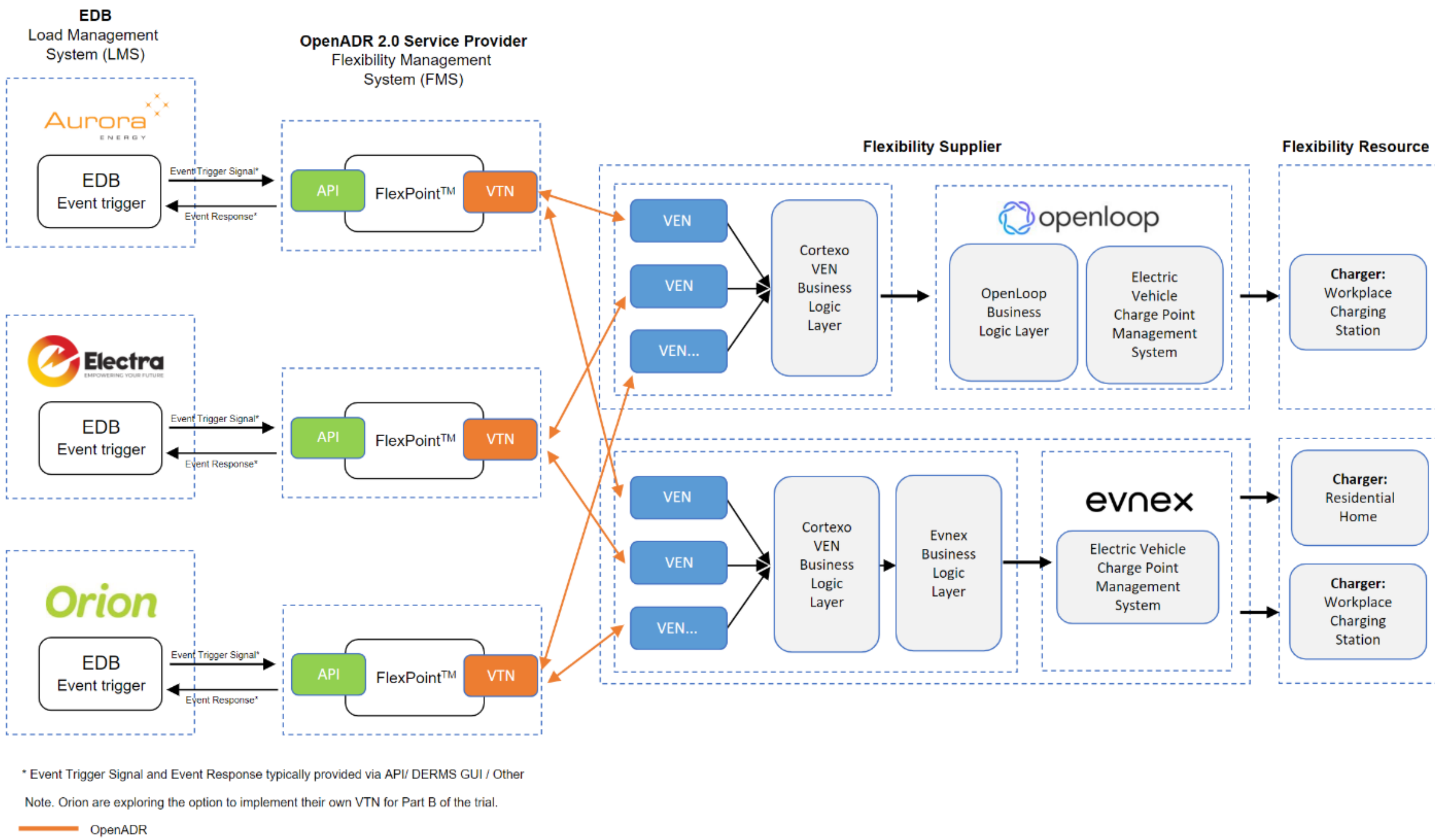


Figure: 13 Trial Configuration Part A

Delivery Partners Experience

"None of this has been what I would call hard, it's all work which needs doing and takes time and money, but the actual technical development has been a matter of working through a very familiar engineering process involving technical building blocks that I recognise from lots of other similar work. Scaling up will be much more a problem of commerciality and social license than a problem of technology" – **Tom Rose, Evnex**

The below table shares the insights from FlexTalk's delivery partners, specific to their implementation of OpenADR implementing OpenADR VTN or VEN with their internal IT systems

Commentary	Ease of implementation (integration of VTN with internal systems)	Ease of use (deploying events via API or GUI?)	Extensibility (Any commentary on future growth / extensions to approach?)
EDB's	The connection of the VTN API to the existing interface used for Solar Zero was utilised, however this was a bit awkward due to the control signals being rather incompatible. To simplify Aurora used the values normally sent to Solar Zero to trigger the initiation of a simple fixed program to the VTN. **Aurora**	Once through the learning curve the deployment of events was OK but not the simplest. **Aurora**	There were some challenges with inability to modify an event once running, needing to send events in advance even for immediate/emergency events. This is a trial limitation of VTN as opposed to the OpenADR protocol. **Aurora**
	Used standalone API approach used in conjunction with the web interface (no integration with internal systems in Part A). **Electra**	Web interface and API for part A were easy to use. **Electra**	Decision not to integrate to SCADA system at this time, due to additional cost for development. **Electra**
	Not easy as not designed to talk to the external world – although we already have a few API to send signals – this is pretty limited and custom-designed. The complexity is in the "Flexible Management Platform" or DERMs equivalent – what are the rules and how do we trigger events etc as opposed to OpenADR. **Orion**	With a bit of user training, GUI was easy to use it was easy. **Orion**	Need a scalable solution to operationalise - a DERMs / Flexibility management system this is where the cost is. **Orion**

