flextalk

# FlexTalk: The Demand Flexibility Common Communication Protocols Project Final Report

**OpenADR® ASSESSMENT, FINDINGS AND RECOMMENDATIONS**

eea Electricity Engineers' Association

EECA TE TARI TIAKI PŪNGAO ENERGY EFFICIENCY & CONSERVATION AUTHORITY

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# Foreword

There are multiple challenges and opportunities facing Aotearoa New Zealand in its transition to a renewable energy future. It is therefore with significant pride that we acknowledge one of the greatest features of our industry – sharing and collaborating in pursuit of solutions to difficult problems.

FlexTalk is a perfect example of this can-do attitude and is unique in Aotearoa today; it is a project where the Energy Efficiency and Conservation Authority (EECA), Electricity Engineers' Association (EEA) and power industry sponsors have come together, addressing a thorny issue for everyone's benefit.

EEA and EECA recognised FlexTalk as a valuable opportunity for Government and industry collaboration while learning lessons informing proactive future system design.

The use of demand flexibility, also known as distributed flexibility, across our electricity system will form an important part of future energy security, reliability, resilience, and investment options. Yet as we have seen from international efforts, demand flexibility poses its own set of challenges.

That's where FlexTalk comes in.

We want New Zealand businesses, homes and flexibility providers actively managing their electricity use within the physical constraints of the grid based on renewable energy availability and system demand.

A key enabler is access to standardised industry communication protocols and information interchange tools that talk to one another regardless of provider or distribution network.

This is the focus of FlexTalk – examining the application and implementation of the widely used open international communication protocol known as OpenADR.

Adopting open communication and data protocols is crucial to ensuring tomorrow's grid is not only a platform, but an open platform. Openness supports competition by making the grid accessible, in turn encouraging connection of emerging or alternate energy sources including solar and wind.

Together with our industry partners, we have trialled and successfully tested OpenADR within a real-life New Zealand context, to actively manage electric vehicle (EV) charging and charge and discharge batteries connected to solar arrays.

This represents the first step on an exciting journey towards the successful future management of Aotearoa New Zealand's power system using flexibility. A future that sees the active participation of all users for more efficient outcomes.

It is extremely rewarding knowing this work helps all stakeholders move with confidence into an exciting future that leverages the full benefit of consumer flexibility resources in a mutually beneficial way.

We are indebted to our design group members, delivery partners, steering group, funding partners, overseas experts, and the EEA project team for their incredible support and contribution, and to all participants for being so highly engaged in FlexTalk.

There is still more to do as technology and the future market and regulatory framework around demand flexibility evolves. The FlexTalk stakeholders look forward to contributing and collaborating on future work.

**Peter Berry**
EEA, Chief Executive Officer

**Marcos Pelenur**
EECA, Chief Executive

SECTION TWO



# Executive Summary

## TRANSFORMATION OF AOTEAROA'S ENERGY SYSTEM

With New Zealand committed to a net zero carbon economy by 2050, the electricity system is set for unprecedented change owing to the at-scale electrification of previously fossil-fuel powered sectors of the economy.

Growing demand, technological advancements, decarbonisation initiatives, and digitilisation are fuelling significant transformations in electricity generation, storage, and usage, while also redefining the key stakeholders in these domains. Notably, the rise of distributed energy resources (DER), which for the purpose of this report is defined as also encompassing consumer energy resources (CER) and emerging connecting loads, is spearheading substantial change within New Zealand's distribution networks and the move to multidirectional flows of energy.

Whilst government policies and international agreements on reducing emissions and combating climate are contributing to drive these changes, the significant driver of change is the role of consumers who are embracing these new technologies and taking control of their energy use. Consumer uptake of electric vehicles (EVs), solar photovoltaics (PV), and battery storage as well as home energy management systems (HEMS), combined with new renewable energy generation connecting to the grid and electrification of public transport and industry are changing the way we view and use the electricity system.

In a future where energy is becoming more decentralised yet still interconnected, electricity networks must be responsive to shifting demands for traditional services while enabling new opportunities for energy resource sharing and balancing. By connecting the ever-increasing number of consumer-owned generators and energy storage systems to each other, networks can act as platforms which help match supply and demand and reduce the need for inefficient duplication of energy investments.

## THE CONSUMER AND BALANCING CONSUMER NEEDS

A consumer-oriented transformation of a complex and essential energy system requires several high-level objectives to be balanced simultaneously in order to serve diverse consumer interests. New Zealand's electricity system must seek to achieve decarbonisation while ensuring affordability for consumers and maintaining the security and reliability of the power grid. Additionally, it should encourage and empower consumer choice and control, while safeguarding consumer rights and preventing negative impacts on vulnerable groups.

As such, when navigating the transition to New Zealand's energy future, it's vital to approach it with a focus on creating an environment that prioritises anticipating and meeting the diverse needs of all consumers.

However, gaining consumer cooperation depends on good consumer engagement and obtaining a social licence. To do this, the sector must improve trust with consumers through better engagement, customised services and reform of consumer protection frameworks.

**FIGURE 1:** DESIGNING A CONSUMER CENTRIC ENERGY SYSTEM


Source: CSIRO and Energy Networks Australia, 2017: Electricity Networks Transformation Roadmap: Final Report

## THE ROLE OF FLEXIBILITY, COMMUNICATION PROTOCOLS AND FLEXTALK

Demand-side flexibility (DSF), also known as distributed flexibility, is the voluntary adjustment of electricity consumption by DER in reaction to market signals and is primed to be a key enabler of New Zealand's future energy system. Flexible DERs feature the capacity to deliver an array of services spanning wholesale and retail electricity markets, ancillary services, as well as transmission and distribution functions, whilst also providing value and lowering costs for consumers.

To accommodate the growing number of DER and controllable load-bearing devices on the grid and to allow them to participate in flexibility, it is essential that they possess the capability to both transmit and receive signals, enabling them to respond appropriately. It is therefore important that they can all communicate and exchange information regardless of the technology, flexibility supplier or distribution network (i.e. that they all have smart capabilities). Therefore, the adoption of an open communication standard could be vital for the practical application of flexibility across New Zealand.

This was the aim of FlexTalk which investigated open communication protocols and their potential application in New Zealand. FlexTalk delved into the application and implementation of the widely used open international communication protocol, OpenADR 2.0 (including versions 2.0a and 2.0b), to assess its potential within the local context. The project's prime focus was to assess OpenADR's ability to achieve interoperability between electricity distribution businesses (EDBs) and flexibility suppliers (aggregators) and actively manage EV and battery charging, to enable their use for flexibility.

## FLEXTALK FINDINGS

Contained in this report is a full explanation of the trial design and methodology, consumer participation, the signals used in the practical implementation and use of OpenADR in New Zealand, as well as the key findings and recommendations for further work.

The pivotal findings outlined in this report underscore the necessity of embracing standardised functionalities for communication and data exchange to achieve demand flexibility in New Zealand. These functionalities encompass interoperability, real-time data exchange, scalability, flexibility, maintainability, platform independence, backward and forward compatibility, and non-proprietary attributes. Our analysis of the global landscape reveals that presently only two established internationally recognised communication protocols fulfil these criteria: OpenADR and IEEE 2030.5. Despite their distinct strengths and weaknesses, both protocols were assessed as being effective in managing DER and demand response initiatives.

The report also outlines FlexTalk's examination of the OpenADR protocol, where no limitations were found during the deployment of events between EDBs and flexibility suppliers. FlexTalk also demonstrated that OpenADR has the capability to fulfil all essential functionalities required for a communication protocol to enable flexibility for New Zealand. As such, the project has successfully demonstrated the suitability of OpenADR for the purpose of effective communication between an EDB and a flexibility supplier, while exposing many of the practical issues and challenges in translating theory into practice.

The FlexTalk findings also highlighted that whilst New Zealand is only early on in its journey to enable flexibility, the need to standardise flexibility programs across New Zealand to reduce technical and contractual complexities between EDBs, flexibility suppliers and consumers will be required.

## WIDER FINDINGS

During the FlexTalk initiative, significant insights and discoveries emerged from our research and engagement with industry at both national and international levels. Although beyond the immediate scope of FlexTalk, which primarily concentrated on open communication protocols (i.e. OpenADR), we identified broader considerations that could potentially inhibit demand flexibility. Consequently, these findings have been synthesized and incorporated into this report for consideration and potential action.

Some of these considerations include:

» Crafting industry guidelines tailored to delineate the functional requisites for end devices in New Zealand.

» Exploring global standards applicable to various flexibility enablers such as data management, cybersecurity, etc., for potential adoption in New Zealand.

» Establishing clarity on data access and management capabilities essential for delivering flexibility.

» Formulating an educational and engagement strategy aimed at actively involving New Zealand consumers to garner social acceptance for the energy transition endeavor.

» Evaluating prospects for future trials.

» Identifying innovative commercial models and other pertinent factors.

## KEY FINDINGS

» **Open communication standards/protocols are a key enabler of flexibility i.e., to exchange network information, pricing signals, and control signals.**

» **Agreed industry standardisation of protocols will provide enhanced interoperability, real-time data exchange, improved scalability and flexibility.**

» **The two most mature open communication protocols are OpenADR and IEEE 2030.5, each have respective advantages specific to their intended use case.**

» **International adoption of standard protocols vary due to individual context and needs.**

» **While simple APIs allow industry to participate in flexibility they are short-term solutions as adoption will hinder participation, interoperability, scalability and security.**

» **Assessment of OpenADR within FlexTalk met all defined assessment criteria for least regrets functionality needed to enable flexibility.**

## TABLE OF RECOMMENDATIONS

The full FlexTalk recommendations are summarised in the table below.

**TABLE 1: FLEXTALK RECOMMENDATIONS FOR COMMUNICATION PROTOCOLS IN NEW ZEALAND**

| NO | ISSUE | RECOMMENDATION |
|---|---|---|
| R1 | International learnings on communication protocols | Continue to monitor international developments, with particular emphasis on:<br>a. Australia due to their market proximity and speed of advancement in managing high penetration levels of DER within their distribution systems; and<br>b. The UK, due to the similarity in structure and drivers in terms of DER penetration, and regulations.<br>c. Identifying, fostering, and coordinating New Zealand's involvement in pivotal international standards working groups or committees dedicated to advancing DER integration and flexibility globally (including enabling technologies such as open communication protocols such as OpenADR and IEEE 2030.5). |
| R2 | Build on existing body of knowledge on communication protocols and map the capabilities against New Zealand's requirements | Therefore, it is recommended that:<br>a. We leverage the findings from the FlexTalk project to develop an industry guideline that outlines the essential functionality necessary for meeting standard communication requirements.<br>b. Initiate further trials (e.g., FlexTalk 2.0) to enhance the current knowledge base and delve deeper into learnings gained.<br>c. We continue to monitor global advancements in communication protocols. |
| R3 | Industry communication guideline | We recommend that an industry communication guideline is created that is inclusive of the fundamental functional requirements of communication protocols to fully enable flexibility based on the learnings of the FlexTalk project. For example, communication protocol must be:<br>a. Open (non-proprietary).<br>b. Interoperable.<br>c. Scalable.<br>d. Maintainable.<br>e. Platform independent.<br>f. Backward and forward compatible. |
| R4 | EDB program design standardisation | It is recommended that:<br>1. The initial seven FlexTalk-designed programs serve as the core foundational set and are refined into the New Zealand OpenADR standardised flexibility programs after industry consultation regarding program design.<br>2. An agile maintenance mechanism is established to ensure flexibility programs are reviewed and can evolve based on industry need.<br>3. That the program owner is defined. |

| TABLE 2: WIDER CONSIDERATIONS FOR FLEXIBILITY RECOMMENDATIONS | | |
|---|---|---|
| **NO** | **ISSUE** | **RECOMMENDATION** |
| WR1 | End device functionality | It is recommended that industry guideline/s that outline end device functionality requirements are either adopted and adhered to, or if not currently available developed and implemented. |
| WR2 | Other technical standards or protocols | It is recommended that:<br>a. Gap analysis is undertaken to identify any gaps in standards required to enable DER integration in the New Zealand power system.<br>b. Based on the outcomes of the gap analysis, the industry establish a work program to evaluate and make recommendations to policy makers regarding other technical characteristics required to enable flexibility that may require standardisation. These include:<br>– Data<br>– Cyber security<br>– Interoperability<br>– Health and safety standards<br>c. Development of a DER interoperability assessment framework to provide policy makers with an objective set of criteria to assess potential standards or features of technical standards to be considered for adoption in New Zealand. |
| WR3 | International standards | It is recommended that a scan of relevant international standards committees and working groups related to DER integration be undertaken to identify gaps and ensure alignment. |
| WR4 | IT system requirements to enable flexibility services | It is recommended that common functional requirements for EDB IT systems be established that will allow for flexibility services to be introduced into their operational activities. |
| WR5 | Definition of roles and responsibilities | It is recommended to initiate work to delineate the roles and responsibilities necessary to achieve flexibility, with the primary aim of optimising outcomes for all consumers. |
| WR6 | Access to data & data management | It is recommended that work be undertaken to clarify data access and management capabilities needed to deliver flexibility. This could include changes in regulations to access and manage this data; and defining standards and operating limits for grid connected flexible devices. |
| WR7 | Consumers | It is recommended that work is undertaken to engage and educate New Zealand consumers, to gain social licence on the energy transition journey, what flexibility is and the value proposition to participate.<br>Key activities to deliver this social licence could include:<br>a. Developing a consumer charter for New Zealand as has been established in other jurisdictions around the world (i.e., Australia and the UK).<br>b. Developing in-depth consumer segments so as to be able to tailor solutions/opportunities for all New Zealand consumers.<br>c. Trials to unlock and test with compelling offers provided to consumers incentivising participation. |

**TABLE 2:** WIDER CONSIDERATIONS FOR FLEXIBILITY RECOMMENDATIONS (CONTINUED)

| NO | ISSUE | RECOMMENDATION |
|---|---|---|
| WR8 | Future project/trial considerations | Leveraging from the outcomes of the FlexTalk project framework, it is recommended a next step trial is established to continue momentum and expand on learnings. Two key gaps identified in FlexTalk include market stimulation and understanding the consumer value proposition. It is recommended that a new project (FlexTalk (2.0) be established to investigate those two issues, with particular focus on:<br>a. Testing real home setups with a wider range of technologies expanding the size and scope of communication (EV chargers, solar arrays, home batteries, HEMs, electric hot water heating, heat pumps and other appliances).<br>b. Testing/uncovering and quantifying the percentage of demand value stack that can be shifted/utilised.<br>c. Uncovering real time consumer insights (such as consumption patterns) and incentives to participation.<br>It is recommended projects/trials are stood up to continue to address considerations exposed in FlexTalk that were out of scope but necessary to achieve a fully demand flexible system. It is recommended a next steps project could focus on issues such as:<br>d. Understanding/quantifying flexibility that exists and can be utilised.<br>e. Investigate commercial opportunities between EDB and flexibility supplier.<br>f. Uncovering real time consumer insights and incentives to participation.<br>g. Designing common consumer flexibility services/products. |
| WR9 | Knowledge sharing | It is recommended that a central collaboration space is created to share local knowledge and enable collaboration across industry. This could be enabled via:<br>» FlexForum (central repository/collaboration mechanism).<br>» Utilising EEA Knowledge Network. |
| WR10 | New Zealand needs a clear vision and roadmap for energy transition | Clarity is needed from government on policy in support of the energy transition and flexibility's role in the future energy system. This will enable industry to progress initiatives and innovations in support.<br>It is recommended that:<br>a. The Ministry of Business, Innovation and Employment (MBIE) finalise the energy strategy so there are clear signals to the sector on what we are building for.<br>b. Support and funding are given to real-world trials, embracing failures, learning by doing. |
| WR11 | Regulatory sandboxes | It is recommended that consideration be given to making it easier to establish regulatory sandboxes in New Zealand to help drive the transformation. It is important however, that any sandbox would adhere to common features, such as:<br>a. Genuine innovation or novelty.<br>b. Identifiable consumer or social benefit.<br>c. Need and readiness for sandbox testing.<br>d. Defined time, sectoral or geographic limits.<br>e. Safeguard mechanisms. |

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## REPORT STRUCTURE

This report provides a comprehensive overview of FlexTalk, structured into nine distinct sections.

**Sections 1 to 4** delve into the background, motivation, scope, purpose, and objectives of testing OpenADR in New Zealand.

**Section 5** offers a detailed account of the trial, including operational challenges faced and the solutions devised. It includes the assessment methodology applied through the trial and wider research into OpenADR and other communication protocols.

**Sections 6 and 7** present FlexTalk's findings from evaluating OpenADR, incorporating direct feedback from participants such as end-user electricity consumers and delivery partners (EDBs). These sections also address potential challenges in transitioning from trial to full-scale deployment. They also highlight the key findings from the international review of communication protocols, and discuss the key insights from the project's research and engagement.

Lastly, **Section 8** concludes the report with a comprehensive summary of FlexTalk's conclusions and recommendations.

SECTION THREE

# Introduction

## 3.1 PROJECT BACKGROUND: WHAT CHALLENGES DOES THE INDUSTRY FACE NOW AND IN THE FUTURE?

Aotearoa New Zealand's electricity system has served the country well for the last 100+ years, providing secure, reliable, and affordable energy for all consumers. However, after decades of stability, the electricity system supporting New Zealand's modern economy and lifestyle is entering a period of unprecedented change.

New Zealand has committed to a target of net zero greenhouse gas emissions by 2050 in accordance with the Paris Agreement (2015). To meet these targets, a transformation of the industry is taking place driven by electrification of various sectors of the economy as well as by consumers as they embrace new technologies and start taking control of their energy use.

This includes a significant rise in the demand for electricity; connection of renewable intermittent energy generation (both of which increase the need for generation reserves); the addition of new and diverse technologies and services; and changing electricity demand patterns across the system.[1]

One of the biggest opportunities and challenges all distribution network operators are facing due to this rise in connections is that electricity networks were built largely for unidirectional energy flow. But as we change the way we generate, distribute, and use energy, there is a need to facilitate multidirectional flows of electricity across the network.

These changes and the speed at which they are taking place are leading to increasing levels of complexity in managing and coordinating Aotearoa New Zealand's 's power system in a way that both meets and benefits consumers' new needs and requirements, without risking power system security.

### DRIVERS OF CHANGE

The following key issues are driving changes to the traditional operational characteristics of Aotearoa's power system:

**Key driver 1:** The signing of international agreements and/or the development of new government policies on emissions reductions to combat climate change as well as government policy settings encouraging the move to electrify aspects of the New Zealand economy (i.e. transport, agriculture etc.) will hasten changes to New Zealand's energy system.

For example policies such as Electrify NZ that encourage investment in renewable electricity generation, industrial processing and domestic use so New Zealand becomes a lower emissions economy, will require significant changes to the way the electricity is generated and conveyed.

**Key driver 2:** Consumers have more options than ever to meet their energy needs. As prices for consumer DERs continue dropping, adoption of EV and PV battery systems is increasing. This can result in consumption patterns with more variability and higher peaks and troughs at the consumer level.[2]

Evolving consumer requirements are transforming power system dynamics in two ways. First, consumer choices are more directly driving investment trends by increasingly valuing services that use energy (e.g., heating, cooling, hot water, etc.). Secondly, technology innovations are enabling active consumer participation, a step change in how consumers participate in meeting their energy supply and demand requirements through distributed resources (i.e. solar panels, EVs, home energy automation and storage).[3]

**Key driver 3:** The connection of numerous new devices and loads at the lowest voltage levels makes the operation of distribution networks more dynamic and unpredictable. This contributes to significant new technical challenges to the performance and quality of electricity supply both at the local level as well as higher voltage levels. For example, the connection of vehicle-to-electric-grid technology will enable bidirectional electricity flow between distribution networks and EV batteries.

However, the dynamic characteristics and potential for disaggregated control of many of these new devices can also provide the mechanism for their effective integration into the distribution networks. This could be enabled through several approaches, including consumer incentives.[4]

An example has been demonstrated overseas in trials where automated structures for charging and discharging electric vehicles based on real-time market signals have been successfully implemented.

As the sophistication of monitoring and control devices continues developing, these devices can be used to achieve fully optimised control levels.

It is also important to highlight that as electrification increases to meet climate objectives, there will be an ever-increasing dependence on electricity for daily activities. Thus, it is crucial to ensure that reliability of the grid continues to match the pace of electrification.

**Key driver 4:** The requirement to provide access to electricity market ecosystems for consumers and new market actors is increasing and diversifying. This trend is taking the shape of greater direct consumer electricity market participation, including both generation and demand response.

1 Boston Consulting Group. (2022). The Future is Electric.
2 Pelka, S., Chappin, E., Klobasa, M. & de Vries, L., (2022). Participation of active consumers in the electricity system: Design choices for consumer governance. Energy Strategy Reviews, November, Issue 44, p. 100992
3 Ofgem. (2023). Smoothing the Journey engaging domestic consumers in energy flexibility.
4 Electricity Authority. (2024). The Future Operation of the New Zealand Power System.

**FIGURE 1:** DESIGNING A CONSUMER CENTRIC ENERGY SYSTEM


Source: CSIRO and Energy Networks Australia, 2017: Electricity Networks Transformation Roadmap: Final Report

The emergence of new players, such as flexibility suppliers (including load aggregators, commercial/industrial customers, retailers etc.) necessitates the development of transparent and more straightforward methods for engaging with the electricity system.

This is crucial for achieving scalability while minimising the risks of disruption. Retailers and other market participants will seek generation and network support to deliver new services on behalf of consumers.[5]

The primary obstacle lies in formulating operational approaches that provide the maximum societal benefit, all while navigating the challenge of overseeing market responses as part of achieving a resilient system operation from a technical standpoint.

### 3.1.2 WHY IS THERE A NEED FOR FLEXIBILITY?

Power system flexibility relates to the power system's capacity to effectively navigate and adapt to changes. As such, demand flexibility will be an important tool in electrifying New Zealand's economy to the greatest extent possible while maximising the use of renewable energy resources.

As New Zealand moves towards a fully decarbonised economy, solutions providing advances in flexibility will be of the utmost importance in the operation and planning of the future power system. Flexibility in the energy system can contribute to resolving the key challenges of scaling the intermittent renewable energy system and driving decarbonisation in at least three ways[6]:

1. Avoiding the curtailment of renewables by utilising flexible demand such as EV charging, battery storage charging, or green hydrogen production at times of high supply.
2. Avoiding the deployment of peak generation capacity (presently typically provided by hydro but may require building new natural gas generation plants to meet future peak demand needs) by, for example, managing demand-side response.
3. Deferring grid and network infrastructure investment by improving utilisation.

From a consumer perspective, there will be an opportunity to play a more active role in managing individual power usage directly, or indirectly through a flexibility service provider. The most obvious benefit is potential consumer cost savings through 'time of use' pricing, where electricity costs less in low-demand periods.[7]

Demand flexibility also supports the coherent integration of other technologies like water heating, solar PV and batteries, maximising self-consumption across a network of home appliances and enabling the selling of electricity or interruption capability.

[5] Sapere. (2020). Distributed Energy Resources Understanding the potential.
[6] O.M. Babatunde, J.L. Munda, Y. Hamam. (2020) Power system flexibility: A review. ISSN 2352-4847, Energy Rep., Volume 6 (Supplement 2), pp. 101-106
[7] Boston Consulting Group. (2022). The Future is Electric.

From a supply perspective, demand flexibility benefits electricity providers as they can easily shift or reduce demand during peak periods and call upon additional dispatchable supply. Demand flexibility also helps offset or defer costly generation, grid, and network capacity upgrades (i.e. more poles and wires).

However, to enable this future, load aggregators (that is flexibility service providers) should be able to communicate with consumers, networks, generators and system operator markets, or maximum benefit will not be realised. They must deal with a variety of devices/proprietary software to gain visibility and dispatch services. Therefore, open communication standards/protocols are among the key enablers of flexibility facilitating the exchange of network information, pricing signals, and control signals.[8]

International open access standards can help boost market participation, cost efficiency, ease-of-access, and allow for faster and more seamless data connection and exchange.

### 3.1.3 VALUE STACK

As DER (including solar power, energy storage and energy management systems) further proliferate, opportunities emerge to provide value beyond electricity. They offer a variety of services allowing reception of revenue forms and compensation, known as value stacking, by providing benefits to consumers, utilities, and the grid.

One benefit is that when DER are aggregated and controlled together, they can offset traditional generation resources. They can also reduce and shift electrical load on-site, lowering monthly utility bills and avoiding peak demand charges.

They further have the potential to provide services to the grid, such as improved management of demand response and participation in wholesale energy markets to help regulate power; this is particularly useful for balancing the intermittent patterns of wind and solar generation.[9]

DER can provide a wide range of system services depending on where they are connected and their technical characteristics, as outlined in *Table 3*.

**TABLE 3: THE POTENTIAL VALUE STACK OF SYSTEM SERVICES THAT DER CAN PROVIDE**

| TYPE OF SERVICE | ACTIVITY | CURRENT AVAILABILITY |
|---|---|---|
| **Energy and capacity** | Energy | currently available |
| | Firm capacity | currently available |
| **Ancillary services** | Inertial response | potential in the future |
| | Fast frequency response | being developed |
| | Primary frequency response | potential in the future |
| | Frequency regulation | currently available |
| | Ramping reserves | being developed |
| | Contingency spinning reserves | currently available |
| | Replacement non-spinning reserves | currently available |
| | Voltage support | currently available |
| | Black-start capability | currently available |
| **Transmission services** | Transmission upgrade deferral | being developed |
| | Transmission congestion Relief | being developed |
| **Distribution services** | Distribution upgrade deferral | being developed |
| | Distribution voltage support | being developed |
| | Distribution loss reduction | potential in the future |
| **End-use applications** | Power quality | potential in the future |
| | Reliability and resiliency | potential in the future |
| | Demand management | currently available |

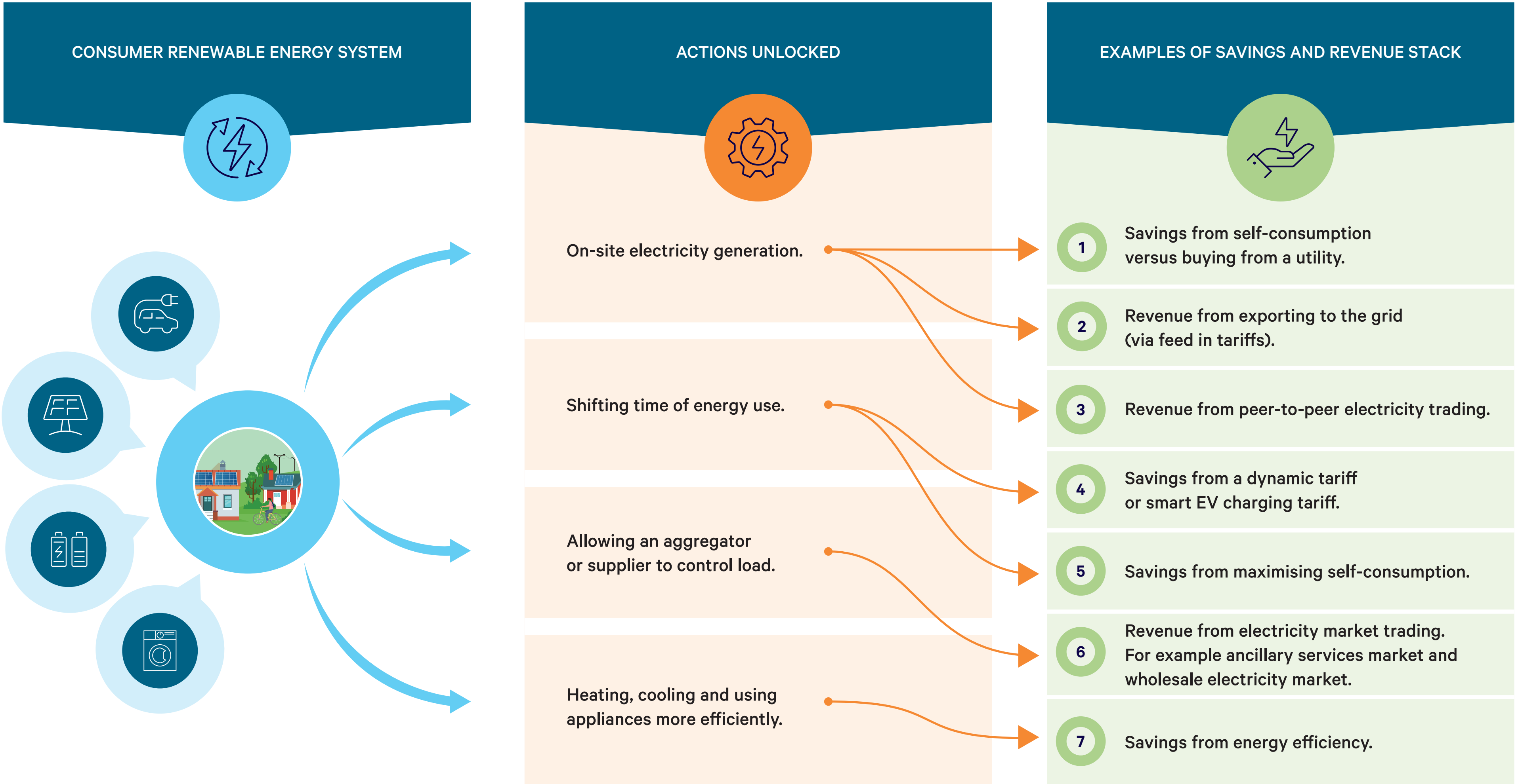
(green) = currently available (orange) = being developed (red) = potential in the future

However, as a relatively new concept, DER aggregation and value stacking face significant challenges, and technical frameworks and regulation are not yet well established to allow provision of a full range of services.[10]

The following *Figure 2* demonstrates the potential value stack that could be released through flexibility.