Commentary	Ease of implementation (integration of VTN with internal systems)	Ease of use (deploying events via API or GUI?)	Extensibility (Any commentary on future growth / extensions to approach?)
Flexibility Suppliers	Relatively simple work since most of the components were there in some form already. It did take longer than expected to complete Working with Cortexo was easy since they are NZ based technical support provider was easy – integration testing would have been much harder with an overseas supplier. **Evnex** For Part A of the FlexTalk project, OpenLoop did not directly integrate our CPMS with the VEN endpoints. During this initial phase, all events were received on the Cortexo UI, which OpenLoop team had access to, events were manually evaluated (as per customer agreements) and actioned via OpenLoop manually. We carried out the integration work between CPMS and VEN towards the end of Part A (and in preparation of Part B). During the integration process, we did not run into many issues, as we had open communications with the Cortexo team. **OpenLoop**	Easy – not really any different to implementing any other API which is something we've done a few times before with various parties. Working with our own charging hardware meant we knew everything about how they'd behave so there were no integration issues downstream. In the past we have done similar exercises with third party hardware which were much more challenging (again due to working with overseas suppliers to understand discrepancies). **Evnex** Fairly easy. All EDBs scheduled events in accordance with a trial schedule for Part A. All events appeared in the Cortexo VEN UI for OpenLoop to opt-in / opt-out, which OpenLoop subsequently were able to send commands to the targeted charge points. **OpenLoop**	The fundamentals wouldn't need to change much, but the 1:1 nature of the connections in part A would make it a very manual process to set up chargers. Part B partly resolves this, though it's still a bit manual at our end. To scale up there would therefore need to be a better way to have chargers move in and out of the program in such a way that we didn't need to involve us, Cortexo, EDBs and Transpower to make a single change Trial participants received detailed comms from us which wouldn't scale easily and would need to be automated in such a way that they knew what they needed to know but without getting annoyed by notifications. **Evnex** Our approach was a manual approach for Part A. Within the scope of the FlexTalk project, this method was manageable for part A, but not ideal from an extensibility or operational standpoint. **OpenLoop**

Table: 1 Delivery Partners commentary on technical implementations

Trial Delivery

Customers and Chargers

Forty nine customers were recruited to the OpenADR trial. Customers were a mix of residential and commercial, as per the customer recruitment criteria, defined by the industry design team in the trial design phase.

Customers were grouped into load management groups by grid exit point (GXP) in order to target specific areas for load reduction on each EDB's network.

Part A programmes deployed

The following programmes have been tested through Part A of the project. Thirty nine events were triggered through Part A, event outcomes are detailed in figure 14 below.

PROGRAMME NAME	DEFINITION	DETAIL
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 meet the required need.	– No pre-event notification will occur. – The dispatch instruction will occur in near real time.
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.

Table: 2 Part A programmes tested

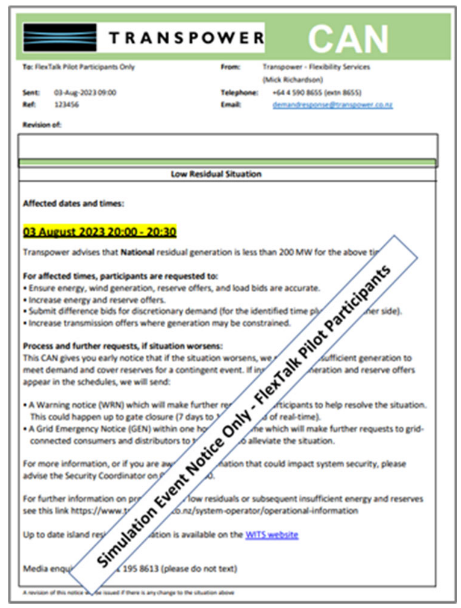
Special Scenarios Tested – System Operator Low Residual Situation / Insufficient Generation Offers - National

FlexTalk delivery partners responded to specific System Operator (SO) simulated scenarios in addition to ad hoc testing with issuing flexibility events through Part A. One simulated scenario in particular mimicked a National Grid emergency event that took place on August 9th 2021.

Details of the two SO simulated test scenarios were as follows:

1. Customer Advice Notice (**CAN**) - Low Residual Situation | Transpower advises that National residual generation is less than 200 MW for the above times.
2. Grid Emergency Notice (**GEN**) – Insufficient Generation Offers – National | Transpower as System Operator advises there are insufficient generation and reserve offers to meet demand and provide for N-1 security for a contingent event.

Both simulated CAN and GEN test scenarios successfully demonstrated OpenADR 2.0 as a communication tool that can be leveraged for signalling SO type of notifications / instructions to EDBs or Flexibility Supplier's directly. OpenADR 2.0a was used as the mechanism to pass along both CAN & GEN instructions which informed each EDB and Flexibility Supplier of the timing (start / end) and level of response that was required. The simulated GEN was issued out in almost near real-time, with limited notice (for the purposes of the trial, events are polled for every 5 minutes).



TRANSPOWER CAN

To: FlexTalk Pilot Participants Only
From: Transpower - Flexibility Services (Mick Richardson)
Sent: 03-Aug-2023 09:00
Telephone: +64 4 590 8655 (extn 8655)
Ref: 123456
Email: demandresponse@transpower.co.nz
Revision of:

Low Residual Situation

Affected dates and times:

03 August 2023 20:00 - 20:30

Transpower advises that **National** residual generation is less than 200 MW for the above ti

For affected times, participants are requested to:
- Ensure energy, wind generation, reserve offers, and load bids are accurate.
- Increase energy and reserve offers.
- Submit difference bids for discretionary demand (for the identified time p… …her side).
- Increase transmission offers where generation may be constrained.

Process and further requests, if situation worsens:
This CAN gives you early notice that if the situation worsens, we … …sufficient generation to meet demand and cover reserves for a contingent event. If in… …eration and reserve offers appear in the schedules, we will send:

- A Warning notice (WRN) which will make further re… …ticipants to help resolve the situation. This could happen up to gate closure (7 days to … of real-time).
- A Grid Emergency Notice (GEN) within one ho… …e which will make further requests to grid-connected consumers and distributors to … alleviate the situation.

For more information, or if you are aw… …ation that could impact system security, please advise the Security Coordinator on …

For further information on pr… …low residuals or subsequent insufficient energy and reserves see this link https://www.t… …o.nz/system-operator/operational-information

Up to date island res… …ation is available on the WITS website

Media enqu… … 195 8613 (please do not text)

A revision of this notice … issued if there is any change to the situation above

Simulation Event Notice Only - FlexTalk Pilot Participants

Furthermore, a CAN and GEN simulated test event was also conducted for both Low Residual Situation / Insufficient Generation Offers – National scenarios, whereby a CAN and GEN was sent from Transpower's FlexPoint VTN to Cortexo test VEN directly.

This set of instructions together with signal type was received as expected and demonstrates the ability for SO to signal directly to Flexibility supplier (bypassing the EDB) which demonstrates another configuration approach for VTN / VEN communication.

Event Outcomes

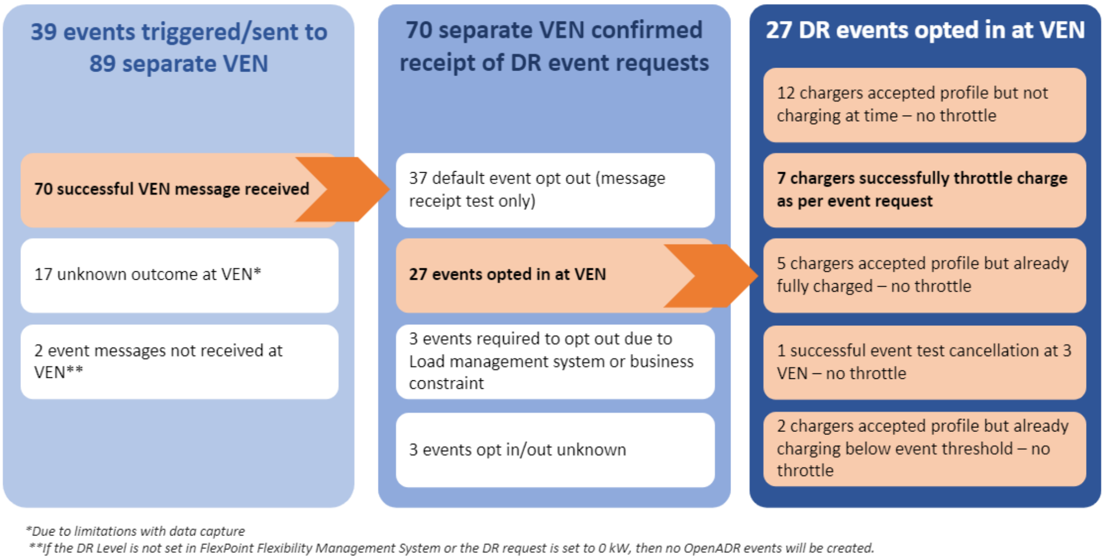


Figure: 14 Part A – Event Outcomes overview

Customer Feedback

At the conclusion of Part A, customers were asked a series of questions to provide insights into their experience within the FlexTalk trial. All customers were surveyed regardless of whether their EV charging was actually managed during a flexibility event. Questions were in Y/N answer format with the ability for customers to comment on each.

The survey explored, awareness of active managed charging of EV, impact on charging routine, potential financial impacts, further participation in demand flexibility trials and any other comments participants wished to share. Summarised survey results as follows:

Commercial customer results:

- There was a general awareness of throttling down occurring, but no material service disruption was reported
- There was no change to charging routines or behaviour
- No financial impacts were reported
- Participants were not sure if they would participate in further trials as didn't fully understand the commercial or customer value

Residential customer results:

- There was mixed awareness of throttling down occurring, with 25% of respondents reporting they were aware their EV was being throttled down. At times customers weren't aware if this was a demand flexibility event or unrelated (charger issue)

- 20% of respondents said participation in the trial impacted their charging behaviour (however, no commentary was provided on behavioural change)
- 13% of respondents noticed a financial impact and the inability to utilise their free hour of power
- 93% of survey respondents were open to participating in further demand flexibility trials, 7% were unsure
- Further customer commentary included suggestions around notifications for demand flexibility events (via flexibility suppliers customer app) and made mention of demand management being essential for the smooth widespread adoption of EVs

Wider Flexibility Learnings

During Part A further insights were gathered from the FlexTalk project team via 1:1 interviews. The interviews explored the FlexTalk partners experience designing flexibility programmes, technical setup and deploying events in Part A of the OpenADR trial. The table below shows the learnings and insights captured, categorised by core themes. The learnings are not specific to OpenADR as a communications protocol but rather the wider flexibility landscape. They speak to the planning and considerations to address future challenges anticipated to operate a fully demand flexible energy system. For full explanation for each insight, see appendix C.