[8] AEMO and Energy Networks Australia. (2019). Open Energy Networks - Interim Report. Required Capabilities and Recommended Actions.
[9] Sapere. (2020). Distributed Energy Resources Understanding the potential.
[10] Project Symphony. (2022). Work Package 2.3 DER Service Valuation Report.

**FIGURE 2:** VALUE STACK



### 3.1.4 WHY IS THERE A NEED FOR INTEROPERABILITY?

Interoperability is the ability of different information technology systems and software applications to communicate, use, and exchange data accurately, effectively, and consistently. Examples of interoperability abound in telecommunications and internet protocols. For example, WiFi allows connecting devices at home, in the workplace, at a coffee shop or whilst travelling around the world using the same standard protocols. This should be the aim for devices connected to the energy system.

A growing number of devices connecting to the energy system have the potential to connect to the Internet and possibly offer additional functionalities. This collection of connected devices is commonly known as the Internet of Things (IoT).

Currently, there are many device types operating independently of each other, particularly on the consumer end behind trade-protected proprietary hardware or software interfaces. Known as behind-the-meter equipment, devices such as EV chargers, or rooftop solar systems when deployed in large numbers, can have a detrimental effect on electricity supply stability if unmanaged.

In most cases, these technologies are not visible to the electricity system operator, and network operator, and are not controllable. Moreover, as consumer demand for electricity is expected to increase as consumers switch from conventional internal combustion engines vehicles to EVs, or replace fossil fuel heating with electric alternatives, additional stress will be placed on the electricity supply system.

To ensure the resilience of the electricity supply system, all embedded technologies in the IoT ecosystem should ideally work together, or interoperate as outlined in *Table 4*.

If interoperability via standardised functionality is not mandated, there is a risk that companies will develop proprietary systems that will only work in silos. Ensuring interoperability means taking actions to ensure all devices connecting to the electricity system have an integrated interface to enable the device to receive and react to external (open) signals.

The interface will need to be integrated to meet regulated communication requirements or any simple firmware change to the device control system to ensure communication is always maintained. To achieve this, international co-operation in the development of common standards and protocols is required.

**TABLE 4: THE KEY ASPECTS REQUIRED TO ACHIEVE INTEROPERABILITY**[11]

| | |
|---|---|
| **Technical interoperability** | Devices are capable of both physical and digital integration.<br>Basic connectivity is a foundational element to enable technologies to speak to one another. |
| **Syntactic interoperability** | Devices should use a common digital language.<br>Communicating between and among technologies and devices requires using the same language fosters semantic interoperability. |
| **Semantic interoperability** | Understanding specific instructions using a standardised set of recognised commands between and among technologies ensures semantic interoperability. |

### 3.1.5 WHAT IS THE IMPORTANCE OF STANDARDS/OPEN PROTOCOLS?

#### Importance of standardisation

The ever-increasing number of DER connecting to the power system can be good for the grid, but only if it can be fully integrated within the system. Therefore, the role of technical standards in supporting DER's successful integration for the long-term benefit of electricity consumers is crucial. These standards cover aspects including the installation of solar PV, inverters, batteries or EV systems, grid connection of these devices and communication protocols.[12]

Technical standards are documents that set out the specifications, procedures, and guidelines to ensure the safety, consistency and reliability of the products, services and systems we interact with. Unless cited in legislation or commercial contracts, standards are a guide and are not mandatory.

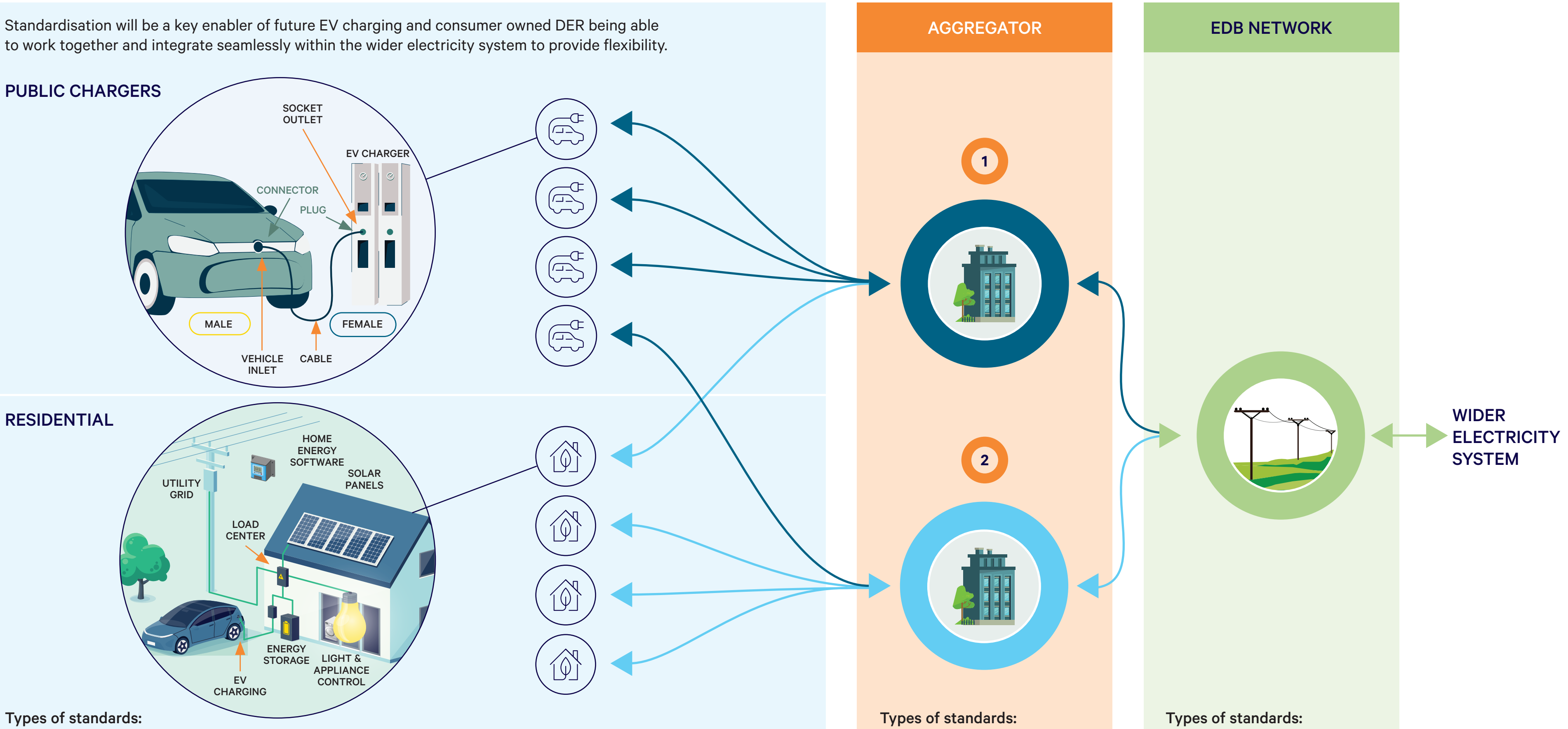
Optimal performance in digital value chains is achieved through minimal barriers to entry and standardised approaches to accessing and disseminating information.

[11] IEA Technological Collaboration Programme – International Smart Grid Action Network

[12] FTI Consulting (December 2021). DER interoperability assessment framework: An assessment framework to develop interoperability policy for distributed energy resources in Australia. Energy Security Board.

**FIGURE 3:** THE IMPORTANCE OF STANDARDISATION

Standardisation will be a key enabler of future EV charging and consumer owned DER being able to work together and integrate seamlessly within the wider electricity system to provide flexibility.




Types of standards:

- Connection standards
- Behavioural standards

Types of standards:

- Behavioural standards
- Interface standards

Types of standards:

- Interface standards
- Information model standards

### Open standards

To make the flexibility services available to all and achieve a level of interoperability (via standardised functionality) in control and switching, greater levels of standardisation (preferably through open access protocols) is essential. The absence of open protocols and standards will result in significant cost to develop private or limited access digital infrastructure by all networks, market operators, and aggregators.

However, it is important to carefully select the timings to strike a balance between the level of standardisation facilitating innovation, whilst also considering local requirements while maintaining a competitive supply chain for cost efficiency.

Open standards and communication protocols achieve shared outcomes while retaining flexibility allowing interactivity, especially for open source developers. These standards allow devices, services, and applications, to work together across a diverse 'network of networks'. They also offer freely accessible specifications, are unencumbered, have open development, and continuously evolve.

Open standard system benefits include[13]:

» Coordinated decentralised optimisation where the volume of local data overwhelms the capability to transfer the data back to central control systems and SCADA.

» Low latency (i.e. delay in communications) for situations where centralised sites are too far away to respond promptly.

» Resiliency when portions of the grid or network are segmented.

» Open, observable, and auditable interfaces at multiple scales of interoperability.

» Interoperability with existing plant and without having to replace or undertake costly augmentations of the system.

» Unified design for reduced operational expenditure, simplified management, and enhanced security.

## 3.2 PROJECT CONTEXT

### 3.2.1 WHAT IS OpenADR?

Open Automated Demand Response (OpenADR) provides a non-proprietary, open, standardised, and secure demand and DER management interface that allows electricity providers to communicate signals directly to existing consumers using a common language and existing communications infrastructure such as the Internet.[14]

The OpenADR standard provides an implementable framework describing all aspects of the OpenADR interfaces, including servers or Virtual Top Nodes (VTNs) and clients or Virtual End Nodes (VENs). It describes services, interactions, transport protocol and security combined with strict conformance statements enabling scalability and interoperability. VTNs have a one-to-many relationship with VENs, and VENs have a one-to-one relationship with VTNs.

This creates a scalable 'tree' of VEN-to-VEN messages through different interoperable parties. See *Figure 4* below depicting how OpenADR acts as a communication protocol with various actors in the electricity supply chain.

In 2019, the International Electrotechnical Commission (IEC) approved the OpenADR 2.0 profile specification as an international standard (IEC 62746–10–1).[15] It is publicly available, free and can be downloaded from the OpenADR Alliance website, openadr.org.

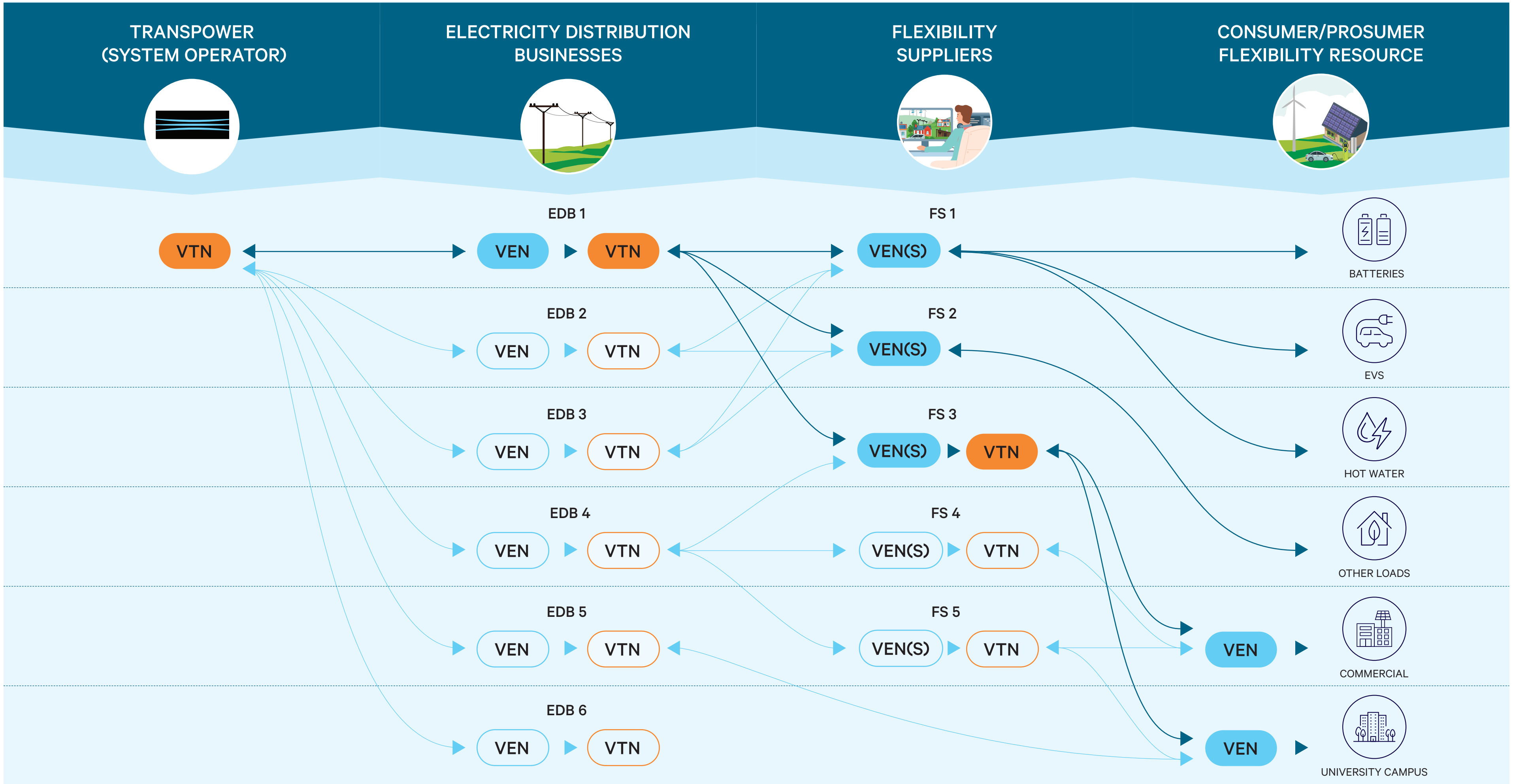
FlexTalk utilised the OpenADR 2.0 standard in its testing.

[13] Maxwell, E (February 2006). Open Standards, Open Source, and Open Innovation: Harnessing the Benefits of Openness. Innovations Technology Governance Globalization 1(3):119-176

[14] OpenADR Alliance (2011) The OpenADR Primer: An Introduction to Automated Demand Response and the OpenADR Standard, https://www.openadr.org/

[15] OpenADR Alliance (2019), OpenADR 2.0b Specification Receives Approval as an IEC Standard, https://www.openadr.org

**FIGURE 4:** OPENADR TREE STRUCTURE



### 3.2.2 WHY OpenADR?

The decision to trial OpenADR is due to its 'non-device level control protocol' status, which enables consumer choice and participation in DER management.

Further, open (non-proprietary) solutions foster market participation by providing open access and non-bespoke technical solutions. New Zealand's 29 EDBs create complexity for new flexibility suppliers joining the market and connecting/operating flexibility services. A standardised replicable solution like OpenADR mitigates technical barriers to entry.

The renewable energy transition along with the introduction of flexibility provides a platform for new markets and competition. Competition in how flexibility is traded ultimately benefits consumers through downward electricity price pressure.

### 3.2.3 HOW DOES FLEXTALK SUPPORT THE MARKET-LED MODEL?

The 'market-led model' is a logical progression from the current state (utility-led model), which is facilitated by economic incentives and the establishment of new commercial entities (see *Section 4.3* for detail).

As identified in *Section 3.1.5*, digital value chains operate best with low barriers to entry and standardised methods of accessing and sharing information. This is ably demonstrated in software, where APIs permit ready access to functions and information between disparate systems; for example, retailers connect to courier networks with APIs, ensuring shipment pickups and tracking.

OpenADR serves a similar purpose, except in the place of APIs, it is a single, standard protocol supporting the business-to-business (B2B) communications necessary for flexibility services; procurement and supply. FlexTalk tested the dispatch, reporting and monitoring elements of OpenADR.

This project demonstrates how the system operator, distribution system operators (DSOs), transmission system operators (TSOs), and flexibility suppliers might integrate OpenADR into backend systems, achieving real-world end-to-end connectivity for messages and responses.

With OpenADR, DSOs and TSOs communicate with flexibility supplier back-end systems, trading flexibility services through the creation and transmission of offers and bids and communicate dynamic operating envelopes closely matching their technical asset capabilities, thereby managing and reducing peak demands in near real time.

OpenADR can provide back-up direct command requests for emergency load shedding, creating an emergency backstop maintaining security of supply. The protocol is complete with guidelines with which participants can develop their own flexibility support systems with a known, secure standard tested in the real world, greatly reducing development time, cost and risk.

Further, in addition to the OpenADR implementation guide, FlexTalk has produced its own 'technical guide' for industry to leverage as a starting point to implementing OpenADR. *FlexTalk: OpenADR Technical Insights*.[16]

## 3.3 PROJECT PURPOSE AND OBJECTIVES

FlexTalk designed and evaluated the processes necessary for the OpenADR 2.0 (2.0a and or 2.0b) communication protocol to achieve interoperability between EDBs and flexibility suppliers (aggregators) and actively manage EV and battery charging, enabling the use of flexibility services in Aotearoa New Zealand's electricity sector.

While FlexTalk focussed on the OpenADR 2.0 standard, we acknowledge there are multiple communication protocols. These are discussed within this report, which also addresses OpenADR's suitability in a local context.

[16] EEA/EECA (2024), FlexTalk: OpenADR Technical Insights, www.eea.co.nz

### 3.3.1 WHAT ARE FLEXTALK'S STRATEGIC GOALS?

**FIGURE 5:** STRATEGIC GOALS

| PROTOCOL | INTEROPERABILITY | SUITABILITY | STANDARDISATION | ACCEPTANCE | INTEGRATION |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Demonstrate active managed charging of EVs through the implementation of a common communication protocol | Illustrate that this protocol can be extended more generally to manage different loads and distributed generation across any platform or system (facilitating flexibility and interoperability) | Assess the suitability of OpenADR in the New Zealand context to facilitate these services | Working with industry to create a guide that achieves consistency in New Zealand and is adopted by the electricity industry | Achieving user acceptance, demonstrated by customers using and investing in smart infrastructure | Enabling intermittent renewable generation to be integrated into the electricity industry, to assist with New Zealand's renewable generation targets |

### 3.3.2 WHAT ARE FLEXTALK'S KEY OBJECTIVES?

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

## 3.4 PROJECT SCOPE

The project scope covers active EV charge management, observing (via a common communications protocol) the impact to EDBs, flexibility suppliers and consumers. Latterly the project extended its scope to include batteries with the ability to signal charge/discharge and report on battery status. This scope inclusion was possible as FlexTalk utilised the Aurora and SolarZero VPP, mapping the existing API to OpenADR signals. *Note battery signalling was only tested between Aurora and SolarZero, not wider FlexTalk partners.

**Included in scope are:**

» Open ADR 2.0 (A and B standard).

» Communication security.

» Development of Virtual Top Node (VTN).

» Development and deployment of 2.0 Certified Virtual End Node (VEN), software or hardware.

» Hardware/software for 2.0 Certified VTN and VEN.

» Three EDBs (Aurora, Electra and Orion).

» Three flexibility services providers/aggregators with end customer access. (Evnex, OpenLoop and SolarZero) *Note, the supplementary addition of SolarZero trialled battery management with back office test battery as opposed to testing with direct customers.

» Commercial EV smart chargers/EV management systems.

» Residential EV smart chargers.

» Direct end customers (smart charger ready).

» Residential batteries (connected to solar).

» Ancillary services.

» Charger/vehicle status and ability to take load.

» Battery status and ability to receive charging signals.

» Consumer reaction to experience of active charging (EV only).

» EV and battery charger response and status.

» Connection and integration into EDB IT systems.

» Control command communication of demand response device from flexibility provider.

» Assessment of OpenADR's fit for New Zealand.

» OpenADR comparison with alternative demand response control protocols (e.g. IEEE 2030.5).

**Out of scope:**

» Financial market.

» Consumer incentives.

» Distribution system operator (DSO) operating models or systems.

» Commercial agreements for demand response incentives.

» Load shifting trials and analysis.

» Communication links, e.g. broadband, cell, fibre.

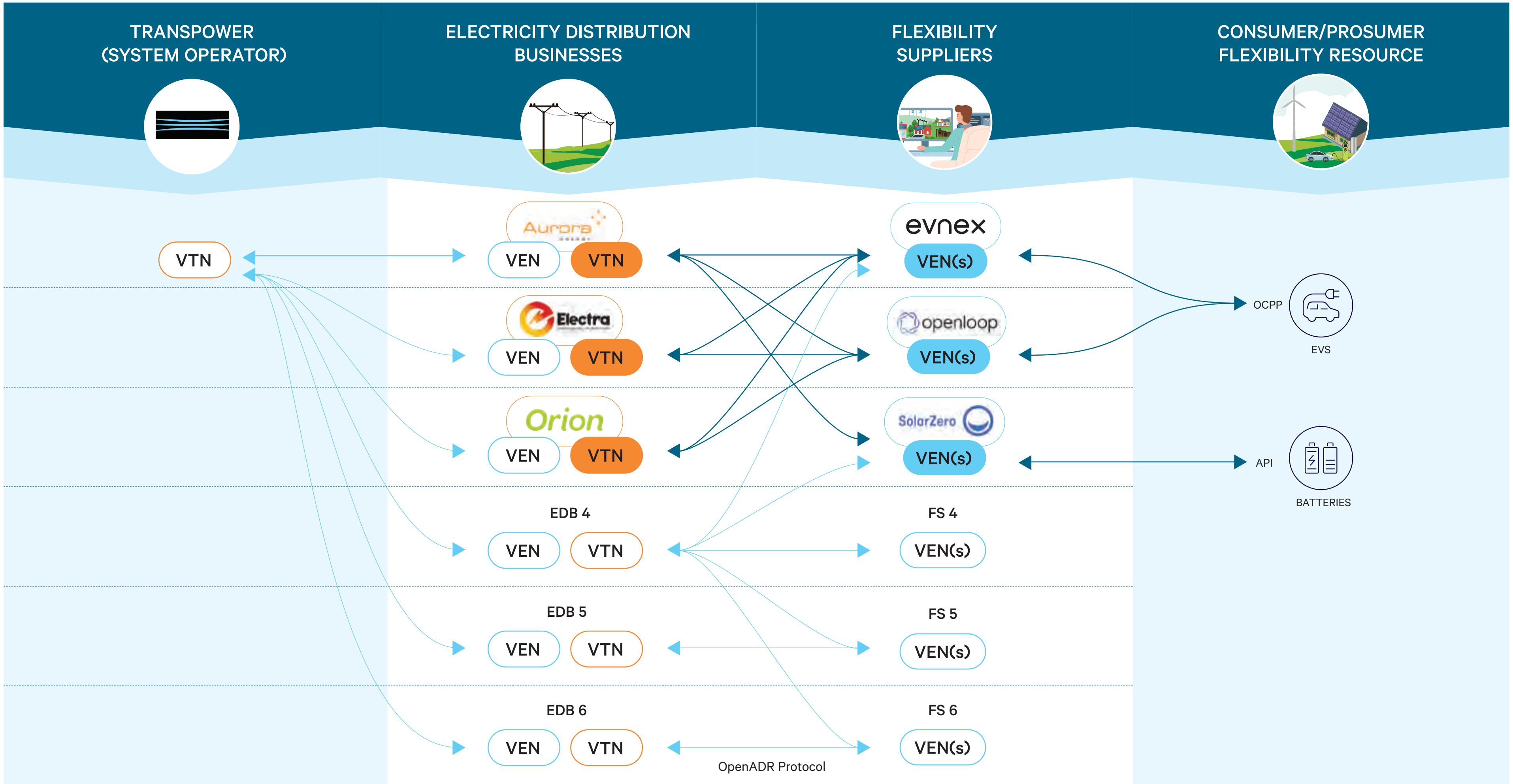
» Electrical infrastructure.

» Policy.

» Data standards.

» Wider interoperability.

**FIGURE 6:** FLEXTALK OPENADR STRUCTURE DEPICTING SCOPE



SECTION FOUR

# Project Approach

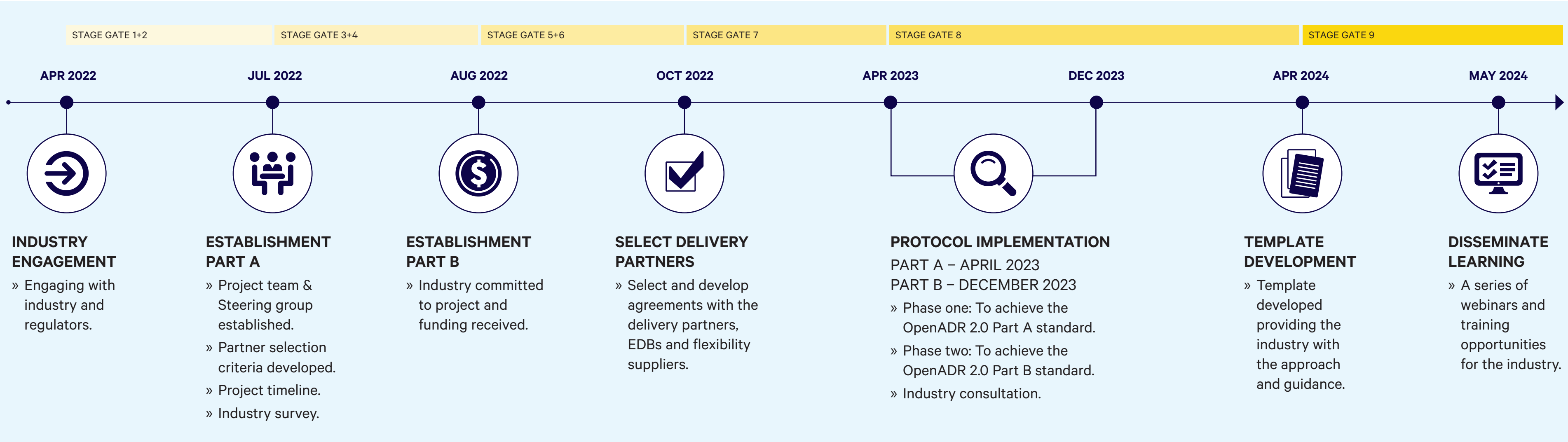


4

## 4.1 PROJECT PHASES

The project was split into seven phases with the aim of ensuring pan-industry participation in each phase from defining project's strategic goals and objectives, trial design, implementation, trial delivery, and report creation to sharing learnings with the wider industry. *Figure 7* below shows high-level activities per phase.

**FIGURE 7:** PROJECT PHASES



## 4.2 PROJECT TEAM

The project team comprised cross-sector industry specialists. An industry steering group governed the project, with all technical and design decisions enacted by the Project Design Team. Delivery partners were responsible for implementing and testing OpenADR.

**TABLE 5:** PROJECT TEAM

| PROJECT STEERING GROUP |
|---|
| **P Berry** – EEA (Industry) |
| **B Fitzgerald** – EECA |
| **G Coates** – South Island EDB representative |
| **R Kuggeleijn** – Retail Sector |
| **B Abernethy** – Electricity Retailers |
| **B Bennett** – Ara Ake (Future Energy) |
| **W Qureshi** – Asset Management Group representative |
| **E Pellicer** – EV Industry |
| **Q Tahau** – Transpower |
| **J Tipping** – North Island EDB Representative |
| **A Davison** – Electricity Authority |

| PROJECT DESIGN TEAM | | | |
|---|---|---|---|
| PROJECT LEAD | INDUSTRY DESIGN TEAM | PROJECT DELIVERY PARTNERS | BUSINESS ANALYST |
| **C Dunbar** | **R Griffiths** – Electronet (Chair) | **Technical Lead** Cortexo | **Assurity Consulting Limited** |
| | **M Smith** – Vector | **EDB** Orion | |
| | **E Trolove** – Orion | **EDB** Aurora | |
| | **T Paddy** – Cortexo | **EDB** Electra | |
| | **L Zheng** – WEL | **Flexibility Supplier** Evnex | |
| | **R Beatty** – Independent | **Flexibility Supplier** OpenLoop | |
| | **R Watson** – Northpower | | |
| | **M Richardson** – Transpower | | |
| | **S McNab** – University of Canterbury – EPECentre | | |
| | **B Fitzgerald** – EECA | | |
| | **S Johnston** – EEA | | |
| | **J Levy** – Mercury | | |

## 4.3 PROJECT MODEL

The project model emerged from a 2021 investigation into future operator models by the South Island Distribution Group[17], examining how EDBs could assist with energy transition through flexibility resources management, including DER. Further work is being conducted in this vein by the Northern Energy Group (NEG)[18] and the Future Network Forum (FNF)[19] with similar models produced discussing the EDB/aggregator relationship for delivery of flexibility.

That research produced three operating models representing the current state (utility-led), a likely future state (price-led), and a transition state required in the coming years in support of the transition (market-led).

These are termed:

**Utility-led:** Describes the current state where EDBs directly control DER (such as electric storage hot water systems) in consumer installations with little or no consumer interaction, or even their knowledge of control events. Consumers are offered reduced tariffs for ceding control. However, without clear drivers or benefits from reducing peak demand, over recent years many EDBs have decided not to maintain demand control systems such as ripple injection plants.

**Market-led:** Seen as a logical progression from the current state. Additional parties undertake new roles creating a market. Consumers offer DER to flexibility suppliers, otherwise known as a load aggregator, which trades on their behalf by offering combined control to a Distribution System Operator (DSO) and Transmission System Operator (TSO). Conversely, the TSO and DSO procure services through flexibility suppliers, effectively bidding for the right to access the DER resources, but only in bulk via flexibility supplier back-end systems. Importantly, the DSO and TSO no longer have direct and guaranteed control access to consumers DER resources but establish (potentially non-exclusive) commercial arrangements.

**Price-led:** Represents a future state where decisions are made by consumer-premise smart devices responding autonomously to real-time distribution and transmission prices. An algorithm in the smart device determines whether the 'bid' price is reflected in real-time price is sufficient to encourage behavioural change, such as reducing hot water or EV charge. With low demand and reduced real-time pricing, consumers might increase demand. While the retail industry is moving toward real-time pricing, such sophisticated signalling mechanisms are not yet available to distribution and transmission operators.