Business / Commercial	Consumers	Technical	Market
Refers to the wider business considerations that need to be considered, designed, and built for interoperability in real world.	Refers to the consumers experience, what needs to be considered in designing flexibility programmes, central to this is awareness on the energy transition and ensuring consumers have the knowledge and tools to make decisions to support NZ's clean energy future.	Refers to the technical considerations that have emerged when implementing OpenADR including learnings from integrations between ADMS, CPMS and end-point device.	Refers to the market settings, who will play in this new world, which actors exist, what are their roles and responsibilities?

Table: 3 Wider flexibility learnings and insight themes

THEME	INSIGHT TOPIC
Business / Commercial and Market	**Contractual Agreements**
Consumer	Consumer buy-in
Consumer	Customer Segments
Consumer	Customer Experience (event duration / event timing)
Consumer / Market	Customer data sharing
Technical	Smart Charger Control
Technical	Load Management Rules
Technical	SIMPLE Signal Interpretation
Market	Role of aggregator and retailer

Table: 4 Themed learnings (summary)

Trial Part A Conclusions

Part A has demonstrated Interoperability with EDBs and Flexibility suppliers' able to send, receive and act on requests for demand flexibility using the OpenADR 2.0a communications protocol. The technical solution (OpenADR 2.0a) is working, enabling communication in a standardised messaging structure.

Part A has been an enabler for getting the delivery team up in running with the OpenADR trial and participating in simple signal demand flexibility events using OpenADR. Participation in the FlexTalk trial is exposing the wider implications that need to be considered to engage operationally (outside of trial settings) in demand flexibility (see table 5. In appendix below). The insights gained through Part A include the need for customer awareness and participation, understanding the differences in participation based on customer segments, understanding what device standards are needed, defining the industry roles and responsibilities, and the potential regulatory settings. Navigating these topics further will help industry through the energy transition and utilise flexibility as a mechanism within this.

Next steps

Part B live customer events commenced 1st October, with Part B expected to run through to end of 2023. Part B learnings reports are due to be released for industry consultation in early 2024. The final technical guide and supporting report will be released March/April 2024. An overview of the Part B trial design can be found in appendices below.

Part B enables the sending of more complex event messages (requests for actual load reductions in kW and the sending of pricing signals). Part B also includes reporting, enabling 2-way communication between EDB's VTN and Flexibility Supplies VEN.

FlexTalk will continue to assess OpenADR's advantages and limitations in the NZ context through Part B of the trial and revise flexibility programmes based on learnings and assist industry participants to understand the systems investment involved in utilising flexibility services. The project will continue to explore topics relevant to communications protocols and the wider considerations for flexibility, sharing domestic and international knowledge with the industry.

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

Appendix A - Trial Part A Message Structure

Programmes 02. Dynamic short-term non-price responsive and 03. Immediate emergency non-price responsive were tested during Part A of trial using the SIMPLE messaging structure.

Typically in OpenADR the levels are mapped as follows:

0 = do nothing,

1 = low use,

2 = moderate use,

3 = maximum use.

The industry design team determined that % as a metric makes logical sense. This is a % change from baseline. Each Flexibility Supplier has provided baseline flexibility capacity to EDB's

The intended behaviour is a reduction in the capacity of what is already occurring with charging.

The mapping should be interpreted as follows:

Level 0 – do nothing, no change to charging behaviour

Level 1- 50% reduction to charge capacity

Level 2 -75% reduction to charge capacity

Level 3 – 100% reduction to charge capacity *stop charging

Levels are to be consistent across all programmes for Part A applicable programmes.

PROGRAMME	BASELINE		LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Programme 02 Dynamic Short Term Non-Price Responsive	Flex Capacity **a.m.**	Flex Capacity **p.m.**	**0%**	**50%**	**75%**	**100%**
Programme 03 Immediate Emergency Non-Price Responsive	Flex Capacity **a.m.**	Flex Capacity **p.m.**	**0%**	**50%**	**75%**	**100%**

Table: 5 Simple messaging levels

Appendix B - Event Outcomes – Learnings Canvas Data Analysis

Event ref no	Date	Time	EDB	FS	Active period (mins)	Message sent	Event outcome
18	16/06/2023	12:30pm	Orion	Evnex	30	Profile updates to all chargers	Only two chargers were in use. One was charging from solar diversion and so did not change behaviour (it was not consuming from the grid). The other responded by reducing charge rate from 32A to 16A for the half hour period.
24	6/21/2023	8:30pm	Aurora	Openloop	30	3 events received on Frankton VEN	Opted in - all chargers accepted smart charging profile and throttling occurred on 4 chargers that were active during the event
30	30/06/2023	5:30pm	Orion	Openloop	60	1 event received on Islington 66kV VEN	Opted in - all chargers accepted smart charging profile, only 1 charger was in use during the time of the event and throttled down correctly
38	27/07/2023	5:00pm	Orion	Openloop	60	3 events received on all 3 Orion VENs	Only one charger (of 7) was actively charging during time of event and was successfully throttled

Table: 6 4 successful Demand Flexibility requests actioned at VEN

Event ref no	Programme	Trigger	Load change requested	Throttle achieved?	Spot power consumption (just before)	Mean power consumption (during)	Spot power consumption (just after)
18	2. Dynamic Non-Price Responsive	Test event	Auto DR Level Low. Target kW 21	Yes	Charge reduced from 32A to 16A	Charge reduced from 32A to 16A	Charge reduced from 32A to 16A
24	3. Immediate Emergency Response	Peak period	Auto DR Level High. Target 67 kW	Yes	29.6kW	23.6kW	29.6kW
30	2. Dynamic Non-Price Responsive	Test event	Auto DR Level High. Target 10.5 kW	Yes	7.4kW	5.9kW	7.4kW
38	2. Dynamic Non-Price Responsive	Test event	Auto DR Level High. Target 87 kW	Yes	7.4kW	5.9kW	7.4kW

Table: 7 Demand flexibility results – throttle down achieved at charge point

Time, Location, Date of successful throttle at charger
12:30pm
4 VEN: Evnex Site – EVNEX Office Test charge + 3 GXPs
16/06/2023
5:00pm
OpenLoop 3 VENs and Evnex 3 VENs
27/07/2023
5:30pm
OpenLoop - VEN ISL0661 - Region A
30/06/2023
8:30pm
Openloop - FKN GXP
6/21/2023

Table: 8 Throttle down achieved – time, date, location

	REASON
3:30pm	
EVNEX - 1 VEN + Orion test charger	
Chargers accepted smart charging profile, only 1 actively charging but it was below request threshold	**Active chargers charging below request threshold**
5:30pm	
Openloop - 3 VENs	
Chargers accepted smart charging profile, but no throttle occurred as active chargers already fully charged	**Active chargers already fully charged**
6:00am	
OpenLoop - 1 VEN - Region B	
Charger accepted smart charging profile but not charging at time	**Not charging at time**
6:00pm	
Openloop - SDN GXP	
Chargers accepted smart charging profile, only 1 actively charging but it was below request threshold	**Active chargers charging below request threshold**
6:30pm	
OpenLoop - 2 VENs - Region A	
Charger accepted smart charging profile but not charging at time	**Not charging at time**
Openloop - 3 VENs	
Event cancelled	**Event cancelled**
9:00pm	
Openloop - CLD and CML GXP	
Charger accepted smart charging profile but not charging at time	**Not charging at time**
unknown	
(blank)	
Charger accepted smart charging profile but not charging at time	**Not charging at time**
Chargers accepted smart charging profile, but no throttle occurred as active chargers already fully charged	**Active chargers already fully charged**

Table: 9 Events where charger opted in but throttle down not achieved

Appendix C – Trial Limitations

There were a number of limitations imposed on the FlexTalk trial to reduce the impact on customers to ensure their participation. The below table provides approach taken within trial Part A.

TRIAL LIMITATION	DETAIL	APPROACH FOR TRIAL
Number of events deployed per month	EDB's and Flexibility Suppliers may have a contractual agreement which might specify a maximum number of events that can be deployed per month. These contracts are outside the scope of the trial.	Limit to a maximum of 10 control events per month per customer.
Control levels	EDB's and Flexibility Suppliers will have a contractual agreement which may specify a control level. These contracts are outside the scope of the trial.	One flexibility supplier limited chargers being throttled back to a maximum of 80% capacity (Thus if requests did not meet criteria, there was an automatic opt-out for these events)
Event Timing	EDB's and Flexibility Suppliers will have a contractual agreement which may specify time that events can occur. These contracts are outside the scope of the trial.	Each of Flexibility suppliers involved in trial had limitations around when chargers could be throttled back For OpenLoop customers, chargers would only be managed after business hours (5pm – 8am) For Evnex customers, chargers would only be managed between 7am – 9pm (to ensure no impact to retail tariffs which utilize low energy periods)
Trial Numbers	For the trial we are working with a small sample size. This has raised several questions for how a Flexibility Supplier responds in a meaningful way to requests.	Decision to apply a multiplier in final output report (for Part B) consensus from industry design team that trial numbers are acceptable, and this is not a consideration for trial as we are testing the OpenADR mechanism for achieving demand flexibility as opposed to measuring how much flexibility can be achieved.