FlexTalk utilised the market-led operating model that enables value-stacking, unlocking maximum electricity consumer value and creating a revenue stream from service purchasers back to the CER owner. The model removes the complexity of consumer-managed CER/DER in real time by abstracting real-time CER/DER management and monetising the value.

The market-led model provides necessary scale required by DSOs and TSOs for efficient operation, while supporting an opportunity and value proposition for flexibility suppliers.

By providing a staged approach, regulators can enable the value chain without major market structure changes. Finally, the market-led model also facilitates access for new, technology-savvy market entrants, who can use existing protocols for management of multiple edge devices, aggregating flexibility resources for value creation.

4

[17] South Island Distribution Group (2021), Our Clean Energy Future – Engaging with our key stakeholders
[18] Northern Energy Group (NEG) (2024), DSO Evolution
[19] ENA NZ, Future Networks Forum, https://www.ena.org.nz/fnf/

**FIGURE 8:** A MARKET-LED/CONTRACT-LED MODEL (INTRODUCTION OF A FLEXIBILITY SUPPLIER)

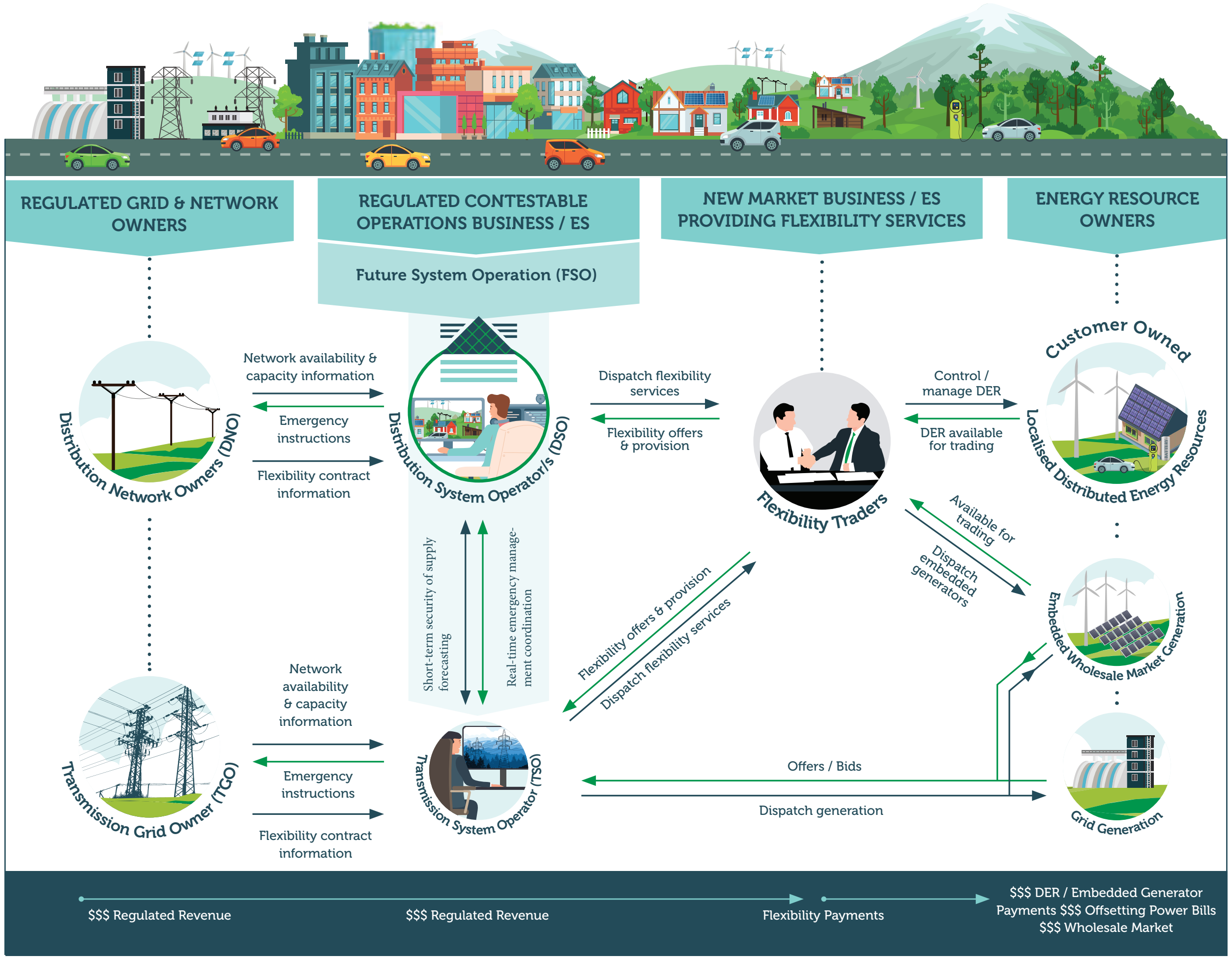



Figure 4: Market-Led Model #2

### 4.3.1 HOW DOES FLEXTALK SUPPORT THE MARKET-LED MODEL?

FlexTalk evaluates OpenADR as a suitable communications standard for flexibility services procurement and supply. The project demonstrates how DSOs, TSOs, and flexibility suppliers can integrate OpenADR into backend systems, providing end-to-end connectivity for ‘real world’ messaging and response signals.

The project also confirms OpenADR as suitable for DSO and TSO communication with flexibility supplier back-end systems; trading flexibility services through the creation and transmission of offers and bids; communicating DoE closely matching DSO and TSO technical asset capabilities to manage and reduce peak demand in near real time.

OpenADR provides back-up direct command requests for emergency load shedding, creating an emergency backstop proposition to maintain supply security.

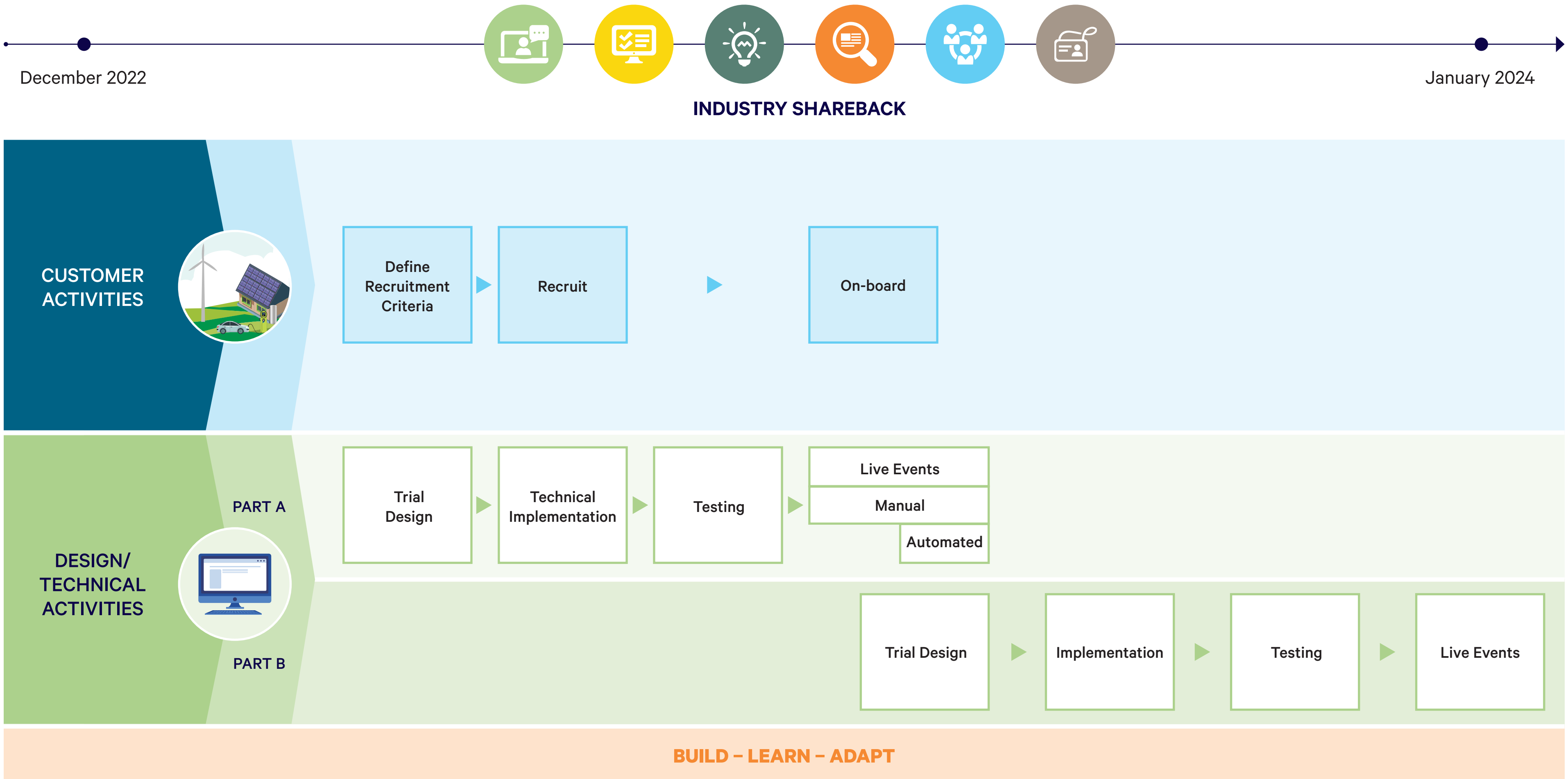
Finally, FlexTalk provides guidelines with which participants can rapidly develop their own flexibility support systems with a known standard protocol tested in the real world, greatly reducing development time, cost and risk.

SECTION FIVE

# The Trial

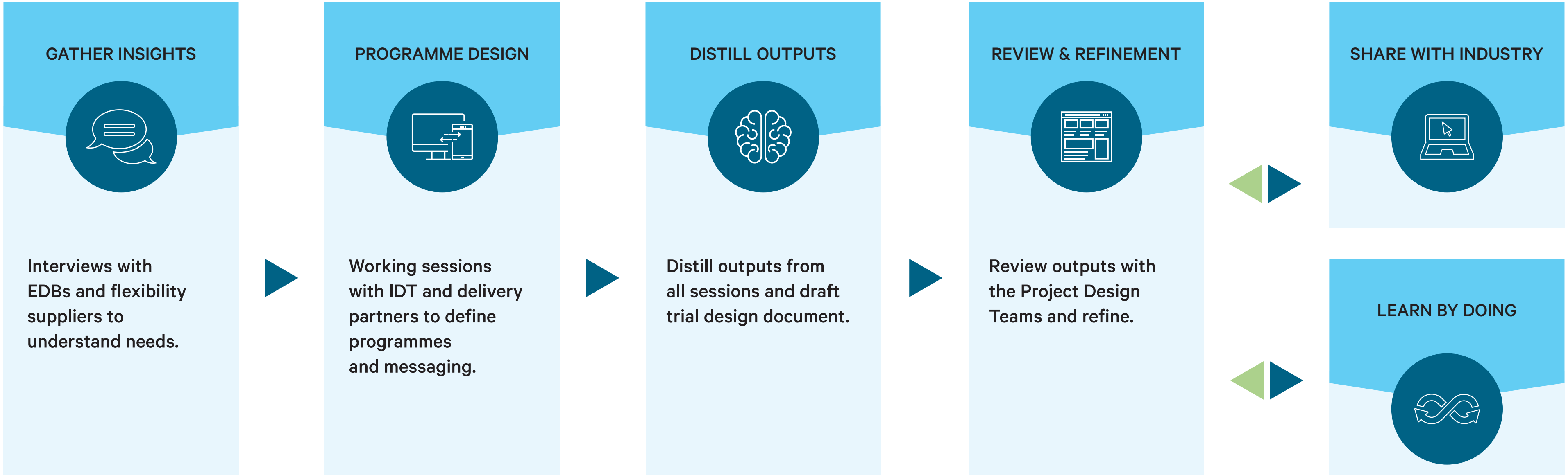
Phase seven, the Protocol Implementation phase, involved the activities depicted in *Figure 9* below is discussed in detail in the subsequent section.

**FIGURE 9:** THE TRIAL ROADMAP



## 5.1 TRIAL DESIGN – METHODOLOGY

**FIGURE 10:** TRIAL DESIGN METHODOLOGY




A design process examined what is necessary for the application of OpenADR in New Zealand while informing the demand flexibility programs to be tested in the trial. *Figure 10* above shows the trial methodology used to inform the trial design inputs. It focuses on gathering insights from user groups (EDBs and flexibility suppliers) and uses a 'learning by doing' approach followed throughout the trial delivery.

Initial workshops run with the Project Design Team included the following objectives:

» Determine the **trial methodology** (customer onboarding criteria, results capture, determining event schedule and success criteria).

» Determine the **scenarios** where flexibility is required (what are the triggers to dispatch flexibility requests?).

» Design the **flexibility programs** (what does the message flow need to be? When are reports sent/received?).

» Design the **reports** (what data/information is needed to participate in flexibility dispatch?).

## 5.2 TRIAL DESIGN – OUR CUSTOMERS

The project recruited customers representative of EV customer segments. It was mandatory for customers to be part of delivery partner networks as represented in *Figure 11*.

Further recruitment criteria included customers with:

- Varying EV battery sizes.
- Varying charging behaviour (day vs. night, charging frequency).
- Varying locations (geographical split, rural vs non-rural).
- Differing driver behaviour (kilometres travelled per week, weekday vs. weekend car users).
- Other attributes: charging from solar, retail tariff customers.

The customer cohort comprised:

- 22 residential customer chargers.
- 56 workplace (commercial) customer chargers.

Workplace (commercial) customers were further split by:

- Workplace – chargers provided at employee's home.
- Workplace – overnight charging fleet.
- Workplace – daytime charging available.

All delivery partner customers matching onboarding criteria were surveyed during onboarding to recruit to trial. FlexTalk targeted a minimum 50 customers and recruited a total of 78 from Evnex and OpenLoop. During the project, 20 commercial customers had to be withdrawn due to building load management hindering chargers accepting smart charging profiles, and one residential customer withdrew to participate in alternate EV trial, taking the total customer count to 57.

**FIGURE 11:** EDB DELIVERY PARTNER NETWORK LOCATIONS

5

## 5.3 TRIAL DESIGN – OUR TRIGGERS

When designing FlexTalk flexibility programs, the team first determined the use cases for flexibility i.e. the circumstances under which flexibility is needed, and the current scenarios where networks call on non-network solutions to solve network constraints.

**TABLE 6: FLEXTALK DEFINED USE CASES (TRIGGERS)**

| TRIGGER | DEFINITION |
|---|---|
| 1 **Temporary Distribution Network Constraint** | Physical network constraints forecast ahead of time, enabling connection of additional renewable distributed generation.<br>This could include management of thermal limits on the medium-voltage/high-voltage network or on low-voltage network. |
| 2 **Power Quality Issues** | Power quality issues caused by:<br>» Low voltage on the LV network due to high demand.<br>» High voltage on the LV network due to solar PV or low demand. |
| 3 **Unplanned Outage Management** | A short notice network event requiring reconfiguration (e.g. a severe weather event). |
| 4 **Planned Outage Event** | Pre-scheduled, planned maintenance. |
| 5 **Network Investment/Deferral Replacement** | Controlling peak demand on networks facing capacity constraints due to demand increase caused by electrification.<br>Defers the need for large capital investment in network infrastructure. |
| 6 **Grid Emergency** | Grid emergency notice received from the system operator requiring immediate response to reduce demand or increase generation. |
| 7 **System Operator/Market Support** | The system operator calls for offers reducing demand, particularly during times of constraints such as extremely dry years.<br>This may include market mechanisms funding participation. This could also occur through a reserves market with money offered to customers making available fast response load shedding. |

## 5.4 TRIAL DESIGN – OUR PROGRAMS

When designing how flexibility may be called, the team determined the process steps and behaviour for flexibility services dispatch, monitoring, and reporting.

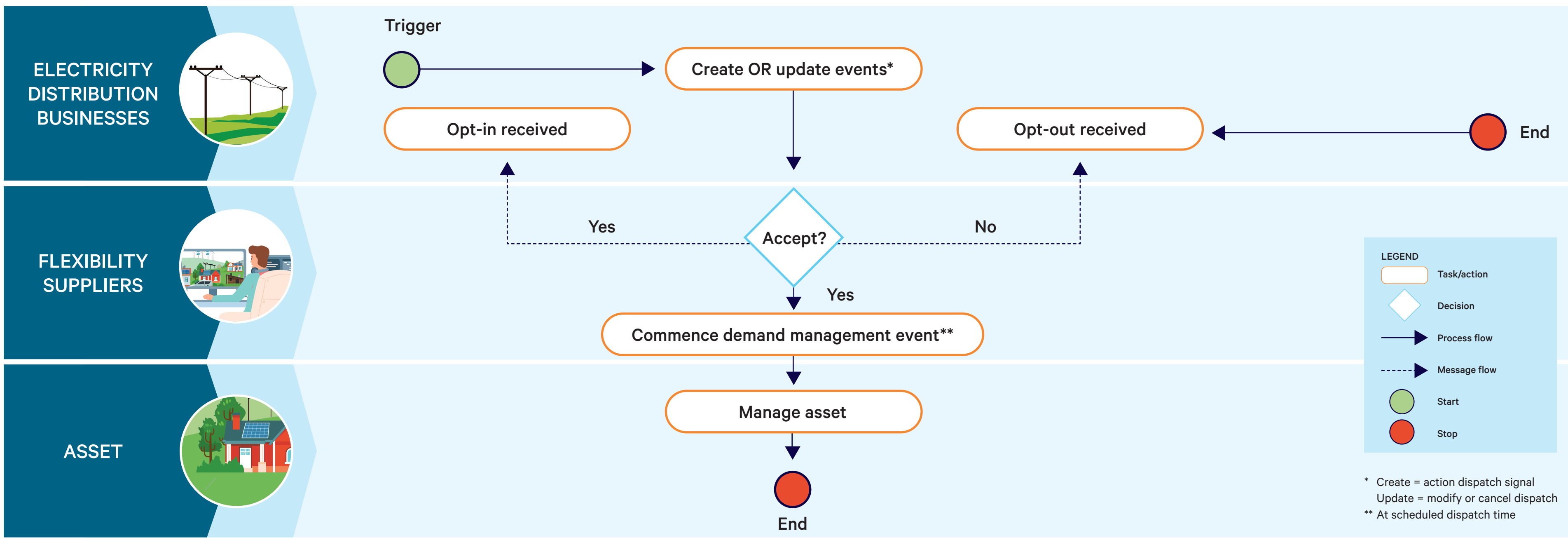
The OpenADR 2.0 Demand Response Program Implementation Guide[20] provides demand response program templates with predefined messaging structure and behaviour for a range of use cases – including EV, thermostat control, and more.

FlexTalk took a unique design approach which avoids pre-determination of the program design. Instead, a 'clean slate' approach saw the project design team define needs and desired program behaviour.

Mapping the OpenADR specification (messaging structure and signals) to this process design ensures programs are designed by industry for industry (whilst meeting the specification). Designed over four workshops, the process and set of programs were iteratively developed throughout trial delivery.

The following visual depicts a typical process for dispatch, monitoring and reporting on flexibility, showing some of the steps that may happen pre-event, during event or post event. The event behaviour and attributes are specific to a program (as defined per program below).

**FIGURE 12:** EXAMPLE PROGRAM PROCESS FLOW DEPICTING TYPICAL ACTIONS BETWEEN ACTORS




20 OpenADR 2.0 Demand Response Program Implementation Guide (2016)

## THE PROJECT DESIGN TEAM DEFINED SEVEN PROGRAMS:

### *In Advance*

The *In Advance* program is generally used for planned demand management events. *In Advance* and *Dynamic* programs use the same signals differentiated by market context. The concept of the *In Advance* program is alerting flexibility suppliers to future events (in days) with time and payload updated prior to event start. Usually, event modification messages occur (for example) an evening prior to start.

**Market Context:** https://openadr.flexibility.nz/advance

| Signal Name | Signal Type | Payload |
|---|---|---|
| load_dispatch | delta | An increase or decrease of a specified amount of *powerReal* in kW. |

### *Dynamic*

The *Dynamic* program is generally used for unplanned demand management events in the immediate future. *In Advance* and *Dynamic* programs use the same signals differentiated by market context. The *Dynamic* program alerts flexibility suppliers to 'near future' events (in hours) with the details of event time and payload unlikely to change.

**Market Context:** https://openadr.flexibility.nz/dynamic

| Signal Name | Signal Type | Payload |
|---|---|---|
| load_dispatch | delta | An increase or decrease of a specified amount of *powerReal* in kW. |

### *Emergency*

The *Emergency* message normally corresponds to system operators issuing a CAN (Customer Advice Notice) or GEN (Grid Emergency Notice). The signal indicates a predefined load reduction with 3 being the highest level (100%) and 0 being no reduction or maintaining normal operation. The flexibility supplier must act on *Emergency* events.

**Market Context:** https://openadr.flexibility.nz/emergency

| Signal Name | Signal Type | Payload |
|---|---|---|
| simple | level | 3 = 100% load reduction |

### *PR Bid*

The *Price Responsive Bid* event contains a load amount and a price. If the flexibility supplier achieves the event requirements and accepts the bid price, it responds with an 'opt-in' message. If it cannot, the response is an 'opt-out' message.

**Market Context:** Market Context: https://openadr.flexibility.nz/bid

| Signal Name | Signal Type | Payload |
|---|---|---|
| load_dispatch | delta | An increase or decrease of a specified amount of *powerReal* in kW. |
| electricity_price | price | A price in $/kWh. |

*PR Discovery*

The *Price Responsive Discovery* event contains a load amount and a price. The price is the maximum bid acceptable, lower offers are requested. If the flexibility supplier achieves the event requirements it responds with an 'opt-in' message and an offer price. If it cannot, it responds with an 'opt-out' message. Unsuccessful offers receive event 'cancellation' messages. If the event remains live, the offer is accepted.

**Market Context:** https://openadr.flexibility.nz/discovery

| Signal Name | Signal Type | Payload |
|---|---|---|
| load_dispatch | delta | An increase or decrease of a specified amount of *powerReal* in kW. |
| electricity_price | price | A price in $/kWh. |

*Dynamic Operating envelope (DoE)*

The *Dynamic Operating Envelope* event alerts flexibility suppliers to network import and export limits at a particular asset point. The event contains multiple time periods representing peak, shoulder, off-peak, or at the extreme, trading periods typically defined over a 24-hour period.

**Market Context:** https://openadr.flexibility.nz/doe

| Signal Name | Signal Type | Payload |
|---|---|---|
| x-import_upper_limit | TBA | TBA |
| x-export_lower_limit | TBA | TBA |
| x-export_limit | TBA | TBA |

*Battery Level (specific to SolarZero)*

The *Battery Level* event is used to charge or discharge storage resources (which could be one or many at a target location).

**Market Context:** https://openadr.flexibility.nz/battery_level

| Signal Name | Signal Type | Payload |
|---|---|---|
| load_dispatch | setpoint | An increase or decrease of a specified amount of *powerReal* in kW. |

For visual representation showing each program's event sequence see *FlexTalk: OpenADR Technical Insights*[21]



[21] EA/EECA (2024), FlexTalk: OpenADR Technical Insights, www.eea.co.nz

## 5.5 TRIAL METHODOLOGY – OUR REPORTS

Reports enable data visibility assisting participants in dispatch, monitoring and reporting pre-, during- and post flexibility events. Reports designed for Part B of the trial enabled two-way communication. Reporting is thus provided from VEN to VTN.

The reports for FlexTalk trial were polled for every 5 minutes, with data presented in dashboard view.

The following reports were defined by the project design team to test during FlexTalk's initial trial design workshops:

| REPORT NAME | DETAIL |
|---|---|
| **Telemetry History/Post event report** | Telemetry history – at a specific target area, displays what happened with load profile over time. |
| **Charger State/Service Availability** | Usage at a specific target (GXP, site, VEN) displaying device count plugged in, charging, offline (comms) or charger fault.<br>Data aggregated power in kW every 5 minutes. |

Example reports can be found in *Appendix 9.2.*

The following reports were defined as useful when engaging in flexibility dispatch, monitoring and procurement but not built/tested during project:

| REPORT NAME | DETAIL |
|---|---|
| **Power Quality** | Aggregated data at VEN displaying power max/min voltage and frequency. |
| **Forecasting** | Forecast of available flexible capacity.<br>Assesses network operator risk and provides LV network insights. |
| **Battery Output** | Shows battery charge/discharge over event duration. |

## 5.6 TRIAL DELIVERY METHODOLOGY – PART A AND B

The OpenADR trial was split into 2 phases enabling the team to start with the simpler specification (2.0a) before trialling more complex elements available with 2.0b.

Trial Part A focused on applying OpenADR 2.0a to achieve one-way communication from the EDB to the flexibility supplier.

This phase established FlexTalk, testing two of the seven designed flexibility services (programs). Part A tested 'SIMPLE' signals as depicted in *Figure 13* below.

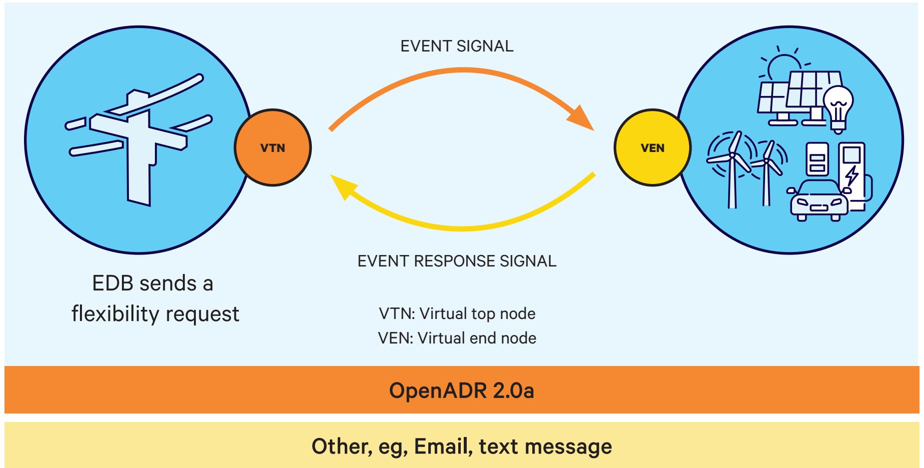
*Figure 13* illustrates OpenADR 2.0a communication flow for trial Part A, summarised as follows:

An Event Signal refers to the signals communicated via OpenADR from the EDB to the flexibility supplier. Part A used SIMPLE messaging structure with signal levels 0 to 3 mapped. Each identified demand flexibility program has a defined messaging structure (see *Appendix 9.1 Trial Part A Simple Signal 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 the VTN. However, any additional information sent from the flexibility supplier to the EDB sits outside OpenADR e.g., email or text message communication.

For Part B of the trial the Event Response signal occurred via OpenADR.

**FIGURE 13:** PART A SIMPLE SIGNAL ONE-WAY DISPATCH OF FLEXIBILITY REQUESTS FROM EDB TO FLEXIBILITY SUPPLIER




Part B of the specification allows testing of complex two-way communication from EDB to flexibility supplier. This includes requests for specific load reduction amounts, sending pricing signals, and reporting on load reduction, EV charger status, and battery status as depicted in *Figure 14*.

**FIGURE 14:** PART B COMPLEX 2-WAY DISPATCH OF FLEXIBILITY REQUESTS AND REPORTING BETWEEN EDB AND FLEXIBILITY SUPPLIER

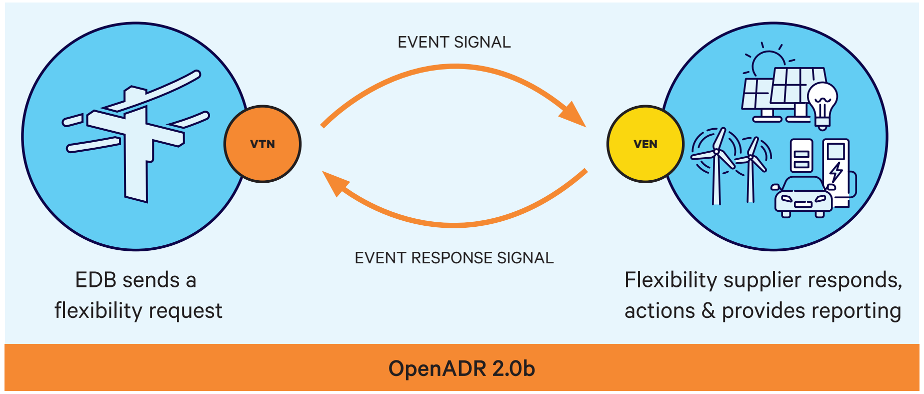



*Table 7* below shows the programs applicable to the 2.0a and 2.0b specification:

**TABLE 7:** PROGRAMS SPLIT BY 2.0A AND 2.0B SPECIFICATION

| Program Name | A | B |
|---|---|---|
| In Advance | | ✓ |
| Dynamic | ✓ | ✓ |
| Emergency | ✓ | |
| PR_Bid | | ✓ |
| PR_Discovery | | ✓ |
| DoE | | ✓ |
| Battery Level | | ✓ |

## 5.7 TRIAL DESIGN – TECHNICAL SOLUTIONS AND TRIAL CONFIGURATION

Assisting the implementation process, Transpower provided access to its Flexibility Management System (FMS) FlexPoint™ which is certified for OpenADR 2.0.

EDB delivery partners could integrate with the FlexPoint system to establish the OpenADR VTN connection or use the GUI (graphical user interface).

Using FlexPoint in Part A simplified the implementation process allowing accelerated deployment of demand flexibility programs using OpenADR.

The communication flow from the flexibility supplier to the EV chargers is outside core trial scope.

The flexibility suppliers used existing communication protocols (OCPP/OCPI). FlexTalk assessed the flexibility suppliers' ability to receive a message and correctly action with the EV charger and battery; the project has supported integration from the VEN to the flexibility suppliers' Charge Point Management System (CPMS).

The high-level technical architecture of how an EDB will connect is depicted below.

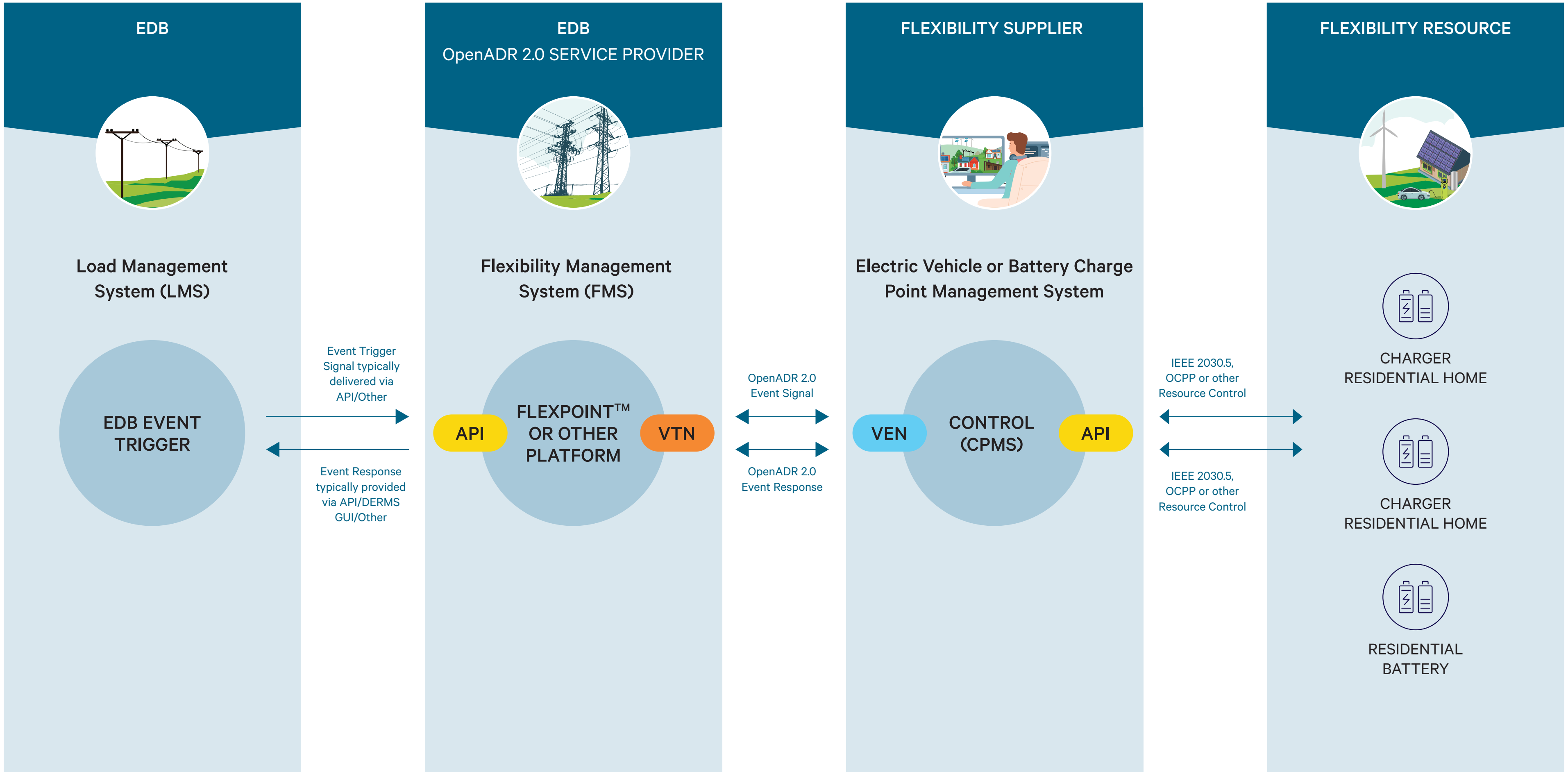
Two further VTN solutions were used in Part B of FlexTalk. This enabled testing several solutions simulating how EDBs may use various products and approaches if deploying outside trial settings. Grid Fabric's Canvas Cloud and Cortexo FlexSplice Hub were available for delivery partners to utilise.

The example – OpenADR Structure diagram below (*Figure 15*) shows the FlexTalk trial configuration (with white background) and depicts how a VTN talks to many VENs, but a VEN can talk to only one VTN. See *Figure 6. FlexTalk OpenADR Structure* depicting scope in *Section 3.4* above. The VEN 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) displaying events, which can be edited, or manually accepted or rejected. There is a second business logic layer taking database events and creating signals to send commands to EV chargers. For the FlexTalk trial, all flexibility supplier partners integrated with a third party VEN.

5

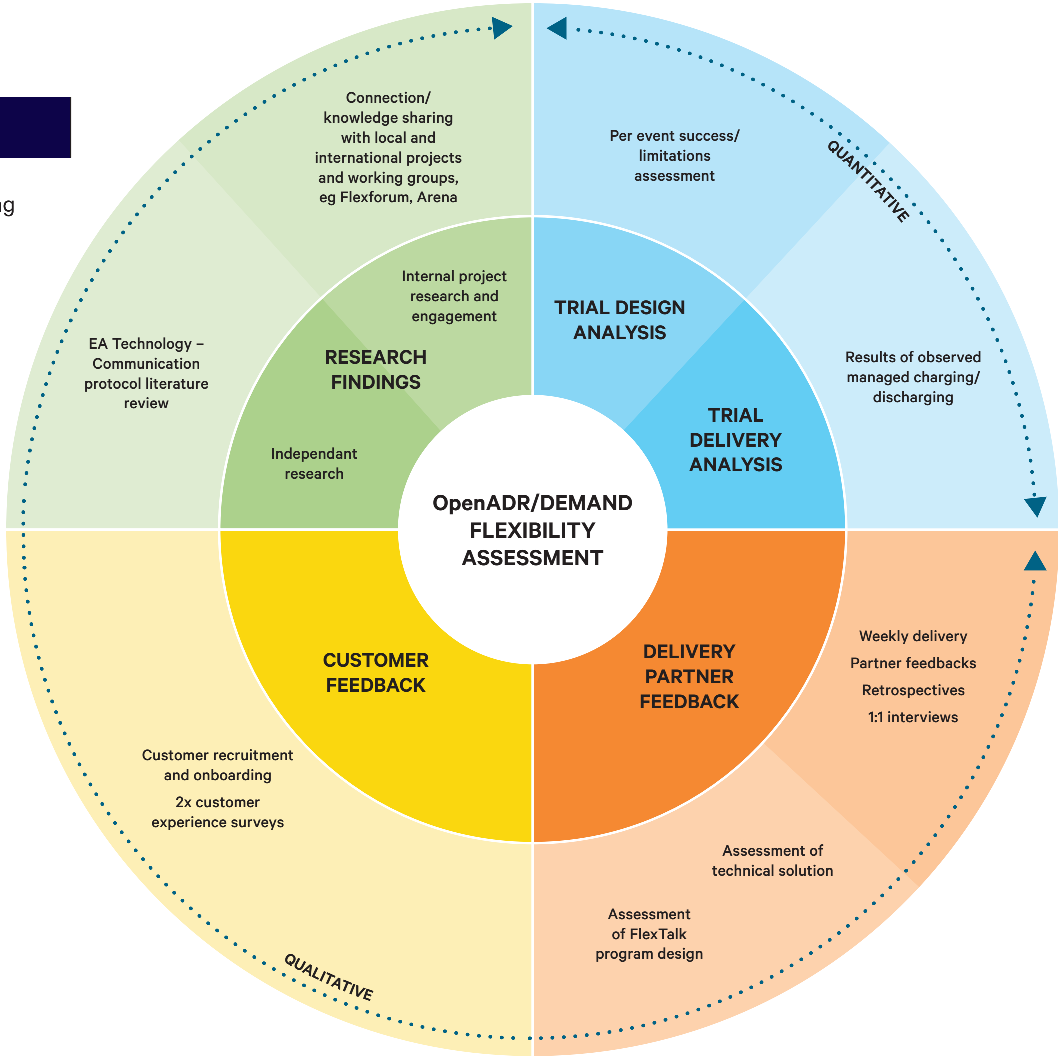
**FIGURE 15:** FLEXTALK PROJECT MODEL – TRIAL CONFIGURATION



## 5.8 TRIAL ASSESSMENT

**FIGURE 16:** OPENADR ASSESSMENT WHEEL

Assessment of OpenADR and the wider considerations of flexibility were gathered using various approaches depicted in *Figure 16* below. The subsequent section details the findings/results gathered using each method.



SECTION SIX

# Our Findings

## 6.1 TRIAL DESIGN

The following section covers the OpenADR trial, discussing the results and conclusions drawn in relation to the trial design (use cases and programs designed) and further to this 6.2 trial delivery (analysis of the events deployed).

A key FlexTalk objective was to **determine the use cases for flexibility services** (when flexibility is needed and what scenarios might prompt the need for flexibility services) **and create process maps for these scenarios**.

### 6.1.1 TRIGGERS/USE CASES

The team determined the types of network scenarios likely to trigger the need for flexibility services as detailed in above *Section 5.3 Trial Design – Our Triggers*. These triggers inform the inputs of the demand flexibility programs.

The triggers (or 'use cases') for flexibility are deemed typical; however, this does not limit the scope of what might trigger an event. It was pertinent to design the reasons/needs to inform how programs (flexibility events) would behave.

### 6.1.2 PROGRAM DESIGN

Following defining typical scenarios (triggers), program design commenced.

FlexTalk took a unique approach to design, implement, and test its own programs. The OpenADR alliance has defined programs per DER type (in the OpenADR implementation guide 2.0); the OpenADR messaging is flexible enough that messages can be bundled to behave as the parties see fit. This enabled programs suitable for New Zealand, designed by industry for industry.

Program design characteristics used to inform event behaviour included:

» *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 can the EDB forecast the event and provide advance notice?

*Table 8* below shows the high-level program attributes designed by EDBs and flexibility suppliers with wider input from the project design team during trial design, and details if they were deemed fit for purpose. Suggested enhancements are also captured.

For full program design details see *Section 5.4 Trial Methodology – Our Programs* above.

**TABLE 8:** FLEXTALK DEFINED PROGRAM ASSESSMENT AND COMMENTARY

| PROGRAM NAME | OpenADR SIGNALS | FIT FOR PURPOSE (Y/N) | COMMENTS AND RECOMMENDED ENHANCEMENTS |
|---|---|---|---|
| In_Advance | **Part A:** N/A<br>**Part B:**<br>Signal = LOAD_DISPATCH<br>Signal Type = Delta | Y | |
| Dynamic | **Part A:** SIMPLE<br>**Part B:**<br>Signal = LOAD_DISPATCH<br>Signal Type = Delta | Y | |
| Emergency | | Y | Operationally the emergency program should cause an immediate stoppage with no ability to ignore i.e. 'stop everything now' (In FlexTalk, flexibility suppliers had the option to opt-out). |
| Price Responsive Offer (PR_Offer) | **Part A:** N/A<br>**Part B:**<br>Signal 1 = LOAD_DISPATCH<br>Signal Type = Delta<br>Signal 2 = ELECTRICITY_PRICE<br>Signal Type = Price | Y | |
| Price Discovery (PR_Discovery) | **Part A:** N/A<br>**Part B:**<br>Signal 1 = LOAD_DISPATCH<br>Signal Type = Delta<br>Signal 2 = ELECTRICITY_PRICE<br>Signal Type = Price | Y | |
| Dynamic Operating Envelope (DoE) | **Part A:** N/A<br>**Part B:**<br>Signal = x-EXPORT_LIMIT<br>Signal Type = Level<br>Signal = x-IMPORT_UPPER_LIMIT<br>Signal Type = Level<br>Signal = x-IMPORT_LOWER_LIMIT<br>Signal Type = Level | N | FlexTalk demonstrated DoE using OpenADR. An EDB could send an envelope ahead of time and modify it during the day based on real-time SCADA and target a specific area or asset.<br>However, the DoE program design requires further industry input/refinement.<br>A suggestion is to allow negative numbers (to maintain minimum generation – high voltages in the middle of the day when solar panels are exporting power into the network). FlexTalk-designed DoE did not allow for this, though it could be achieved or handled by including the ability to allow negative numbers as payload. |

### 6.1.3 DELIVERY PARTNER FEEDBACK

Feedback from delivery partners was that all programs are fit for purpose and met requirements with the exception of DoE as outlined in *Table 8* above.

It was further highlighted that the emergency program should disable the ability for flexibility suppliers (or customers) to opt-out, as in an emergency there would be no choice to ignore the request to cease consumption. Due to the trial setting, flexibility suppliers and customers could opt-out of flexibility requests.

It was noted that whilst FlexTalk designed and tested pricing programs (PR Bid and PR Discovery) it is unlikely they would be implemented soon due to system maturity; however, FlexTalk did test the ability to send pricing signals, as this is a likely requirement for the future energy system.

It is likely all programs will evolve with the maturity of the New Zealand energy system. A call out from delivery partners was that ultimately, the contract between EDB and flexibility suppliers (or actors engaging in flexibility) will determine program behaviour such as notification message timing and further event logic.

There is an opportunity to standardise the industry flexibility programs and further reduce technical and contractual complexity between EDB, flexibility supplier, and customers. A maintenance mechanism could be established to ensure flexibility programs are reviewed and can evolve based on industry needs.

Note, programs could be altered between EDB/flexibility supplier if they have differing requirements. The intention is not stifling innovation, but rather providing for the establishment of 'core programs' for differing requirements, with the option of adding new programs, rather than running multiple versions of an existing program.

It is worth noting that UK Distributors have taken this approach by standardising 'flexibility products'[21] under four offerings (Sustain, Secure, Dynamic, Restore), with further development underway to evolve these products.

OFGEM UK[22] notes: "An agreed format for the categories of information that need to be shared to achieve a successful transaction can lower barriers to entry for new participants. It can also help flexibility providers and purchasers to participate across multiple platforms."

The Market Development Advisory Group (MDAG)[23] further recommends standardisation of flexibility services in its paper 'Price Renewables', writing:

> **"Standardisation will limit technical barriers and ability for EDB and flexibility suppliers or further grid configurations to operate in a uniform manner".**

[21] Flexible Power: https://www.flexiblepower.co.uk
[22] OFGEM: https://www.ofgem.gov.uk Flexibility Platforms in Flexibility Markets (2019)
[23] Market Development Advisory Group (MDAG): Price Discovery in a Renewables-Based System: Final Recommendations Paper (2023) https://www.ea.govt.nz

### 6.1.4 WHAT CHALLENGES WERE OBSERVED WHEN DESIGNING AND TESTING PROGRAMS?

Several challenges were noted through the design and deployment of the programs within FlexTalk.

**Design Challenge 1: Nomenclature**

Unfamiliar terminology required agreement by all parties on the meaning of terms. The team had to cement mutually agreed definitions to understand what element was being designed and to assign shared meaning. These definitions included:

**Trigger:** Defined by the team to mean network scenarios (use cases) that are likely to trigger the need for flexibility services.

**Program:** The particular events (or services) designed to achieve flexibility. Typically including event information such as signal type, event notification period, pricing details etc.

**Design Challenge 2: SIMPLE Signal Behaviour**

As aforementioned, Part A of the OpenADR specification allows for 'simple signals' mapped to level (0,1,2,3). It is the user's responsibility to define the meaning of each level. The project design team determined that levels should reflect a percent change from baseline. Each flexibility supplier provided baseline flexibility capacity to EDBs. The intended behaviour is a reduction in the capacity of what is already occurring with charging.

During the trial, it came to light that the interpretation of signals had been implemented differently by each flexibility supplier. One partner had interpreted as 'charge at 75% of full charging capacity' while another interpreted this as action a '75% reduction of full charging capacity'. The latter was the intended behaviour the EDB wanted. Once initial interpretation was resolved and remedied, signals behaved as expected per mapping.

This shows that ambiguity can be observed in new service design, as these are unchartered waters and novel problems to solve. Design documentation and ultimately contractual agreements must provide clarity to ensure it is interpreted the same across the participating actors to achieve the desired outcome.

There may be some alignment/understanding hurdles as new services are designed and implemented. A 'learn by doing' approach was explored in FlexTalk, enabling the team to trial simple signals and feedback on behaviour to ensure the solution design met the expectations of the participants.

**Conclusions:**

FlexTalk identified key use cases for flexibility and designed and trialled six fit-for-industry programs, providing confidence that the protocol works for the use cases identified for the New Zealand energy system.

It is recommended that industry utilise the core set of programs designed and tested as a starting point and that there is further consultation with industry on programme design in readiness for these to be published in a New Zealand version of the OpenADR guide as standardised flexibility programs.

Challenges were observed and solved during the trial in relation to nomenclature and intended behaviour of SIMPLE signals, proving the need to collaborate to solve and design flexibility services to cement understanding with all industry actors.

## 6.2 TRIAL DELIVERY

The trial (Part A and B) was designed to assess the OpenADR protocol based upon a minimum of 100 observed events. The key project objective for trial Part A and B was to demonstrate communication protocol interoperability between EDBs, flexibility suppliers, and consumers.

The below *Table 9* shows the summary of events deployed for EV designed programs through Part A and B of the trial.

### 6.2.1 EV PROGRAM RESULTS

**TABLE 9:** EV EVENT SUMMARY – PART A AND B

| | PART A | PART B |
|---|---|---|
| **No. of events dispatched** | 42 | 91 |
| **No. of modifications actioned** | *Not captured* | 12 |
| **Programs tested** | 2<br>(Dynamic & Emergency) | 7<br>(In_Advance, Dynamic, emergency, PR_Bid, PR_Discovery, DoE, Battery_Level) |
| **Standard tests** | 40 | 91 |
| **Simulated scenarios tested** | 2 | 0 |
| **Simulated scenarios detail** | CAN & GEN simulated | NA |
| **No. OpenADR limitations identified** | 0 | 0 |
| **Other limitations** | Two events not received at VEN due to FMS rules (event will not be sent if no DR level defined or the DR request is set to 0kW) | Two events not received at VEN due to software update in progress |
| **No. events opted in** | 30 | 63 |
| **No. events opted out** | 12 | 28 |
| **No. events where managed charging observed** | 5 | 8 |

The following table displays the active managed charging observed in Part A of the trial.

**TABLE 10: OBSERVED MANAGED CHARGING – THROTTLE DOWN ACHIEVED AT CHARGE POINT – PART A**

| EVENT REF NO | PROGRAM | LOAD CHANGE REQUESTED | THROTTLE ACHIEVED? | SPOT POWER CONSUMPTION (JUST BEFORE) | MEAN POWER CONSUMPTION (DURING) | SPOT POWER CONSUMPTION (JUST AFTER) |
|---|---|---|---|---|---|---|
| 18 | Dynamic | 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 | Emergency | Auto DR Level High. Target 67 kW | Yes | 29.6kW | 23.6kW | 29.6kW |
| 30 | Dynamic | Auto DR Level High. Target 10.5 kW | Yes | 7.4kW | 5.9kW | 7.4kW |
| 38 | Dynamic | Auto DR Level High. Target 87 kW | Yes | 7.4kW | 5.9kW | 7.4kW |
| 40 | Not specified by EDB | | Yes | 7.4kW | 5.9kW | 7.4kW |

*Target = The target kW EDB aimed to achieve.

Note, targets specified were based upon known assets and charge load at the target area (provided by flexibility supplier to EDB at commencement of Part A). The simple signal then acted as a % decrease (reduction) to charge capacity and was sent as the associated payload 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 were to be consistent across all programs for Part A applicable programs.

Actual load reduction was affected by whether vehicles were plugged in, available and charging at time of event. Further to this, there was a limit to throttle back of OpenLoop commercial chargers to no lower than 80% of maximum charging capacity. Both aspects effected the ability to achieve the targeted load reduction.

### 6.2.2 BATTERY PROGRAM RESULTS

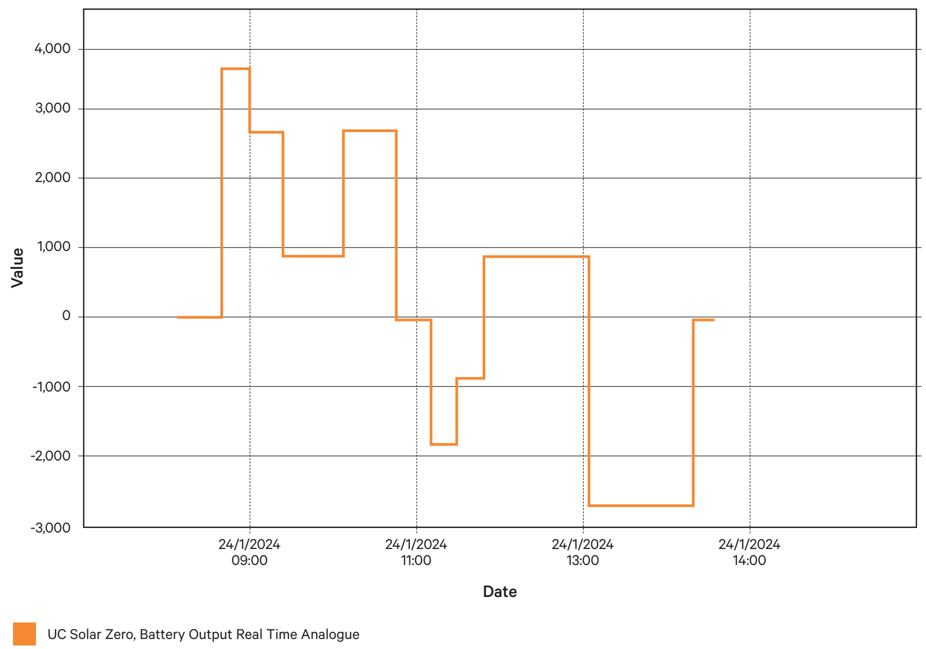
**TABLE 11:** BATTERY EVENT SUMMARY – PART B

| | PART A | PART B |
|---|---|---|
| No. of events dispatched | | 2 |
| No. of modifications actioned | | 14 |
| Programs Tested | | Battery_Level |
| Standard tests | | 2 |
| Simulated scenarios tested | | 0 |
| Simulated scenarios detail | Not applicable | NA |
| No. OpenADR limitations identified | | 0 |
| Other limitations | | 0 |
| No. events opted in | | 2 |
| No. events opted out | | 0 |
| No. events where managed charging observed | | 2 |

The above *Table 11* shows the summary of events deployed for battery programs through Part B of the trial.

**FIGURE 17:** OBSERVED MANAGED CHARGING – BATTERY LEVEL EVENT 1 – PART B

The following graph displays an example of the active managed charging observed in battery event on 24/01/2024.



### 6.2.3 TRIAL DELIVERY DISCUSSION

Part A acted as an enabler for getting the delivery partners started with OpenADR and participating in simple signal demand flexibility events involving one-way communication via the OpenADR protocol, testing two of the seven programs. Forty-two events were triggered through Part A, with forty standard tests deployed between EDB and flexibility supplier, and two simulated scenarios tested proving interoperability. Twenty-five events included real customers, of which five events resulted in observed managed charging.

Please note, whilst the trial commenced in March, live customer events did not commence until June. Thus 40% of Part A events occurred between EDB and flexibility supplier but were not actioned down to customer.

This can skew the results on the number of events where managed charging occurred. This did not materially affect trial outcomes as the core objective was communication between EDB and flexibility supplier, but it is worth understanding this context and limitation when reviewing the amount of load shed.

For Part A, thirty events were opted into and twelve were opted out. Opt-out was initially set as the default until business logic at the Charge Point Management System (CPMS) was defined to determine when an event should be opted in/out, i.e. what are the business rules or conditions deciding factors on go/no go for an event.

Typical reasons for opt-out include:

» **Event timing** – Event was for a duration outside of acceptable throttling hours, as previously mentioned there were stipulations that for commercial customers, managed charging could only occur between 9pm – 5am. For residential customers, managed charging was only accepted and actioned if event was set to occur between 7am – 5pm.

» **Charger schedules** – If chargers were not scheduled to be charging at the time of event and would therefore not be able to deliver requested load change, auto opt out occurred.

» **Car not plugged in** – Originally business logic was setup to automatically opt-out if no car was physically plugged in. However, this logic was revoked part-way through the trial.

» **Pricing** – Some events were opted out of in Part B due to a price signal set below $0 or below the minimum price set in business logic. One event was also opted out of due to clarification needed around the pricing unit sent (cents or dollars).

Part A enabled testing of the following simulated scenarios:

» **Scenario 1:** A Customer Advice Notice (CAN) was issued advising a Low Residual Situation. Transpower advised that national residual generation is less than 200 MW for a specified time.

» **Scenario 2:** A Grid Emergency Notice (GEN) was issued advising of Insufficient Generation Offers – National. Transpower as System Operator advised 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 suitable for directly signalling System Operator type notifications/instructions to EDBs or flexibility suppliers.

Note, for GEN event, EDBs received email communications, and were expected to trigger an emergency event using the OpenADR protocol. The desired effect being immediate stoppage of EV charging across network.

There were some limitations to full simulation of GEN event as two EDB partners were unavailable to action at time of event due to competing business as usual (BAU) meetings. One partner received and actioned GEN per instruction from system operator across the Aurora network.

FlexTalk also tested sending an emergency event directly from System Operator to flexibility supplier VEN, demonstrating a different model of OpenADR communications directly between System Operator and flexibility supplier. Note, it was possible to test this scenario due to utilising Transpower's FlexPoint system as the VTN in Part A and the Cortexo test VEN.

This test highlighted the potential for adopting OpenADR to communicate CAN and GEN if this is the standard adopted by industry. This could replace email communications of this type.


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 pl 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 ins neration and reserve offers appear in the schedules, we will send:

- A Warning notice (WRN) which will make further re rticipants to help resolve the situation. This could happen up to gate closure (7 days to 1 d of real-time).
- A Grid Emergency Notice (GEN) within one ho me which will make further requests to grid-connected consumers and distributors to t o alleviate the situation.

For more information, or if you are aw mation that could impact system security, please advise the Security Coordinator on 0.

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

Up to date island resi ation is available on the WITS website

Media enqui 1 195 8613 (please do not text)

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

### DELIVERY CHALLENGE 1

There were some initial issues with smart charger control and access to smart charging functions. A key charging manufacturer had to be contacted to resolve access issues and ability to manage charging for that charger type.

Consideration/technical knowledge may be needed to access/control charging functions. In this instance, troubleshooting was required. (this links further to End Device Functionality discussion in *Section 6.6*).

### DELIVERY CHALLENGE 2

The second issue was also related to end device functionality and necessitated removing 20 customer chargers 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, adhering to a building/site power limit) and would not accept smart charging profiles due to their load management rules.

Load management building rules may need to be considered and may limit the ability to access assets for demand flexibility.



Part B of the trial allowed for more complex interactions, including two-way communication (sending of information from VEN to VTN such as telemetry reporting, charger status reporting and pricing information). Ninety-one events were triggered through Part B, across seven program types. Sixty-three events were opted in and twenty-eight opted out. Eight EV events resulted in observed managed charging, and two battery events with multiple modifications resulted in battery charge/discharge. For Part B, two events were not received at VEN; this was due to a VTN software update inflight.

The inclusion of batteries in the trial in Part B utilised the existing contract for flexibility services between Aurora and SolarZero for a non-network solution, which calls on residential battery charge to be made available during times of grid constraints in the Upper Clutha, demonstrated that other DER could be integrated using the OpenADR protocol. Two events with many modifications behaved as expected, mimicking how the existing API for this communication behaves.

It is worth noting for Part B, two new VTN products were utilised to allow testing FlexTalk programs. This meant taking a 'building a plane whilst flying' approach at the beginning of Part B. This caused two data limitations; firstly, Cortexo VEN to VTN reporting was not operational until midway through the trial, thus data is not available to discuss the managed charging from 1 October to 1 November 2023. Secondly, The Grid Fabric license type used did not display nor store reporting data from VEN to VTN, thus the seventeen events sent from Grid Fabric VTN could not be assessed for load reduction/managed charging.

### CONCLUSIONS

No OpenADR limitations were identified through the trial, and all VTN to VEN messages were received except where business rules residing at flexibility management system level prevented it. FlexTalk provides confidence that OpenADR works for the use cases identified for the New Zealand energy system. The trial demonstrated interoperability between EDBs and flexibility suppliers to achieve active managed charging of EVs and batteries.

Further, FlexTalk provided a successful application of the protocol from the EDB to flexibility supplier and dispatch of emergency CAN/GEN from system operator to flexibility supplier VEN. This demonstrated that OpenADR would be a viable solution for any of the future system operation scenarios being considered at the Electricity Authority either by allowing direct connectivity between the SO and flexibility providers or by having connectivity happen via EDBs. The practicalities of using EV chargers for FlexTalk showed that, like hot water control, scale is a necessary consideration. Sufficient EVs would have to be plugged in, charging, and available to be curtailed at any given time. The successful inclusion of the battery case study showed that other types of DER could be readily firmed up to enhance the availability of flexible resources.

No OpenADR limitations were identified by trial partners during the deployment of 133 events across Part A and B of the trial. Thirteen events resulted in observed managed charging.

## 6.3 DELIVERY PARTNER FEEDBACK

The FlexTalk design team was integral to the successful trial of OpenADR and assessing its advantages and limitations within the New Zealand context.

Delivery partners were responsible for developing user requirements for VTN and VEN and undertaking the implementation and assessment of OpenADR.

An assessment framework leveraged from the Energy Networks Association UK[24] was used to discuss the FlexTalk experience trialling OpenADR; additionally, delivery partners provided wider insights on the key enablers and inhibitors of operationalising flexibility as discussed below.

**TABLE 12:** OPENADR PERFORMANCE AND DELIVERY ASSESSMENT METHODOLOGY

| |
|---|
| **DELIVERY** |
| Ease of implementation for all parties |
| Cost efficiency |
| **PERFORMANCE** |
| Open standard |
| Interoperability |
| Scalability |
| Security |
| Maintainability |
| Platform independency |
| Backward and forward compatibility |

Framework adapted from ENA UK.