Table: 10 Part A Trial Limitations

Appendix D – Wider Flexibility Learnings (Detail)

BUSINESS / COMMERCIAL	CONSUMERS	TECHNICAL	MARKET
Refers to the wider business considerations that need to be considered, designed, and built for interoperability in real world.	Refers to the consumers experience, what needs to be considered in designing flexibility programmes, central to this is awareness on the energy transition and ensuring consumers have the knowledge and tools to make decisions to support NZ's clean energy future.	Technical considerations that have emerged when implementing OpenADR including learnings from integrations between ADMS, CPMS and end-point device.	Refers to the market settings, who will play in this new world, which actors exist, what are their roles and responsibilities? Nb. For the purposes of trial, we have adopted a market-led model (see appendix "market-led" model below)

Table: 11 Wider flexibility learnings and insight themes

THEME	INSIGHT TOPIC	DESCRIPTION
Business / Commercial and Market	**Contractual Agreements** **(Between the EDB and Flexibility supplier)**	Contractual input requirements need to be considered to inform the design of the programmes in real world. For example, the contractual components to participating, requesting, and providing flexibility will need to be designed for actors to participate. The technology is working, but the end-to-end process will require effort with changes to contracts, rebates, regulations, and internal processes.
Consumer	**Consumer** **buy-in**	For an end-to end process to work operationally, there is work required to bring the customer along on the journey, i.e. awareness of demand flexibility and to gain social license.
Consumer	**Customer Segments**	The trials customer recruitment process suggested that commercial customers (workplace charging stations) are likely to be more sensitive to the impacts of demand flexibility than residential customers. Fleet Management Operators (FMO's) agreed to be involved in the trial but specified prerequisites such as when throttle requests would be accepted and setting throttle limits.
Consumer	**Customer Experience**	While the customer experience and the connection from the Flexibility Supplier to Flexibility Resource is outside the core scope, it's important for this to be

THEME	INSIGHT TOPIC	DESCRIPTION
	(event duration / event timing)	considered as requirements can have an impact on programme details e.g., event duration. Our FlexTalk trial partner, Evnex have opted for residential customers to only participate in the trial between the hours of 7am – 9pm. This is to ensure that their retail tariffs which utilise low energy periods will not be affected (i.e., Throttle downs would not occur during customers free hour of power and therefore the customer will not be financially disadvantaged by participating in the trial). Timing of events is precautionary as with the alignment of peaks and pricing it is very unlikely that low usage times would be used in trial (typically just periods of congestion), thus the likelihood of customers unintentionally being financially impacted is low risk. It is however prudent to point out that retail tariffs and time of use are factors in customer participation of demand flexibility. OpenLoop have opted for commercial customers to only participate in the trial between hours of 5pm – 8am this is to ensure no impact to charging during business hours. For the purposes of the trial, OpenLoop have requested limiting the charge reduction to no lower than 80%, to minimise the impact to customers participating.
Consumer / Market	**Customer data sharing**	We need to consider customer data sharing and what can we share between EDB / Flexibility Supplier and how we protect customer privacy / customer obligations through this process. For the purposes of the trial, a mapping exercise was conducted to protect customers ICP data in line with the Flexibility Supplier's customers data / privacy agreements. One partner was comfortable sharing customer ICP data due to this being pre-agreed in their customer contracts. This is an important learning for the trial and a consideration for real world deployment. This topic will be explored further through the trial, particularly through Part B, with the project engaging with other projects internationally to seek guidance on how data sharing may be navigated for a demand flexible electricity system.
Technical	**Smart Charger Control**	During Part A, remediation was required to connect to and enable smart charging on key charging manufacturer charger involved in trial. Consideration / technical knowledge may be needed to be able to access / control charging functions.
Technical	**Load Management Rules**	During trial Part A, some customers had to be removed from the trial. It was discovered that some of their charge points were configured on a 'load management system' (designed to distribute power at a set limit to all EV chargers connected, to adhere to a building/site power limit) and would not accept smart charging profiles due to their load management rules.

THEME	INSIGHT TOPIC	DESCRIPTION
		Load management building rules may need to be understood further to understand smart charger behaviour and the ability to be able to access assets for demand flexibility.
Technical	**SIMPLE Signal Interpretation**	The team discovered during trial Part A that there was ambiguity around the interpretation of the SIMPLE signals sent and the intended behaviour on the EV vehicle. A discussion commenced on if the signal should be interpreted as charge at 75% of full charging capacity (as had been actioned) OR action a 75% reduction. The latter was the intended behaviour the EDB wanted. This shows the need to be clear and ensure design documentation for Flexibility programmes is understood and interpreted the same across the actors participating in the Flexibility event.
Market	**Role of aggregator and retailer needs to be defined**	More work is needed to map the end-to-end impact and understand the key roles in energy supply chain as well as the business models and business case for investment.

Table: 12 Themed learnings (Detailed)

Appendix E - OpenADR Trial Part B

Part B Overview

Design for trial Part B commenced in June 2023. The team has cemented the design requirements and is in the technical implementation phase. Live customer events are expected to commence 1st October.

The following components have been designed as a starting point to test through Part B:

- ✓ Part B complex signals (load reductions in kW and pricing signals)
- ✓ Reporting
- ✓ Dynamic Operating Envelope programme design (DoE) (see table 13 below for programme details)

Part B Flexibility Programmes

The following programmes in addition to Part A defined programmes will be tested through Part B:

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 and 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.
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.

PROGRAMME NAME	DEFINITION	DETAIL
		- 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.
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 a certain load limit (for the assets they control) This envelope will be static and determine the limit for the charger(s) that Flex Supplier controls. Flexibility supplier must not breach limit. Note the limit (kW) will change throughout day, envelope will provide limit across 24-hour period, in 30 min increments. (Ability to also set lower limit) The envelope is sent a day ahead (24 hours) and behaves as a set and forget mechanism for controlling load on that group of chargers for a 24-hour period. Based on long term contracts between EDB / Flexibility Supplier	- The limit(s) are controlled by the EDB, but the actual management of the loads and how the net outcome is achieved is up to the DERMS of the Flexibility Supplier.