[24] Energy Networks Association (2023), UK Flexibility Services Dispatch Interoperability, https://www.energynetworks.org/

### 6.3.1 DELIVERY – EASE OF IMPLEMENTATION

#### EDB connection of Load Management System to VTN

EDBs took varying approaches to implementing OpenADR. Connection was explored via API prototypes in Part A moving to testing of Feature Manipulation Engine (FME) and API connectivity for Part B. A GUI (graphical user interface) was also available to EDBs for manually deploying events through Part A and B.

*Utilising the GUI*

FlexPoint was provided by Transpower for Part A. This enabled the team to establish the technical solution, utilising a GUI to deploy events.

Feedback from EDBs shows that all found the GUI solution relatively easy to use once familiar with the nomenclature and program names, and once several events were deployed. GUI ease of use was further enhanced during Part B as the VTNs utilised (Grid Fabric and Cortexo) were established with FlexTalk-specific requirements (such as FlexTalk program naming) aiding with understanding.

*Automating Events*



In Part A, Aurora explored a prototype API to automate events. An event was triggered if forecasted load would exceed the load limit, Aurora was able to utilise the existing interface used for Aurora/SolarZero battery signalling; however, the control signals were incompatible (given EV programme as opposed to their operational battery management).

To simplify, Aurora used the values normally sent to SolarZero to trigger the initiation of a simple fixed program to the VTN (the API would create and schedule an event). There were some challenges such as inability to modify an event once running. This was a limitation of the implementation and design of API as opposed to a limitation of OpenADR but tested a simple automation of event dispatch.

In Part B, all partners explored integration of VTN with internal systems, with varying approaches adopted.

In Part B, Electra opted to use FME which manipulates an API to automate sending of events. Whilst this wasn't a full integration of VTN to SCADA, it demonstrated the principle of light-touch approaches that could be used to automate flexibility with little time/effort.

The inclusion of the Aurora and SolarZero case study demonstrated automation of events and gave insights into how a bespoke simple API may be mapped to OpenADR. This mapping process switched out a proprietary API for signalling battery charge and discharge to OpenADR.

The process involved using a User Acceptance Testing (UAT) system and back-office battery. While further work is needed to get the solution 'production ready', including purpose-built middleware providing translation between the ADMS environment and OpenADR VTN, establishing such as solution was not deemed technically complex. The exercise proved that an API can be mapped to OpenADR with little complexity.

Participant David Mulder of Aurora Energy comments:

> **"As the solution largely already existed, most of the effort involved consuming the new Cortexo API endpoint(s) and adapting the existing application flow to utilise these instead. There were some minor changes in messaging cadence while required additional modification of the control message submission logic, but overall, it wasn't a significant amount of effort."**

There was some hesitancy from EDBs to approach implementation as they might if the solution was under BAU settings, as the trial was exploring the protocol (and yet to determine its fit for the New Zealand context). The nature of the project design meant participants were giving time in kind, with competing BAU commitments. This factored into how EDBs approached their respective technical implementations.

#### Flexibility supplier connection of charge point management systems to VEN

All three flexibility suppliers demonstrated integration of their charge point management systems with OpenADR VEN in Part B. Business logic was defined to make sensible and automated decisions when receiving flexibility requests. One delivery partner commented on the technical solution taking one month's development time. (This was two developers at approximately thirty hours per week) to integrate CPMS with VEN and build the business logic with their smart charging interface to receive, evaluate and action each program for Part B and develop the end point for VEN to VTN reporting data. Another partner estimated resourcing commitment of five hundred hours development time. For the mapping of SolarZero existing API to OpenADR signals, this took approximately three days development time, as the bulk of the development already existed due to operational API integration with Aurora.

All three flexibility suppliers commented on the solution not being technically complex, with documentation of the specification and on the ground local support allowing ease of implementation.

For example, Evnex's Tom Rose noted:

> **"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 licence than a problem of technology."**

The following table summarises the technical approaches taken by each partner. Due to the manual nature of Part A (using GUI/manually actioning EV charging) technical ratings were gleaned only for Part B.

**TABLE 13:** EDB – DELIVERY PARTNER APPROACH AND TECHNICAL DIFFICULTY RATING

| PARTNER NAME | TECHNICAL APPROACH | | PART B TECHNICAL RATING |
|---|---|---|---|
| | PART A | PART B | (1 - EASY – 5 – DIFFICULT) |
| Aurora | API prototype used between the EDBs ADMS & Flexpoint VTN. | EV Programs -Utilised Cortexo GUI<br>Battery Programs – VTN integration with User Acceptance Testing (UAT) SCADA system. | 3/5 |
| Electra | Manual use of the Flexpoint GUI. | EV Programs – Used Feature Manipulation Engine (FME) to manipulate API and automate events (no direct integration with SCADA). | 2/5 |
| Orion | Manual use of the Flexpoint GUI. | EV Programs – Utilised GUI – Grid Fabric and Cortexo. | 1/5 |

**TABLE 14:** FLEXIBILITY SUPPLIER APPROACH AND TECHNICAL DIFFICULTY RATING

| PARTNER NAME | TECHNICAL APPROACH | | PART B TECHNICAL RATING |
|---|---|---|---|
| | PART A | PART B | (1 - EASY – 5 – DIFFICULT) |
| Evnex | Integration of VEN to CPMS (simple signals). | Integration of VEN to CPMS. DoE not implemented. | 2/5 |
| OpenLoop | Manual actioning of events (simple signals). | Integration of VEN to CPMS. DoE not implemented. | 2/5 |
| SolarZero | N/A – SolarZero not involved in Part A. | Integration of VEN to battery management system. | 1/5 |

The key challenges identified during implementation are highlighted below:

### KEY CHALLENGE 1

**Onboarding customers / charger scalability –** The approach for onboarding chargers into participating in FlexTalk trial was very manual with chargers mapped to VEN location. Operationally a solution is needed to automate this, as new chargers (or other DER) come online. This includes automating the enrolment of chargers and communicating to EDB to update what the available load is within each group.

### KEY CHALLENGE 2

**Customer data protection –** During FlexTalk, it was requested that data be shared at customer ICP level from flexibility supplier to EDB. This was deemed to be a privacy/data sharing issue and so the team explored other ways geotargeting could be achieved through trial (ICPs were mapped to a VEN location). However, this is a key learning consideration and discussion point for real-world application. This topic is discussed further with key recommendations highlighted in *Section 6.6* 'access to data and data management'.

### KEY CHALLENGE 3

**Defining business logic –** The business logic layer is particularly important. For the EDB, decisions may be made in the ADMS or in some specific software at the VTN that gets information from load management systems, ripple control signals etc.

For FlexTalk, EDB partners kept logic simple, automating events based upon artificial load limits. Determining the business logic will be central to real world deployment, and EDBs will need to determine the limits, rules and conditions that cause flexibility dispatch. All business logic would be specific to each EDB and implemented by their internal IT capability or an external software company.

For the flexibility suppliers involved in FlexTalk, flexibility suppliers noted that business logic decisions were where the complexity arose and making smart decisions about where/how events were accepted took time and effort but once defined was not technically difficult. Flexibility suppliers' business logic included rules relating to the required minimum and maximum prices acceptable for price-responsive events based on current spot prices and opt-in/out of events if meeting event timing conditions.

For further information on ease of implementation per delivery partner see *Appendix 9.6, Table 27: Delivery Partner Feedback – Part A Technical ease of implementation and extensibility* and *Table 28: Delivery Partner Feedback – Part B Technical ease of implementation and extensibility.*

### 6.3.2 IMPLEMENTATION COST

A core project objective was assisting industry participants to understand the systems investment necessary for flexibility services. Indicative costing for products utilised in FlexTalk is discussed below.

Of the utilised VTN products, FlexPoint is not available for commercial use.

» Grid Fabric has various solutions/pricing models, with Canvas Server around $15,000 – $35,000 USD per annum (excluding initial customisation).

» Cortexo FlexSplice Hub is around $15,000 NZD per annum (excluding initial customisation).

» GE's Gateway module is around $500,000 USD per annum (excluding initial customisation). The GE solution provides other features and is IEEE 2030.5 compatible so is not directly comparable.

Users can also build and certify their own VEN or VTN. If a user chose to build their own VTN, based upon FlexTalk project estimates, VTN build to certification level would be eight-10 months development time (1 FTE, full time). Note, internal software teams or external development companies may have different estimations after reviewing the codebase.

The VTN would require certification costing approximately NZ$20,000.

Certification is provided by several international test houses approved by the OpenADR Alliance. To assist with certification, a test harness is available that runs all required tests so users can confirm the product will pass. The cost for the test harness is approximately NZ$9,000.

Testing also requires the VEN or VTN to be put in specific known 'states' to enable the test to run. When submitting a VTN or VEN for certification, the user must also provide a software tool to enable the test house to put the VTN or VEN into a particular known state. Developing the specific VTN or VEN is estimated to take one month of development time.

Of the utilised VEN products, Cortexo VEN is NZ$6,000 per annum.

Users implementing their own VEN can do so with hours estimated as 1 FTE, full time development for six months and certification costing NZ$10,000. Again, the cost for the test harness is approximately NZ$9,000.

Accurate commentary on the cost of implementation is difficult owing to:

» The specific requirements of EDBs/flexibility suppliers including individual system environments and architecture or reporting/data management needs.

» Understanding what specific business rules or logic might need to be designed and implemented.

It is worth noting that any automated communication solution will require a 'brain' or flexibility management interface that is integrated with the user's load management system (EDBS) or charge point management system (flexibility supplier). Consideration also needs to be given to the purchase of separate user acceptance testing or a quality assurance system, and the need to connect to the 'other end' of the OpenADR pipe (be it the VTN or VEN) to test messages, programs, etc. prior to moving to production. Investment in integration will be required regardless of the selected protocol.

By adopting a standard, this is a 'least regrets' approach with proven interoperability and reduced bespoke development required in the long term to allow actors such as EDBs and flexibility suppliers to engage in flexibility trading.

The accompanying *FlexTalk: OpenADR Technical Insights Report* provides further insights into how industry participants might implement an OpenADR VTN or VEN.

Further details on products utilised and indicative costs can be found in *Section 9.7*.

### 6.3.3 OpenADR PERFORMANCE

As previously mentioned, the ENA UK recently defined a framework for assessing interoperable dispatch systems for flexibility. FlexTalk adopted the framework as an effective way to share observations from the FlexTalk trial against the assessment criteria.

For each performance criteria, FlexTalk has assessed whether this meets the criteria (*Table 15* below) and discussed what each criteria means and its application to FlexTalk project.

**TABLE 15:** OpenADR ASSESSMENT VS ENA (UK) PROTOCOL ASSESSMENT FRAMEWORK

| ASSESSMENT CRITERIA | OpenADR MEETS CRITERIA? |
|---|---|
| Open Standard | Y |
| Interoperable | Y |
| Scalable | Y |
| Secure | Y |
| Maintainable | Y |
| Platform independent | Y |
| Backward/forward compatible | Y |

#### Open (non-proprietary)

***OpenADR is Open Standard.*** 'Open Standard' refers to a set of specifications for a certain technology, product, or service that is publicly accessible, and has been developed (or is being developed) through a collaborative and consensus-driven process. Open Standards are designed to be implemented by anyone, without significant restrictions, enabling interoperability, compatibility, and reliability across a wide range of products and services.

***OpenADR is freely available at openadr.org*** and is collaboratively developed by the OpenADR Alliance. All members can contribute to the standard's ongoing development. It is technology-neutral and interoperable across different platforms and technologies, and flexible and adaptable.

The demand management programs created during FlexTalk were designed by EDB participants without any knowledge of OpenADR or its capabilities. The protocol is flexible enough to code with the required programs (and more).

#### Interoperable

FlexTalk proved OpenADR interoperability by exchanging messages between VTN and VEN in Part A and B of the trial. Interoperable software systems should exchange data in standardised formats such as XML, JSON, or CSV, and supporting standard protocols for data transmission, like HTTP or FTP.

OpenADR exchanges data in XML (v2.0a/b) and JSON (v3) with HTTP data transmission.

***Standards and Compliance:*** Interoperable software adheres to widely accepted open standards and specifications defining common protocols, data formats, and interfaces. The OpenADR standard which is recognised by the International Electrotechnical Commission (IEC) and published as IEC 62746–10–1.

Certification of OpenADR implementations by independent testers guarantees interoperability. During FlexTalk, three independent local and international OpenADR products were used demonstrating the effectiveness of these standards.

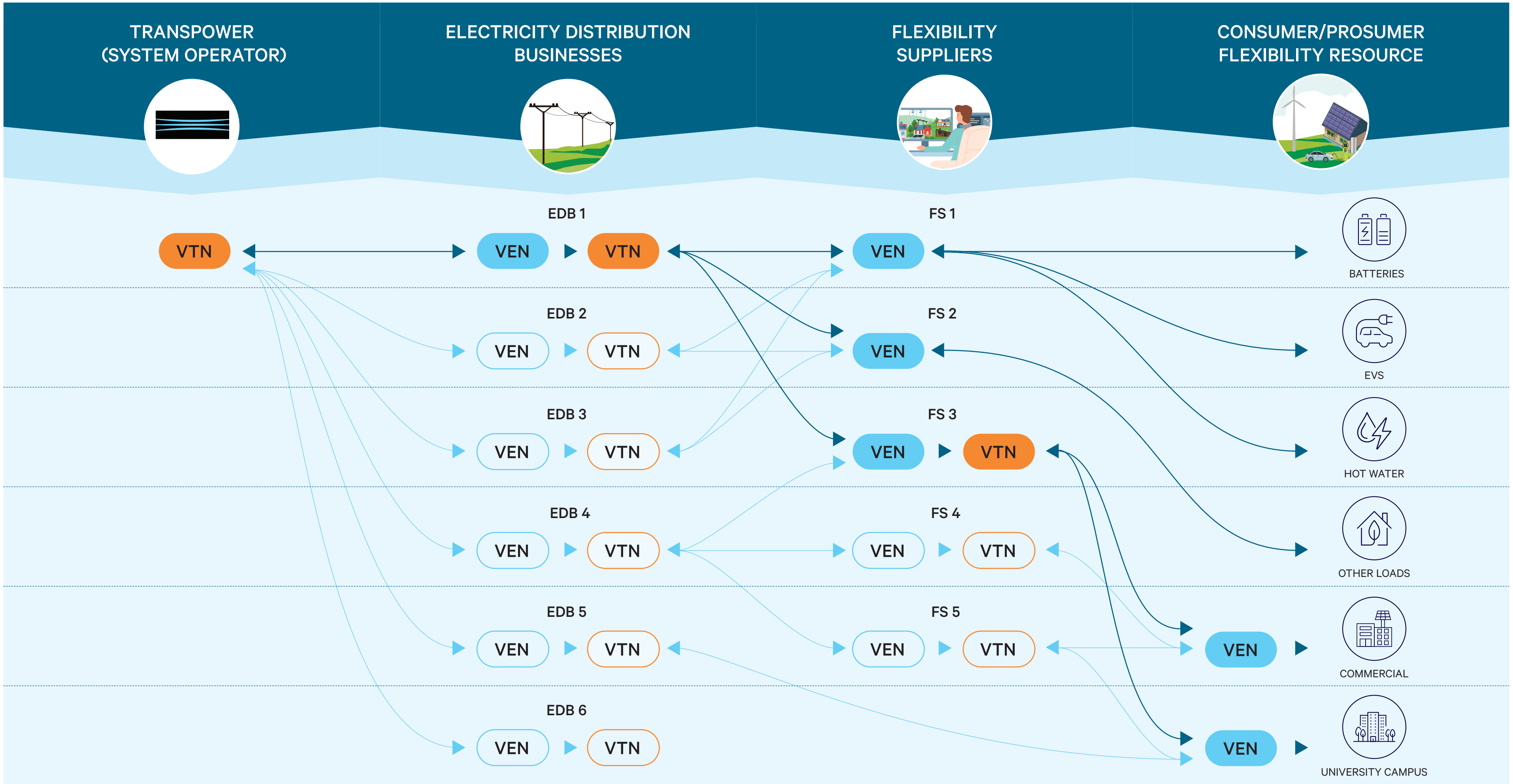
#### Scalable

Scalability refers to a system's ability to handle growing quantities of work. This concept is crucial for designing systems that can evolve with growing user demands or data volumes without requiring a complete redesign or significant architectural changes.

OpenADR architecture is based on interconnected nodes in which a Virtual Top Node (VTN) can communicate with one or more Virtual End Nodes (VEN). At the same time, the system in which VEN is deployed could act as a flexibility supplier/aggregator implementing a VTN in the lower layer.

FlexTalk's research into and testing of OpenADR demonstrates flexibility to accommodate various architectures and is therefore adaptable as roles and responsibilities are cemented in relation to the energy transition. The *Figure 18* below shows the FlexTalk participants as well as the ability to add additional VTNs/VENs at the required layer/level to enable communication between parties.

**FIGURE 18:** OPENADR TREE STRUCTURE WITH NODES ACROSS VARIOUS ACTORS/DER



### Secure

OpenADR is designed to ensure the safe and reliable exchange of information between utilities and their customers. OpenADR security encryption protecting data in transit, authentication and authorisation of participants, digital signatures verifying message integrity and origin, and secure communication channels combining HTTP with SSL/TLS encryption.

### Maintainable

Maintainability considers the feasibility of market participants operating the necessary infrastructure without unduly onerous burden. FlexTalk used cloud service OpenADR VTNs and VENs where the onus on installation, maintenance and performance was provided by that service provider. The standard itself is maintained by the OpenADR Alliance.

Comment from FlexTalk participants indicates a low level of effort in connecting via API to the cloud services required to achieve the project goals.

### Platform independency

The ability to run independently of any one vendor or platform helps avoid single points of failure or dominant market players creating expensive solutions. Platform independence maintains interoperability by avoiding non-standardised interfaces gaining significant adoption as ‘de-facto’ standards. FlexTalk used multiple suppliers of OpenADR VTN and VEN components.

### Backwards/Forwards compatibility

Backwards compatibility ensures that the broader system behaves in the presence of an older component. OpenADR 2.0b is a ‘superset’ of OpenADR 2.0a, so older OpenADR 2.0a systems interoperate with 2.0b systems.

Forwards compatibility is effectively the opposite – ensuring that the wider system can support newer components being introduced without causing incompatibility. OpenADR recently released v3.0 using JSON as the data format, while 2.0a/b use XML. certified OpenADR 3.0 VTNs use both data formats for interoperability with existing VEN implementations. OpenADR 3.0 VENs will only communicate with 3.0 VTNs.

Further discussion and research into international protocols can be found in section *6.5 Research Findings* below.

### 6.3.6 WHAT DO DELIVERY PARTNERS SEE AS KEY INHIBITORS/ENABLERS TO OPERATIONALISING FLEXTALK?

The consensus is that the technical solution is not complex and the adherence to a standard is the 'least regrets' approach.

What became evident from interactions and feedback was that there were many wider considerations of flexibility that need to be solved to fully participate in demand flexibility and these factors play into when and how partners may operationalise a solution.

The following *Table 16* depicts project delivery partner key considerations that would enable participation in flexibility, and what currently inhibits participation.

These considerations are not unique to New Zealand, and these issues came up in wider research findings from collaboration with various local and international projects, work groups and programs in flight. For this reason, we have discussed these in *Section 6.6* research findings below. These topics form the basis of FlexTalk's Recommended Next Steps on what needs to be solved for to fully participate in a demand flexible electricity system.

**TABLE 16:** DELIVERY PARTNER FEEDBACK – ENABLERS AND INHIBITORS TO FLEXIBILITY PARTICIPATION

| ENABLERS ✓ | INHIBITORS ✗ |
|---|---|
| **Commonality or similar programs** (or products or events) and associated contractual agreement/RFP and processes shared by all EDBs procuring flexibility in New Zealand. | **Investment needed in BI and internal systems (EDBs)**<br>Significant Business Intelligence effort required to predict, measure, monitor and interpret DR activity. |
| **Sustainable investment**<br>Development is good quality and reusable – 'least regrets' – so investment of time and resource is sustainable. | **System costs**<br>For OpenADR or any DERMS solution to be bought off the shelf or developed. |
| **Clear/robust contracts defined between EDB/flexibility supplier [or participants in Flex].** The more we have in the *contract between EDB/Flex supplier* the easier technical implementation becomes. | **Consumer buy-in/awareness and social licence needed**<br>Consumers unaware of need for demand response and incentives therefore no social licence. |
| Establishing **commercial models and value stacking** will be necessary for a large-scale deployment. | **Commercial side is incredibly unclear**<br>Understand business models, return on investment (ROI), etc. |
| **Market development and stimulation.** | **Customer hesitancy**<br>Customers reluctant to allow utilities to access their energy consumption and data. |
| **Standardisation of a common communications protocol**, whether OpenADR or IEEE 2030.5 for DER manufacturers and aggregators to adhere to. | **Lack of market**<br>Commercials around pricing yet to be defined. |
| **Regulatory incentives** for aggregators to partake in demand response markets. | **Industry alignment**<br>Need to standardise approaches, technology and experience as much as possible without losing choice and stifling innovation. Need to control quality of end-point connections. |
| **Standardisation (other)**<br>Keep it simple by using HTTP APIs with standard message format. | **Dumb chargers/Protocol compatibility**<br>Need ability to control via protocol and provide reporting data (power consumption and voltage).<br>**Prohibitive upfront costs of smart chargers**<br>High cost for the consumer means difficulty selling them on the future potential of flexibility, which means they opt for dumb chargers or three-pin chargers. Reducing the costs of hardware and/or installation would help (as well as exploring other ways to achieve this outcome). |

### 6.3.8 CONCLUSIONS

***Ease of implementation:*** The average ease of implementation rating was 2/5 for complexity by delivery partners. The technical solution was not deemed difficult to implement and technical implementation was not seen as a barrier to OpenADR adoption.

The inclusion of the Aurora/SolarZero use case demonstrated that a bespoke API could be mapped to the OpenADR standard with little technical effort. In terms of our partners, no partner has currently operationalised their OpenADR implementation. Each will need to consider when it needs to invest further in any protocol/system based on their business needs and priorities.

***Cost of implementation:*** The cost of implementation is difficult to comment on as is specific to user requirements and any products selected. Adherence to a standard is likely to be more costly than proprietary solutions in the short-term due to necessary governance (such as certification). However, in the long term it could end up being more cost effective as there is a single implementation of flexibility services affirming adherence to that standard. FlexTalk has evaluated adherence to a standard as a 'least regrets' approach as it diminishes technical barriers with future development in line with industry standards and approaches.

***Performance:*** Assessment of OpenADR's adherence to key functionality (open, interoperable, scalable, secure, maintainable, platform independent and backward/forward compatible) supports a 'least regrets' technical solution, as the solution can evolve over time, in a standardised fashion based on user needs.

Our delivery partners concluded that OpenADR is not complex. However, it should be noted that the implementation approach did limit full insights into implementation with internal EDB systems as if operationalising. FlexTalk did give insights into technical approaches and the challenges to be solved and provided confidence that the protocol works for the use cases identified and tested for the New Zealand energy system.

What further emerged from the trial is that there are, wider implications of flexibility that are critical to address in addition to adoption of a common protocol. These implications are discussed in *Section 6.6 Research Findings*.

## 6.4 – CUSTOMER FEEDBACK

Fifty-seven OpenLoop and Evnex customers were involved in the FlexTalk trial. The FlexTalk project assessed customer willingness to participate in a trial at a high-level whereby their EV charging was managed for research purposes. The subsequent section discusses the onboarding and survey insights gleaned.

### 6.4.1 CUSTOMER ONBOARDING

When onboarding customers it was noted that customers (and flexibility suppliers) were keen to minimise the impact of managed charging. Further to this, customer interest in trial participation was lower than expected with a high degree of caution needed to mitigate any adverse effects or relationship risk.

Commercial customers (workplace charging stations) were more sensitive to the impacts of demand flexibility than residential customers. Fleet management owners (FMOs) agreed to be involved in the trial but specified limitations to managed charging including:

» Limiting charge reduction to no lower than 80% of full charging capacity.

» Only allowing managed charging outside of business hours (between 5pm – 8am).

For residential customers, stipulations included only allowing managed charging between 7am – 9pm, (the key driver being non-interference of managed charging with retail tariffs potentially financially disadvantaging customers on 'free hour of power' plans).

Timing events for residential customers was precautionary as with the alignment of peaks and pricing it is very unlikely that low-usage times would have to be targeted (typically just periods of congestion), thus a low risk of customers unintentionally being financially impacted.

It is, however, prudent to point out that retail tariffs and time-of-use are factors in customer participation in demand flexibility, and as we can see in the survey results, a customer's free hour of power did align with a period where their EV charging was managed.

### 6.4.2 SURVEY RESULTS

FlexTalk 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.

The survey results are summarised below. See full customer survey results in *Appendix 9.8*.

#### Part A

**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 they 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.

**Part B**

**Commercial customers**

There was a general awareness of throttling down occurring, but no material service disruption was identified as and when throttling occurred.

- 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 they didn't fully understand the commercial or customer value.

**Residential customer results:**

All survey respondents noted that they were not aware of the managed charging of their EV, and all respondents commented that there was no impact on their charging behaviour.

- There was no financial impact to any customer.
- One customer noted they have a timer to ensure all energy is purchased off-peak.
- All survey respondents were willing to participate in future demand flexibility trials.
- One customer surveyed utilised the 'Charge Now' feature during trial to utilise their Genesis Power Shout.

### 6.4.3 CUSTOMER DISCUSSION AND CONCLUSIONS

There was no adverse customer reaction to participating in FlexTalk. However, there was a higher caution than expected on participating in the trial, particularly by commercial customers.

Commercial customers were unsure if they would participate in demand flexibility unless there was a clear benefit to them. FlexTalk did not test financial incentives (outside scope), so trial participants joined for research purposes and a $100 Prezzy Card. This highlights the need to understand what value exists for customers to participate as they will be unlikely to participate in the absence of clear benefit.

It can be observed that residential customers involved in the trial were willing to participate in future trials. Survey results reflect that there was a level of awareness on grid constraints and customers' ability to be a part of the solution for those who opted to be involved in trial.

There are limitations to the insights that can be gleaned from customers. Firstly, direct customer feedback per event was not in scope, and insights were obtained via delivery partners at various intervals during the trial (at conclusion of Part A and B). Furthermore, the survey response rate was low with sixteen out of twenty-two residential customers responding in Part A, and five out of twenty-one in Part B.

All commercial survey responses were answered by one fleet management operator on behalf of the thirty-six EV chargers included under the commercial customer segment in the trial. This does not provide rich feedback from individual driver experiences.

It is recommended that further work is conducted to understand the customer motivators/drivers to participation particularly around the value that may be unlocked from offering up flexibility. See *Section 6.6 Wider Research Findings; consumer recommendations* for further detail.

## 6.5 INTERNATIONAL REVIEW

EA Technology was commissioned to review the existing literature concerning available interface standards and protocols, alongside the established IEC 62746/OpenADR 2.0 framework. This comprehensive study aimed to identify pertinent use cases, the rationale driving the adoption of these standards or protocols, and their applicability within the New Zealand context.

Specifically, the focus was on facilitating the establishment and effective implementation of demand flexibility mechanisms to propel the decarbonization journey and seamlessly integrate Distributed Energy Resources (DERs)/Consumer Energy Resources (CERs), such as Electric Vehicles (EVs) and home batteries.

To ensure a robust analysis, the literature search targeted jurisdictions sharing similarities in electricity market structure and regulatory frameworks. Consequently, the selected regions included the United Kingdom, Europe, Australia, and the United States.

The findings of this study underscored that one of the primary impediments to fostering a flexible market lies in the communication standards required to facilitate the exchange of information and control signals across the entire ecosystem.

Key areas of concern identified in the literature encompassed registration processes, fostering competition, ensuring availability, dispatching resources efficiently, reporting mechanisms, performance monitoring, settlement procedures, and maintaining an accurate grid model. Addressing these challenges will be crucial in realizing the full potential of demand flexibility and advancing the integration of DERs/CERs effectively.

### OUTCOMES OF THE REVIEW

Based on the findings from the analysis of the four jurisdictions, it was evident that the uptake of open access communication protocols has been limited thus far.

Among the various communication protocols examined, OpenADR and IEEE 2030.5 emerged as the most prevalent options for enabling flexibility at this juncture. Presently, OpenADR demonstrates a higher level of maturity in demand management market functionalities, while IEEE 2030.5 exhibits robust capabilities in smart control functionalities.

However, both standards are still undertaking evolution to address identified gaps and accommodate emerging requirements. Notably, OpenADR 3.0 has introduced more dynamic pricing structures and capacity management (DOE), whilst IEEE 2030.5 is leveraging site Energy Management Systems (EMS)/aggregators to translate DM requirements into specific device commands.

It should be noted that the international review revealed that no jurisdiction is currently pursuing a singular pathway regarding communication protocols. Instead, diverse protocol pathways are being explored to meet specific jurisdictional needs.

For instance, the Energy Networks Association (ENA) in the UK is presently investigating the development of a distinct communication standard. As an interim measure, they are using APIs to allow data access and support communication between SCADA/ADMS and DER management systems (DERMS). *Table 17* provides a summary of key findings from all four jurisdictions and its significance for the New Zealand context.