Table: 13 Part B flexibility programmes

Complex Signal Design

Part B enables the sending of more complex event messages and reporting, enabling 2-way communication between EDB's VTN and Flexibility Supplies VEN.

Figure: 15 Trial Part B - OpenADR 2.0b communication flow

For Part B, two more "complex" signal types were required in addition to the SIMPLE signals used in Part A. The FlexTalk Industry design team have agreed to trial the below signal types and behaviour through Part B.

SIGNAL TYPE 1:

A LOAD_DISPATCH signal will identify an amount of energy or power, e.g., "50," and the units "kW", "kWh" or "MW", "MWh" etc. As part of the LOAD_DISPATCH signal, there is also a signal_type.

The signal type defines how the payload (50 kW, for example) is interpreted by the resource.

As a starting point the team will trial delta signal type to, increase / decrease by x kW

Delta = This is used to dispatch loads to some offset from an agreed upon baseline.

Note that the baseline may be the current power consumption.

SIGNAL TYPE 2:

The other signal needed is for ENERGY_PRICE, to support the Price_responsive_bid programme. We need to identify a load to be reduced (or increased) AND the price the EDB is offering to pay. This is achieved by sending two event signals for exactly the same time period.

This is a standard use case in OpenADR.

LOAD_DISPATCH + ENERGY_PRICE

As a starting point the team will trial a delta, using cents per kWh.

Delta = This is used to dispatch loads to some offset from an agreed upon baseline.

Note that the baseline may be the current power consumption.

Reporting

The following reports are being explored for Part B:

- Post event reporting
- Location data
- Utilisation data
- Service availability
- Power quality data

Glossary of terms

This Glossary describes terms and concepts relevant to 'flexibility' and distributed energy resources.

TERM	DEFINITION
Active Managed Charging	This form of managed charging, also known as direct load control, supersedes customer charging behaviour and imposes utility preferences on charger functionality. Charging is controlled by communication signals sent from an electricity distribution business or aggregator to a vehicle or charger. Active managed charging can be event based, where load is controlled during a limited number of events in a given time period. Active managed charging can also be continuous, which enables more constant control that is responsive to grid conditions on a more granular scale.
Advanced Distribution Management System (ADMS)	Is the software platform that supports the full suite of distribution management and optimisation. An ADMS includes functions that automate outage restoration and optimise the performance of the distribution grid. ADMS functions being developed for electric utilities include fault location, isolation, and restoration; volt/volt-ampere reactive optimisation; conservation through voltage reduction; peak demand management; and support for microgrids and electric vehicles.
Application Programming Interface (API)	An API, or application programming interface, is a set of defined rules that enable different applications to communicate with each other. It acts as an intermediary layer that processes data transfers between systems, letting companies open their application data and functionality to external third-party developers, business partners, and internal departments within their companies.
Charge Point Management System (CPMS)	Charge point management software (CPMS) simplifies charge point operations by representing an entire charging network digitally and managing communications and data exchanges with individual charging stations.
Demand Response (DR)	Demand response (DR) is the voluntary reduction or shift of electricity use by customers, which can help to keep a power grid stable by balancing its supply and demand of electricity. It can help to make electricity systems flexible and reliable, which is beneficial if they contain increasing shares of variable renewable energy.

TERM	DEFINITION
Distributed Energy Resources (DER)	Technologies used to generate, store, or manage energy are referred to as distributed energy resources (DER). DER are smaller–scale devices that can either use, generate, or store electricity and form a part of the local distribution system, which primarily serve homes and businesses. DER can include renewable generation, energy storage, electric vehicles (EVs), and technology to flexibly manage loads (such as water heaters or pool pumps) at the premises. Generation or storage DER operate for the purpose of supplying all or a portion of the customer's electrical load and may also be capable of supplying power into the system or alternatively providing a load management service for customers. DER can also include front-of-meter small generation or storage located in lower-voltage parts of the network
Distributed Energy Resource Management System (DERMS)	The software and digital information flows that enable DERM by controlling Distributed Energy Resources (DER).
Demand Flexibility (DF)	The modification of generation and/or consumption patterns in response to an external signal, to provide a service within the energy system.
Distribution Systems Operator (DSO)	A Distribution System Operator (DSO) has a role to monitor, control and actively manage the power flows on the distribution system to maintain a safe, secure and reliable electricity supply. As a neutral facilitator of an open and accessible market for network services, a DSO will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole system optimisation. A DSO enables customers to be producers, consumers and storers of energy, enabling customer access to networks and markets, customer choice and great customer service.
Electricity Distribution Business (EDB)	Lines companies (or distribution companies) provide and maintain the power lines that carry electricity via power poles and lines from the national transmission grid to homes and businesses across New Zealand.
Electrical Vehicle Supply Equipment (EVSE)	The equipment that interconnects the AC electricity grid at a site to the EV. It can be Level 1, Level 2, or Direct Current Fast Chargers (DCFC) charging. Also known as a charger.