**TABLE 17:** SUMMARY OF ALL JURISDICTIONS AND ITS SIGNIFICANCE FOR NEW ZEALAND CONTEXT*

| COUNTRY / AREA | USE CASES/PROBLEM TRYING TO SOLVE | COMMS PROTOCOL | COMMENT/COMPARISON TO FLEXTALK/ NEW ZEALAND CONTEXT |
|---|---|---|---|
| **Australia** | » Flexibility & interoperability<br>» DoE (dynamic operating envelope)<br>» Solar PV Inverter Control | » IEEE 2030.5.<br>» CSIP-Aus.<br>» APIs. | » New Zealand does not currently have very high levels of solar penetration.<br>» Foresee EV growth as biggest challenge.<br>» However, it will be interesting space to watch for high levels of DERs. |
| **UK** | » DER dispatch system and interoperability | » OpenADR<br>» Development of API standards for dispatch system interoperability across ESO, DSO.<br>» Rollout use of the standardised API by Dec 2023 for the summer 2024 flexibility tender. | » Rationale for New Zealand and UK are similar, although at a very different scale. |
| **Europe** | » DER integration | » Single flexibility platform. | » New Zealand to watch this space and see the global convergences. |
| **USA** | » Situational awareness and Distribution Services using DERMS | » Open ADR- Aggregated demand response/management across networked energy devices.<br>» IEEE 2030.5- Curtailing PV inverters. Broader deployment to manage DERs at town level has been trialled.<br>» EEBUS- Aggregated control of heat pumps at multiple sites, dynamic building power limitation setpoints, HVAC and electric vehicle management. | » The key focus of the DERMS projects is to monitor, control and coordinate DERs and not on the development of the competitive flexibility services market. This may not suit New Zealand's use cases currently. |

* EA Technology (2024), International review of open communication/standards or protocols for flexibility management

**TABLE 18:** SUMMARY OF THE INTERNATIONAL REVIEW'S KEY FINDINGS AND THEIR CONSIDERATION FOR THE NEW ZEALAND POWER SYSTEM

| NO. | KEY FINDINGS FROM THE INTERNATIONAL REVIEW | RELEVANCE FOR NEW ZEALAND |
|---|---|---|
| 1 | Inherent flexibility in the DER/CER can support networks by enabling them to manage constraints through the utilisation of non-network solutions and allowing enhanced access to electricity markets. | EDBs and Transpower can use the inherent flexibility in the DER to benefit consumers by reducing network infrastructure costs, and by maintaining and improving quality, reliability and resilience of the network service. |
| 2 | Open communication standards / protocols are one of the key enablers of flexibility i.e., to exchange network information, pricing signals, and control signals. | Across Aotearoa New Zealand there are 29 electricity distribution businesses and one transmission business, who will all need to decide what technology they might use to enable demand flexibility.<br>Without a standardised approach, there is a possibility that networks could implement different protocols, meaning we risk limiting or vastly under-utilising, demand flexibility. This, in turn, may impede effective grid integration.<br>Standardisation simplifies the integration of different systems and components, reducing complexity and ensuring consistency in communication. The genuine advantage of standardization lies in enabling any flexible supplier entering the market to develop capabilities that seamlessly 'plug and play' with any EDB without the necessity to create bespoke solutions.<br>Open communication protocols also provide:<br>» Enhanced Interoperability which ensures that devices and systems from different manufacturers can communicate seamlessly and consumers can switch between flexibility supplier and EDBs without having to buy new devices<br>» Real-time data exchange ensuring timely access to accurate information. This real-time data is vital for making informed decisions and responding quickly to dynamic energy demand, improving the overall effectiveness of demand response programs.<br>» Improved scalability and flexibility by being able to accommodate both small-scale and large-scale deployments. This alleviates limitations of communication infrastructure, lowering the barriers to entry and enabling wider participation. |
| 3 | Establishing interoperability is an important enabler for establishing:<br>a) Common language between networks, DSO, and aggregators/ flexibility service providers/market facilitators; and<br>b) Controllability of devices from different OEMs e.g., PV inverters, EV chargers etc. | Across Aotearoa, there are many types of devices and equipment operating independently of each other behind-the-meter. As increasing numbers of these devices connect to the system such as electric vehicle chargers, or rooftop PV solar systems etc., they can have a detrimental effect on electricity grid stability if left unmanaged.<br>In most cases, these technologies are neither visible to the electricity system operator nor controllable. To ensure the continuing resilience of New Zealand's electricity grid, all of these embedded technologies must be able to work together or be able to interoperate.<br>Interoperability is not a given, and there is a risk that companies will develop proprietary systems that will only work in silos. This might require costly infrastructure investment to increase the capacity of the electricity system to manage local constraints, if not done smartly.<br>Ensuring interoperability means all connected devices are capable of both physical and digital integration and taking actions to adopt international standards that facilitate basic connectivity and data exchange.<br>If this is achieved, consumers will not only enjoy the benefits of their DER via a sole flexibility provider but will also possess the capability to effortlessly transition between different flex providers using the same devices. This will empower them with the freedom to select and alter flexibility suppliers according to the value they offer, with choice to choose and change flexibility suppliers based on value. |

**TABLE 18:** SUMMARY OF THE INTERNATIONAL REVIEW'S KEY FINDINGS AND THEIR CONSIDERATION FOR THE NEW ZEALAND POWER SYSTEM (CONTINUED)

| NO. | KEY FINDINGS FROM THE INTERNATIONAL REVIEW | RELEVANCE FOR NEW ZEALAND |
|---|---|---|
| 4 | International open access standards can help boost market participation, cost efficiency, and easy access, as defined common protocols and standards allow for faster and more seamless connection and exchange of data. | The adoption of international open access standards for New Zealand's power system will allow the establishment of protocols and building blocks that can help make devices and applications more functional and interoperable. This will discourage players in the industry developing bespoke systems that are not compatible with the rest of the system but will also make it more affordable for consumers as there will be access to wider product availability in New Zealand as it removes vendor-imposed boundaries by ensuring standardised data exchange and interchange. |
| 5 | The two most mature communication protocols for flexibility currently being considered for adoption internationally are OpenADR and IEEE 2030.5.<br>a) Currently, OpenADR is more mature in Demand Management (DM) market functions while<br>b) IEEE 2030.5 is stronger in smart control functionality. | Whilst FlexTalk focused on the application of OpenADR 2.0, we acknowledge that there are multiple communication protocols currently being considered internationally. However, the international review identified that currently only two of these protocols, OpenADR and IEE2030.5 are mature enough to be considered for adoption and implementation. It should be noted however, that both of these protocols still have some weaknesses in providing the end-to-end functionality required to fully deliver all aspects of flexibility services required for New Zealand, and that some aspects are still in development to deliver those functions.<br>Therefore, whilst the international review validated our choice to test OpenADR in FlexTalk, it highlights that it is that it's premature to enforce any specific protocol at this juncture. Instead, a more effective approach is requiring implementation of essential functionality necessary for meeting standard communication requirements, as outlined in an industry guide. This would enable the industry to leverage both protocols (potentially incorporating APIs in the short term) based on their respective advantages and the specific use case at hand. |
| 6 | Whilst each have strengths, both require further progression to meet all the requirements of demand flexibility, with some components still in development to provide end to end functionality. Current enhancements being developed include:<br>a) OpenADR 3.0 offering more dynamic price structures, as well as capacity management (DOE); and<br>b) IEEE 2030.5 using site EMS/ aggregator to translate DM requirements into specific device commands. | As above. |

**TABLE 18:** SUMMARY OF THE INTERNATIONAL REVIEW'S KEY FINDINGS AND THEIR CONSIDERATION FOR THE NEW ZEALAND POWER SYSTEM (CONTINUED)

| NO. | KEY FINDINGS FROM THE INTERNATIONAL REVIEW | RELEVANCE FOR NEW ZEALAND |
|---|---|---|
| 7 | From the international scan it was observed that currently no jurisdiction is following a single pathway on communication protocols and instead are moving down different protocol pathways due to their specific requirements. | The International Review highlighted that whilst the development and implementation of a common communication protocol is seen as a priority for all jurisdictions in enabling flexibility, none of these jurisdictions has followed the same pathway. This is due to the individual, context and needs of each jurisdiction and the ever-evolving components of the energy transition (such as grid configuration, policy settings, DER type and penetration, hardware specification and regulation, data regulation etc.)<br>For example:<br>» European jurisdictions seem to prefer OpenADR.<br>» Australia has adopted IEEE 2030.5 and CSIP-AUS as the communication protocols to communicate network capacity information (dynamic operating envelope) and control solar PV inverters respectively for all major innovation trials. However, it has not mandated these standards and have not ruled out other standards.<br>» The USA is currently evaluating and trialing both protocols as neither protocol currently can fully meet all of their current functional requirements. How this is being implemented differs between systems and State jurisdictions.<br>» The UK is leading the development of local flexibility markets. As such, they are currently evaluating whether or not to develop a standard from OpenADR as a baseline, or to develop from scratch (informed by existing standards and APIs).<br>Based on these findings, New Zealand should acknowledge that it shouldn't blindly follow any one jurisdiction's pathway, but instead take the learnings and establish its own course based on needs and priorities. This would include mandating necessary functionality to deliver common communication requirements for the country (i.e. in an industry guide). This will allow the industry to utilise both protocols (and possibly others in the future) based on their relative strengths and the use case. |
| 8 | APIs can support basic functionalities such as enabling communication between flexibility providers and networks (SCADA/ADMS/DERMS). | Simple APIs can allow industry flexibility participation as a short-term measure before transitioning to a standard, However, there are risks. The goal should be short term with adoption of an 'least regrets' international standard. New Zealand's network structure and division across 29 EDBs as well as the system operator (i.e. Transpower) means there is further risk of individualised 'bespoke' technical approaches. Risks include:<br>» Hindering participation and interoperability due to technical complexity to connect with bespoke APIs between flexibility supplier and EDB.<br>» Hindering participation enables monopolies and stymies competition.<br>» Difficulty to scale solution.<br>» Differing security models with each technical connection.<br>Note: A DERMs/Flexibility management system is still required for API dispatch. |

**TABLE 19:** SUMMARY OF THE INTERNATIONAL REVIEW'S KEY RECOMMENDATIONS AND THEIR CONSIDERATION FOR THE NEW ZEALAND POWER SYSTEM

| NO | KEY RECOMMENDATIONS | RELEVANCE FOR NEW ZEALAND |
|---|---|---|
| 1 | Continue to monitor closely international developments, with particular emphasis on:<br>a) Australia due to their market proximity and speed of advancement in managing high penetration levels of DER within their distribution systems; and | Whilst Australia has adopted IEEE 2030.5 and CSIP-AUS as the communication protocols to communicate network capacity information (dynamic operating envelope) and control of solar PV inverters, it has not mandated these standards and has not ruled out other communication standards/protocols for use on other use cases. This has been driven by the need to manage the high penetration of DER (i.e. household PV and batteries and loads such as heat pumps etc.) and their impact on the grid. Whilst New Zealand does not face the same challenges as Australia, it can still obtain learnings particularly in relation to the integration and management of DER that will be useful as EVs and household electrification increases.<br>In addition, due to the proximity of the Australian market, new devices coming into the New Zealand market will need to have similar technical specifications to ensure costs for consumers are minimised. This includes continuing to work jointly with Australia to share resources to develop joint equipment standards (i.e., AS/NZS 4777).<br>Therefore, both industry and regulators in New Zealand need to establish closer ties with Australian counterparts (including standards committees) to stay informed of developments in Australia and any local implications. |
| | b) The UK due to similarity in structure and drivers in terms of DER/CER penetration, and regulations. | The structure and drivers for change in New Zealand are similar to those identified for the UK, i.e. primarily the need for communication protocols to enable the DER dispatch system and also deliver greater interoperability of grid connected devices. However, it should be noted that they are at very different scales. |
| 2 | Build on existing body of knowledge on communication protocols and map the capabilities against New Zealand's requirements as it moves through the energy transition, before finalising any specific standard/protocol. | Whilst FlexTalk validated our choice to test OpenADR, it highlighted that more work needs to be undertaken before consideration is given to mandate any specific communication standard/protocol.<br>Therefore, it is recommended that:<br>» We leverage the FlexTalk findings to develop an industry guideline that outlines the essential functionality necessary for meeting standard communication requirements.<br>» Initiate further trials (e.g., FlexTalk 2.0) to enhance the current knowledge base and delve deeper into learnings gained.<br>» We continue monitoring global advancements in communication protocols. |
| 3 | Consider the following 'least regrets' actions:<br>a) Establishment of a DER/CER integration working group to monitor the New Zealand market, scan global developments, and help design and undertake future trials. | Several working groups have already been formed to facilitate the better integration of DER into the New Zealand energy system. Notably, FlexForum and the Electricity Authority's – Future Security and Resilience Program are actively engaged in advancing this objective.<br>However, to expedite this program of work, it is imperative to allocate greater resources to these forums. |

**TABLE 19:** SUMMARY OF THE INTERNATIONAL REVIEW'S KEY RECOMMENDATIONS AND THEIR CONSIDERATION FOR THE NEW ZEALAND POWER SYSTEM (CONTINUED)

| NO | KEY RECOMMENDATIONS | RELEVANCE FOR NEW ZEALAND |
|---|---|---|
| 3 | b) Connect and collaborate with similar DER integration and flexibility working groups in other jurisdictions such as the UK, USA, Europe and Australia. | The success of FlexTalk underscores the immense potential of collaboration and knowledge exchange, signaling a need for greater investment and focus.<br>Whilst it should be acknowledged that international collaboration is already taking place, there are gaps, coordination is a challenge, learnings are not necessarily widely disseminated.<br>Further investment is recommended to identify, foster, and coordinate New Zealand's involvement in pivotal international working groups or committees dedicated to advancing DER integration and flexibility.<br>Creating an online central collaboration space to share local knowledge across industry is also recommended. The inclusion of an online database cataloguing key international organisations or bodies, emphasising their primary focus areas, alongside the pertinent New Zealand organisation or individual serving as our primary contact, would prove highly beneficial. It should be noted that the EEA's Knowledge Network could be utilised for this purpose. |
| | c) Establish a taskforce/study immediately to design and obtain consensus on future energy scenarios for New Zealand; and combine knowledge from local trials. | There are currently a number of forums and studies are presently established and underway, envisioning the potential shape of New Zealand's future energy system. For example:<br>» *Electricity Authority* – Future Security and Resilience consultation.<br>» *Ministry of Business, Innovation and Employmen*t – Energy Strategy.<br>» *FlexForum* – Delivering flexibility for consumers.<br>» *Re-wiring Aotearoa*.<br>» *Ara Ake*.<br>» *Energy Networks Aotearoa* – Future Network Forum.<br>» *Commerce Commission*.<br>» *Electricity Engineers Association*.<br>However, we recommend that New Zealand learn from other jurisdictions by establishing a new Energy Advisory Panel coordinating market body advice (including working with the organisations outlined above) to government to help drive transformation of the energy system. |
| | d) Design and implement an 'regulatory sandbox' enabling trials (innovation with flexible rules) and work with government, industry and regulatory bodies to identify gaps and develop solutions in technology, regulation, functionality, and consumer education to ensure industry preparedness. | Regulatory sandboxes have successfully been established and implemented to test new business models with reduced regulatory requirements both internationally and to a limited extent in New Zealand (i.e. exemptions).<br>We recommend, however, that consideration is given to easing the establishment of sandboxes/exemptions to help drive transformation. It is important that any sandbox/exemption adhere to common features, such as:<br>» Genuine innovation or novelty.<br>» Identifiable consumer or social benefit.<br>» Need and readiness for sandbox testing.<br>» Defined time, sectoral or geographic limits.<br>» Safeguard mechanisms. |

## 6.6 WIDER RESEARCH FINDINGS

In order to ensure that FlexTalk thoroughly evaluated the broader implications of its analysis of communication protocols to deliver flexibility through its OpenADR testing and analysis, extensive literature research (in addition to the work outlined in *Section 4.1*) and industry engagement were conducted at both national and international levels.

This research highlighted that flexibility management will be a key lever for enabling electricity grids to support renewables integration and demand electrification at scale, while avoiding over-investment in grid infrastructure. Making flexibility management work will require building data-driven grid capabilities, adapting operational frameworks and re-thinking regulation and policy along multiple dimensions.

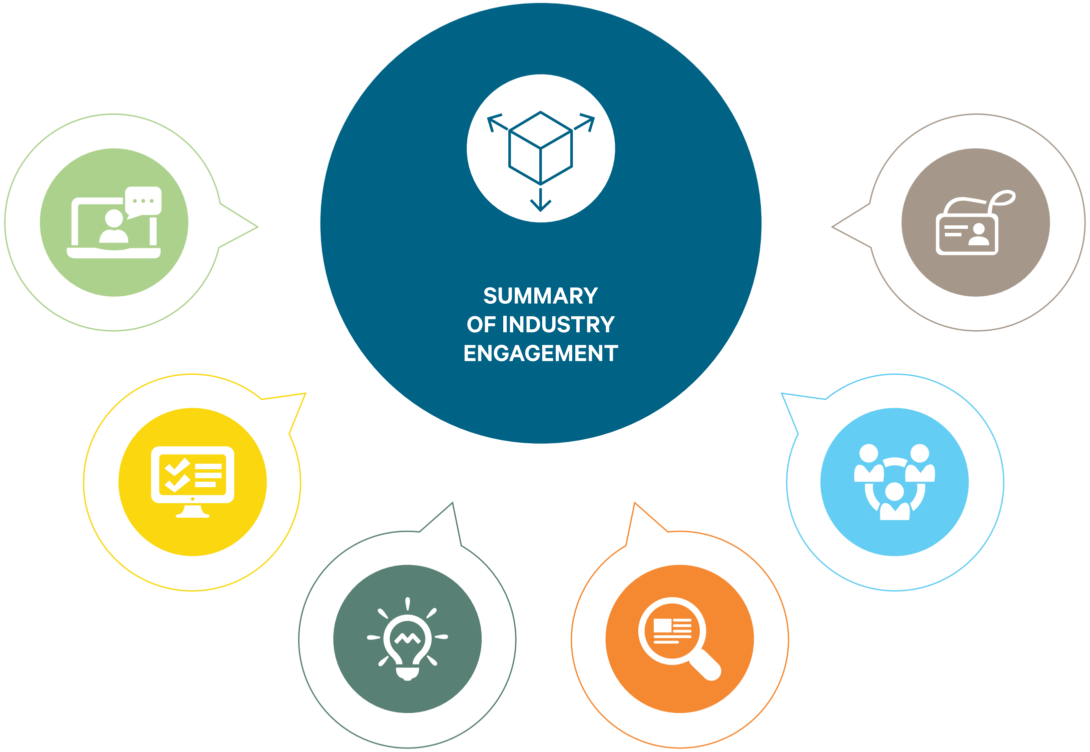
As depicted in *Figure 19*, these external insights, and inputs to FlexTalk were drawn from various channels. These included participation in industry webinars, attendance at workshops and forums, thorough research, and engagement with similar projects both in New Zealand and globally, participation in conferences, conducting literature reviews, and collaborating closely with key organisations worldwide.



During this research and engagement process, several critical issues emerged. Although they fell beyond the initial scope of FlexTalk , they offered valuable insights into broader concerns that must be tackled to ensure flexibility can fully unlock its potential in New Zealand's future energy system, while providing optimal value to all consumers.

The broader research and engagement phase of FlexTalk revealed several key areas of concern, notably: the functionality of end devices; the necessity for technical standards to facilitate flexibility; emphasising their international recognition; and the pivotal role of the consumer. The key findings and our suggested actions concerning those findings are detailed in *Figure 19*.

**FIGURE 19: OVERVIEW OF THE BROADER RESEARCH SOURCES UNCOVERED THROUGHOUT FLEXTALK**




**WEBINARS**

- Project Proposal webinar – Mar 2022
- Why OpenADR – Dec 2022
- Expanding Electric Vehicle Infrastructure in NZ – Sept 2023
- FlexTalk Part A – Oct 2023
- FlexTalk: making sense of communication protocols to enable demand flexibility – Feb 2024

**RELATED PROJECTS**

- South Island Distribution Group, DSO project
- Project Edge (Australia)
- Project Edith (Australia)
- Project Symphony (Australia)
- Resi-Flex
- My Electric Avenue (UK)
- National Grid ESO's Winter Demand Flexibility Service (UK)
- Smart Flex demand flexibility trial (UK)
- NREL – Electrification Futures Studies (USA)

**WORKSHOPS/FORUMS**

- FlexTalk Workshop – 27 June 2023
- FlexTalk Workshop at AMG Forum – 2 Nov 2023
- EEA Asset Management Group

**RESEARCH**

- Readings
- Referrals

**CONFERENCES**

- EEA Conference 2023
- OpenADR Alliance Conference 2023 – (London)
- Clean Energy Summit 2023 – (Sydney)
- Electric Energy Society of Australia 2023 – (Melbourne)

**COLLABORATION**

- Ara Ake
- ARENA (Australia)
- DEIP Interoperability Steering Committee (Australia)
- Drive Electric
- Flexforum
- Northern Energy Group (NEG)
- Electricity Authority
- ENA NZ Future Network Forum (FNF)
- ENA UK
- Energy Catapult (UK)
- ERANZ
- Octopus Energy
- OpenADR Alliance
- RACE for 2030 (Australia)
- SolarZero
- Xcel Energy

**TABLE 20:** SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK

| THEME | KEY FINDING | RECOMMENDATION |
|---|---|---|
| **End device functionality** | Flexibility can only be utilised if the capabilities and limitations of the end devices are well understood and meet minimum functional requirements. The categories of technical features that DER require include:<br>» **Grid support DER functions** – Technical requirements or features that are defined for DER devices, inverters or connection points that support the security and reliability of the connecting distribution network and wider power system. Grid support DER functions typically seek to manage the impact DER is having on the network and use centralised communication to leverage DER to support the network.<br>» **Mechanisms for control** – The way the EDB, flexibility supplier, or system operator, communicates with or has visibility of the DER device. Mechanisms for control represent the method upon which grid support DER functions are delivered to DERs. This is primarily via interfaces through which EDBs and flexibility suppliers (and ultimately DER devices) communicate. These protocols need to be open sourced – i.e., OpenADR or IEE 2030.5.<br>» **Data** – The measurement, collection and reporting of data specific to the DER device and site or connection point. A variety of data may be measured and/or collected relating to the physical performance of the DER as well as the resulting impact on the network. Data may be measured and recorded at differing intervals and is likely to include monitoring data (power, voltage, frequency), operational status reports (device activity, state of charge, enabled) or alarms.<br>» **Registration** – The static information or data that defines the technical characteristics of DER. Registration data specifies (for example) the size, number, type and model of DER devices and inverters, and aggregates this up to the connection point. Registration includes identifiers for the purpose of centralised registry or oversight.<br>» **Cyber security** – The protection of devices and data in relation to DER with the potential to be visible to other devices, flexibility suppliers, site hosts and centralised bodies. Cyber security standards and protocols protect these information flows and the hardware and software itself.<br>» **Interoperability** – i.e. that it can plug-and -play with other devices in a home energy management system (HEMS), the flexibility provider and the network it is connected to. | We recommend industry guideline/s that outline end device functionality requirements are either adopted and adhered to, or if not currently available developed and implemented.<br>For example, EECA's smart EV charger PAS SNZ PAS 6011:2023 :: Standards New Zealand (residential) SNZ PAS 6010:2023 :: Standards New Zealand (commercial).<br>Consideration should also be given to updating current regulations such as, the Electricity Industry Participation Code (the code) to require that DERs such as distributed PV systems have crucial advanced inverter functions, such as voltage/frequency ride-through (that enable DERs to remain online through minor grid disturbances) and voltage regulation. |

**TABLE 20:** SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK (CONTINUED)

| THEME | KEY FINDING | RECOMMENDATION |
|---|---|---|
| **Other technical standards or protocols** | To ensure that DER connected to the New Zealand power system can provide support to system reliability and security, or such that consumers who own DER can switch their energy flexibility supplier etc.; other standardisation may be required. Technical characteristics that require investigation regarding standardisation include:<br>» Data.<br>» Cyber security.<br>» Interoperability.<br>» Health and safety standards.<br><br>However, where some technical characteristics such as cyber security will need stricter levels of standardisation, other technical characteristics where a degree of flexibility of how devices and interfaces inter-operate may be more appropriate to encourage competition and innovation for consumer benefit. Therefore, instead of mandating a specific standard, mandating the technical functionality could potentially be more appropriate.<br><br>To help policy makers adjudicate between areas where standardisation for the purposes of DER interoperability may be desirable, and thus achieve an appropriate balance of standardisation in the industry, we recommend developing an assessment framework that will provide policymakers with an objective set of criteria to assess potential standards or features of technical standards to be considered for adoption. This should seek to help policymakers understand the implications and trade-offs associated with specific aspects of technical feature design. For example, Australia has established a framework designed to assist development of DER interoperability policy. This framework is based on seven key assessment criteria:<br>1. System security and reliability.<br>2. System and network costs.<br>3. Consumer equity and acceptability.<br>4. Market facilitation.<br>5. Data privacy and cyber security.<br>6. Flexibility, adaptability and innovation.<br>7. Compliance and monitoring burden. | It is recommended that:<br>1. Gap analysis is undertaken to identify any gaps in standards required to enable DER integration in the New Zealand power system.<br>2. Based on the outcomes of the gap analysis, the industry establishes a work program to evaluate and make recommendations to policy makers regarding other technical characteristics required to enable flexibility that may require standardisation. These include:<br>– Data.<br>– Cyber security.<br>– Interoperability.<br>– Health and safety standards.<br><br>Development of a DER interoperability assessment framework to provide policymakers with an objective set of criteria to assess potential standards or features of technical standards to be considered for local adoption. |

| TABLE 20: SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK (CONTINUED) | | |
|---|---|---|
| THEME | KEY FINDING | RECOMMENDATION |
| International standards | When considering standardising DER technical characteristics, aligning New Zealand's technical standards for DER with international standards is a key component of any deliberation. When significant differences are found, misalignment can constitute major impediments to new technologies and products being easily integrated into the New Zealand power system and can potentially increase costs for consumers.<br>By using global standards New Zealand can improve access and leverage global technology, providing certainty for a small market.<br>An example of an international standards that could be considered for evaluation and either full or part adoption in New Zealand are:<br>» IEEE 1547-2018 – IEEE Standard for 'Interconnection and Interoperability of DER with Associated Power Systems Interfaces' for interoperability.<br>» ISO/IEC JTC 1/SC 32 - Data management and interchange. | A scan of relevant international standards committees and working groups related to DER integration is recommended to identify gaps and ensure alignment. |
| IT system requirements to enable flexibility services | EDBs' current IT infrastructure is tailored to suit existing operational models, primarily focusing on load management. Introducing flexibility would require significant technological investment to adapt IT systems to align with evolving business strategies. This adaptation is crucial to automate demand flexibility and accommodate the scalability of this function.<br>Developing functional requirements is imperative for EDBs to delineate how they will function and outline their IT infrastructure necessities. While FlexTalk has begun exploring the identification of needs and potential integration of demand flexibility programs with EDBs' IT systems, it's essential to recognise that each EDB has unique requirements dictated by its network configurations and choices regarding new operational services.<br>Moreover, the agreements that EDBs establish with flexibility suppliers will vary, influencing the specific requirements and solutions needed for EDBs to thrive in a more flexible operational environment. Therefore, while standardised functionality is required, a tailored approach should be adopted to allow for the diverse needs and circumstances of individual EDBs as they navigate towards a more adaptable future.<br>It should be noted that the Commerce Commission will need to be consulted on the additional functional capabilities that will be required for EDB IT systems to enable flexibility to ensure that they will be included as allowable investments in future EDB determinations. | Establishing common functional requirements that are recognised as allowable investments for EDB IT systems is recommended. This will allow for flexibility services to be introduced into their operational activities. |
| Definition of roles and responsibilities | Clear regulatory direction is required to define the EDBs' current and evolving roles, aligned with the system operator, to harness flexibility (i.e. distribution system/network operator/s (DSO/DNO)).<br>In addition, the role and responsibilities of intermediaries (i.e., aggregators and retailers) to act on behalf of consumers who may struggle or be reluctant to adjust to a smart, market-based energy ecosystem needs to be established.<br>However, it is important to emphasise that when defining roles and responsibilities to enhance flexibility throughout the energy supply chain, it's crucial to prioritise consumer needs and ensure they aren't financially burdened. | Initiating work to understand and define the roles and responsibilities necessary to achieve flexibility is recommended, with the primary aim of optimising outcomes for all consumers. |

| **TABLE 20:** SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK (CONTINUED) | | |
|---|---|---|
| THEME | KEY FINDING | RECOMMENDATION |
| **Access to data & data management** | Data access for all key players including EDBs is one of the key enablers to delivering flexibility. This includes information from respective devices and communication technology to provide close-to-real time visibility of low-voltage grid and flexible resources connected to the grid (smart meters, batteries, PV inverters, EV chargers, IoT devices for other flex load assets etc), and forecasting capabilities.<br>It should be noted that with the proliferation of DER will have a commensurate proliferation of data which must be managed efficiently and securely. Consideration will need to be given to data management and its associated costs. The Ministry of Business, Innovation & Employment (MBIE) is actively engaged in developing new legislation regarding customer and product data.<br>Whilst its prime focus has been the banking sector, the forthcoming 'Customer and Product Data Bill' is exploring data for other sectors like energy and aims to enhance the utilisation of data for individuals and enterprises by:<br>» Enhancing customers' ability to access and manage their own data.<br>» Standardising data exchange procedures.<br>» Accrediting trustworthy entities requesting data access.<br>The objective is delivering advantages for customers by reducing costs, enhancing product offerings, and amplifying overall productivity.<br>See https://www.mbie.govt.nz/business-and-employment/business/competition-regulation-and-policy/consumer-data-right/. | It is recommended that work be undertaken to clarify the necessary data access and management capabilities required for achieving flexibility. This may entail clearly outlining criteria for accessing and managing such data, as well as establishing standards and operational boundaries for grid-connected flexible devices.<br>These considerations could be integrated into the proposed 'Customer and Product Data Bill' by MBIE, or other possible amendments to the existing regulatory regime. |

**TABLE 20:** SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK (CONTINUED)

| THEME | KEY FINDING | RECOMMENDATION |
| --- | --- | --- |
| **Consumers** | Procurement of demand-side flexibility at the distribution network level requires customer permission to utilise their assets. Evidence derived from FlexTalk delivery partner customers and external sources strongly indicates that consumers have limited awareness of flexibility advantages for themselves and the electricity system.<br>Examples of insights supporting this finding are outlined below:<br>1. There was low customer buy-in for the trial. It was difficult to recruit customers to the trial and they were unaware of the incentives to participate.<br>2. The public is unaware of the growing need for demand response and the benefits for the grid and themselves.<br>3. The upfront costs of EV smart chargers limits consumer appetite based solely on potential future benefit from flexibility services.<br>Despite increasing options and value for consumers from flexibility, the energy sector suffers from low customer knowledge and trust. Key reasons identified for low engagement include<br>1. **Economic** – Consumers don't have the right incentives to engage in energy/flexibility markets. Current market structures are not conducive to consumer participation.<br>2. **Behavioural** – Consumer knowledge of the energy transition and their role is limited and hinders DER uptake. Social license could be gained through engagement/education strategies which could include establishing a consumer charter as in Australia and the UK, fostering collaboration between industry and consumers. An overview of the Australian example is found below.<br>**Australia's Energy Charter** – Its purpose is to empower organisations across the energy supply chain to deliver better energy outcomes for customers and communities. The development of the Energy Charter was a collaborative process with consumer and customer representatives sharing critical perspectives and insights with the industry and government and is based on the principles that signatories will:<br>– Make customers the centre of the energy system.<br>– Improve energy affordability.<br>– provide energy safely, sustainably and reliably.<br>– improve the customer experience.<br>– support customers facing vulnerable circumstances.<br>As part of their commitment to the Energy Charter, businesses agree to publicly disclose how they are delivering against the Energy Charter Principles through Public Disclosures and engagement with their customer/community councils or stakeholder forums, and area assessed against the Energy Charter Maturity Model.<br>3. **Technical** – Consumers are not aware of the technical requirements needed of their equipment to maximise the benefits of their investments in DER. Consumers need to be better informed and engaged to make the right choices to participate in flexibility markets. | Work to engage and educate New Zealand consumers is recommended to gain social license on the energy transition journey, what flexibility is and the value proposition.<br>Key activities could include:<br>1. Developing a consumer charter for New Zealand consumers.<br>2. Developing in-depth consumer segments to tailor solutions/ opportunities for all New Zealand consumers.<br>3. Trials to unlock and test with compelling consumer offers incentivising participation. |

**TABLE 20:** SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK (CONTINUED)

| THEME | KEY FINDING | RECOMMENDATION |
|---|---|---|
| **Future project/trial considerations** | FlexTalk identified several issues beyond its scope that must be considered and resolved to effectively implement a fully demand-flexible system.<br>Therefore, addressing these challenges requires concerted efforts to trial and refine potential solutions, to ensure New Zealand's energy sector keeps moving forward and to enable a flexible future. This entails accelerating the introduction of crucial innovations and emerging technologies into the market through demonstration, commercialisation, and deployment processes.<br>Focus areas identified by FlexTalk and that could be a focus of future trials and projects include:<br>» Identifying the current flexibility resources that exist<br>» Investigating commercial opportunities for third parties<br>» Identifying and mapping network constraints<br>» Investigating new incentives and tariff structures to incentivise customer engagement<br>» Investigate customer segmentation and motivations<br>» Designing and testing technical requirements for common consumer flexibility services/products.<br>It should be noted that Ara Ake has been established in New Zealand to specifically help foster and support innovation and to commercialise energy solutions so that the industry can "learn by doing" and could be used to ensure the outcome of future trials integrate into the energy sector in New Zealand . | Projects/trials are recommended to address out-of-scope considerations exposed in FlexTalk which are necessary to achieve a fully demand flexible system.<br>A recommended 'next steps' project could focus on:<br>a) Understanding/quantifying flexibility that exists (and can be utilised).<br>b) Investigating commercial opportunities between EDB and flexibility supplier.<br>c) Uncovering real time customer insights and participation incentives.<br>d) Designing common consumer flexibility services/products. |
| **Local knowledge sharing** | Knowledge sharing is the process of exchanging information between people, researchers, organisations and/or across industry. Industry collaboration is crucial for New Zealand's electricity sector to ensure:<br>» Understanding, context, insight, and information to drive innovation, and<br>» getting everyone rowing in the same direction.<br>FlexTalk has proven the power of collaboration and knowledge sharing on communication protocol requirements for New Zealand to help deliver flexibility.<br>Learnings from other industries which have transitioned to consumer centric models (broadband, telecommunications) could assist the electricity industry. | It is recommended that a central collaboration space is created to share local knowledge and enable collaboration across industry. This could be enabled via:<br>» FlexForum (central repository/ collaboration mechanism).<br>» Utilising EEA knowledge network. |

| **TABLE 20:** SUMMARY OF THE KEY FINDINGS AND RECOMMENDATIONS FROM THE BROADER ENGAGEMENT AND RESEARCH PHASE OF FLEXTALK (CONTINUED) | | |
|---|---|---|
| THEME | KEY FINDING | RECOMMENDATION |
| **A clear vision and roadmap for energy transition** | During the project, industry stakeholders recognised that Aotearoa lacks a cohesive plan to steer it through the energy transition. While government bodies like the EA, EECA, Commerce Commission, MBIE, and Ara Ake are actively engaged in their own work programs, a unified strategy is absent. While MBIE is in the process of developing a new energy strategy, expediting this effort would offer clarity and effective signals for the industry, investors, and consumers.<br><br>FlexTalk underscored the necessity for increased support and funding to facilitate large-scale real-world trials. Stakeholders emphasised the deficiency in incentive mechanisms within the regulatory framework. This limits testing of innovations and trial executions, particularly at scale. | Clarity is needed from government on policy in support of the energy transition and flexibility's role in the future energy system. This will enable industry to progress initiatives and innovations in support.<br><br>It is recommended that:<br><br>a) MBIE finalise the energy strategy so there are clear signals to the sector on what we are building for.<br><br>b) Support and funding are given to real-world trials, embracing failures, learning by doing. |

SECTION SEVEN

# Summary Conclusions, Recommendations and Next Steps

The following summarises the key project findings based on the analysis discussed within the report. The conclusions and recommendations are split by communications protocol learnings (core scope) and then by the wider considerations and requirements identified to enable flexibility.

**TABLE 21:** FLEXTALK COMMUNICATION PROTOCOLS PROJECT CONCLUSIONS

| NO | ISSUE | CONCLUSION |
|---|---|---|
| GENERAL CONCLUSIONS | | |
| PC1 | **Open communication protocols** | Open communication standards/protocols are one of the key enablers of flexibility i.e., to exchange network information, pricing signals, and control signals.<br>Without agreed industry standardisation regarding open communication protocols, there is a possibility that individual networks across New Zealand could implement different protocols resulting in underutilisation of demand flexibility, and/or impeding effective grid integration of DER.<br>Open Communication protocols provide:<br>» Enhanced interoperability.<br>» Real-time data exchange.<br>» Improved scalability and flexibility.<br>The two most mature open communication protocols for flexibility management internationally are OpenADR and IEEE 2030.5. Both OpenADR and IEEE 2030.5 have advantages and use cases for managing the DER and Demand Response based programs. |
| PC2 | **International communication protocols/ standards adoption** | The International Review highlighted that whilst the development and implementation of a common communication protocol is seen as a priority for all jurisdictions in enabling flexibility, none of these jurisdictions have followed the same pathway. This is due to the individual, context and needs of each jurisdiction and the ever-evolving components of the energy transition (such as grid configuration, policy settings, DER type and penetration, hardware specification and regulation, data regulation etc.). |
| PC3 | **Use of APIs to support basic functionalities such as enabling communication** | Simple APIs can allow industry to participate in flexibility as a short-term measure before transitioning to a standard.<br>Whilst APIs can be utilised as a short-term option, long term adoption could lead to risks such as:<br>» Hindering participation and interoperability due to technical complexity to connect with bespoke APIs between flexibility supplier and EDB.<br>» Hindering participation enables monopolies and lack of competition.<br>» Difficulty to scale solution.<br>» Differing security models with each technical connection. |

**TABLE 21:** FLEXTALK COMMUNICATION PROTOCOLS PROJECT CONCLUSIONS (CONTINUED)

| NO | ISSUE | CONCLUSION |
|---|---|---|
| FLEXTALK PROJECT SPECIFIC CONCLUSIONS | | |
| PC4 | OpenADR communication protocol | No OpenADR limitations were identified through FlexTalk. The results provide confidence that OpenADR works for the use cases identified for the New Zealand energy system.<br><br>Assessment of OpenADR within FlexTalk met all defined assessment criteria for least regrets functionality needed to enable flexibility.<br><br>FlexTalk provided a successful application of OpenADR for various tested scenarios including – dispatch to from EDB to FS for load management and dispatch of emergency CAN/GEN from Grid owner to flexibility supplier VEN.<br><br>The successful inclusion of the battery case study showed that other types of DER could be readily firmed up using OpenADR to enhance the availability of flexible resources.<br><br>The trial and the investigation into the protocol showed that OpenADR as a demand side management tool is scalable to accommodate various architectures as roles/responsibilities evolve along with the energy system.<br><br>FlexTalk demonstrated that OpenADR provided interoperability to enable flexibility services between EDB and flexibility supplier(s) by demonstrating active management of DER. |
| PC5 | EDB program design standardisation | In alignment with MDAG recommendation 8, 'new flexibility products should be standardised', it is recommended that the seven FlexTalk-designed programs are used as a 'core set' and published as the New Zealand OpenADR programs following consultation with industry on program design. Standardising the industry flexibility programs (or products) will further reduce technical and contractual complexity between EDB, flexibility supplier and customers.<br><br>It is also recommended an agile maintenance mechanism is established to ensure flexibility programs are reviewed and can evolve based on industry need, managed by an industry body such as EEA or EECA.<br><br>*Note: programs could be altered between EDB/Flexibility supplier if they have differing requirements, the intention is not to stifle innovation, but 'core programs' would be established with a view that if differing requirements, a new program is created (rather than creating multiple versions of an existing program. |
| PC6 | DER scalability | The implementation of EV chargers for FlexTalk highlighted the importance of scale, like the requirements for managing hot water systems. Sufficient EVs need to be actively charging and accessible for potential curtailment at any moment. The integration of a battery case study demonstrated that various DER could be effectively optimised to bolster the availability of flexible resources. |

**TABLE 21:** FLEXTALK COMMUNICATION PROTOCOLS PROJECT CONCLUSIONS (CONTINUED)

| NO | ISSUE | CONCLUSION |
|---|---|---|
| **PC7** | **OpenADR implementation** | FlexTalk identified that OpenADR can be readily adopted by the electricity industry in New Zealand. It was found that:<br>» OpenADR is not difficult to implement and there are no technical barriers for its adoption. The Aurora/SolarZero use case demonstrated that a bespoke API is mappable to OpenADR with little technical effort.<br>» Estimating the implementation costs of Open ADR for the wider industry based on the FlexTalk trial is problematic as EDBs aiming to integrate it into their systems must consider distinct user needs and existing products.<br>However, whilst the adoption of a standard can be initially more costly than proprietary solutions due to the establishment and adherence to necessary governance requirements, it may yield long-term cost effectiveness. This is because adhering to a standard offers a “least regrets” approach, that minimises the technical hurdles as the system evolves thanks to its standardised framework.<br>» The performance of OpenADR was assessed as able to provide all key functionality required for a communication protocol that will enable flexibility. |
| **PC8** | **Consumers** | The project team uncovered that residential and commercial customers lack awareness of demand flexibility and were initially hesitant. After gaining a better understanding of the trial’s aims and objectives, most joined out of a desire to contribute, bolstered by a $100 gift card incentive. Exploring broader incentives fell beyond the project scope.<br>While residential customers expressed willingness to participate in future trials, the commercial customers were more uncertain unless clear benefits were demonstrated. This underscores the necessity for additional research to understand customer motivators for participating in demand flexibility. Work is also required to better inform both commercial and residential consumers regarding the benefits and potential value of flexibility for themselves and the wider energy system. |

**TABLE 22:** FLEXTALK RECOMMENDATIONS FOR COMMUNICATION PROTOCOLS IN NEW ZEALAND

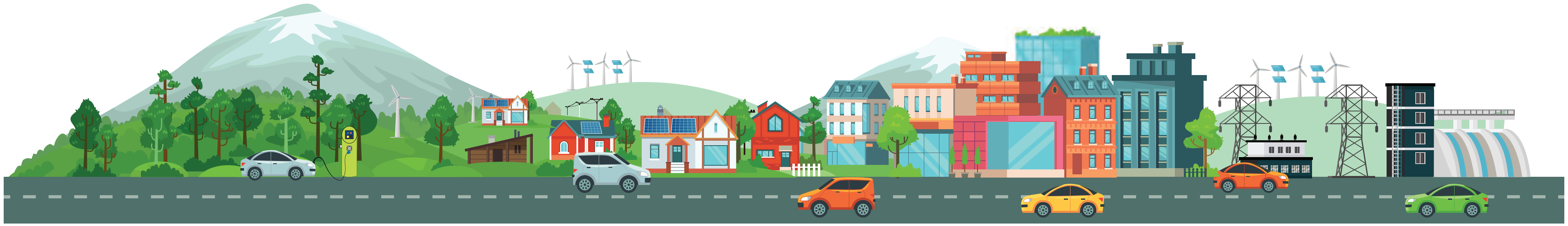
| NO | ISSUE | RECOMMENDATION |
|---|---|---|
| R1 | **International learnings on communication protocols** | Continue to monitor closely international developments, with particular emphasis on:<br>a. Australia due to their market proximity and speed of advancement in managing high penetration levels of DER within their distribution systems; and<br>b. The UK, due to the similarity in structure and drivers in terms of DER penetration, and regulations.<br>c. Identifying, fostering, and coordinating New Zealand's involvement in pivotal international standards working groups or committees dedicated to advancing DER integration and flexibility globally (including enabling technologies such as open communication protocols such as OpenADR and IEEE 2030.5). |
| R2 | **Build on existing body of knowledge on communication protocols and map the capabilities against New Zealand's requirements** | Therefore, it is recommended that:<br>a. We leverage the findings from the FlexTalk project to develop an industry guideline that outlines the essential functionality necessary for meeting standard communication requirements.<br>b. Initiate further trials (e.g., Flextalk 2.0) to enhance the current knowledge base and delve deeper into learnings gained.<br>c. We continue to monitor global advancements in communication protocols. |
| R3 | **Industry communication guideline** | We recommend that an industry communication guideline is created that is inclusive of the fundamental functional requirements of communication protocols to fully enable flexibility (based on the learnings of the FlexTalk project). For example:<br>a. Communication protocol must be open (non-proprietary).<br>b. Interoperable.<br>c. Scalable.<br>d. Maintainable.<br>e. Platform independent.<br>f. Backward and forward compatible. |
| R4 | **EDB program design standardisation** | It is recommended that:<br>1. The initial seven FlexTalk-designed programs serve as the core foundational set and are refined into the New Zealand OpenADR standardised flexibility programs after industry consultation regarding program design.<br>2. An agile maintenance mechanism is established to ensure flexibility programs are reviewed and can evolve based on industry need.<br>3. That the program owner is defined. |

**TABLE 23:** WIDER CONSIDERATIONS FOR FLEXIBILITY RECOMMENDATIONS

| NO | ISSUE | RECOMMENDATION |
|---|---|---|
| WR1 | End device functionality | It is recommended that industry guideline/s that outline end device functionality requirements are either adopted and adhered to, or if not currently available developed and implemented. |
| WR2 | Other technical standards or protocols | It is recommended that:<br>a. Gap analysis is undertaken to identify any gaps in standards required to enable DER integration in the New Zealand power system<br>b. Based on the outcomes of the gap analysis, the industry establish a work program to evaluate and make recommendations to policy makers regarding other technical characteristics required to enable flexibility that may require standardisation. These include:<br>– Data<br>– Cyber security<br>– Interoperability<br>– Health and safety standards<br>c. Development of a DER interoperability assessment framework to provide policy makers with an objective set of criteria to assess potential standards or features of technical standards to be considered for adoption in New Zealand. |
| WR3 | International standards | It is recommended that a scan of relevant international standards committees and working groups related to DER integration be undertaken to identify gaps and ensure alignment. |
| WR4 | IT system requirements to enable flexibility services | It is recommended that common functional requirements for EDB IT systems be established that will allow for flexibility services to be introduced into their operational activities. |
| WR5 | Definition of roles and responsibilities | It is recommended to initiate work to delineate the roles and responsibilities necessary to achieve flexibility, with the primary aim of optimising outcomes for all consumers. |
| WR6 | Access to data & data management | It is recommended that work be undertaken to clarify data access and management capabilities needed to deliver flexibility. This could include changes in regulations to access and manage this data; and defining standards and operating limits for grid connected flexible devices. |
| WR7 | Consumers | It is recommended that work is undertaken to engage and educate New Zealand consumers, to gain social license on the energy transition journey, what flexibility is and the value proposition to participate.<br>Key activities to deliver this social license could include:<br>a. Developing a consumer charter for New Zealand as has been established in other jurisdictions around the world (i.e., Australia and the UK).<br>b. Developing in-depth consumer segments so as to be able to tailor solutions/opportunities for all New Zealand consumers.<br>c. Trials to unlock and test with compelling offers provided to consumers incentivising participation. |

**TABLE 23:** WIDER CONSIDERATIONS FOR FLEXIBILITY RECOMMENDATIONS (CONTINUED)

| NO | ISSUE | RECOMMENDATION |
|---|---|---|
| WR8 | Future project/trial considerations | Leveraging from the outcomes of the FlexTalk project framework, it is recommended a next step trial is established to continue momentum and expand on learnings. Two key gaps identified in FlexTalk include market stimulation and understanding the consumer value proposition. It is recommended that a new project (Flextalk (2.0) be established to investigate those two issues, with particular focus on:<br>a. Testing real home setups with a wider range of technologies expanding the size and scope of communication (EV chargers, solar arrays, home batteries, HEMs, electric hot water heating, heat pumps and other appliances).<br>b. Testing/uncovering and quantifying the percentage of demand value stack that can be shifted/utilised.<br>c. Uncovering real time consumer insights (such as consumption patterns) and incentives to participation.<br>It is recommended projects/trials are stood up to continue to address considerations exposed in FlexTalk that were out of scope but necessary to achieve a fully demand flexible system. It is recommended a next steps project could focus on issues such as:<br>d. Understanding / quantifying flexibility that exists (and can be utilised).<br>e. Investigate commercial opportunities between EDB and flexibility supplier.<br>f. Uncovering real time consumer insights and incentives to participation.<br>g. Designing common consumer flexibility services/products. |
| WR9 | Knowledge sharing | It is recommended that a central collaboration space is created to share local knowledge and enable collaboration across industry. This could be enabled via:<br>» FlexForum (central repository/collaboration mechanism).<br>» Utilising EEA knowledge network. |
| WR10 | New Zealand needs a clear vision and roadmap for energy transition | Clarity is needed from government on policy in support of the energy transition and flexibilities role in the future energy system. This will enable industry to progress initiatives and innovations in support.<br>It is recommended that:<br>a. MBIE finalise the energy strategy so there are clear signals to the sector on what we are building for.<br>b. Support and funding are given to real-world trials, embracing failures, learning by doing. |
| WR11 | Regulatory sandboxs | It is recommended that consideration be given to making it easier to establish regulatory sandboxes in New Zealand to help drive the transformation. It is important however, that any sandbox would adhere to common features, such as:<br>a. Genuine innovation or novelty<br>b. Identifiable consumer or social benefit<br>c. Need and readiness for sandbox testing<br>d. Defined time, sectoral or geographic limits<br>e. Safeguard mechanisms |



## FIGURE 20: DELIVERING FLEXIBILITY IN THE ELECTRICITY SYSTEM

**WHY:** EMPOWERING ALL CONSUMERS WITH GREATER CHOICE, CONTROL AND AUTONOMY WHILST ENJOYING THE SECURITY AND BENEFITS OF THE GRID

### WHO: INSTITUTION & ACTORS — DECISION MAKERS

**POLICY SETTINGS**
- Government
- Energy Ministry/MBIE

**REGULATORY AGENCIES**
- Electricity Authority
- EECA
- Commerce Commission

**OPERATION**
- System Operator
- Network company EDB
- Aggregator
- Standards body/EECA

### HOW: POLICY, MARKET, REG & TECH FRAMEWORK — CATEGORIES OF INTERVENTIONS / FLEXTALK: RECOMMENDATIONS

| Categories of interventions | R1 | R2 | R3 | R4 | WR1 | WR2 | WR3 | WR4 | WR5 | WR6 | WR7 | WR8 | WR9 | WR10 | WR11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Energy Strategy | | | | | | | | | | ✓ | ✓ | | ✓ | ✓ | |
| Legal frameworks | | | | | | | | | ✓ | ✓ | ✓ | | | | ✓ |
| Policy & programmes | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Consumer Energy Charter | | | | | | | | | | ✓ | ✓ | | | | |
| Regulatory frameworks | | | | | ✓ | ✓ | | | ✓ | ✓ | | | | | |
| Power system planning | | | | | | | | ✓ | | | ✓ | | | | ✓ |
| Retail pricing | | | | | | | | | | ✓ | ✓ | | | | |
| Market rules | | | | | | | | | ✓ | ✓ | ✓ | | | | |
| Incentive mechanisms | | | | | | | | | | | ✓ | ✓ | | | |
| Electricity code | | | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | | | | |
| System operation protocols | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Standards/Guidelines | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | |
| Connection Agreements common process | | | ✓ | | ✓ | ✓ | | | | | | | | | |
| Enabling technologies/system | | | | | ✓ | ✓ | | ✓ | | | | ✓ | | | |
| – communications protocols | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | | |
| – data protcols | | | | | ✓ | ✓ | | ✓ | | ✓ | | | | | |
| Cyber security | | | | | ✓ | ✓ | | ✓ | | | | | | | |
| Workforce | | | | | | | | | | | | | | ✓ | |

### WHAT: HARDWARE & INFRASTRUCTURE — ASSET TYPES

**POWER PLANTS**
- WIND
- HYDRO
- GEOTHERMAL
- SOLAR
- COAL/GAS

**ENERGY STORAGE**
- BATTERIES
- HYDRO

**ELECTRICITY NETWORKS**
- TRANSMISSION
- MICRO-GRID
- DISTRIBUTION

**DISTRIBUTED ENERGY**
- EVS
- HOUSEHOLD BATTERIES
- COMMERCIAL
- HOUSEHOLD APPLIANCES

SECTION EIGHT

# Acknowledgements

FlexTalk is a collaborative partnership between the Electricity Engineers' Association (EEA), the Energy Efficiency and Conservation Authority (EECA) and industry participants.

We would like to thank all partners for sharing our vision of maximising participation in flexibility services, and for making FlexTalk possible.

Members of our Steering Committee, Industry Design Team and delivery partners have volunteered their time and expertise. Their contributions, along with our funding partner, are invaluable.

The team's enthusiasm to collaborate and share findings will transform how we operate the grid and better enable customer engagement around the role they can play in embracing demand flexibility.

We look forward to continuing this work with you.

SECTION NINE

# Appendix

## 9.1 TRIAL PART A SIMPLE SIGNAL MESSAGING STRUCTURE

**TABLE 24:** FLEXTALK OPENADR 2.0A SIMPLE SIGNAL LEVELS

| PROGRAMME | BASELINE | | LEVEL 0 | LEVEL 1 | LEVEL 2 | LEVEL 3 |
|---|---|---|---|---|---|---|
| Immediate and Emergency Programmes | Flex Capacity a.m. | Flex Capacity p.m. | 0% | 50% | 75% | 100% |

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 were to be consistent across all programs for Part A applicable programs.

## 9.2 EXAMPLE REPORTS – PART B

**FIGURE 21:** EXAMPLE TELEMETRY HISTORY REPORT

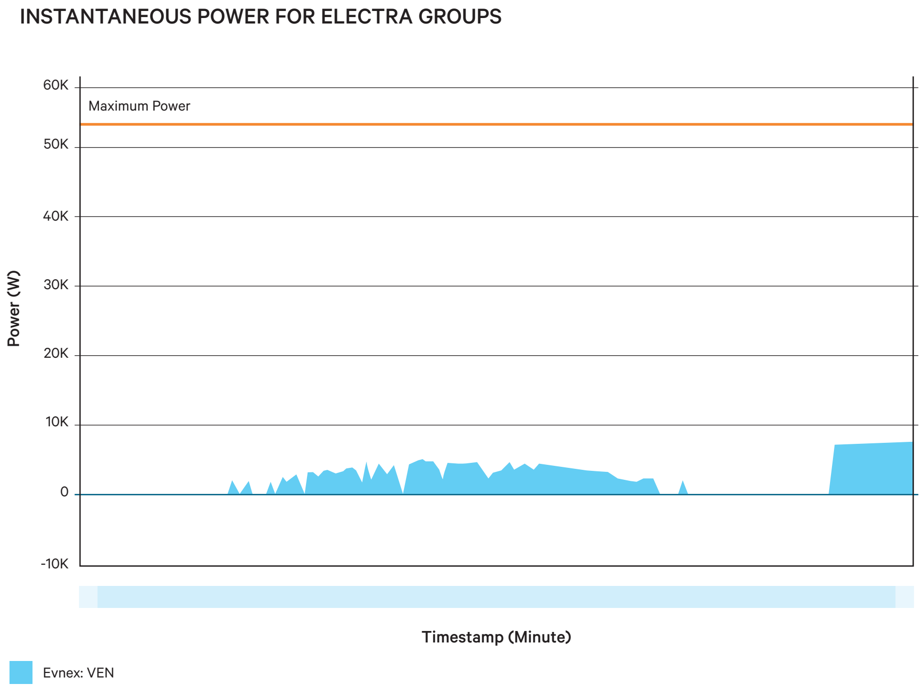
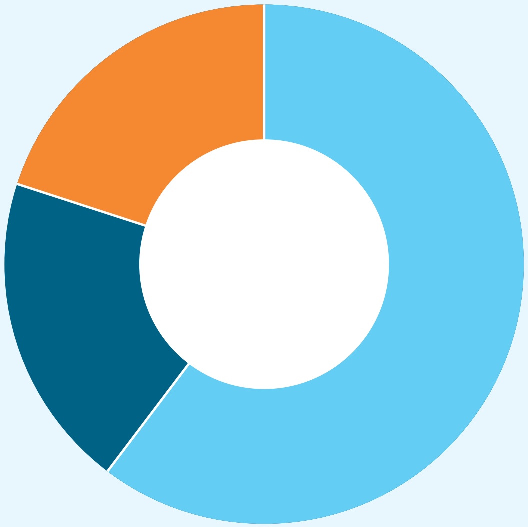


**FIGURE 22:** EXAMPLE CHARGER STATE REPORT



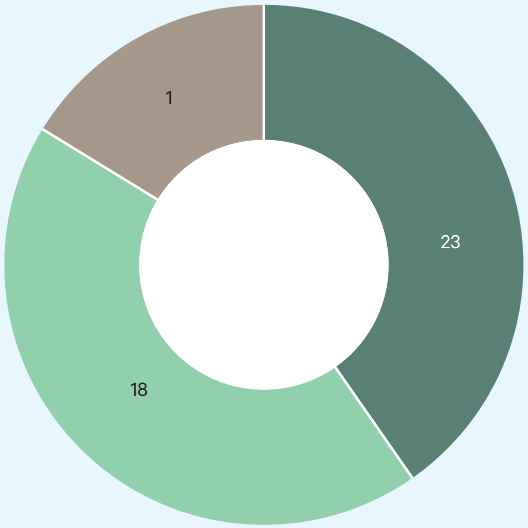
Size: lastValueCount (Custom)

STATE

- count_available
- count_charging
- count_connected
- count_fault_comms
- count_fault_hardware
- count_unavailable

## 9.3 EVENTS TESTED PER PROGRAM TYPE

**FIGURE 23:** PROGRAM COVERAGE – PART A

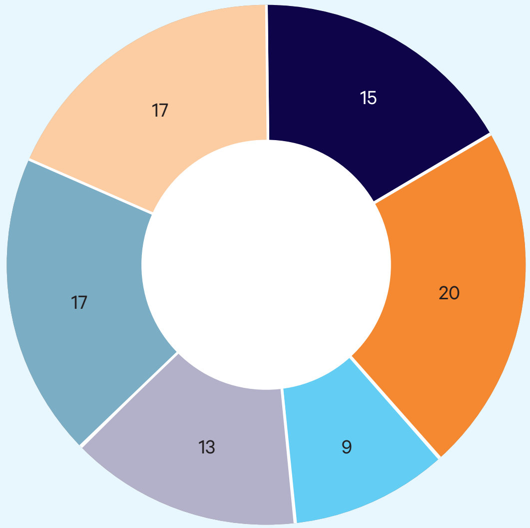



Program Coverage

- Dynamic
- Emergency
- Not specified by EDB

Total Events: 42

**FIGURE 24:** PROGRAM COVERAGE – PART B




Program Coverage

- DOE
- Dynamic
- Emergency
- In_Advance
- PR_Bid
- PR_Discovery

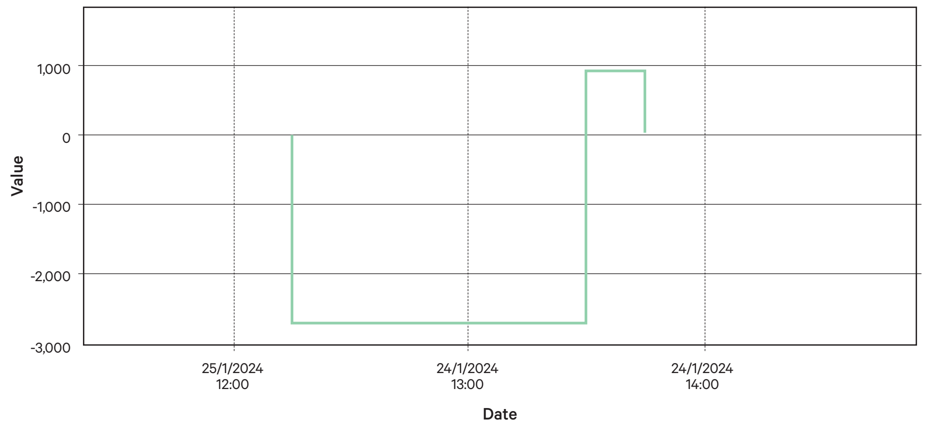
Total Events: 91

## 9.4 OBSERVED MANAGED CHARGING – PART B

**TABLE 25:** OBSERVED MANAGED CHARGING – PER EVENT VIEW – PART B

| | LOAD CHANGE REQUESTED (KW) | LOAD CHANGE ACHIEVED (KW) |
|---|---|---|
| Dynamic Aurora Event 1 | 3 | 1.2 |
| In_Advance Aurora Event 2 | 5 | 1.6 |
| Dynamic Orion Event 3 | 9 | 1.7 |
| In_Advance Aurora Event 4 | 30 | 1.5 |
| Dynamic Aurora Event 5 | 2 | 0.9 |
| Emergency Aurora Event 6 | High | 3 |
| PR_Discovery Electra Event 7 | 10 | 1.5 |
| PR_Bid Electra Event 8 | 5 | 6 |