TERM	DEFINITION
Flexibility Management System	Flexibility Management Systems are software-based platforms used to communicate, manage and orchestrate Distributed Energy Resources (DER).
Flexibility Supplier / Aggregator	An entity providing flexibility to perform a service for an electricity participant. A flexibility supplier may act as an aggregator. An aggregator means a person who contracts with 1 or more consumers so that the person is able to deal with the electricity otherwise required by those consumers in any way, including putting in place agreements under which those consumers voluntarily change their consumption level, so that the person is able to offer the combined increase or reduction in the interruptible load of all those consumers as collective demand, either in the wholesale electricity market or under any other bilateral agreement or contract.
Flexibility Resource	Typically distributed generation, storage or demand response, are connected to the electricity network, and are flexible in how they operate and impact the network. Flexibility Services: The offer of modifying generation and/or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system.
Grid Exit Point (GXP)	A grid exit point (GXP) is defined in Part 1 of the Code and means any point of connection on the grid at which electricity predominantly flows out of the grid or is determined as being such by the Authority following an application in accordance with clause 13.28.
Load Management System (LMS)	EDBs internal IT infrastructure (systems) responsible for controlling load. This may be referred to by EDBs as DERMs, ripple system, load management system or other.
OpenADR 2.0	OpenADR is an open, highly secure, and two-way information exchange model and global Smart Grid standard. OpenADR standardises the message format used for Auto-DR and DER management so that dynamic price and reliability signals can be exchanged in a uniform and interoperable fashion among utilities, ISOs, and energy management and control systems. While previously deployed Auto-DR systems are automated, they are not standardised or interoperable.

TERM	DEFINITION
	OpenADR was created to automate and simplify DR and DER for the power industry with dynamic price and reliability signals that allow end users to modify their usage patterns to save money and optimise energy efficiency, while enhancing the effectiveness of power delivery across the Smart Grid.
IEEE2030.5	IEEE 2030.5 is a standard for communications between the smart grid and consumers. The standard is built using Internet of Things (IoT) concepts and gives consumers a variety of means to manage their energy usage and generation.
Open Charge Point Protocol (OCPP)	Open Charge Point Protocol (OCPP) is a communication protocol that enables EV charging stations to communicate with central systems, such as network management platforms or billing systems. It was first developed by the Open Charge Alliance (OCA), a non-profit organisation dedicated to promoting open standards in EV charging. OCPP is an open-source protocol, meaning that it is freely available for anyone to use and modify. This makes it an attractive option for charging network operators and manufacturers, as it allows them to build their own charging stations and systems without being locked into proprietary solutions.
Throttle down	Slowing down or stopping EV charging in response to a demand flexibility request.
Variable renewable energy (VRE)	Renewable energy sources, such as wind and solar, which have variable supply.
Virtual end node (VEN)	Typically, a client, an end device that accepts a signal from a server (VTN).
Virtual top node (VTN)	Typically, a server that transmits OpenADR signals to end devices or other intermediate servers.

Definitions have been gathered from multiple sources including:

- https://arena.gov.au/renewable-energy/demand-response/
- https://www.chargecloud.de/en/blog/charging-management-software/
- https://www.ea.govt.nz/industry/distribution/
- https://www.ea.govt.nz/documents/527/IPAG_review_of_the_Transpower_demand_response_programme.pdf
- https://www.emi.ea.govt.nz/Glossary
- https://www.gartner.com/en/glossary/all-terms
- https://www.ibm.com/topics/api
- https://www.openadr.org/overview
- https://static.transpower.co.nz/public/publications/resources/TP%20Whakamana%20i%20Te%20Mauri%20Hiko.pdf?VersionId=FljQmfxCk6MZ9mIvpNws63xFEBXwhX7f
- Congressional Research Service (CRS), Variable Renewable Energy: An Introduction, 2019
- Electricity Industry Act, 2010
- ENA, Open Networks Project, Flexibility Market Principles, July 2019
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Who we are

Electricity Engineers Association (EEA)

Who is EEA?

Founded in 1927, the Electricity Engineers' Association ("EEA") provides a focal point for collaboration and thought leadership in engineering, safety, and asset management across the Aotearoa NZ electricity supply industry.

The EEA enables members to continuously learn and develop in a dynamic and rapidly changing low carbon environment.

How does EEA operate?

The EEA facilitates learning, projects and working groups to develop engineering, technical and safety capability, standards, and guidelines, that reflect national and international trends and support, improve, and build on the knowledge and understanding of industry.

Energy Efficiency and Conservation Authority (EECA)

Who is EECA?

EECA is a Crown agency, established under the Energy Efficiency and Conservation Act 2000 to encourage, promote and support energy efficiency, energy conservation and the use of renewable sources of energy. EECA's purpose is to mobilise New Zealanders to be world leaders in clean and clever energy use. It strives for a sustainable energy system that supports the prosperity and well-being of current and future generations.

EECA's work programme is guided by the New Zealand Energy Efficiency and Conservation Strategy.

How does EECA operate?

EECA works to create positive systems change using three important levers; co-investing in energy efficient technologies and the use of renewable sources of energy, motivating people to make clean and clever energy choices, and regulating proven technologies and processes. Some on their own, but most in combination.

The Authority's work spans across productive and low-emissions businesses, efficient and low-emissions transport, energy efficient homes, government leadership and engaging hearts and minds.

Electricity Engineers' Association

TE TARI TIAKI PŪNGAO
ENERGY EFFICIENCY & CONSERVATION AUTHORITY

REPORT 02 - PART A LEARNINGS

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