**FIGURE 25:** OBSERVED MANAGED CHARGING – BATTERY LEVEL – PART B




Event 2 – 25/01/2024

UC Solar Zero, Battery Output Historical Analogue

9

## 9.5 DELIVERY PARTNER TECHNICAL IMPLEMENTATION APPROACHES

**TABLE 26:** DELIVERY PARTNER TECHNICAL APPROACHES – PART B

| | DELIVERY PARTNER | APPROACH | COMMENTS / LIMITATIONS |
|---|---|---|---|
| VTN | Aurora | EV programs – Cortexo GUI. | For EV programs used GUI (manual input) and prototype API. |
| | | Battery program – integration of ADMS to Cortexo VTN. | For battery program, Aurora adapted an existing Network Flexibility solution for OpenADR. The existing solution was not initially developed for OpenADR and was a 'best effort' evaluation of OpenADR within a current business process. Operationally, purpose-built middleware is required to provide a translation layer between an ADMS environment and OpenADR VTN. |
| | Electra | EV programs – FME Solution. | A feature manipulation engine (FME) was used to manipulate the API and send automated flexibility events. Note: Electra opted to demonstrate automation without full integration of VTN to ADMS. |
| | Orion | EV programs – Grid Fabric GUI & Cortexo GUI. | Used GUI only (manual input). |
| VEN | Evnex | Integration from Cortexo VEN to Charge Point Management System. | Full integration of all programs with exception of DoE. |
| | OpenLoop | Integration from Cortexo VEN to Charge Point Management System. | Full integration of all programs with the exception of DoE. |
| | SolarZero | Integration from Cortexo VEN to Battery Management System. | Full integration of battery program |

## 9.6 DELIVERY PARTNER TECHNICAL IMPLEMENTATION COMMENTARY (DETAILED)

**TABLE 27:** DELIVERY PARTNER FEEDBACK – PART A TECHNICAL EASE OF IMPLEMENTATION AND EXTENSIBILITY

| COMMENTARY | EASE OF IMPLEMENTATION (INTEGRATION OF VTN OR VEN WITH INTERNAL SYSTEMS) | USER EXPERIENCE (DEPLOYING EVENTS VIA API OR GUI) | EXTENSIBILITY (ANY COMMENTARY ON FUTURE GROWTH / EXTENSIONS TO APPROACH) |
|---|---|---|---|
| **EDBs** | 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 dynamic/emergency events. This is a trial limitation of VTN as opposed to the OpenADR protocol. **Aurora** |
| | 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 APIs to send signals – this is 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** |
| **Flexibility suppliers** | Relatively simple work since most of the components were there in some form already. It did take longer than expected to complete.<br><br>Working with Cortexo was easy since they are New Zealand based, technical support provider was easy – integration testing would have been much harder with an overseas supplier. **Evnex** | 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** | 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.<br><br>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.<br><br>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** |

**TABLE 27:** DELIVERY PARTNER FEEDBACK – PART A TECHNICAL EASE OF IMPLEMENTATION AND EXTENSIBILITY (CONTINUED)

| COMMENTARY | EASE OF IMPLEMENTATION (INTEGRATION OF VTN OR VEN WITH INTERNAL SYSTEMS) | USER EXPERIENCE (DEPLOYING EVENTS VIA API OR GUI) | EXTENSIBILITY (ANY COMMENTARY ON FUTURE GROWTH / EXTENSIONS TO APPROACH) |
|---|---|---|---|
| Flexibility Suppliers | 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 the OpenLoop team had access to, events were manually evaluated (as per customer agreements) and actioned via OpenLoop manually.<br>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** | 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 was able to send commands to the targeted charge points. **OpenLoop** | 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 28:** DELIVERY PARTNER FEEDBACK – PART B TECHNICAL EASE OF IMPLEMENTATION AND EXTENSIBILITY

| COMMENTARY | EASE OF IMPLEMENTATION AND USER EXPERIENCE | EXTENSIBILITY (ANY COMMENTARY ON FUTURE GROWTH / EXTENSIONS TO APPROACH) |
|---|---|---|
| EDBs | As the solution largely already existed, most of the effort involved consuming the new Cortexo API endpoint(s) and adapting the existing application flow to use these instead. There were some minor changes in messaging cadence which required additional modification of the control message submission logic but overall, it wasn't a significant effort.<br>Cortexo GUI was fairly self-explanatory. **Aurora** | It isn't a perfect "production ready" solution. It is a best effort solution allowing the business to evaluate the usability of OpenADR within a current business process, but it is by no means a final solution to be deployed for BAU operations. Ideally, we would develop a purpose-built middleware solution to provide the translation between our ADMS environment and an OpenADR VTN. **Aurora** |
| | It was simple to build an FME to manipulate the API and send events automatically, whilst not a full integration to SCADA system this demonstrated the principle. **Electra** | |
| | Simple due to using GUI, Both the Cortexo system and Grid Fabric use similar terminology – so, easy to use. **Orion** | |

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**TABLE 28:** DELIVERY PARTNER FEEDBACK – PART B TECHNICAL EASE OF IMPLEMENTATION AND EXTENSIBILITY (CONTINUED)

| COMMENTARY | EASE OF IMPLEMENTATION AND USER EXPERIENCE | EXTENSIBILITY (ANY COMMENTARY ON FUTURE GROWTH / EXTENSIONS TO APPROACH?) |
|---|---|---|
| **Flexibility Suppliers** | Technical integration took some time but wasn't all that challenging – the hardest part was agreeing on what the spec meant and clearing up confusion during integration testing.<br>Developing the integration alongside Cortexo worked well, with very open comms between the two organisations as they are in the same timezone. **Evnex** | Onboarding is very manual, so we would need a way to automate that (enroll chargers, communicate to EDB to update what the available load is within each group). **Evnex** |
| | Development for Part B was not too complex; the OpenADR 2.0b signals used during Part B were easy to understand, interpret and implement.<br>It was a learning process for our team in general as we were not too familiar with OpenADR as a communications protocol early on. Fortunately, the information on this is easily accessible online and through the help of Cortexo. The concept of demand response and flexibility, however, was not new to us, so there was no issue there.<br>Overall, it took our dev team just a little over two full sprints (or 1 month) to integrate with Cortexo and build the logic within our 'Smart Charging Interface' to receive, evaluate and action each program for Part B, as well as developing the endpoint for Cortexo to retrieve reporting metrics. **OpenLoop** | |
| | Very simple, since we already had a Demand/Response API in place, we simply added a new endpoint to accept messages in a different format, but the core logic of sending instructions to our batteries was already there.<br>The technical implementation was, 1 – Low difficulty. Only some minor confusion about the specs (for example what constitutes the unique key of a message), which are common when dealing with API integration. **SolarZero** | Specific to our use case with Aurora: the timing of the polling of the current state of the fleet could be a problem (i.e. we only update our state every 5min, which is not ideal to begin with, and by introducing Cortexo in the middle which polls at its own frequency the data could be quite outdated by the time it reaches Aurora). **SolarZero** |

## 9.7 INDICATIVE COSTS – VTN AND VEN

During FlexTalk , the following products were explored and utilised as potential VTN and VEN solutions. Please note this table is indicative only and is not an exhaustive list of the products available, it is for ballpark understanding only. Costs can change based on specific customer needs/ scope of deployment. Each user of OpenADR is recommended to do their own vendor research.

**TABLE 29:** INDICATIVE OpenADR CERTIFIED PRODUCT COSTS

| VTN / VEN | PRODUCT NAME | DESCRIPTION | COMMERCIAL AVAILABILITY | INDICATIVE COST |
|---|---|---|---|---|
| VTN | **Transpower – FlexPoint** | FlexPoint is Transpower's Distributed Energy Resources (DER) Management System coordinating distributed energy resources and managing the grid effectively together with DER providers. FlexPoint was provided to FlexTalk in support of Part A. | N | N/A |
| | **Cortexo – FlexSplice Hub VTN** | FlexSplice Hub VTN is a licensed OpenADR VTN software solution that customers have hosted on their behalf. Intended to integrate with existing load management systems and managed through API or GUI. | Y | $14,400 NZD per annum<br>*note cost estimate does not include initial customisation costs. |
| | **Grid Fabric – Canvas Cloud** | Canvas Cloud is the simplest Grid Fabric solution for testing VENs and running small OpenADR pilots.<br>Note, this license type is not intended for operational use. Grid Fabric's Canvas Server solution is recommended | Y | Test Plan $900 USD per annum (2 VEN limit)<br>Pilot Plan $2700 USD per annum (10 VEN limit) |
| | **Grid Fabric – Canvas Server** | Canvas Server is a licensed OpenADR VTN software solution that customers host themselves, intended to integrate with existing load management systems and managed through API or GUI. | Y | Canvas Ongoing<br>Canvas $15,000 - $35,000 USD<br>*note cost estimate does not include initial customisation costs |
| | **GE Opus One DERMS/FMS – Gateway module** | GE's "Gateway" module is a licensed OpenADR VTN software solution that integrates with GE's PowerOn Advantage (SCADA). Gateway module also encompasses IEEE 2030.5 functionality for direct device control. | Y | $300,000 – $500,000 USD per annum<br>$500K USD initial customisation costs |
| VEN | **Cortexo – FlexSplice Edge VEN** | FlexSplice Edge is a Virtual End Node with additional flexibility management tools and reporting functionality, intended to integrate with flexibility suppliers internal flexibility management systems (charge point management system, battery management system etc) | Y | $6,000 NZD per annum |
| | For further VEN solutions, a comprehensive list can be found at **https://products.openadr.org/** | | | |

## 9.8 CUSTOMER SURVEY RESULTS (DETAILED)

**TABLE 30:** CUSTOMER SURVEY RESULTS – PART A

| TRIAL PHASE | CUSTOMER TYPE | QUESTION 1: Were you aware your charging was managed (throttled down or stopped)? Any comments? | QUESTION 2: Has participation in the trial impacted your charging behaviour in anyway? Any comments? | QUESTION 3: Do you feel the trial has had any financial impact on you? Any comments? | QUESTION 4: Can you see yourself participating beyond this trial in demand flexibility, by allowing your EV charging to be managed during periods where demand needs to be managed? Any comments? | QUESTION 5: Have you used the 'Charge Now' feature at any point in the trial? | QUESTION 6: Is there any other comments you would like to make about your experience involved in the FlexTalk EV managed charging trial to date? |
|---|---|---|---|---|---|---|---|
| Part A | Residential | No | Yes | Yes | Yes | No | |
| | | Yes, I was aware but didn't notice then it happened. | No | No | Yes | No | |
| | | No, One night the charger didn't charge – Tuesday 29 August | No | No | Yes | No | |
| | | Yes | No, Just plugged in as normal and hoped it was charging | No | Unsure, If I can be assured that it doesn't impact on the actual charging of my car! | No | |
| | | No | No | No | Yes | No | |
| | | No, Unfortunately I think that for a large chunk of the trial my car was being repaired after the heater element failed so I am not sure how useful my data will be. | No | No | Yes. Definitely, especially if there is a financial incentive. TOU pricing is fairly coarse on my current plan and I think it would take a system wide approach (system regulators and retailers) to be able to achieve this but I am keen to be a part of it and be a Guinea pig. | No | Just sorry that I was not able to be a bigger part of it with my vehicle issues during the trial. |
| | | Yes | No | No | Yes | No | |

**TABLE 30:** CUSTOMER SURVEY RESULTS – PART A (CONTINUED)

| TRIAL PHASE | CUSTOMER TYPE | QUESTION 1: Were you aware your charging was managed (throttled down or stopped)? Any comments? | QUESTION 2: Has participation in the trial impacted your charging behaviour in anyway? Any comments? | QUESTION 3: Do you feel the trial has had any financial impact on you? Any comments? | QUESTION 4: Can you see yourself participating beyond this trial in demand flexibility, by allowing your EV charging to be managed during periods where demand needs to be managed? Any comments? | QUESTION 5: Have you used the 'Charge Now' feature at any point in the trial? | QUESTION 6: Is there any other comments you would like to make about your experience involved in the FlexTalk EV managed charging trial to date? |
|---|---|---|---|---|---|---|---|
| Part A | Residential | No, We did have a couple of times when the car didn't charge overnight, but not sure this was related. | No, We generally charge at night and occasionally when it's sunny, but not during peak times. I have reduced the amount it can charge so we don't pull too much from the grid during the day and just use solar generation. | No, If energy could be sold back to the grid at peak times at higher rates, this would definitely have a financial impact. | Yes, Happy to be involved, but I'm not sure it helps if it's night charging. | No | I have suggested to Evnex Support that more notifications would be helpful to tell you when things are plugged in, charging or not charging, rather than having to check the app, which I don't always do. That would avoid some of these issues and could also be helpful for FlexTalk. |
| | | No | Yes, Makes us more aware of not just price. We do now have solar so that has changed things | No | Yes | Yes | |
| | | No | No | No | Yes | No | |
| | | No, I knew you were planning to do this but didn't notice any impact at all. | No | No | Yes | No | I think we all need to recognise that demand management will be essential for the smooth widespread adoption of EVs and home charging. That said, I would be pretty miffed if I put my car on to charge overnight at off peak hours, knowing I needed a full battery the following morning for a long trip, only to find that the car was only partially charged as a result of restricting charge as part of demand management. |

**TABLE 30: CUSTOMER SURVEY RESULTS – PART A (CONTINUED)**

| TRIAL PHASE | CUSTOMER TYPE | QUESTION 1: Were you aware your charging was managed (throttled down or stopped)? Any comments? | QUESTION 2: Has participation in the trial impacted your charging behaviour in anyway? Any comments? | QUESTION 3: Do you feel the trial has had any financial impact on you? Any comments? | QUESTION 4: Can you see yourself participating beyond this trial in demand flexibility, by allowing your EV charging to be managed during periods where demand needs to be managed? Any comments? | QUESTION 5: Have you used the 'Charge Now' feature at any point in the trial? | QUESTION 6: Is there any other comments you would like to make about your experience involved in the FlexTalk EV managed charging trial to date? |
|---|---|---|---|---|---|---|---|
| Part A | Residential | Yes | Yes | Yes, Wasnt able to take use of free hour of power some days | Yes | No | |
| | | No | No | No | Yes | Yes | |
| | | No | No | No | Yes | Yes | We haven't noticed that it has been happening :-). |
| | | No | No | No | Yes, Yes but I expect to share in the benefits; otherwise I would not allow control of it except for a trial. | Yes | I think I used the charge now feature; I can't quite recall when the trial started. |
| | Commercial | Yes. We were aware of the agreeement to throttle in advance, however no material service disruption was identified as/when it occurred. | No | No | Unsure, this would be subject to yet to be determined commercial/ customer value. | N/A | |

**TABLE 31:** CUSTOMER SURVEY RESULTS – PART B

| PROJECT PHASE | CUSTOMER TYPE | QUESTION 1: Were you aware your charging was managed (throttled down or stopped)? Any comments? | QUESTION 2: Has participation in the trial impacted your charging behaviour in anyway? Any comments? | QUESTION 3: Do you feel the trial has had any financial impact on you? Any comments? | QUESTION 4: Can you see yourself participating beyond this trial in demand flexibility, by allowing your EV charging to be managed during periods where demand needs to be managed? Any comments? | QUESTION 5: Have you used the 'Charge Now' feature at any point in the trial? | QUESTION 6: Is there any other comments you would like to make about your experience involved in the FlexTalk EV managed charging trial to date? |
|---|---|---|---|---|---|---|---|
| Part B | Residential | No | No | No | Yes, I already use the EVNEX solar function to take excess solar to charge my vehicles when I can. I find this function great as its plug in and forget. | I occassionaly used Charge Now as we have 2 electric vehicles and sometimes, jmust need to charge. To be honest this is when Genesis gives us a power shout. But not due to the Flextalk trial. | I think it is important this work is carried out. We installled solar to not only take advanatge but to take stress of the grid as well. A small contribution, but one we wanted to make. |
| | | No | No | No, at least not a negative one. | Yes | No | None further. |
| | | No | No | No, we have a timer to ensure all energy is purchased off peak. We have never needed to charge during peak times due to the managed charging. | Yes | I wasn't aware of the feature, but wouldn't have needed it anyway. | No |
| | | No | No | No | Yes | Don't think so. If we did, didn't notice any effect | very much running in the background & didn't affect our charging in any noticeable way. |
| | | No | No | No | Yes | No - not needed | Happy to have this as a permanent feature if it helps manage demand better as a whole. |
| | Commercial | No | No | No | TBC | No | |

## 9.9 TERMS, DEFINITIONS AND ACRONYMS

| 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 EDB 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)** | 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 EVs. |
| **Aggregator** | An aggregator is an agent of the consumer/s who manages their DER resources, and who then bundles them with numerous other consumer resources to engage as a single entity that can be sold as demand response management and supply to energy system actors such as distribution network operators and/or the energy market whilst ensuring that the needs of the consumer owners are met. |
| **Application Programming Interface (API)** | 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. |
| **Behavioural standards** | Behavioural standards describe the expected behaviour of electrical equipment. They often include components and capabilities designed to protect the equipment itself, or the things connected to it. |
| **Charge Point Management System (CPMS)** | Charge point management software simplifies charge point operations by representing an entire charging network digitally and managing communications and data exchanges with individual charging stations. |
| **Connection standards** | Connection standards describe how connections are made safely between electrical equipment and the electricity grid or other equipment. This group also include standards for how equipment should be designed and installed to avoid or reduce hazards such as electric shock, mechanical damage or fire. |
| **Consumer Energy Resources (CER) also referred to as Distributed Energy Resources (DER) (see below)** | Consumers' resources that generate or store electricity and includes flexible loads that can alter demand in response to external signals. DER includes:<br>» rooftop solar<br>» batteries<br>» EV chargers<br>» controlled loads such as water heaters and air conditioners.<br>Distributed energy resources (DER) includes larger assets such as community batteries installed in the distribution network. |
| **Demand Response (DR) also known as Demand Management (DM)** | 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) this includes Consumer Energy Resources (CER) (see above) | 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. DERs can include renewable generation, energy storage, EVs, and technology to flexibly manage loads (such as water heaters or pool pumps) at the premises.<br>Generation or storage DERs 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) | Both the business processes software and digital information flows that enable DERM by controlling distributed energy resources. |
| Demand Flexibility (DF) | The modification of generation or consumption patterns in response to an external signal, to provide a service within the energy system. For the purpose of this report, this definition also covers the term distributed flexibility. |
| Dynamic Operating Envelope (DoE) | Dynamic operating envelopes provide upper and lower bounds on the import or export of power in a given time interval for each distributed asset(s) or customer connection point. Think of how neatly an envelope contains a letter, an operating envelope elegantly bounds the system behaviour within its safe operating capacity. |
| Distributed Generation (DG) | In the past we had large scale energy generators like power station or nuclear power plants which were often located a long way from where the electricity was being used. We have a growing number of smaller scale and more environmentally friendly ways of generating electricity now, such as solar panels and wind turbines. Their generated energy is often used more locally. Energy generated locally to where it is being used is called Distributed Generation. |
| Distribution Network Operator (DNO) | The Distribution Network Operator, or DNO, is responsible for owning, operating, and maintaining the electrical network in a geographical licence area and delivering electricity to communities and customers throughout the licence area, including, homes, businesses, and industry. A DNO also maintains upkeep and investment in the electricity network to ensure it is functioning and capable of handling electricity demand. |
| Distribution System Operator (DSOs) | A Distribution System Operator, or DSO, plays a key role in coordinating and managing the operation of the distribution electricity system. It securely operates and develops an active distribution system comprising electricity networks, electricity demand and generation management, and other flexible distributed energy resources. |
| Electricity Distribution Business (EDB) | Lines companies (or distribution companies) that provide and maintain the power lines that carry electricity via power poles and lines from the national transmission grid to homes and businesses. |
| Electricity Industry Participation Code (the code) | The code is a set of rules that governs nearly every aspect of New Zealand's electricity industry - from generation, to transmission, system operation, security of supply, market arrangements, metering, distribution and retail. |
| Electric Vehicle (EV) | EVs are plug-in vehicles powered at least partly by electricity. This includes battery electric vehicles, (BEVs), plug-in hybrid electric vehicles (PHEVs) and fuel cell electric vehicles (FCEVs). The term 'EV" doesn't just cover cars – heavy transport, marine transport, planes, scooters, bicycles and motorcycles can all be powered by electric motors. |
| Feature Manipulation Engine (FME) | Data integration tool used for transforming data. FME accomplishes data integration by reading data from multiple sources, using transformer tools to change or restructure the data to fit the users' needs, and writing it into a destination. |
| Flexibility Management System | Software-based platforms used to communicate, manage, and orchestrate distributed energy resources. |

| TERM | DEFINITION |
|---|---|
| **Flexibility Supplier/Load Aggregator/DER Manager** | An entity providing flexibility to perform a service for an electricity participant. A flexibility supplier may act as an aggregator of load. A load aggregator is an entity contracting with one or more consumers and dealing 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 the entity can 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** | Resources like generators, consumers, and electricity storage connected to the distribution network. |
| **Flexibility Services** | The offer of modifying generation 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)** | Defined in Part 1 of the Electricity Industry Participation 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 Electricity Authority following an application in accordance with clause 13.28. |
| **Graphical User Interface (GUI)** | An interface through which a user interacts with electronic devices such as computers and smartphones through the use of icons, menus and other visual indicators or representations (graphics). |
| **Home Energy Management System (HEMS)** | An efficient method to deal with energy issues on the demand side rather than the generating side. In traditional homes, the HEMS can shift the loads over the day or night hours to achieve technical or economic purposes. In modern homes, renewable resources and energy storage systems are integrated into the buildings and the HEMS becomes more flexible. |
| **Information model standards** | Information model standards define concepts, and describe how to represent those concepts as data. These are useful building-blocks when defining network protocols. Using the postal system as an analogy, a protocol defines a way to put a letter in an envelope and have it delivered to a specified address, whereas an information model describes how to interpret the contents of the letter. |
| **Interface standards** | Interface standards describe ways to communicate with equipment, to observe and/or control it's operation. These include:<br>» Physical interface standards which involve a hardware connection to the equipment<br>» Network protocol standards (including APIs) which define how to communicate with equipment via a computer network. |
| **Internet of Things (IoT)** | A network of physical devices that are equipped with sensors, software, and other technologies that allow them to communicate with other devices and systems over the internet |
| **Inverter-based resources (IBRs)** | An inverter-based resource (IBR) is equipment that uses an inverter when functioning. An inverter is an electronic device that converts direct current (DC) electricity to alternating current (AC) electricity. |
| **Load Management System (LMS)** | EDB's internal IT infrastructure (systems) responsible for controlling load. This may be referred to as DERMs, ripple system, load management system or other. |
| **Non-Network Solutions (NNS)** | Non-network solutions, also referred to as non-wire alternatives, are projects chosen to deliver flexibility services as an alternative to investing in greater network capacity. |
| **OpenADR 2.0** | An open, secure, 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. OpenADR was created to automate and simplify DR and DER for the power industry with dynamic price and reliability signals allowing end user modification of usage patterns. This can save money and optimise energy efficiency, while enhancing the effectiveness of power delivery across the Smart Grid. |

| TERM | DEFINITION |
|---|---|
| Heating, cooling and ventilation (HVAC) | HVAC stands for heating, ventilation, and air conditioning. It's a collective term for all the different types of cooling and heating systems homeowners use to change the temperature and humidity indoors. HVAC systems include central air conditioning units, ductless mini-splits, furnaces, and boilers. HVAC also encompasses large-scale refrigeration in commercial buildings. |
| IEEE 2030.5 | A standard for communications between the smart grid and consumers. The standard is built with Internet of Things concepts and gives consumers a variety of means to manage their energy usage and generation. |
| Open Charge Point Protocol (OCPP) | A communication protocol enabling 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, 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. |
| Open Charge Point Interface (OCPI) | The OCPI protocol is designed to facilitate interaction between charge point operators and the many networks that provide electricity for EVs. This enables instantaneous two-way communication between the two sets of interested parties. OCPI facilitates information such the location, cost, and accessibility of charging stations, as well as individual charge point details. OCPI enables EV drivers to use a common language while connecting to various EV charging networks. |
| powerReal | Real power measured in Watts (W) or Joules/second (J/s) defined in the OpenADR specification |
| Photovoltaic (PV) | A photovoltaic (PV) cell, commonly called a solar cell, is a nonmechanical device that converts sunlight directly into electricity. Some PV cells can convert artificial light into electricity. |
| Quality Assurance (QA) | Any systematic process of determining whether a product or service meets specified requirements. |
| Supervisory Control and Data Acquisition (SCADA) | SCADA is a system of different hardware and software elements that come together to enable a plant or facility operator to supervise and control processes. |
| System Operator (SO) | The entity tasked with maintaining power system security in New Zealand, which it does by operating the wholesale electricity market through which generators sell electricity to retailers who then supply consumers, and procuring ancillary services |
| User Acceptance Testing Environment (UAT) | User Acceptance Testing Environment. User acceptance testing (UAT) environments—also called staging environments—allow the application's main users to test new features before they are pushed into the production environment. |
| Virtual End Node (VEN) | Typically, a client end device that accepts a signal from a server (VTN). |
| Virtual Power Plants (VPPs) | VPP broadly refers to an aggregation of DER (such as decentralised generation, storage and controllable loads) coordinated to deliver services for power system operations and electricity markets. |
| Virtual Top Node (VTN) | Typically, a server that transmits OpenADR signals to end devices (VEN) or other intermediate servers. |

## 9.10 TRIAL AND PROJECT LIMITATIONS

**TABLE 32:** TRIAL AND PROJECT LIMITATIONS

| TRIAL LIMITATION | DESCRIPTION |
|---|---|
| Number of events deployed per month | Limit to a maximum of 10 control events per month per customer. |
| Control levels | Commercial customer charger limit throttle 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 | Commercial customer chargers only available after business hours (5pm – 8am).<br><br>Residential chargers only available between 7am – 9pm (to ensure no impact to retail tariffs which utilise low energy periods). |
| Trial numbers | Trial participant numbers low (57 chargers) but considered acceptable, as the trial is focussed on testing the OpenADR mechanism for achieving demand flexibility as opposed to measuring how much flexibility can be achieved. |
| **PROJECT LIMITATIONS** | **DESCRIPTION** |
| Project resourcing and time | Lack of resource and time hindered the approach some delivery partners took to implementing OpenADR with their respective internal systems. This was observed by EDBs opting not to implement full integration of VTN with ADMS/LMS. |
| VTN limitations | The Grid Fabric Canvas solution is created for the purpose of running trials (low cost/low effort to utilise) it enabled trialing of flexibility dispatch, but did not allow for reporting or monitoring, nor did it enable demonstration of DoE program. For full FlexTalk requirements to be met the user (EDB) would need to purchase the Canvas Cloud solution which would accommodate wider needed functions. The solution still gave insight into flexibility dispatch and demonstrated interoperability by connecting an alternate VTN with flexibility suppliers VEN(s) (and thus met a core objective of FlexTalk). |
| Manual data capture | For Part A of trial all event data was manually captured due to technical limitations of trial. The data is of mixed quality but is adequate for high-level analysis of trial outcomes for this phase. |
| Part B reporting implementation delay | For Part B, two new VTN solutions were stood up at short notice to allow for testing the FlexTalk designed programs. This meant that at the beginning of Part B, a 'building the plane whilst flying' approach was taken. This caused data limitations such as VEN to VTN reporting was not operationalised until mid-way through trial, thus we do not have data to discuss the managed charging from 1 October to 1 November 2023). |
| Part B reporting – Provision of charger status data | Decision to omit real data specific to charger status report for Part B by OpenLoop which opted to omit 'chargers connected' and 'chargers charging' data from reporting due to desire to protect commercial and customer data. |

| **TABLE 32:** TRIAL AND PROJECT LIMITATIONS | |
|---|---|
| **PROJECT LIMITATIONS** | **DESCRIPTION** |
| **Data capture approach** | For Part A and B, differing VTNs were used and as per above, manual data capture occurred in Part A, with Part B automating the reporting / data per event. For this reason, the data displayed in the report has slight variation between Part A and B. Where possible, data tables and results are standardised to provide consistency in user interpretation. |
| **Customer real time feedback** | The project did not have a direct feedback loop with customers; however, customers were surveyed for feedback at 2 intervals within trial (end of Part A/Part B).<br>Getting real customer feedback per event and learning more about their experience and observations would enhance wider aspects of the flexibility service design. An example is understanding how and when customers wish to be notified of demand flex events. |
| **Fictitious testing (not based on network constraints)** | Most events were fictitious and not caused by a trigger or network constraint but rather deployed based on a trial schedule. |

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Electricity Engineers' Association

EECA

TE TARI TIAKI PŪNGAO

ENERGY EFFICIENCY & CONSERVATION AUTHORITY